

**CORPORATION OF THE CITY OF THUNDER BAY**



**ENGINEERING  
AND  
DEVELOPMENT  
STANDARDS**

**2019 EDITION**

INFRASTRUCTURE AND OPERATIONS DEPARTMENT  
ENGINEERING & OPERATIONS DIVISION OFFICE  
THUNDER BAY, ONTARIO



**CITY OF THUNDER BAY  
ENGINEERING AND DEVELOPMENT STANDARDS**

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### REVISION SUMMARY

<b>M - DRAWINGS</b>	<b>SUPERCEDES</b>
<b>M-108:</b> Rainfall Intensity – Density – Frequency Table <ul style="list-style-type: none"> <li>• Revisions:               <ul style="list-style-type: none"> <li>○ Graph redrawn and notes updated.</li> </ul> </li> </ul>	M-108 – Feb. 2013
<b>M-116:</b> Multi Use Trail Swing Barrier Detail <ul style="list-style-type: none"> <li>• Revisions:               <ul style="list-style-type: none"> <li>○ Added Gussets to swing gate.</li> <li>○ Added note to 80 mm dia. SCH 40 pipe “Insert a min. 300 mm into HSS support.”</li> <li>○ Added note “2-10mm weepholes 50mm above grade”</li> </ul> </li> </ul>	M-116 – Jan. 2016
<b>R – DRAWINGS</b>	<b>SUPERCEDES</b>
<b>R-101-2:</b> Section Through Local Road With Common Utility Trench Details <ul style="list-style-type: none"> <li>• Revisions:               <ul style="list-style-type: none"> <li>○ Revised storm sewer depth from 1.5m to 1.8m</li> </ul> </li> </ul>	R-101-2 – Dec. 2017
<b>R-119:</b> Concrete Sidewalk 1.5 m Residential <ul style="list-style-type: none"> <li>• Revisions:               <ul style="list-style-type: none"> <li>○ Added “and adjacent to curb” to note #6.</li> <li>○ Added note #13 “See also R-121 for curb sidewalk application”</li> </ul> </li> </ul>	R-119 – Jan. 2018
<b>R-120:</b> Concrete Sidewalk Ramping At Curb <ul style="list-style-type: none"> <li>• Revisions:               <ul style="list-style-type: none"> <li>○ Removed herringbone pattern details and notes and replaced with details and notes for tactile warning surface plates.</li> <li>○ Removed note “C”.</li> </ul> </li> </ul>	R-120 – Jan. 2018



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### REVISION SUMMARY

<p><b>R-121:</b> Concrete Sidewalk – 1.5 m Residential Curb Type Showing Driveway Cut</p> <ul style="list-style-type: none"> <li>• Revisions: <ul style="list-style-type: none"> <li>○ Added section B-B.</li> <li>○ Added Note #9, “Concrete curb and gutter as per O.P.S.D. 600.040 and C.T.B. standard drawing R-109-1 with modified lip.”</li> </ul> </li> </ul>	<p>R-121 – Jan. 2018</p>
<p><b>R-122:</b> Concrete Sidewalk – 3.6 m Commercial Type “A” Showing Driveway Cut</p> <ul style="list-style-type: none"> <li>• Revisions: <ul style="list-style-type: none"> <li>○ Added Note #9, “Concrete curb and gutter as per O.P.S.D. 600.040 and C.T.B. standard drawing R-109-1 with modified lip.”</li> </ul> </li> </ul>	<p>R-122 – Jan. 2018</p>
<p><b>W – DRAWINGS</b></p>	<p><b>SUPERCEDES</b></p>
<p><b>W-117-1:</b> Disinfecting and Flushing Watermains</p> <ul style="list-style-type: none"> <li>• Revisions: <ul style="list-style-type: none"> <li>○ Added note #8 “Refer Also to City of Thunder Bay Drinking Water Works Permit No. 024-201.”</li> <li>○ Corrected Spelling.</li> </ul> </li> </ul>	<p>W-117-1 – Dec. 2015</p>



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Details of Sacrificial Anode Test Station Connections	W-128
Valve Replacement for Non-Standard Pipe Type	W-129
Non-Metallic Watermain Thaw/Tracer Cable Installation	W-130
Water Hauling Equipment and Backflow Devices	W-131
Water Pressure Zone Boundary Circulation By-Pass	W-132



**2019 LIST OF STANDARD DRAWINGS**

**DESCRIPTION**

**DRAWING NUMBER**

Seasonal Backflow Prevention & Water Meter  
Installation

W-133

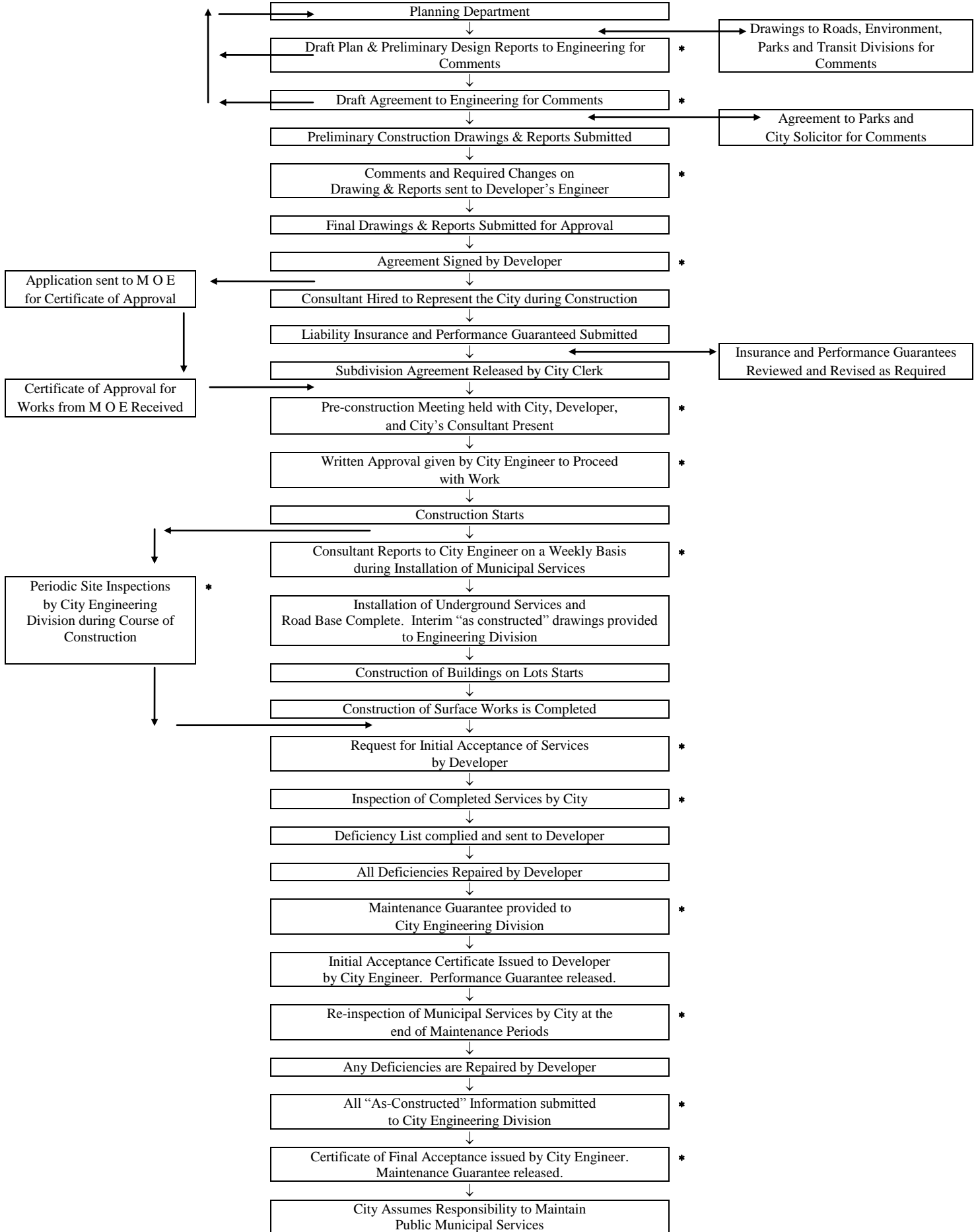


## **2019 LIST OF REFERENCE DRAWINGS**

<b><u>DESCRIPTION</u></b>	<b><u>DRAWING NUMBER</u></b>
1200mm Nom. I.D. Reinforced Precast Concrete Flat Manhole Cap	67 – 6358B
Precast Catch Basin Components	73 - 6992B
2100 mm Nom. I.D. to 1200 mm Nom. I.D. Reinforcing Precast Concrete Reducing Cap and 2100 mm Nom. I.D. Reinforced Precast Concrete Flat Cap	83 - 8310B
1650 mm Nom. I.D. to 1200 mm Nom. I.D. Reinforced Precast Concrete Reducing Cap And 1650 mm Nom. I.D. Reinforced Precast Concrete Flat Cap	86 - 8621B
City of Thunder Bay Standard Manhole Frame and Cover	09 - 0395B
City of Thunder Bay Short Manhole Frame	09 – 0400B
Standard Catch Basin Frame And Grate Assembly	13 – 0569B



## SUBDIVISION DEVELOPMENT PROCESS FIGURE I





### **1.0     INTRODUCTION**

#### **1.1     PURPOSE**

The purpose of this document is to outline the Engineering Division requirements for the processing of applications for the development of land and especially the Engineering Division requirements for the Design, Construction and Acceptance into the City System for the Roads and Services which are part of the Development. The purpose of these requirements is to make fair and reasonable demands of the Developer of the lands so as to ensure that the interests of the residents of both the new Development and the City as a whole are fully protected.

#### **1.2     PROCESS**

The typical Subdivision Development planning and approval process is shown on Figure 1, page 15. The marked boxes indicate items that concern the Engineering Division. The Development approval process requires the close co-operation of the Developer, the City Planning & Building Services Divisions, and the Engineering and Parks Divisions.

#### **1.3     EXEMPTIONS**

Developers having five (5) lots or less on an existing opened and serviced road, may be exempted from some of the requirements and procedures outlined in this document. These exemptions will depend on the circumstances of the location and shall be at the discretion of the Engineering Division.

#### **1.4     DESIGN AND CONSTRUCTION OF SERVICES**

The services for the Development shall be designed for the actual site conditions which are encountered in the area to be serviced. The standards outlined in this book are minimum standards only. Site conditions and good engineering practice will dictate the work which shall be carried out. All sanitary sewer, water and storm water facilities shall be designed in accordance with the latest edition of the Ministry of the Environment guidelines for such facilities.

#### **1.5     OPERATION OF EXISTING SERVICES**

During the course of obtaining field information for and the construction of the development services, the opening of manhole covers, operation of all water valves and fire hydrants shall be only by City of Thunder Bay Engineering Division or Environment Division Staff or by those specifically authorized by those divisions.



### 1.6 ENVIRONMENTAL CONSIDERATIONS

All development shall meet the requirements of the Environmental Protection Act, the Environmental Assessment Act (Ontario Regulation 205), The Federal Fisheries Act, and the Provincial Policy Statement under Section 3 of the Planning Act.

### 1.7 GENERAL CONDITIONS OF CONTRACT

Unless authorized otherwise by the Engineering Division all City contract documents shall include the Ontario Provincial Standards (OPS) General Conditions of Contract, September 1999. The above General Conditions are modified by the OPS Supplemental General Conditions as prepared by the Engineering Division. The use of CCDC General Conditions may also be approved by the Engineering Division as modified by the City's Supplemental General Conditions for use with CCDC documents. The use of CCDC General Conditions may also be approved by the Engineering Division as modified by the City's Supplemental General Conditions for use with CCDC Documents. The Supplemental General Conditions are available on request on disk or in hard copy at the Engineering Division.

The above General Conditions of Contract shall be utilized for all municipal work that is tendered and contracted out either directly by the City or by a consultant on behalf of the City. These general conditions shall also apply to all land development projects where the actual construction work is carried out using a tendering format or the work is undertaken directly by the developers' forces.

### 1.8 CONSTRUCTION OF SERVICES ON CITY LANDS

Private Contractors and Land Developers are not authorized to undertake construction work on any Municipally Owned Infrastructure.

In order to proceed with any development proposal which will require either the construction of new Municipal Infrastructure or alteration of existing Municipal Infrastructure authorization shall first be obtained from the Engineering Division. Prior to start of any work on Municipally owned infrastructure the proponent may be required to enter into an Agreement with the City, including the requirement to provide financial guarantees, and shall produce construction drawings in accordance with the standards contained in this book and with other applicable municipal and provincial standards, obtain all necessary Municipal, Provincial and Federal approvals, make the necessary arrangements for resident inspection/certification/as-built record drawings for the completed works and provide liability insurance coverage as required by the Engineering Division.



### **2.0     DESIGN STANDARDS**

Note: Additional material specifications and construction methods related to Section 2.0 Design Standards are defined in the specifications located in Section 10.4 “Master Project Specifications” under the section headings titled “Products” and “Execution”.

### **2.1     APPROVALS**

#### **2.1.1   Drinking Water Approvals – City of Thunder Bay**

The City of Thunder Bay reviews and approves Drinking Water applications under the authority of Drinking Water Works Permit Number 024-201.

The Design Engineer shall prepare the Ministry of the Environment application forms for approval of the water system and shall submit them along with three (3) sets of the plans and system design calculations to the Engineering Division. The City will carry out a full technical review of the application to ensure that the design is in accordance with City Engineering Standards and the M.O.E.’s “Watermain Design Criteria for Future Alterations Authorized Under a Drinking Water Works Permit (March 2009).” At the conclusion of the review, the reviewing engineer would recommend to the Manager – Engineering Division, or his designate, that a “Form 1 – Record of Watermains Authorized as a Future Alteration” be signed. No construction will be allowed to start prior to the receipt of a signed and verified Form 1. The Design Engineer should allow for a minimum two (2) months turn-around time for the technical review and approval by the City and the issuance of a signed Form 1.

#### **2.1.2   Sanitary and Storm Sewer Approvals – Ministry of the Environment**

The Design Engineer shall prepare the Ministry of the Environment application forms for approval of the sewer system(s) and shall submit them along with three (3) sets of the plans and system design calculations to the Engineering Division. The City will carry out a full technical review of the application to ensure that the works are in accordance with published M.O.E. guidelines and City Engineering Standards. At the conclusion of the review, the City would recommend to the Ministry’s Approvals Branch that a Certificate of Approval be issued. The Ministry of the Environment’s approval must be received before the City will allow construction to start. The Design Engineer should allow for a minimum two (2) months turn-around time for the technical review by the City and issuance of the approval certificate by the Ministry of the Environment.



## **2.2 SANITARY SEWERS**

### **2.2.1 Area**

Sanitary sewers shall have enough capacity to service the total area which is likely to be drained by the sewer including areas beyond the boundaries of the area to be developed. Information regarding the area to be drained may be obtained from the Engineering Division. Sewers are to be terminated at the Development boundaries when outside drainage areas are considered in the design.

### **2.2.2 Design Flow**

All sanitary sewers shall have the capacity to carry the design flow determined as follows:

#### **DESIGN FLOW FOR SANITARY SEWERS**

<b><u>Land Use</u></b>	<b><u>Allowance for Sewage Flow</u></b>	<b><u>Average Groundwater Infiltration</u></b>
Residential	400 L/cap/day	0.260 L/ha/sec
Existing Industrial	2.10L/ha/sec	Includes Infiltration and Peaking
New Industrial	1.75L/ha/sec	Includes Infiltration and Peaking
Existing Commercial	2.25L/ha/sec	Includes Infiltration and Peaking
New Commercial	1.80L/ha/sec	Includes Infiltration and Peaking

#### **ALLOWABLE INFILTRATION/EXFILTRATION**

The allowable infiltration/exfiltration for sewer pipe shall not exceed 0.075 litres per millimeter of pipe diameter per 100 metres of sewer pipe. Infiltration/exfiltration shall be measured in accordance with O.P.S.S. 410.

### **2.2.3 Population Densities**

When more accurate information is not available, the following values shall be used for population:

Single Family Residential	37 persons/ha
Semi-Detached Residential	75 persons/ha
Row Housing	125 persons/ha
Low Rise Apartment Developments	175 persons/ha
High Rise Apartment Developments	2,275 persons/ha
Commercial Areas	125 persons/ha
Light Industrial Areas	37-125 persons/ha



**2.2.4 Peak Factor**

The ratio of peak flow to average flow  $m$  is determined by the following formula:

$$m = 1 + [ 14 / (4 + P^{0.5}) ]$$

$P$  = tributary population in thousands

**2.2.5 Roughness Co-Efficient**

When capacities of pipe are calculated using the Manning Formula the roughness coefficient " $n$ " shall not be less than 0.013 for all smooth walled pipe and 0.025 for corrugated metal pipe.

**2.2.6 Velocity**

All sewers shall be designed and constructed to give, when flowing full, a minimum velocity of 0.60 m/s and a maximum velocity of 3.0 m/s unless otherwise authorized by the Engineering Division.

All sewers with slopes such that flow velocities will approach "critical velocity" shall be designed to reduce turbulence.

All sewers shall be designed and constructed so that surcharging above the pipe obvert from backwater conditions does not occur.

In the event the surcharging under backwater conditions is deemed minor in the opinion of the Engineering Division and mitigating measures are not required to eliminate such surcharging, the following conditions shall be complied with:

- a) The level of surcharging in the sewer shall be plotted on the profile view of the sewer.
- b) The surcharging shall not extend into any lateral connection past the property line of any land served by the sewer.

**2.2.7 Grades**

The minimum grade is 0.30% while the preferable grade which should be provided whenever possible is 0.50%. The first sewer length between manholes starting from a dead-end shall have at least a 0.50% grade. Grades of less than 0.30% shall be approved by the Engineering Division prior to starting of construction drawings.



**2.2.8 Minimum Size and Strength of Sanitary Sewer**

The minimum size of all sanitary sewer pipe shall be 250 mm diameter.

Pipe sizes up to and including 375 mm diameter shall be P.V.C. sewer pipe having a minimum S.D.R. of 35 conforming to O.P.S.S. 1841.

Pipe sizes larger than 375 mm diameter shall be reinforced concrete pipe conforming to CSA A257.2-M1982 strength classification - 100-D. (formerly Class IV).

**2.2.9 Depth**

The minimum depth of cover on sanitary sewers shall be 2.50 m (preferably 2.75 m). If this depth of cover cannot be obtained then the elevation of the proposed basement floor for each building which will be serviced by this sewer shall be raised. When this situation is encountered the basement floor elevations shall be approved by the Engineering Division and shown on the plans.

**2.2.10 Clearance Between Pipes**

A minimum of 75 mm clearance is required between outside pipe barrels at all pipe crossings.

**2.2.11 Manholes**

The maximum distance between manholes is to be 110 m with the desired maximum being 100 m. Manholes are required at any change in alignment, grade, size, type and class of pipe. Manholes shall be constructed as shown on the standard drawings included in this manual.

If a drop in a manhole is 1 m or greater, a drop connection and manhole shall be constructed. A detail of such shall be included on the construction drawings and be acceptable to the Engineering Division.

All manholes exceeding 5.0 m in depth must have a safety platform as per OPSD 404.020 and OPSD 404.021.

Where future connections are likely to be made to a manhole, a 1.25 m length of pipe of proper size shall be installed in the manhole and sealed with a standard plug.

The obverts of all pipes into manholes shall never be below the obvert of the pipe taking the flow out of the manhole. The extra fall through manholes over the slope of the sewer shall be in accordance with the following table:



**TABLE FOR ADDITIONAL FALL THROUGH  
A MANHOLE FOR VARIOUS PIPE BENDS**

<b><u>Degree of Bend</u></b>	<b><u>Additional Fall</u></b>
0° - 10°	15 mm
11° - 45°	45 mm
46° - 90°	75 mm
91° - 110°	150 mm

**2.2.12     Locations**

Sanitary sewers shall be located as shown on the standard drawings included in this manual and any variance from these locations shall be authorized by the Engineering Division.

**2.2.13     Building Connections     (Sanitary Sewer)**

A minimum 135 mm diameter sanitary sewer building connection shall be provided to all residential buildings and 150 mm diameter for all non-residential buildings.

Larger building connections shall be provided when additional capacity is required to accommodate larger buildings.

Individual separate connections from the building to the sewer main shall be provided to all portions of buildings which may be held in separate ownership.

All sanitary sewer building connections shall be constructed with minimum 2% grade in accordance with standard drawing S-102 and be connected into the main by means of an approved tee or approved saddle and machine cut connection hole.

At the discretion of the City Engineer, sanitary sewer connections for commercial, industrial and institutional properties shall require a manhole located on the property line for maintenance access and inspection purposes.

**2.2.14     Bedding Pipe**

The minimum bedding required for all sanitary sewers shall be Class "B" type and the type of bedding and class of pipe shall be noted on all plans. Bedding shall be in accordance with standard drawings S-100, W-122 and W-123.



**2.2.15     Construction**

The construction of sanitary sewers and appurtenances shall be carried out in conformance with the City of Thunder Bay Construction Standards for installation of sanitary sewers. All manholes constructed shall be set to the temporary road grades and then raised when final roadway construction is carried out.

**2.2.16     Television Inspection**

Prior to acceptance, all sewers shall be inspected using pan and tilt closed circuit television sewer inspection camera.

A hard copy report outlining the condition of the sewer shall be submitted for the review of the Engineering Division.

The hard copy report shall be accompanied by a colour video of the sewer inspection and a computer disk coded using WRc Defect Coding Standards.

The format and media of the video and computer disk shall be approved by the Engineering Division.

**2.3     STORM WATER MANAGEMENT****2.3.1     Objectives**

The City of Thunder Bay follows the recommendations of the Province regarding the implementation of watershed management planning and the promotion of a comprehensive ecosystem approach. All new developments and re-developments will have storm water management infrastructure that is appropriate for the reduction of the environmental impact of storm water discharge on receiving waters.

A Storm Water Management (SWM) plan will be required for all new developments and re-developments. The SWM plan shall incorporate a combination of Best Management Practices (BMP), Low Impact Development (LID), and end-of-pipe facilities, such as SWM ponds and oil/grit separators, as appropriate.

The guidelines as outlined in the Stormwater Management Practices Planning and Design Manual (Ontario Ministry of Environment et al. 2003) or the latest revision thereof, shall be used in the design of storm water facilities and shall comply with the policies of the M.N.R.F. and Lakehead Region Conservation Authority to the satisfaction of the Engineering Division.

The goals of Storm Water Management are:



- a) to preserve groundwater and baseflow characteristics;
- b) to protect water quality;
- c) to protect downstream watercourses from undesirable geomorphic change;
- d) to minimize the risk of injury and property damage resulting from floods exceeding the capacity of the piped (minor) storm sewer system and the capacity of the overland (major) storm flow routes;
- e) to protect wetlands, lakes, and rivers;
- f) to protect natural topography, bluffs, and biologically significant areas;
- g) to protect wooded areas, native trees, shrubs, and grasses;
- h) to develop in sustainable fashion by mimicking natural hydrology of the site; and,
- i) to reduce nutrient, sediment, metals and other pollutant loading to the Area of Concern (AOC).

New development and re-development projects should be designed using Best Management Practices (BMP) techniques, such as Low Impact Development (LID) methods, which are applied early in the design process to preserve natural areas, reduce impervious cover, distribute runoff and use pervious areas to more effectively treat stormwater runoff. The use of conventional and end-of-pipe facilities are also acceptable for use in combination with BMP's (i.e. treatment train approach), and where it can be shown that BMP's are not suitable for use due to site specific conditions.

Site design shall address and consider open space protection, impervious cover minimization, runoff distribution and minimization, and runoff utilization, as outlined below:

- a) Open space protection and restoration
  - i. Conserve and protect existing natural areas (upland and wetland);
  - ii. Implement reforestation efforts;
  - iii. Re-establish dominant forest type;
  - iv. Restore wetlands;
  - v. Establish or protect stream, shoreline and wetland buffers; and,
  - vi. Re-establish native vegetation into the landscape.
- b) Reduction of impervious cover
  - i. Reduce new impervious cover through re-development of existing sites and use of existing roadways, trails etc.;
  - ii. Minimize street width, parking space size, driveway length, and sidewalk width; and,
  - iii. Reduce impervious surface footprint (e.g. two story buildings, parking structures).
- c) Distribution and minimization of runoff



- i. Utilize vegetated areas for stormwater treatment (e.g. parking lot islands, vegetated areas along property boundaries, front and rear yards, building landscaping);
  - ii. Direct impervious surface runoff to vegetated areas or to designed treatment areas (roofs, parking, driveways drain to pervious areas, not directly to storm sewer or other conveyances); and,
  - iii. Encourage infiltration and soil storage of runoff through grass channels, soil compost amendment, vegetated swales, rain gardens, etc.
- d) BMP treatment train
  - i. Utilize a connected network of pre-treatment practices, BMP's, such as LID's, and proprietary devices.
- e) Runoff utilization
  - i. Capture and store runoff for use for irrigation in areas where irrigation is necessary.

### **2.3.1.1 Storm Water Rate and Volume Control**

Storm water rate and volume control is required where increased storm volume and peak discharge rate, due to development, will cause detrimental impacts downstream of the development site via flooding and erosion. A site-specific storm water management assessment will identify the detailed storm water management methods required to comply with the City and MOECC standards.

Site-specific controls are required where post development peak discharge rates for the 2-year through 100-year storm events exceed the pre-settlement rates for the development lands. Pre-settlement conditions, based on historic land cover typical for the development site, are generally defined for the City as land use of mixed forest with soils as currently mapped.

For new development, the minimum volume control required is to maintain post-development volume at pre-settlement levels for the 2-year event. In developments with high percentages of impervious surfaces, pre-settlement levels can be attained through site storage and infiltration methods (for additional information, refer to Section 3.6.2 of the *City of Thunder Bay Stormwater Management Plan – Volume I – April 2016*). Additional rate and/or volume controls may be required where the receiving storm sewer and/or watercourse are at capacity, or where existing flooding or erosion problems have been identified.

Re-development that proposes to disturb more than 50% of existing impervious surfaces must meet the stormwater rate and volume criteria for the entire site, otherwise, the stormwater rate and volume criteria will apply only to net increase in impervious surfaces. Notwithstanding, for road and other linear projects, only the



net increase in impervious surfaces will be considered. The stormwater rate and volume control criteria are summarized in the table below:

**Stormwater Rate and Volume Control Criteria**

Development Scenario	Trigger	Rate Criteria	Volume Criteria	Other Criteria
<b>New Development</b>	All development. Modified submittal requirements for Site area < 1,000 m <sup>2</sup>	Match Post-Development peak rate to Pre-Settlement peak rate for 2-year through 100-year events	Match Post-Development runoff volume to Pre-Settlement runoff volume for the 2-year event	Do not cause erosion or flooding damage downstream of site.  Do not exceed capacity of downstream infrastructure.
<b>Re-Development</b>	Disturbs > 50% existing impervious (criteria apply to entire site) OR Net increase in impervious surfaces	Match Post-Development peak rate to existing peak rate for 2-year through 100-year events	Match Post-Development runoff volume to Pre-Settlement runoff volume for the 25 mm event	

### **2.3.1.2 Storm Water Quality Control**

Water quality controls are to be implemented on all developments and re-developments in accordance with the MOECC's enhanced level of protection (level 1), which requires the long-term average removal of 80% of total suspended solids. For re-development projects, quality treatment is required for the new impervious surfaces, such as parking lot expansions, and where greater than 50% of the existing impervious surface will be disturbed; otherwise, treatment of existing impervious surfaces is encouraged where possible.

The use of BMP's are encouraged to address water quality requirements where impervious surfaces can be directed to pervious surfaces. The use of conventional and end-of-pipe facilities are also acceptable for use in combination with BMP's (i.e. treatment train approach), and where it can be shown that BMP's are not suitable for use due to site specific conditions.

Subdivision level development will generally incorporate an end-of-pipe SWM facility which will provide quality and quantity control functions, in combination with upstream linear BMP's, and lot level and conveyance controls. Pre-treatment measures are required for infiltration based BMP facilities to reduce sediment loading to the infiltration areas. SWM ponds are to be incorporated adjacent to existing natural features and park facilities. The City will determine safety, aesthetic and additional maintenance criteria based on each specific development. Separate SWM pond and BMP planting plans are required for all new facilities and are to be approved by the City's Parks Division.



Developers are required to maintain and monitor the operation of detention ponds, BMP's, and all SWM facilities to ensure the facility meets the criteria outlined in the design brief and the current MOECC criteria prior to the City assuming the facility. Performance testing, such as TSS removal, infiltrations rates, etc., and satisfactory results, over a six month period, or minimum two storm events will be required prior to the City assuming responsibility for City owned facilities.

The developer is responsible to provide an Operation and Maintenance Manual, including a record of all inspection and maintenance works completed while under the developer's ownership, to the City prior to the City assuming the facility. The developer shall complete a final maintenance program, including oil and sediment removal, weed removal, supplemental planting, etc., to the satisfaction of the City, prior to the City assuming the facility.

For private developments, the property owner shall be responsible for the long term operation and maintenance for all SWM facilities. Operation and Maintenance Manuals, including inspection schedules and procedures are to be included with the design brief and incorporated into Site Plan Control and Development Agreements.

Oil/grit separators may generally be used for catchment areas of  $\leq 2$ ha where alternative quality control facilities, such as BMP's, are not practical due to site specific conditions. When completing sizing calculations for oil/grit separators, the following requirements shall apply:

- a) TSS removal efficiency to the Enhanced level of treatment is required, based on treating 90% of the annual runoff volume, as per the MOECC Guidelines.
- b) The following particle size distribution should be used:

<b>Particle Size Distribution</b>	
Particle Size Fraction [ $\mu\text{m}$ ]	Percent by Mass [%]
$\leq 20 \mu\text{m}$	20
$20 \mu\text{m} \leq x \leq 40 \mu\text{m}$	10
$40 \mu\text{m} \leq x \leq 60 \mu\text{m}$	10
$60 \mu\text{m} \leq x \leq 130 \mu\text{m}$	20
$130 \mu\text{m} \leq x \leq 400 \mu\text{m}$	20
$400 \mu\text{m} \leq x \leq 4000 \mu\text{m}$	20

*\*Adapted from the MOE SWM Planning & Design Manual (1994)*

Alternative particle size distributions may only be used if approved by the City Engineer.

- c) The owner is responsible for inspecting, maintaining, and repairing oil/grit separators located on private property. Operation and Maintenance requirements for oil/grit separators are to be identified in the SWM report for the property and shall be implemented by the owner to ensure the continued performance of the



system as designed. Maintenance records are to be provided to the City upon request.

The quality of discharged storm water shall also comply with the City's Sewer Use By-law (By-law 373-1992).

#### **2.3.1.3 Dedication for Watercourses**

Where a subdivision is traversed by a watercourse, drainage way, channel or stream, a stormwater separation, right-of-way, or park dedication, whichever the Planning Services Division may deem the most appropriate, will be required, including a buffer corridor that conforms to the lines of such watercourses, should be also provided.

- a) Vegetative Buffers: The purposes served for vegetative buffers include bank and shoreline stabilization; erosion prevention; filtration of nutrients, sediments, and other pollutants from storm flows; protection of stream beds and banks and mitigation of downstream flooding through moderation of peak flows both into and within the resource; regulation of in-stream temperatures; preservation of aquatic and terrestrial habitat; protection of scenic resources; and maintenance of property values.
  - i. Protected stream buffers with a minimum width of 15 meters, as measured from the top of bank, is required;
  - ii. Before any disturbance of ground vegetation or contour, or placement of any structure on the ground, a declaration, separation, or other instrument acceptable to the City must be implemented; and,
  - iii. The buffer should be indicated by either permanent, flush to the ground markers or permanent, post markers at the buffer's upland edge, with a design and text approved by the City.
- b) The following activities are prohibited within a stream buffer:
  - i. Creating impervious cover;
  - ii. Excavation or placing fill or debris; and,
  - iii. Altering vegetation, such as mowing, landscaping, and applying fertilizer except for as approved in writing by the City and the removal of invasive exotic species or trees for disease control or re-vegetation.

#### **2.3.1.4 Wetland Inundation and Source Control**

New development shall not increase the bounce (fluctuation) in water level or duration of inundation beyond the specified limit, for a 24-hour precipitation event with a return frequency of 2-, 10-, and 100-years, for any downstream wetland within 300 meters as outlined in the table below:



### Bounce and Inundation Period Standards

Wetland Susceptibility Class	Permitted Storm Bounce	Inundation Period for Two-Yr event	Inundation Period for 10- and 100- Yr Event
1. Highly susceptible	Existing	Existing	Existing
2. Moderately susceptible	Existing plus 0.15 metres	Existing plus 1 day	Existing plus 7 days
3. Slightly susceptible	Existing plus 0.3 metres	Existing plus 2 days	Existing plus 14 days
4. Least susceptible	No limit	Existing plus 7 days	Existing plus 21 days

Note: Wetland susceptibility classification is determined based on wetland type:

- Highly susceptible wetland types include: sedge meadows, bogs, coniferous bogs, open bogs, fens, coniferous swamps, lowland hardwood forests, and seasonally flooded basins.
- Moderately susceptible wetland types include: shrub-carrs, alder thickets, fresh (wet) meadows, and shallow & deep marshes.
- Slightly susceptible wetland types include: floodplain forests and fresh wet meadows or shallow marshes dominated by invasive species.
- Least susceptible wetland includes severely degraded wetlands. Examples of this condition include cultivated hydric soils, dredge/fill disposal sites and some gravel pits.

#### **2.3.1.5 Wetland Impacts**

The following shall apply where wetland designated areas may be disturbed as a result of development (in addition to any other requirements from other approval authorities such as the LRCA, MNRF, etc.):

- Applicants must adequately explain and justify each individual area of wetland alteration in terms of impact avoidance and minimization alternatives considered.
- Wetland replacement: Wetland Replacement must be located within the watershed and as close as possible to the site of impact. Qualifying City or Provincial impacts may be mitigated outside the watershed. However, the balance of replacement, required below, must be located within the watershed.
- Wetland Replacement Ratios: Full replacement of all wetland functions is required at the following ratios (new wetland area : impacted wetland area):
  - 6:1 for impacts to wetlands in Class 1 Highly Susceptible;
  - 4:1 for impacts to wetlands in Class 2 Moderately Susceptible;
  - 3:1 for impacts to wetlands in Class 3 Slightly Susceptible; and,
  - 2:1 or minimum required by City, whichever is greater for impacts to wetlands in Class 4 Least Susceptible.
- Eligible Replacement Activities & Priorities: The following activities, listed in order of priority, are eligible for replacement credit. Applicant must first consider replacement of unavoidable impacts by restoring or, if wetland restoration opportunities are not reasonably available, creating replacement wetland areas having equal or greater function. Restoration and creation activities eligible for replacement credit include:



- i. Restoration of completely drained or filled wetland areas;
  - ii. Restoration of partially drained or filled wetland areas;
  - iii. Upland buffer areas (established or preserved);
  - iv. Vegetative restoration of farmed wetlands; and,
  - v. Wetland creations.
- e) If the above activities are not reasonably available to satisfy the entire replacement required, the following additional activities, where they protect or improve the functions of wetlands, should be considered for replacement:
- i. Protection of high quality upland;
  - ii. Protection of landlocked basins;
  - iii. Protection and restoration of corridor connections; and,
  - iv. Those activities preserving wetland functions are eligible for 25% replacement credit on an area basis. Those activities restoring and preserving wetland functions are eligible for 50% replacement credit on an area basis.

#### **2.3.1.6 Coldwater Streams**

When a stormwater management facility discharges to a cold water stream, either via a directly connected (i.e. storm sewer) system or within 30 meters via grassed or naturally vegetated conveyance path, the facility should be designed such that the discharge from the project will minimize any increase in the temperature of cold water stream receiving waters resulting from the 2-year, 24-hour precipitation event. Projects that discharge to cold water streams must minimize the impact using one or more of the following measures, in order of preference:

- a) Minimize new impervious surfaces;
- b) Minimize the discharge from connected impervious surfaces by discharging to vegetated areas, or grass swales, and through the use of other non-structural controls;
- c) Infiltration or other volume reduction practices to reduce runoff in excess of pre-settlement conditions (up to the two (2) year 24 hour precipitation event);
- d) If ponding is used, the design must include an appropriate combination of measures such as shading, filtered bottom withdrawal, vegetated swale discharges or constructed wetland treatment cells that will limit temperature increases. The pond should be designed to draw down in 24-hours or less; and
- e) Other methods, as approved by the City, which will minimize any increase in the temperature of the coldwater stream.



### **2.3.2 Minor/Major Systems**

The Minor System is the underground piped sewer system designed to carry away storm water from the area in accordance with the City Storm Sewer Design Criteria. The Major System is the overland flow route which will be followed by the storm sewer water when the capacity of the Minor System is exceeded.

The route for the major storm flow shall be over publicly owned rights-of-way and open space areas and not through private property.

In the event an overland flow route entirely on publicly owned lands cannot be achieved by reasonable regrading of the lands the design engineer may make application to the Engineering Division for approval to drain over privately owned lands.

Any approval to allow the major storm route to cross privately owned lands will require the developer to provide specialized drainage plans for the approved locations, wider than normal drainage easements and specialized drainage facilities as may be deemed appropriate by the Engineering Division.

### **2.3.3 Requirements**

All developments shall be designed to minimize the possibility of backup of the minor storm system into any foundation drain system and to provide for the safe overland flow for all storm water in excess of the capacity of the piped storm drainage system.

All roof water shall be discharged onto splash pads on the ground and directed to pervious surfaces and BMP facilities, such as rain gardens, as much as practical, and the overflow should be directed to the street.

All lots shall be contoured so that the rear yards will drain to the street. The only exception to this will be situations where existing contours and reasonable regrading by the addition of fill material will not allow front street drainage of the rear yard. Alternate methods of draining rear yards such as swales, catchbasins or through lot drainage will only be considered on a site specific basis and will require a pre-design consultation with the Engineering Division.

All new paved parking larger than 250 m<sup>2</sup> in area require stormwater quality treatment being draining to the municipal drainage system. Drainage from parking areas should be directed to pervious surfaces and BMP facilities as much as possible to meet the quality control requirements. Catch basins, oil-grit separators, and other proprietary devices are acceptable methods of meeting quality control where site specific conditions do not allow for BMP facilities.



In instances where the local storm system can accommodate the flows parking lot storm sewer systems shall be designed to a five year return storm, otherwise the two year return storm shall be used.

#### **2.3.4 Design Brief**

All development, whether designated as either Major or Minor Site Alteration, is required to comply with the Storm Water Rate and Volume Control and Quality Standards, and must submit a Stormwater Management Design Brief. The requirements and scope of the Design Brief will be determined by the City Engineer, or a qualified person approved by the City Engineer, and will vary based on the scope and designation as Major or Minor Site Alteration. Below is an outline of the contents to be included in a typical Design Brief for new development designated as Major Site Alteration:

- a) Overview
  - i. A description of the site alteration activities;
  - ii. A key map showing the location of the site, site boundaries, number of hectares of the site, the site address or legal description, the nearest major intersection, a legend, scale, and a north arrow; and,
  - iii. A list of all required and/or obtained permits from other regulatory agencies (i.e. LRCA, MNRF, DFO, etc.).
- b) Existing Conditions
  - i. A field survey of the existing site topography at a contour interval not to exceed one half of one metre determined in accordance with the Canadian Geodetic Datum and with spot elevations along the property to clearly show the existing drainage patterns on the site and the adjacent sites and for all development designated as major site alteration, to extend into adjacent lands to understand the potential impacts of drainage both from and to adjacent lands, i.e. a minimum of thirty (30) metres beyond the site boundary for large development such as subdivisions;
  - ii. The location of lakes, streams, wetlands, channels, ditches, other water courses, Environmental Protection Zones, and all other water bodies that will receive stormwater from the construction site, during or after construction, on and within three hundred (300) metres beyond the site boundary;
  - iii. The location of the regulatory storm flood line and fill regulation lines;
  - iv. The location and identification of predominant soil types;
  - v. The location and species types of existing vegetative cover , including the species and size of all trees and shrubs;
  - vi. The location and dimensions of any existing and proposed stormwater drainage systems and natural drainage patterns on and within thirty (30) metres beyond the site boundary; and,



- vii. The location and dimensions of utilities, structures, roads, highways and paving on the site within thirty (30) metres beyond the site boundary.
- c) Proposed Conditions
  - i. The location and dimensions of all proposed site alteration activities;
  - ii. The location, dimensions and use of the buildings and other structures existing or proposed to be erected on the site;
  - iii. The location of driveways on each site and all easements and right-of-way over, under, across or through each site;
  - iv. The identification of the proposed finished grade elevations of the site;
  - v. The location and dimensions of all proposed temporary stockpiles for fill, soil and other materials;
  - vi. The location and dimension of all proposed access routes from roadways;
  - vii. The location and dimensions of all proposed staging areas for equipment; and,
  - viii. An indication on the drawing of the directions of overland flow and overland flow routes.
- d) Erosion and Sediment Control
  - i. The Erosion and Sediment Control (ESC) Plan should propose BMP's to control the discharge of sediment and/or other potential pollutants from the site. A provision should instruct the installation of ESC measures before initiation of site alteration;
  - ii. Narrative regarding the potential for discharge of sediment and/or other potential pollutants from the site;
  - iii. Identification of a person knowledgeable and experienced in the application of erosion prevention and sediment control BMP's who will oversee the implementation of the ESC Plan;
  - iv. A schedule of the anticipated start and completion dates of each land disturbing or land developing activity including the installation of erosion control measures needed at the site to meet the requirements of these standards;
  - v. Any specific chemicals and the chemical treatment systems that may be used for enhancing the sedimentation process on the site and how compliance will be achieved must be described;
  - vi. Estimated preliminary quantities anticipated for the life of the project must be included for all erosion prevention and sediment control BMP's (e.g., linear meters of silt fence, square metres of erosion control blanket, mud mats, etc.);
  - vii. The nature of stormwater runoff and run-on at the site, including factors such as expected flow from impervious surfaces, slopes, and site drainage features.
  - viii. If any stormwater flow will be channelized at the site, the applicant must design BMP's to control both peak flow rates and total stormwater volume to minimize erosion at outlets and to minimize downstream channel and stream bank erosion; and,
  - ix. Provisions for the maintenance of the site and control measures and a schedule for monitoring procedures during construction including a mud tracking prevention



program which describes the procedure for mud tracking prevention and road clean up and designating a contact person for such a program throughout each land disturbing and land developing activity.

- e) Stormwater Management – Rate and Volume Control, Quality Control
  - i. The expected amount, frequency, intensity, and duration of precipitation, including the criteria for the design of the major/minor storm water systems including runoff coefficients, storm return period, initial inlet time, pipe friction factors, etc.
  - ii. Calculations showing the peak flows of storm water to be handled by the major/minor storm water systems from within the development, for tributary areas outside the development and for backwater effects during the major storm event.
  - iii. The design engineer shall also provide calculations to verify that surface drainage under major storm conditions will not result in significant erosion or flooding.
  - iv. A plan of the development showing the major/minor storm systems including all water courses, contributing areas, manholes, catch basins, pipes, outfalls, as well as the major storm route, all drainage easements/rights of way and showing the extent of the flooded area expected during the major storm event.
  - v. Supporting calculations for the sizing and design of all stormwater quantity and quality control facilities.
  - vi. Calculations showing development will not increase the bounce in water level or duration of inundation beyond the specified limit in immediately downstream receiving wetlands;
  - vii. The number of hectares of impervious surface for both pre- and post-construction must be specified;
  - viii. Methods used to minimize soil compaction and preserve topsoil must be described. Minimizing soil compaction is not required where the function of a specific area of the site dictates that it be compacted;
  - ix. The location, dimensions, design details and design calculations of all site control measures, including plan and profile drawings of stormwater management facilities, rate control devices, and erosion control devices necessary to meet the requirements of these standards; and
  - x. Standard details and/or specifications for the BMP's used on the project must be included in the final plans and specifications for the project.
- f) Operation and Maintenance Plan
  - i. A maintenance plan that includes, but is not limited to, who will conduct the maintenance, type of maintenance needed, maintenance intervals, standard inspection forms, and demonstrating that at the time of final stabilization that the stormwater facilities conform to design specifications.



g) Site Completion

Methods to be used for final stabilization of all exposed soil areas must be described. Final stabilization is not complete until all requirements outlined below are complete:

- i. All soil disturbing activities at the site have been completed and all soils are stabilized by a uniform perennial vegetative cover with a density of 70 percent of its expected final growth density over the entire pervious surface area, or other equivalent means necessary to prevent soil failure under erosive conditions;
- ii. The permanent stormwater management system is constructed and is operating as designed. Temporary or permanent sedimentation basins that are to be used as permanent water quality management basins have been cleaned of accumulated sediment. All sediment has been removed from conveyance systems and ditches are stabilized with permanent cover;
- iii. All temporary synthetic and structural erosion prevention and sediment control BMP's (such as silt fence) have been removed. BMP's designed to decompose on site (such as some compost logs) may be left in place;
- iv. For residential construction only, individual lots are considered finally stabilized if the structure(s) are finished and temporary erosion protection and down-gradient perimeter control has been completed; and,
- v. For construction projects on agricultural land (e.g., pipelines across crop, field pasture or range land) the disturbed land has been returned to its preconstruction agricultural use.

h) List of Appendices

- i. Existing and Proposed Runoff Calculations;
- ii. Storage Calculations and Stage-Storage Discharge;
- iii. Storm Sewer Design Sheet;
- iv. Stormwater Management Facility Operation and Maintenance Manual; and Existing and Proposed Storm Catchment Drawings

### 2.3.5 **Lot Grading Plan**

In order to complement the storm water management design brief and to obtain the necessary approvals to construct the storm water management systems a complete set of grading plans for each lot and the development as a whole shall be submitted.

The grading plan shall show details of the grading of the property and shall include:

- a) Existing one metre contours and all existing natural drainage courses on the land to be developed.



- b) Existing elevations at each lot corner and at the centre of each lot at a point 10 m back from the front lot line.
- c) A review of existing drainage from surrounding properties. The proposed grading works are to have no negative impact on surrounding properties and must respect and accommodate existing drainage from surrounding properties.
- d) Proposed elevations as follows:
  - finished road elevations and grades;
  - finished grade elevations at all lot corners at each proposed building and at appropriate locations around large or multi-level buildings;
  - finished grade spot elevations along all swales, ditches, at each catch basin and at appropriate intervals on large sites such as parking lots and open space areas.
- e) Details to show how rear lot drainage will be directed to the street.
- f) Details for all drainage facilities which will be constructed, the size and location of all proposed drainage easements and the limits of any flooding anticipated as a result of a major storm event.
- g) For properties which will not be serviced by sanitary sewers, the location of the proposed septic field and alternate septic field location shall be shown along with the proposed design finished grade elevation of the septic fields.
- h) Where rear drainage is approved by the Engineering Division additional catch basins will be required as follows:
  - at intervals not exceeding 150 m along any drainage swale.
  - at any location where drainage from more than 6 urban residential lots or 500 m<sup>2</sup>, whichever is less, is discharged to a roadway.
  - at low points and bends in any drainage swale where in the opinion of the Engineering Division ponding may occur.
- i) The location of the Geodetic Datum used as a reference point for elevations on the lot grading plan shall be shown on the lot grading plan.
- j) The average slope of residential rear yard surfaces shall not exceed 10% and shall be measured by dividing the elevation difference by the distance using the following three measurements:



- between the rear of the building and the rear lot line.
  - between the rear of the building and the centre line of the rear swale.
  - from side lot line to side lot line over the full width of the lot.
  - the measurement giving the steepest grade shall govern.
- k) The grade difference in the rear yard shall be taken up by the use of grading as follows:
- generally the slope of the rear yard shall be between 1 1/2 % and 5% to maximize the useable area of the rear yard.
  - Slopes shall be 1:2 maximum at the extremities of the property when matching surrounding lands.
  - retaining walls shall be used to reduce the grade differentials to an acceptable amount wherever the finished grade between two adjacent properties exceeds 400 mm within 1.2m of the interior side lot line unless approved by the Engineering Division or where erosion of soil may occur.
  - where retaining walls are proposed they shall be contained on the higher property.
- l) The desirable depth of a drainage swale is 200 mm - 250 mm. Minimum depth shall be 150 mm and the maximum depth shall be 300 mm
- m) Drainage flows which are carried around buildings shall be contained in defined swales located as far from the building as practical.
- n) The type of building to be placed on the property shall be determined by the type of grading which is allowed by the topography of the land.
- o) Where rear drainage of the lot is approved by the Engineering Division all rain water downspouts shall be directed to the front of the lot and not directly into any drainage swale.
- p) At the Building Permit Stage for lots developed under a Plan of Subdivision or Consent to Sever through the Committee of Adjustment, and for all developments subject to a Planning Division Agreement, a lot specific grading plan must also be submitted and shall include:



- The proposed outline of the building(s), garage(s), driveway(s), parking lot, and the property boundary.
  - Proposed elevations along the perimeter and throughout the site, at each building corner, along the driveway(s), throughout the parking lot, and along any required swales or drainage features.
  - Proposed surface drainage arrows and surface slopes.
  - The underside of footing elevation(s) and finished floor elevation(s) for the building(s).
  - Roof drain outlet locations.
  - The lot number and municipal address.
- q) In areas where in the opinion of the Engineering Division existing or future ground water levels may compromise basement construction the following shall be shown on the Grading Plan:
- i) Elevation of existing ground water table elevation.
  - ii) Estimate of future ground water table elevation.
  - iii) Minimum foundation footing elevation.
- r) In areas of development adjacent to water courses the Engineer in consultation with the Lakehead Region Conservation Authority shall determine the possible effects of hydrostatic ground water fluctuations during storm events on the building foundation and provide minimum footing elevations or other measures to mitigate such effects.
- s) Parking lots shall be contoured to pond water to a maximum depth of 300 mm at each catch basin during the 100-year storm event. Where parking lot storage is used as a form of stormwater quantity control, the 2-year storm event shall generally be stored underground.

### **2.3.6 Lot Grading**

The grading of the lands shall be carried out in accordance with the lot grading plans. Prior to the granting of initial acceptance for the surface work portion of the development, the Developer shall supply the Engineering Division with a certificate signed by his consulting engineer indicating that the property as a whole has been graded in conformity with the lot grading plan.



**2.3.7      Storm Sewer Location**

The storm sewer shall be located on the road allowance as shown on the standard drawings included in this manual or as otherwise authorized by the Engineering Division.

The minimum depth of cover on the storm sewer shall be 1.8 m below the road surface measured to the top of the pipe.

**2.3.8      Pipe Sizes and Strength**

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

Pipe sizes up to and including 375 mm diameter shall be P.V.C. sewer pipe having a minimum S.D.R. of 35 conforming to O.P.S.S. 1841.

Pipe sizes larger than 375 mm diameter shall be reinforced concrete pipe conforming to CSA A257.2-M1982 strength classification 100-D. (formerly Class IV).

At the discretion of the City Engineer, HDPE pipe meeting the criteria outlined in Section 2.3.17 may be used for pipe sizes up to and including 900mm diameter. Additional testing and inspection may be required where HDPE is approved for use, including deflection testing in accordance with OPSS 410.

**2.3.9      Manholes**

Manholes shall be located not more than 110 m apart and the same requirements as for sanitary sewer manholes are to be met. Drop manholes are not required for storm sewers of 450 mm diameter and larger.

All manholes exceeding 5.0 m in depth must have a safety platform as per OPSD 404.020.

The fall through manholes over the slope of the sewer shall be in accordance with the table provided in Section 2.2.11.

Where catch basin manholes are approved for use, a minimum sump depth of 300mm is required.

**2.3.10    Building Connections (Storm Sewer)**

Storm sewer connections to single family residential buildings when provided shall be minimum 100 mm diameter and be constructed in accordance with standard drawing S-103. The minimum grade for all residential storm sewer building



connections shall be 2%. All storm sewer building connections into storm sewers shall be made using an approved tee or approved saddle and machine cut connection hole.

Any roof drainage shall be directed to the surface and shall not be directly connected to the storm sewer unless permission has been received from the Engineering Division.

Individual separate connections from the building to the sewer main shall be provided to all portions of buildings which may be held in separate ownership.

At the discretion of the City Engineer, storm sewer connections for commercial, industrial and institutional properties shall require a manhole located on the property line for maintenance access and inspection purposes.

### **2.3.11 Rainfall Intensity**

The rainfall intensity shall be determined from the curves listed in the standard drawings included in this manual.

For all new developments, assuming a major system can be adequately provided, the criteria for the design of the minor system is a 5-year return storm. In re-development areas, a lesser standard, such as the 2-year return storm, may be accepted at the discretion of the City Engineer provided that a major system can be adequately provided and foundation drains are either non-existing or are connected via sump pump and check valve systems. For all scenarios, the combination of the minor and major system should be checked for a total capacity to accommodate either the regional storm or the 100 year storm event whichever results in the greater peak flows. Where overland flows can cause unacceptable flooding on roadways or on private property, the minor system shall be enlarged to reduce the flooding to acceptable levels.

Storm sewers on arterial roads and trunk storm sewers shall be designed for a 10-year return period.

Storm sewers, in areas where flooding will cause an unacceptable barrier to access or in low lying areas susceptible to flooding, shall be designed for a higher return period at the discretion of the Engineering Division.

The initial inlet time for runoff entering the storm system shall be ten minutes including overland flow time unless otherwise authorized by the Engineering Division.



### **2.3.12     Calculating Runoff Flows**

For the design of stormwater management facilities with a drainage area of five hectares and larger, a UNIT HYDROGRAPH program such as PCSWMM, Visual OTTHYMO, or other suitable technique shall be used to calculate the flows.

For all storm sewer designs, and the design of stormwater management facilities less than five hectares, either the RATIONAL METHOD or a UNIT HYDROGRAPH program for calculating flows may be used. When using the "Rational Method" of calculating flows the following design criteria shall be used.

$$Q = 2.78 A.I.R.$$

Where	Q=	Peak Flow in litres/second (L/s)
	A=	Area in hectares (ha)
	I =	Rainfall intensity in millimeters/hour (mm/hr)
	R=	Runoff co-efficient

### **2.3.13     Runoff Co-efficients**

#### **a) Residential**

- |  |          |
|--|----------|
| 1. With rear lot drainage not flowing directly onto the street, area including road allowance plus 15 m from the street line on both sides | R = 0.40 |
| Remainder of Lot area  | R = 0.20 |
| 2. When all of the lot slopes toward the street, total area plus the road allowance  | R = 0.30 |
| 3. Row Housing   | R = 0.60 |

#### **b) Park Land** R = 0.20

#### **c) Playgrounds** R = 0.25

#### **d) Commercial and Industrial** R = 0.60 to 0.75

#### **e) Asphalt, Concrete, & Roof Areas** R = 0.90

#### **f) Gravel Areas** R = 0.60

For new developments, the runoff co-efficient shall be calculated based on the breakdown of pervious and impervious areas using the values provided above and the



Ministry of Transportation Drainage Management Manual Design Chart 1.07 (latest edition).

### **ALLOWABLE INFILTRATION/EXFILTRATION**

The allowable infiltration/exfiltration for sewer pipe shall not exceed 0.075 litres per millimeter of pipe diameter per 100 metres of sewer pipe. Infiltration/exfiltration shall be measured in accordance with O.P.S.S. 410.

#### **2.3.14 Roughness Co-efficient**

When capacities of pipe are calculated using the Manning Formula the roughness co-efficient "n" shall not be less than 0.013 for all smooth walled pipe and 0.025 for corrugated metal pipe.

#### **2.3.15 Velocity**

All sewers shall be designed and constructed to give when flowing full a minimum velocity of 0.80 m/s and a maximum velocity of 6.0 m/s unless otherwise authorized by the Engineering Division.

All sewers with slopes such that flow velocities will approach “critical velocity” shall be designed so as to reduce turbulence.

All sewers shall be designed and constructed so that surcharging above the pipe obvert from backwater condition does not occur.

In the event the surcharging under backwater conditions is deemed minor in the opinion of the Engineering Division and mitigating measures are not required to eliminate such surcharging the following conditions shall be complied with:

- a) The level of surcharging in the sewer shall be plotted on the profile view of the sewer.
- b) The surcharging shall not extend into any lateral connection past the property line of any land served by the sewer.

#### **2.3.16 Catch Basins**

Catch basins shall be not more than 100 m apart with each side of the road being considered separately. Catch basins shall be constructed at the low points in the road grade and at the beginning of corner curves at intersections to catch the water before it flows around the corner. The following spacing for catch basins are recommended:



- 100 m apart with road grades up to 3%
- 90 m apart with road grades from 3.1 % - 4.5%
- 75 m apart with road grades over 4.5%
- in instances where the Engineering Division approves the construction of a road with a grade in excess of 6% double catch basins shall be used.

Catch basins shall be installed at mid-lot locations to avoid conflict with driveway entrances and shall not be installed at locations which coincide with fire hydrant locations.

Catch basins shall be connected into the storm sewer at manholes using Polyvinyl Chloride (PVC) SDR 35 pipe.

The connection into each manhole shall be made so that the flow from the catch basin does not oppose the flow in the sewer.

Catch basins which do not have a sump shall not be connected directly into the storm sewer system.

The minimum size for catch basin leads is 250mm diameter. For catch basins connection in series, the downstream catch basin lead shall be increased to 300mm diameter.

### **2.3.17 Culverts**

Roadway cross culverts under arterial roads shall be designed to accommodate a storm with a twenty-five year return period.

All other roadway cross culverts shall be designed to accommodate a ten year return storm.

Driveway culverts on arterial roads and in other locations where flooding will result in unacceptable damage or barrier to access shall be designed to accommodate a ten year return storm unless otherwise authorized by the Engineering Division.

Driveways in these locations shall require edge of driveway surface protection (concrete headwalls, rip rap, asphalt). The method of edge protection applied shall be reviewed and approved by the Engineering Division prior to construction.

Construction methods for pipe culvert installations shall be in accordance to OPSS 421 as they apply to the specifications listed below.



Driveway and roadway culverts shall be either aluminized type 2 corrugated steel pipe or high-density polyethylene (HDPE) pipe and shall meet the following specifications:

### Aluminized

Shall have a minimum wall thickness of 2.0 mm, subject to the following exceptions:

- a) Driveway culverts 300 mm in diameter or smaller with 300 mm or more of earth cover may be 1.6 mm wall thickness.
- b) The wall thickness of driveway and roadway culverts of sizes larger than 900 mm shall be determined by the Engineering Division on a site specific basis.

### HDPE

Shall be an open profile HDPE pipe (corrugated exterior with a smooth interior wall) manufactured according to CSA B182.8 and certified by an independent 3<sup>rd</sup> party agency as per OPSS 1840.

The minimum pipe stiffness shall be 320 kPa and the maximum diameter shall be 900mm.

Pipe joints shall typically be type 3 (external split coupler) with the exception where water tight gaskets are specified for certain applications.

Install metal locate piece (U bolt) at ends of HDPE culverts.

## **2.3.18 Television Inspection**

Prior to acceptance, and prior to placing top course of asphalt, all sewers shall be inspected using pan and tilt closed circuit television sewer inspection camera.

A hard copy report outlining the condition of the sewer shall be submitted for the review of the Engineering Division.

The hard copy report shall be accompanied by a colour DVD of the sewer inspection and a computer disk coded using WRC Defect Coding Standards.

The format and media of the DVD and computer disk shall be approved by the Engineering Division.



**2.3.19     Erosion Protection and Sediment Control**

An Erosion and Sediment Control (ESC) Plan should be completed and submitted as part of all construction and development project approval and prior to site alteration activities, and should address construction and post-construction conditions. An ESC plan should include but may not be limited to the following requirements:

- a) Protection of receiving water bodies, wetlands, and storm sewer inlets;
- b) Significant effort shown to minimize the following:
  - i. Disturbance of natural soil cover and vegetation;
  - ii. Exposed soil and unstable soil conditions;
  - iii. Off-site sediment transport on trucks and equipment;
  - iv. Work in and adjacent to water bodies and wetlands; and
  - v. Compaction of site soils.
- c) Description of areas within the site that have potential for serious erosion or sediment transportation problems;
- d) A delineation and description of the measures to be undertaken to prevent erosion and to retain sediment on the Site, including but not limited to, the designs and specifications for swales, dikes, drains, sediment control ponds, and a schedule for their maintenance and upkeep;
- e) A delineation and description of the vegetative measures to be used, including, but not limited to, mulches, types of seeds and fertilizers and their application rates, the type, location and extent of pre-existing and undisturbed vegetation types and a schedule for maintenance and upkeep;
- f) Description of any new ESC techniques and effective measures provided such techniques are proven to be as or more effective than the equivalent ESC;
- g) Record keeping procedure including sample inspection and maintenance forms. Maintenance record-keeping procedure including name of the person who will keep the inspection and maintenance records;
- h) An estimate of the cost of implementing and maintaining all interim ESC measures as per standards acceptable to the Municipality; and

**2.3.20     Catch Basin Retrofit - Policy**

In order to address drainage concerns of privately owned occupied lands which are not subject to a current land development proposal the following criteria shall be used to determine the need for installation of a publicly funded and maintained catch basin:



- 1) Areas involving more than one lot which have historically been subject to repeated flooding which for topographical reasons cannot be resolved by filling or regrading.
- 2) Areas involving public lands including open space, lanes, road allowances which for topographical reasons cannot be drained on surface and are impacting surrounding private lands to the extent that the City will incur liability.

Catch basins will not be installed by the City to correct flooding involving only a single lot. Such situations will require the lot owner to privately install and maintain the necessary catch basin and associated piping.

Prior to the installation of any catch basin and piping the land owner shall obtain all necessary approvals for the design and construction of the works from the Engineering Division.

All catch basins and associated piping constructed on privately owned lands shall be placed on an easement. The width of any easement shall be determined in accordance with Section 2.4.12.

Due to limitations on depth of bury of catch basin piping and accessibility limitations of catch basins, such facilities are subject to periods of time when they are inoperative resulting in temporary flooding.

The City will not accept liability for the consequences of such flooding.

The decision to install any publicly funded and maintained catch basin and associated piping shall be subject to available funding and shall be priority at the discretion of the Engineering Division.

### **2.3.21 Storm Sewer Outfalls into Lake Superior and Neebing McIntyre Floodway**

Storm sewers and outfall structures discharging into Lake Superior or the Neebing McIntyre Floodway system shall be designed in consultation with the Lakehead Region Conservation Authority (LRCA). The storm sewers shall be designed to accommodate backwater effects from normal seasonal/annual fluctuations in water levels of Lake Superior and the Floodway as well as fluctuations resulting from storm events.

The design shall be based on water level fluctuation criteria contained in Lakehead Region Conservation Authority Neebing McIntyre Integrity Evaluation Study.



Storm sewers outfalling into the Neebing McIntyre Floodway shall not impinge upon the integrity of the Floodway to act as a flood control device, per the Neebing McIntyre Floodway Agreement between the LRCA and the City of Thunder Bay.

#### **2.3.22 Storm Sewers located within the Approximate Regulated Area of the LRCA**

Storm sewers, outfall structures and any required site grading located within the approximate area of the LRCA will require a permit from the LRCA under the *Conservation Authorities Act*. It is noted that the approximate regulated area will include: all watercourse and adjacent lands; all Provincially Significant Wetlands and 120 meter adjacent areas; 15 meters landward and one kilometer lakeward from the 100-year Lake Superior flood level; ravines, valleys, steep slopes and talus slopes; hazardous lands including unstable soil and bedrock, and all land zoned Environment Protection.

### **2.4 ROADWAYS, CURBS, GUTTERS, SIDEWALKS, AND PARKING LOTS**

#### **2.4.1 General Construction**

All roads, curbs, gutters and sidewalks shall be constructed in accordance with the City of Thunder Bay Engineering Standards. All geometric design shall conform to the Transportation Association of Canada Geometric Design Guide for Canadian Roads (TAC) and the Integrated Accessibility Standards Regulation Guidelines Part 4.1 – Design of Public Spaces Standard.

As part of land development projects the proponent shall prepare a transportation analysis showing street classifications within the development and the effects of traffic from the development on streets that abut or may be affected by the development for the approval of the Engineering Division.

The width and cross section of the roads being constructed shall be as indicated on the applicable standard drawing for the classification of roads called for in the transportation study.

At the discretion of the City Engineer, two points of access / egress will be required for all residential developments greater than 25 lots or 25 units.

In the event a land development project includes provisions for a future road allowance to adjacent lands, at the discretion of the City Engineer, the developer may be required to either construct the road allowance within their lands or to provide a deferred service payment to the City for the future construction.



### 2.4.2 **Radii**

The minimum curb radius for the intersection of local streets shall be 8.0 m. This minimum radius shall be increased as required when local streets intersect at angles other than 90° and when the intersection involves collector or arterial streets.

When intersections involve collector or arterial streets the intersection radii shall be determined by using the appropriate turning movement design templates for the type of vehicular traffic which could be reasonably expected to use the intersection.

The minimum curb radius for intersections involving arterial roads shall be 12.0 m.

### 2.4.3 **Road Grades**

The minimum road grades on all streets shall be 0.30% with preferable being 0.50%. The maximum grade shall be 6% on all streets unless otherwise approved by the Engineering Division.

To maintain a route for the major storm drainage system, sags in roadways between intersections are not acceptable, unless a suitable overland outlet is provided.

### 2.4.4 **Concrete**

Concrete curb and gutters as required shall be built as indicated on the standard drawings included in this manual.

Allowable amounts of air shall be 5 - 8% air entrainment unless otherwise specified.

### 2.4.5 **Sidewalks**

Sidewalks in residential developments shall be 1.5 m wide. The running slope of sidewalks should not exceed 1:20 (5%) unless impractical due to the physical terrain.

Sidewalks as shown on the standard drawings included in this manual shall be constructed on all streets in accordance with the current revision of Corporate Policy Number 11-03-07, (Sidewalk Construction in New Development Areas). At the discretion of the City Engineer, new developments subject to Planning Division Agreements will be required to either construct new sidewalks along their property limits in accordance with this Policy, or to provide deferred service payments for the future installation of sidewalks by the City.

Tactile walking surface indicators (TWSIs) are required on curb ramps to warn people with disabilities that they are entering a potentially hazardous area. Curb ramps directing people across stop controlled side streets do not require TWSIs.



**2.4.6 Pavement Construction**

- a) All roadways shall be designed to satisfy the following minimum performance standards:
  - 1. Pavement, curbs, sewer manholes, catch basins shall not be subject to cumulative damage from movement due to frost action.
  - 2. During the first two years of service after the placement of top lift, any cracking of the pavement shall be minimal and shall be repaired by the developer in accordance with the City's Pavement Management System Guidelines.
  - 3. The pavement shall not require resurfacing for at least 15 years.
  - 4. All pavement shall be warranted by the developer for a minimum period of two years from the date of installation of the second lift. (This requirement is subject to the acceptance provisions for surface works contained in this manual)
- b) Prior to the City granting approval for the construction of roadways, the developer shall submit, for approval of the Engineering Division, a complete set of construction drawings prepared by a Professional Engineer for the roadways showing details of the proposed construction. The construction drawings shall be supplemented by a design brief prepared by a Professional Engineer specializing in Soils Engineering which include a review of the following:
  - 1. Log of bore holes showing soil types and their depths.
  - 2. Geodetic elevation of the water table including estimates of potential variations.
  - 3. Volume of traffic and loads to be expected.
  - 4. Make reference to the design criteria outlined in Section 2.4.6 (a)
  - 5. Review ground water conditions and potential variations to determine the need for subsurface drainage facilities.
  - 6. Identify the proposed use of the land served by the road as well as traffic volumes and loads to be expected.



7. Determine additional road base requirements (if any) required to accommodate construction traffic on partially completed roadways.
  8. Determine proposed design for pavement structure, road base, subbase and any subsurface drainage and specify the thickness of the asphalt and granular layers.
- c) The minimum road base design shall consist of two (2) - 40 mm layers HL4 asphalt, 150 mm Granular “A”, 500 mm Granular “B” all atop a road sub-base free from organic or frost susceptible material.
  - d) The mix design for all asphalt pavement shall be approved by the Engineering Division prior to placing.
  - e) Paved roadways with curb and gutter shall not be left indefinitely with only one layer of asphalt without suitable arrangements made to eliminate standing water on the pavement. Any such arrangements to disperse the standing water shall be proposed to the Engineering Division for approval prior to any pavement being laid. In the event that suitable arrangements to disperse the standing water are not approved then the second layer of asphalt paving must be placed immediately. The responsibility for the repair of any damage to the finished roadway shall remain with the developer until final acceptance has been granted.

### **2.4.7 Boulevards**

The boulevard shall be that area lying between the shoulder of the road or the concrete curb and the property limits of the adjacent private property not occupied by a sidewalk.

The boulevards shall have a uniform rising grade from the finished roadway to the property limits of minimum 2% where feasible. Deviation from this will be permitted depending on the existing contours in the area. The boulevards shall be sodded as outlined in Section 2.4.9.

### **Exceptions**

Where the distance between the edges of the sidewalk and the curbing is less than one (1) metre, the area may receive an asphalt surface, subject to the approval of the Engineering Division.

### **2.4.8 Walkways, Ramps and Stairs**



Walkways shall be that area lying between the limits of adjacent private properties designated for pedestrian access between streets to parkland, commercial or institutional sites.

All walkways shall have a 1.50 metre concrete sidewalk constructed on them for pedestrian travelers, and the walkway shall be fenced on both sides with a 1.829 m high chain link fence along the length of the walkway, with the exception of the portion of the fence that is located within the front yard set-back, which shall be 1.219m in height. Walkways shall be sodded as outlined in Section 2.4.9, between the sidewalk and the fence.

The running slope of walkways should not exceed 1:20 (5%) unless impractical due to the physical terrain.

Walkways that have a running slope greater than 1:20 (5%) and elevate the person above the surrounding terrain shall be considered a ramp. The maximum allowable running slope for a ramp shall be 1:15 (6.7%). The maximum cross slope of a ramp surface shall be 1:50 (2%). Ramp designs shall include all required landings, handrails, and edge protection as defined by the applicable design code.

Stairs shall have uniform riser heights (rise) and uniform tread depths (run). The stair riser height shall not be more than 175mm and not less than 125mm. The stair run depth shall not be more than 355mm and not less than 280mm. Handrails shall be installed on both sides of all stairs at a uniform height ranging between 865mm and 965mm above the stair nosing.

### **2.4.9 Sodding and Seeding**

The owner shall furnish all top soil, labour, material and equipment as required to complete the work as described.

#### **Within the Street Right of Way, Walkway Blocks, or City Easement**

Prior to the placing of top soil and sod the total area shall be fine graded to a uniform surface 100 mm minimum grade below controlling grade factors such as curbs, road shoulders, manholes, etc., to allow for the placing of a minimum of 75 mm of top soil and 25 mm of sod. All sub-grades shall be loosened to a depth of 150mm prior to leveling (especially where heavy equipment has been in operation) allowing a bonding of top and sub-soil, for adequate root expansion.

Top soil shall be as per master project specification Section 02530 Landscaping and be free of roots, stones or other foreign debris. Soils infested with seeds or roots of noxious weeds will not be acceptable. .



Sod shall not be less than 300 mm in width nor wider than 500 mm. Sod of the 25 mm soil thickness will be the minimum acceptable. All sod shall be taken from loamy soil, free from weeds, in a healthy growing condition without sign of decay and containing sufficient moisture to maintain vitality during transportation and placing.

Sod shall be laid lengthwise across the face of slopes or parallel to curbs with ends close together. Joints in adjacent rows shall be staggered. Joints and broken sod shall be rolled or tamped to a uniform surface. Sod shall be harvested, delivered and installed within a period of thirty-six (36) hours and shall not be laid in a frozen condition nor laid on frozen soil.

The entire work shall be done in a thorough manner, achieving upon completion a quality natural turf approximately even with the top of the curb (where applicable).

The developer shall be responsible for the care and maintenance of sodded areas for a period of one (1) year from the date of initial acceptance.

During this period any defects caused by slope failure, soil compaction or failure of the sod to grow will be repaired, removed and replaced with fresh live sod.

Seeding can only be used in the Right of Way when authorized by the Engineering Division.

### **Within Park Lands**

When installing topsoil and sod or seeding in Park Lands the latest revision of the Parks Division Standards and Specifications shall apply.

#### **2.4.10 Specifications for Drivable Gravel Roads for New Subdivisions**

Road(s) in a land development project which is in the construction phase shall be constructed to a "drivable gravel standard" prior to the issuance of building permits for lots in the development. The following conditions shall be met in order to meet the drivable gravel road standard:

- a) The design engineer shall certify that the road is capable of carrying the anticipated loading of construction traffic at this partially completed stage.
- b) All clearing, brushing and excavation of the road allowance must be complete.
- c) All granular "B" must be in place up to the designated elevation for "top of granular "B" as indicated on the construction drawings.



- d) The granular "B" road base shall be compacted to 90% proctor density and be graded to have sufficient crown to provide adequate drainage for the roadway surface
- e) The road base shall be constructed to full design width of the proposed road and all dead-end roads shall have a turning basin of adequate size to accommodate emergency vehicles and Roads Division maintenance equipment.
- f) All manholes, catch basins, valve boxes and other appurtenances shall be lowered to be flush with the gravel road surface. Manholes may be temporarily covered with steel plates in lieu of frames and covers if necessary to accommodate this requirement. The steel plates shall have steel legs or lugs attached to prevent being pushed off the manhole structure.
- g) The storm water collection system which is proposed for the completed road shall be complete to the extent that it is operational and can provide adequate drainage of the gravel road.
- h) The road shall be graded to provide adequate drainage into the storm water collection system.
- i) The developer of the land shall maintain the road in a driveable state at all times and shall take whatever action is necessary to ensure proper drainage of the road.
- j) The developer shall ensure that any or all underground utilities are properly covered and that all construction materials and construction debris are removed from the road allowance.
- k) The developer shall install temporary traffic control and street name signs at all intersections.

The developer shall carry out the above-noted requirements prior to the Engineering Division notifying the Chief Building Official that "sufficient work has been carried out by the developer so as to warrant this issuance of building permits for the lots in a development".

Following the issuance of building permits the developer will be responsible for snow plowing operations for the roads within the development on which building permits have been issued, including snow clearing around all hydrants, as well as any roads providing access to the said road, until such time that the base lift of asphalt has been placed. After the base lift of asphalt has been placed, the Roads Division will snow plow these roads, with all plowing being completed on a "non-priority basis" until Acceptance has been granted by the City.



Any additional costs incurred by the Roads Division due to non-compliance with the above-noted requirements will be chargeable to the developer of the land.

#### **2.4.11 Parking Lots**

In the instance where the construction of parking lots falls under the jurisdiction of the Engineering Division as is the case in Site Plan Control Agreements, Condominium Agreements and Development Agreements, such parking lots shall be constructed to the following standards:

- a) See Section 2.3.3 for grading requirements for parking lots.
- b) All paved parking area and driveways shall have a minimum of 40 mm thick HL4 asphalt paving on 80 mm thick granular "A" base over a suitable granular sub-base.

Driveways and/or parking areas which are subject to heavy loads or high traffic volumes shall be designed and constructed for such traffic.

The Engineering Division may require the design of proposed parking areas to be certified by a professional engineer.

- c) All driveways to parking lots shall be curbed to prevent vehicular encroachment onto adjacent public sidewalks and boulevards.
- d) All parking lot illumination shall meet the minimum requirements of I.E.S. (Illuminating Engineering Society) guidelines and shall be installed in accordance with Section 6.2.

#### **2.4.12 Easements**

In order to accommodate the ongoing maintenance of services which are constructed, easements will be required for those services which are outside of normal service corridors. All easements which are provided to the City of Thunder Bay shall be of sufficient width for excavation of the services in conformity with current Occupational Health and Safety Regulations without the need for excavation aids such as trench boxes or sheet piling.

In determining the width of easements required to provide maintenance access to a particular service, the depth of the service and anticipated soil type will be considered. The minimum easement required shall be wide enough to allow and excavation with side slopes of 1:1 or flatter. Additional width may be required if a separate maintenance access road is required to access the service, such as along trunk drainage ditches.



**2.4.13    Trees**

All municipal trees must be selected and planted in accordance with the latest edition of the Parks Division “Standards and Specifications”. This document can be downloaded from the City of Thunder Bay web site.

**2.4.14    Bike Lanes**

Dedicated bike lanes may be required where an existing commuter route exists, or where an extension to the commuter route is being proposed by the Engineering Division. Bike lane widths and configurations shall be designed in accordance with the Transportation Association of Canada “Bikeway Traffic Control Guidelines for Canada”, and shall accommodate all required vehicle lanes and parking along the commuter route. The following lane dimension criteria shall apply:

Minimum Bike Lane Width with Parking	-	1.5m
Minimum Bike Lane Width with no Parking	-	1.2m

**2.4.15    Signs**

All regulatory, warning, guide and information signs shall be in accordance with the Ontario Traffic Manual.

**2.4.16 Transit Facilities**

All transit facilities shall be constructed in accordance with the Transit Accessibility Design Guidelines for the City of Thunder Bay.

**2.4.17 Separation from Municipal Services and Utilities**

The following separation distances are provided for general information purposes (all “preferred” separations are to be provided unless otherwise approved by the City Engineer):

- a) Storm and sanitary fixtures (catch basins and manholes) from hydro ducts – 1.0m preferred separation, 0.5m minimum separation.
- b) Water fixtures (water valves) from hydro ducts – 2.0m preferred separation, 1.5m minimum separation.
- c) When civil service mains (storm, sanitary, and water in the right-of-way) are running parallel to hydro ducts, 3.0m preferred separation.



- d) Civil service connections (storm, sanitary, and water into private property) from hydro secondary services, 2.0m preferred separation.
- e) All civil services must be located a minimum of 3.0m away from transformer bases, which is equivalent to a minimum 2.0m away from the grounding grid.

## **2.5 WATER SYSTEMS**

### **2.5.1 Cathodic Protection**

Water systems shall be designed to include cathodic protection as specified under section 8.0.

### **2.5.2 Water Demand**

Water supply systems shall be designed using the City of Thunder Bay Water System Model. The model has been designed to use Epanet computer software to simulate flows for present day and future demands. This water system model shall be used to determine system pressures under the following conditions for both present day and for future demands (typically 10-years), as directed by the City:

- a) Minimum daily demand - (reservoirs full).
- b) Maximum daily demand.
- c) Maximum daily demand and fire demand.
- d) Maximum hourly demand.

The water system shall be designed to satisfy the greater of these demands.

All updates to the City of Thunder Bay Water System Model will be completed by the City of Thunder Bay's water modeling consultant. All data required for the assessment of new developments and new water supply systems shall be provided to the City by the developer's consulting engineer. For private developments where the new water supply system will not be transferred to the City, the developer shall reimburse the City for the cost to update the Water System Model.

### **2.5.3 Peaking Factors**

The following peaking factors shall be used in conjunction with an average day per capita consumption of 600 litres for domestic use and 700 litres for a mix of domestic, commercial and industrial usage.

Design water demands and associated peaking factors for flows other than residential or domestic flows shall be in accordance with proposed design water demands contained in the M.O. E.E. "Guideline for the Design of Water Distribution System".



<b><u>Population Range Factor</u></b>	<b><u>Minimum Rate Factor</u></b>	<b><u>Maximum Day Factor</u></b>	<b><u>Peak Rate Factor (Max.Hr.)</u></b>
Up to 500	.40	3.00	4.50
500 - 1000	.40	2.75	4.13
1001 - 2000	.45	2.50	3.75
2001 - 3000	.45	2.25	3.38
3001 - 10000	.50	2.00	3.00

When analyzing larger areas appropriate peaking factors shall be used. The water system model contains peaking factors which shall be used for City wide analysis.

#### **2.5.4 Fire Demands**

In order to estimate the fire flow demand for water system extensions the designer shall take into consideration all applicable existing and proposed structures on the affected land. Design flows shall be in accordance with Part 3 of the Ontario Building Code and the Ontario Fire Code.

The designer is also referred to the Publication “Water Supply for Public Fire Protection - A Guide to Recommended Practice, 1999”, prepared by Fire Underwriters Survey, Insurer’s Advisory Organization.

The minimum fire flow for residential land developments with detached dwellings shall not be less than 4550 L/min.

#### **Background**

Fire hydrant flow tests are undertaken to obtain actual flow rates and pressures at certain locations within the water distribution system. The rates of flow, static and residual system pressures as well as system operating parameters (SCADA System Data) all obtained at the time of the flow test are used to calibrate our Water System Model.

The calibrated model is used to estimate available flows and pressures under various predetermined operating conditions for the purpose of designing fire suppression systems and planned expansions of the water distribution systems.

The Following Information is required at the time of the test:

1. Date and time of test.



2. Hydrant ID numbers for Flow and Residual Pressure Hydrants and Street Name from Fire Hydrant Database or Engineering Division mapping.
3. Flow each hydrant(s) using a single nozzle and at least two nozzles to provide varying rates of flow. Ensure that a difference in pressure drop of at least 105 KPa. (15 PSI) is attained in the two test results.

The range of flows for each test shall be predetermined depending on the purpose of the flow test. Flow tests for the design of Private fire Protection Systems (sprinklers and/or standpipes) the hydrants(s) shall be at a rate equal to the design flow of the sprinkler/standpipe system and a rate equal to the flow required from the fire hydrant(s) serving the site.

If the design flow of the sprinkler/standpipe system or the required flow rate for the subject hydrant cannot be attained then the hydrant shall be flowed at its maximum flow using both hose ports simultaneously.

The rate of flow required for the sprinkler/standpipe system shall be obtained from the Fire Protection System designer requesting the flow test.

The rate of flow required for the fire hydrant serving the site can be obtained from the Engineering Division.

4. Record Pitot Gauge Pressures for each nozzle flowed. Use the Darley Nozzle Discharge Table to calculate the actual flows.
5. Record System Pressure for zero flow and for each measured flow. System Pressures shall be read at the Residual Pressure Hydrant.
6. Obtain the Geodetic Elevation of the Flow and Residual Pressure Hydrants from Engineering Division topographical records.
7. Record the following information at the time of the test for the applicable pressure zone from Water Treatment Plant shift operator (683-8141 ext 4).
  - Name the Applicable Reservoir
  - Reservoir level at start and end of flow test
  - Reservoir inflow and outflow rate
  - Pump on/off status at Station (s) which would impact the test (i.e. Bare Point for Zone 1N and Broadway for zone 2S)
  - Suction and Discharge pressures of pumps
  - Discharge flow from stations
8. Complete Flow Test Report and forward to the Engineering Division.



### **2.5.5 Private Fire Protection Systems**

All private fire protection systems shall be equipped with a backflow prevention device to the satisfaction of the Environment Division. Depending on the configuration of the private system and the potential risk for contamination to the municipal system, the private fire protection system may include the requirement for a backflow prevention device and metering chamber to be provided at the property line. Pre-consultation with the City is recommended when designing private fire protection systems.

For buildings requiring fire protection, individual connections shall be provided outside the building for fire and domestic services with separate shut off/isolation valves outside the building, and a valve located on City property.

All private fire protection systems which will depend on the Municipal Water System shall be designed to provide the required flows at a static supply pressure not greater than the minimum pressure designated in the M.O.E. Guidelines for water distribution systems on the day of maximum system demand (350 KPa - 50 psi).

If it can be shown to the satisfaction of the Engineering Division using flow records and appropriate water system modelling that a higher supply pressure in the water system may be approved as a basis for design purposes. In this case, the Engineering Division may require the system to be designed to enable upgrading in the future to operate under a static pressure of 50 psi with minimal impact on the building:

1. Determine appropriate location for Flow and Residual pressure Hydrants. The Flow Hydrant should be as close as possible to the subject site. The Residual Pressure Hydrant should be a hydrant that is connected to the main that carries the
2. Largest flow to the site (if identifiable) and be as close as possible to the Flow Hydrant.
3. Undertake the flow testing of appropriate Fire Hydrants adjacent to the subject property.
4. Obtain all information required by “Information Required for Fire Hydrant Flow Tests”.
5. Using the obtained information and Approved Software, model the water system for Maximum Day conditions for both Present Day and future demands.
6. Private Fire Protection Systems shall be designed to operate on a maximum available Water System Static Pressure at the service connection of 350 KPa (50 PSI). The system shall be designed to include all necessary equipment with pipes



sized to provide the required flows and pressures at the maximum available static pressure of 350 KPa (50 PSI).

7. In the event that modeling shows the available static pressure is lower than 350 KPa (50 PSI) then the system shall be designed to operate at the lower pressure.

In the event that modeling shows significantly higher static pressures are available a second design may be undertaken to determine the pipe sizes and equipment necessary for the Private Fire Protection System to operate at the higher pressure. The installation of any of the equipment required to operate at the 350 KPa (50 PSI) pressure can be deferred; so long as provisions are made to allow the installation of the deferred equipment at a later date if necessary, with minimum disruption to the building.

Such provisions may consist of but are not limited to the following:

- a) Dedicated space within the building for future installation of pumps, generators, and addition electrical service capacity;
  - b) Additional piping and fittings blanked off with caps, blind flanges etc. as required to accommodate the simplified installation of the additional equipment at a later date etc.
8. The building owner shall be responsible for all costs for the retrofitting of the Private Fire Protection System in the event of a change in supply pressure of the water system.
  9. All non-metered dedicated fire supply piping shall be equipped with alarmed flow detection equipment in accordance with Part 3 of The Ontario Building Code and to the satisfaction of the Environment Division.

### **2.5.6 System Pressures**

The water distribution system shall be sized to function within the following parameters:

- a) Under minimum daily demand conditions with reservoirs at the maximum level water system pressures shall not exceed 700 KPa. (100 psi)
- b) Homes subjected to water pressures exceeding 550 KPa (80 psi) shall be equipped with a pressure regulating device to maintain water pressure in the home at less than 550 KPa.
- c) Under maximum daily demand water system pressure shall be not less than 350 KPa. (50 psi)



- d) Under maximum hourly demand system pressures shall not be less than 275 KPa. (40 psi)
- e) Under maximum daily demand plus fire demand system pressures shall not be less than 140 KPa. (20 psi)

### **2.5.7 Friction Factors**

The following Hazen- Williams "C" values shall be used for all new pipe for the design of distribution systems regardless of material:

<u>Diameter</u>	<u>"C" Factor</u>
150 mm	100
200 mm - 300 mm	110
300 mm - 600 mm	120

Existing pipes shall be analysed using "C" values which are appropriate for the age and condition of the pipe. The estimating of appropriate "C" values may require the developer to undertake field flow testing of the existing watermains.

### **2.5.8 Minimum Size of Watermains**

The following shall be used as the standard for minimum size of mains used for hydrant supply:

- a) Residential Areas - 200 mm diameter main shall be used with the exception that 150 mm diameter main may be used where it completes a good gridiron with intersecting mains located at not more than 180 m intervals.
- b) Mercantile and Business Districts - 200 mm diameter main shall be used.
- c) Dead end watermains not required for hydrant supply shall be sized to prevent stagnation of the water in the main.

### **2.5.9 System Layout**

- a) Dead-End Mains - Where possible, water distribution system layouts shall be designed to eliminate dead-end sections. Where dead-end mains cannot be avoided, there shall be provided a fire hydrant, or other acceptable measure to prevent problems associated with water stagnation.  
At the discretion of the City Engineer, all significant new developments, including residential developments greater than 25 lots or 25 units, shall require a looped watermain system to be provided.



For dead-end systems with minimal demand, the developer may be required to enter into a flushing program agreement with the City until such time that Acceptance of the system has been granted by the City.

- b) Valves - Gate valves in direct bury valve boxes shall be installed on all water mains equal to and less than 400 mm in diameter. Butterfly valves shall be installed on all watermains greater than 400 mm in diameter and preferably will be direct bury but must be reviewed individually to determine if a chamber is required for operation and maintenance access.

Valves in direct bury valve boxes shall be installed at a spacing not to exceed 275 m in continuous watermains. Valves on watermain greater than 400mm in diameter shall be installed at a spacing not to exceed 425 m in continuous watermains.

In grid patterns, intersecting watermains shall be equipped with a minimum number of shut-off valves as follows:

### Number of Valves

"T" Intersection	at least 2 valves
Cross Intersection	at least 3 valves

All valves at intersections are to be installed as per standard drawing R-100 unless approved by Engineering.

- c) Hydrants - All hydrants shall be installed 3.75 m back from the corner, formed by intersecting street lines and setback from the street line in accordance with the applicable standard road cross-section, except where the City Engineer directs otherwise. Hydrants located in mid-block areas shall be located near the centre of a lot to avoid interference with driveways. Hydrants shall be spaced so that the average area of coverage shall not exceed 10,000 square metres per hydrant in principal mercantile areas or 15,000 square metres per hydrant in built-up residential areas. The spacing of hydrants shall not exceed 90 m in business districts or 150 m in residential areas.
- d) Depth of Watermains - At least 2.15 m of cover shall be provided for all watermains and house services. In no case shall a watermain be laid with over 2.75 m of cover or a building service at a depth of cover over 2.5 m.

In areas of rock where the developer has obtained approval from the Engineering Division to install building service pipes at less than 2.15 m of earth cover the minimum earth cover shall be 1.5 m. The water service pipe shall be insulated



with “Ducted Tube” insulation and heat traced. The insulation and heat tracing of the water service pipe shall be an “Engineered Design” and shall be custom designed for each specific application.

- e) Separation from Sewers - Except in areas of rock, all sewer and watermains shall be laid with a minimum horizontal separation of 2.50 m. Where sewer and watermains in areas of rock are laid in the same trench, the horizontal clear distance between sewer and watermains shall not be less than 600 mm horizontal with a vertical distance between the bottom of the watermain and the top of the sewer of not less than 500 mm.
- f) Building Service Connections - The minimum size of house water service connections shall be 20 mm with larger sizes being used where required by water demand, lengths of service connections or area water pressure. Services shall be designed to maintain a minimum 240 KPa water pressure at the house water meter under maximum building water demand. Streets with curb and gutter shall have the service curb stop located as per applicable standard road cross-section. On streets with ditches the curb stop shall be located 500 mm out from the property line to prevent the curb stop from being located in the ditch. In rear lot easements curb stops shall be located 500 mm from the easement line.

In front and side lot easements, curb boxes shall be located to suit conditions and as approved by the Engineering Division. All building services shall be laid at least 2.15 m and no more than 2.50 m depth.

All water service connections shall be installed in accordance with the requirements of the latest revision of the Ontario Building Code Act - Part 7 as amended.

In the case of multiple or semi-detached dwellings, apartment buildings, or buildings divided into separate units, where portions of buildings may be divided by sale and used by separate owners in conformity with the zoning by-law, or where separate payment of water usage is required within one building, such portions of buildings shall be serviced by an independent outside curb stop and service pipe.

- g) The building service connection shall be defined as that portion of the water service pipe between the municipal supply main and the building control valve (compression stop and drain at the meter).
- h) Every non-metallic water connection or fire service main shall be installed with a minimum fourteen (14) gauge TWH solid copper light coloured plastic coated tracer wire attached.



- i) All water services in the Neebing Ward or any other non-residential water service shall be installed with a wire from the water meter location to an external receptacle location to facilitate the installation of City supplied remote water meter reading equipment.

The wire shall be installed to the outside receptacle location in one (1) continuous length with no sharp bends, creases or splices.

The wire shall exit the building into a receptacle at a distance from the meter of not more than 45 metres (as measured along the wire) and a vertical distance from finished grade level of 1.2 metres.

A 0.6 metre length of cable shall be left at the metre location and receptacle location.

Details regarding access to the receptacle location and location for obtaining City supplied cable can be obtained from the plumbing inspector.

- j) All water meters larger than 50 mm shall be provided with suitable drainage facilities to allow on-site testing of the water meter.
- k) Water meters shall be at a maximum one size smaller than the service pipe feed. To install a smaller meter, permission must be obtained from the Environment and Building Divisions.

The drainage facilities shall be designed and installed so as to accept and dispose of a volume of water equal to the full flow capacity of the water meter.

All piping shall be installed in accordance with the latest revision of the Ontario Building Code Act – Part 7 as amended.

- l) Thaw/tracer cable and testing shall be as per City of Thunder Bay master project specification 02580 – Watermains, Section 2.3.
- m) Where the municipal system connects to a “non-municipal water distribution system” (as determined by the M.O.E.), or where there is more than one (1) serviced building, or the intention to have more than one (1) serviced building, or where the potential for backflow into the municipal system is deemed to be a concern by the City, a backflow prevention device and metering chamber shall be installed at the property line to the satisfaction of the City. Pre-consultation with the City is recommended when designing systems under these situations.

For “non-municipal water distribution systems”, additional approvals are required to be obtained by the developer directly from the M.O.E.



**2.5.10 Interim System Operation**

For additions and extensions of the municipal water distribution system that are approved under Subdivision or Developments Agreements with the City, the following additional criteria shall apply:

- a) The Developer shall be responsible to provide a Chlorine Residual Maintenance Plan prepared by a Professional Engineer. At a minimum, the Plan must:
  - Illustrate the location of all permanent and temporary dead-end watermains.
  - Determine the necessity for a flushing program to maintain minimum chlorine residuals in the new system.
  - Provide recommended locations for flushing of dead-end watermains.
  - Provide recommendations for the volume of water to be flushed, and the flushing frequency, for each dead-end to maintain minimum chlorine residuals.
  - Provide time frames and proposed minimum build-out requirements to cease the flushing program (i.e. # of houses occupied).

The Plan shall be submitted for the review and approval of the City prior to the issuance of building permits for any lot in the current stage of the development.

The form of flushing shall be determined by the City (i.e. auto-flusher, manual flushing, etc.). Regardless of the method chosen, flushing and chlorine residual sampling shall only be performed by the City's licensed operators. All water used for flushing shall be recorded by the City and charged to the Developer at the City's current water usage rates. All labour, materials, and equipment associated with the flushing program, including chlorine residual sampling, shall also be charged to the Developer.

The flushing program, and associated costs to the Developer, shall continue until such time as Final Acceptance for the underground works for the dead-end system has been granted by the City. Prior to Final Acceptance, all, or a portion, of the dead-end system may be removed from the flushing program if the minimum build-out requirements or alternative works (i.e. looping with an adjacent development stage) have been met or completed to the point where minimum chlorine residuals can be maintained. Formal request for removal is to be made to the City with supporting documentation from the Developer's Engineer, and acceptance of this request shall be at the City's sole discretion.

Upon Final Acceptance, all responsibility for determining and maintaining flushing requirements and associated costs going forward shall be borne by the City.



- b) Only the City's licensed operators shall operate the distribution system, including, but not limited to, operating main line and hydrant valves, curb stops, flushing and winterizing hydrants, etc.
- c) Notwithstanding the above, until Final Acceptance is granted, the Developer shall remain responsible for any repairs to the system at its sole cost. In the event repairs are required to be completed by the City, all labour, materials, and equipment associated with the repairs shall be charged to the Developer.



### **3.0 PLANS AND DRAWINGS**

#### **3.1 PRELIMINARY DRAFT**

At the time of initial application to the City Planning & Building Services Divisions, an extra four (4) copies of the draft plan shall be included for the Engineering Division to review and establish the feasibility of servicing and to make whatever comments may be necessary concerning the plan. These plans shall show the proposed street layout and lots, and shall also include one (1) metre contours, all existing watercourses, and all lands owned by the Developer.

#### **3.2 FINAL DRAFT**

Upon approval of the draft plan by the City Planning Services Division, the Ministry of Housing, and City Council, the Developer shall have the property staked out on the ground and the final plan prepared (and registered after the Development Agreement has been signed). This final plan will serve as a basis for all preliminary surveys and construction drawings. One good quality printable film transparency of the registered plan or plans will be required by the Engineering Division

#### **3.3 PRELIMINARY CONSTRUCTION DRAWINGS**

After draft plan approval, the Developer shall employ a firm of engineering consultants acceptable to the City for the purpose of designing all services for the development. The service for the development shall be designed for the actual site conditions that are encountered in the area to be serviced. The standards contained in this manual are minimum standards only. Site conditions and good engineering practice shall dictate the work which shall be carried out.

All construction drawings shall be prepared in accordance with the digitized standards outlined in Section 3.5 (o) and include ties to G.P.S. Reference points. All elevations shall refer to a metric geodetic datum.

The consultant shall submit two (2) prints of each of the following drawings to the Engineering Division for checking:

- a) Plans and profiles showing roads, sidewalks, storm sewers and sub-surface drainage works;
- b) Plans and profiles showing sanitary sewers and watermains;
- c) Overall plans showing all sanitary sewers and watermains to be constructed;



- d) Overall plans showing all roads, sidewalks, storm sewers, roadway illumination and hydro services to be constructed;
- e) Typical road cross-section showing road base details and sub-surface drainage works;
- f) A lot grading plan showing how each lot will be drained and how the water will be discharged from the area to be developed as a whole. Directions of storm flow and contributing areas shall be shown as well as back of lot drainage systems, major storm routes and outfall details;
- g) Boundaries of all work to be carried out shall be clearly indicated and all drainage and service easements are to be shown;
- h) Plan profile drawings shall have the profile on the bottom portion of the sheet and north arrows shall point to the top or right side, scale to be:

Horizontal 1:500

Vertical 1:50

### 3.4 **CONSTRUCTION DRAWINGS**

The construction drawings shall show everything that the preliminary construction drawings show and be to the same scale plus:

- a) Indicate all legal plans, registered plans and reference plans;
- b) All survey bars, street lines, lot lines and lot numbers;
- c) All lot dimensions, intersection radii and all curve data;
- d) Any other underground services contemplated for the development (i.e. gas, hydro, telephone, cable T.V.). These services need only to be shown in the plan view;
- e) Street names;
- f) The consultant shall make all required corrections to his drawings and resubmit them for final approval. Three completed sets of the drawings of the proposed construction plans will be required for submission to the Ministry of The Environment for the Certificate of Approval application.



- g) Upon receipt of the drawings approved by the Engineering Division, the consultant shall forward to the City two (2) additional sets of drawings and specifications of the development services. These drawings are to be used by various City departments dealing with the construction of the development. Additional sets of drawings and specifications shall be supplied to the Engineering Division if required

### **3.5 AS-CONSTRUCTED DRAWINGS**

As-constructed drawings shall include the following information:

- a) All as-constructed elevations including watermain inverts and sewer main inverts;
- b) All pipe lengths between manholes and watermain lengths between valves;
- c) All pipe sizes, material and bedding;
- d) Ministry of Environment Certificate of Approval numbers for sewer and water works;
- e) All final grades;
- f) Rock profiles, if rock was encountered;
- g) All new building connections are to be shown and dimensioned in the plan view, so that they can be readily located;
- h) All electrical and roadway illumination installations;
- i) All dimensions are to be from legal survey lines, or survey bars, not buildings, poles. Water system appurtenances such as hydrants, valves or boxes, are to be dimensioned to each other and to legal survey lines or survey bars;
- j) All off-set dimensions are to be 90° from street lines;
- k) Dimensioning may be indicated by chainage so long as 0+00 chainage is on an established survey bar or legal survey line;
- l) As-constructed dimensions shall be designated by the Symbol (ASB) after the dimensions;
- m) Any other changes including property or lot division shall be shown;
- n) Overall drawings need not have dimensioning but shall be pictorially correct and any pipe sizes or pipe lengths shall be as-constructed pipe sizes or lengths.



- o) AutoCAD based design drawings shall be required and submitted on CD ROM or other medium acceptable to the City in “.DWG” format. (The version of AutoCAD shall be compatible with the present version in use by the Engineering Division’s Office) The AutoCAD drawings are to be based on one drawing unit equals one metre and shall be tied to NAD 83 Horizontal control. (Where non-standard AutoCAD fonts, menus, line types, etc. are used, a copy of these files shall be supplied to the City.)

All digital drawings to be sent with e-transmit (i.e., complete with pen settings, etc)

### **3.6 PRELIMINARY AS-CONSTRUCTED PRINTS**

After the completion of the underground services and building connections, and prior to the Engineering Division clearing the requirements to allow for the issuance of building permits, preliminary street servicing plans, including fire hydrant FDM forms, and preliminary service connection drawings showing as-constructed details shall be submitted to the Engineering Division. These plans may be in the form of prints, and must provide sufficient detail to locate services prior to the completion of the roads.

### **3.7 SERVICE CONNECTION DRAWINGS**

Two drawings to a scale of not less than 1:500 on 216 mm x 279 mm paper, showing in plan view the location and tie-ins of all water, sanitary sewer, storm sewer service connections and any easements in relationship to the property lines and houses. These drawings shall be in accordance with standard drawing M-101, "Information Required on All Sewer and Water Connections". This information is required for the City record books which are used for maintenance purposes.

The final as-constructed service connection drawing shall also show the finished grade elevation at the front wall of the building.

As constructed service connection drawings shall be prepared in a digitized format as outlined in Section 3.5 (o).

### **3.8 AS-CONSTRUCTED ORIGINALS**

When all of the work is completed one complete set of good quality reproducible signed and sealed “As-Constructed” drawings shall be submitted to the Engineering Division. These drawings shall be submitted prior to Final Acceptance being granted for the services within the developed land.



**4.0     DEVELOPMENT CONSTRUCTION STANDARDS**

**4.1     SUPERVISION OF CONSTRUCTION OF DEVELOPMENT SERVICES**

All construction work on the development services will be performed under the control of the Engineering Division who may engage the services of a professional engineering firm. All costs associated with the retaining of professional engineers or supervision by City personnel will be borne by the Developer. The engineering firm that is hired to provide resident supervision for and inspect all work carried out in the subdivision will report to the Engineering Division. The duties of the firm shall include (without limiting the generality of the foregoing) the following:

- a) Provide an instrument check of the Contractor's line and grade for sewers and/or waterlines;
- b) Carry out detailed inspection of construction to ensure that the work is done in accordance with the contract documents and the standards contained in this manual;
- c) Carry out all necessary testing and inspection of materials and equipment installed;
- d) Investigate, report and advise of any unusual circumstances which may arise during construction;
- e) Provide weekly written reports on work progress and construction methods, including copies of the results of materials and equipment testing;
- f) Maintain a daily diary recording special instructions;
- g) Carry out final inspection at the conclusion of construction at the end of the maintenance period and as part of the acceptance program of the Corporation;
- h) Obtain field information for modification of the contract drawings;
- i) Provide detailed final inspection, liaison and other assistance required to expedite the acceptance and takeover of the work and submit a certificate that the work is complete and was completed in accordance with the standards of the City of Thunder Bay;
- j) Record all construction details necessary and modify the contract drawings to show the work as built and to prepare service connection drawings as per City of Thunder Bay standard drawing M-101 for each lot in the developed land;



- k) Supply to the City one set of good quality reproducible intermediate as-constructed drawings illustrating the installed services;
- l) Supply to the City AutoCAD drawings and data files as described in section 3.5 o);
- m) Arrange and attend monthly site meetings during construction;

#### **4.2 START OF CONSTRUCTION**

No construction work shall take place on the development until the following requirements have been met:

- a) All construction drawings shall be approved by the Engineering Division;
- b) Any approvals from the Ministry of the Environment for sewer, stormwater management facilities, and/or water systems shall have been received by the Engineering Division;
- c) Approvals that may be required from any other governmental body that has jurisdiction over the development shall have been received by the Engineering Division;
- d) Any zoning amendments shall have been approved;
- e) All bonding and insurance requirements shall have been met;
- f) Any monies to be paid to the City as a requirement of the Subdivision Agreement or Development Charge Act Agreement shall have been paid;
- g) The Engineering Division shall be in receipt of a properly signed copy of the Development Agreement;
- h) A pre-construction meeting shall be held with the City, the Developer and the consultant, who will supervise the work, present;
- i) The Developer shall have received written permission from the Engineering Division to start work.



**4.3 FIRE HYDRANTS OUT OF SERVICE**

Any fire hydrant which is not put into service during this inspection or which has become damaged or inoperative at any time prior to "Acceptance" of the water system extension shall be flagged or bagged "Out of Service" in the field by the developer. Such flagging or bagging shall be to the satisfaction of the Engineering Division.

The Developer shall promptly notify the Engineering Division of any fire hydrants out of service and the Developer shall immediately undertake the necessary repairs to return such hydrants to active service at their sole cost.

**4.4 ROAD CLOSURES**

If the development construction requires an existing City road/street to be closed the Developer/Contractor must submit a "Road/Sidewalk Closure" application to the Engineering Division for approval prior to the closure. This requirement shall apply to the closure of a single lane of traffic, and/or a full road closure. Applications must be submitted 4 days prior to the planned date of closure.

If a full road closure is required for more than 7 days on an arterial or collector road detour signage shall be mandatory. Detour signage may be required for shorter duration closures at the discretion of the Engineering Division.

**4.5 SIDEWALK CLOSURES**

If the development construction requires an existing City sidewalk to be closed the following shall apply:

- If the sidewalk is located in a business district, or services a large volume of pedestrian traffic, the Developer/Contractor must submit a "Road/Sidewalk Closure" application to the Engineering Division for approval prior to the closure. Applications must be submitted 4 days prior to the planned date of closure.
- All closed sidewalks must be identified with a "Sidewalk Closed" sign placed at the nearest point of sidewalk intersection on either side of the closed area so that pedestrians can take an alternate route without having to back track.
- The portion of sidewalk that is intended to be closed must be barricaded so that pedestrians cannot unintentionally access it (e.g. at the excavation point, start of construction zone);
- Barricades must remain in place until the new sidewalk can be poured or until a temporary cold patch asphalt surface is installed. A temporary gravel sidewalk surface will not be permitted. The entire perimeter of the excavation must be barricaded, unless it is located inside a closed section of road.



### **5.0 ACCEPTANCE OF DEVELOPMENT**

#### **5.1 BASIS OF ACCEPTANCE**

Prior to accepting any services, the Developer shall provide the City with deeds for all lands and easements required by the City for park, recreation and/or school purposes, for drainage systems and sewer outlets. The Developer shall also have submitted whatever cash deposit that may be required in the development agreement for enlargement or extension of existing underground services, or for any other purpose and also "Interim As Constructed Prints" outlined in "Drawings Required by the Engineering Division".

Acceptance of the development is subject to and contingent upon inspection which will be carried out in the development upon completion of the development.

It should be noted that the City reserves the right to make whatever connections that may be required from time to time to any development services when in the opinion of the Engineering Division such services are ready for use. This shall not constitute acceptance of these services.

#### **5.2 INITIAL (PROVISIONAL) ACCEPTANCE**

An inspection by City staff will be carried out on written certification from the consulting engineer that the services have been installed in accordance with City of Thunder Bay Engineering and Development Standards and that the consultant has inspected the works prior to submitting the written certification. Any costs relating to inspections by City staff for Acceptance inspections shall be billed to the Developer. The written certification and request for "Initial Acceptance" shall be accompanied with two complete sets of as-constructed prints of the completed subdivision and one copy of the sewer camera inspection report, and shall include a list of any deficiencies. When "Initial Acceptance" is warranted, the Developer will be notified in writing and when an acceptable maintenance guarantee has been deposited with the City, a certificate will be issued by the Engineering Division stating the date of initial acceptance and start of the maintenance period. This certificate will also indicate to which section(s) of the development the "Initial Acceptance" applies.

The Developer shall be responsible for making any repairs to any appurtenances or for any grade changes which adversely affect the appurtenances until a "Certificate of Final Acceptance" has been issued. Any emergency repair work performed by City forces prior to the issuance of a "Certificate of Final Acceptance" will be charged to the Developer.

The maintenance and warranty period shall generally be one year from the date of initial acceptance, with the exception of tree planting, which has a two year warranty, and pavement, which has a warranty of either one year from the date of initial acceptance or two years from the placement of top lift (whichever is greater).



**5.3 FINAL ACCEPTANCE**

An inspection similar to the "Initial Acceptance" inspection will be carried out prior to the expiration of the maintenance period and the Developer will be notified of any deficiencies which shall be corrected before a "Certificate of Final Acceptance" will be issued. Should "Final Acceptance" be warranted the City will issue a "Certificate of Final Acceptance", and will return the unused portion of the maintenance guarantee and will proceed to maintain those municipal services which are public services.

All constructed information including the as-constructed drawings and the two (2) copies of the sewer and water connection drawing for each lot in the development as per standard drawing number M-101 shall be submitted to the Engineering Division prior to the issuance of a "Certificate of Final Acceptance" and the release of the unused portion of the maintenance guarantee.

**5.4 ACCEPTANCE OF SECTIONS OF THE DEVELOPMENT**

Initial acceptance of separate sections of a development may be granted provided that the required work for each section to be accepted is complete and provided that the necessary performance guarantees are kept in force for all other sections of the development. At the discretion of the City Engineer, for Subdivision Agreements, initial acceptance will not be granted until approximately 85% of lots within the Plan of Subdivision, or within the section requested to be accepted, are developed. Acceptance of a section of a development is subject to the approval of the Engineering Division and the sections which may be accepted independently are as follows:

**5.4.1 Underground Services**

- a) All underground services shall be complete and be certified by the consulting engineer that the works were constructed in accordance with the City of Thunder Bay standards.
- b) All hydrants shall operate correctly and not leak.
- c) All valves shall operate correctly and have a plumb valve box with the valve operating spindle centered in the valve box. There shall not be debris in the valve box.
- d) All sewers shall be clean and free flowing.
- e) All manholes shall be complete and have all joints in the barrel correctly mortared and watertight.



- f) All catch basins shall be complete with leads properly mortared and any holes, joints, etc. correctly mortared and watertight. The catch basin sump shall be reasonably clean.

### **5.4.2 Building Connections**

The "Building Connections" portion of the development is that portion of the underground services which connects the sewer and/or watermain with each lot in the development. The following work shall be complete before "Initial Acceptance" will be considered for the "Building Connection" portion of the development.

- a) Suitable arrangements shall be made with the Engineering Division to provide the necessary financial guarantees to ensure that any damage to existing facilities during the construction of the buildings on any undeveloped lots will be repaired by the Developer.
- b) All building connections shall be installed to the building line of each lot in the development.
- c) Two copies of the service connection drawings as per standard drawing number M-101 shall be submitted to the Engineering Division for each developed lot in the development.
- d) The curb stops shall operate correctly. The curb box shall be straight and plumb with no debris in it.

### **5.4.3 Surface Works**

The surface works of a development shall mean all works not mentioned in the underground services portion or the house connections portion of the development and shall include (without limiting the generality of the foregoing) valve box top sections, curb box tops, manhole frames and covers, catch basin frames and grates, roads, curbs, boulevards, fire hydrants, sidewalks, ditches, parks, and stormwater management facilities. The following work shall be completed prior to the granting of "Initial Acceptance" for the surface works portion of the development.

- a) All surface works shall be complete and be certified by the consulting engineer that the works were constructed in accordance with City of Thunder Bay standards.
- b) The concrete work shall have been inspected by the consulting engineer and been repaired according to the "City of Thunder Bay Policy for Acceptance of Concrete Work in Developments" which is included in this book.
- c) All valve boxes, fire hydrants, curb boxes, manholes, catch basins and any other appurtenances shall be set at the correct finished grade and be undamaged.



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- d) All fire hydrants shall be acceptably painted and have all gaskets, screws, caps, etc. intact.
- e) All ditches shall be clean and flow correctly.
- f) All manholes and catch basins shall have the frames securely mortared on.
- g) All valve boxes shall be plumb and straight.
- h) All parkland development within the stage for which acceptance is being requested shall be completed and acceptable to the Parks Division.
- i) Suitable arrangements shall be made with the Engineering Division to provide the necessary financial guarantees to ensure that any damage to existing facilities during construction of the buildings on any undeveloped lots will be repaired by the Developer.
- j) A certificate signed by the consultant shall be submitted for each and every lot certifying that the property has been graded in conformity with the lot grading plan.
- k) The developer shall prepare and distribute septic field operation and maintenance information packages to the owner/occupant of all occupied lots within the development (suburban developments only) in accordance within the City of Thunder Bay Development requirements for on-site sub-surface sewage treatment facilities.
- l) All stormwater management facilities have been inspected and maintained, and an acceptable Operation and Maintenance Manual provided to the Engineering Division. For oil/grit separators, the unit(s) are to be vacuumed and cleaned out in accordance with the manufacturer's recommendations.



**5.4.4      Roadway Illumination**

The roadway illumination portion of the development shall mean all related underground & surface construction. The following works shall be completed prior to the granting of "initial acceptance" for this portion of the development.

- a) The underground wiring shall be complete & inspected by the consultant, Thunder Bay Hydro and the Electrical Safety Authority. The Engineering Division shall receive a copy of the acceptance certificate as issued by the Electrical Safety Authority pertaining to this work.
- b) The street light poles, luminaires & brackets shall be in place with all necessary wiring & electrical connections completed. This work shall be inspected by the consultant, Thunder Bay Hydro and the Electrical Safety Authority. . The Engineering Division shall receive a copy of the acceptance certificate as issued by the Electrical Safety Authority pertaining to this work.

**5.5      POLICY FOR ACCEPTANCE OF CONCRETE WORK IN DEVELOPMENTS**

**5.5.1      Initial Acceptance**

- a) Sidewalk slabs with cracks larger than 6 mm shall be replaced.
- b) Sidewalk slabs with more than one crack of any size shall be replaced.
- c) Sidewalks with differential settlement of 20 mm or more shall be replaced.
- d) Sidewalk slabs with spalled surfaces shall be replaced.
- e) Sidewalk slabs with a crack of any size which has concrete breaking or spalling away at the edges of the crack shall be replaced.
- f) Sidewalk slabs with a corner broken off may be saw cut and repaired at this stage.
- g) Curbs and/or gutters which have spalled may be patched at this stage.
- h) Repairs or patching done to broken curb and/or relocated/widened driveways shall be restored according to standard drawing R-109-3.



**5.5.2      Final Acceptance**

- a) Items No. a and No. f for initial acceptance will also apply for "Final Acceptance".
- b) Sidewalk slabs with a corner broken off shall be replaced.
- c) Curbs and/or gutters which have spalled shall be replaced.

Any work which was repaired for "Initial Acceptance" and has deteriorated shall be replaced.



### **6.0 ROADWAY ILLUMINATION SYSTEMS**

#### **6.1 DESIGN SPECIFICATIONS**

Note: Additional material specifications and construction methods related to Section 6.0 Roadway Illumination Systems are defined in the specifications located in Section 10.4 “Master Project Specifications” under the section headings titled “Products” and “Execution”.

##### **6.1.1 Illumination**

The roadway illumination shall be designed to the latest ‘American National Standard Practice for Roadway Lighting’ specifications as prepared by the I.E.S. Roadway Lighting Committee (ANSI/I.E.S. RP-8-0) and to the latest ‘Guide for the Design of Roadway Lighting’ specifications as prepared by Transportation Association of Canada (TAC).

All designs are to be complete with computer generated illuminance and luminance calculations that are submitted to the Engineering Division as part of the overall design review prior to construction.

##### **6.1.2 Electrical**

The electrical design of the roadway illumination systems shall be in accordance with the latest standards and specifications of Ontario Hydro, EUSA, Thunder Bay Hydro, Electrical Safety Association and any other appropriate governing bodies.

##### **6.1.3 Road and Pedestrian Conflict Area**

The roadway illumination designs and specifications shall conform to the applicable Roadway and Pedestrian Conflict Area classifications as outlined in the ANSI/IES RP-8-0 Manual.



### 6.2 CONSTRUCTION SPECIFICATIONS

Note: Additional material specifications and construction methods related to Section 6.2 Construction Specifications are defined in Section 10.4 “Master Project Specifications”.

#### 6.2.1 Qualifications

All electrical construction shall be done by a certified Electrical Contractor capable of working in accordance with the standards and specifications of Thunder Bay Hydro, Hydro One, Electrical Safety Authority, EUSA and any other appropriate governing bodies. The Contractor shall apply to these offices for the latest copies of these standards and specifications prior to commencing any work.

All workers and agents employed by the Contractor and working upon Thunder Bay Hydro Commission hydro poles shall be qualified certified electrical power linemen or apprentices-in-training under the on-site, direct supervision of qualified certified power linemen. Comply with Thunder Bay Hydro specifications for working on Thunder Bay Hydro poles.

Any contracting firms shall be members in good standing of the Electrical Utility Safety Association (EUSA).

#### 6.2.2 Approval

All construction shall be in accordance with the latest standards and specifications of Thunder Bay Hydro, Ontario Hydro, Electrical Safety Association, EUSA and any other appropriate governing bodies.

All electrical construction shall be inspected by the Electrical Safety Association. The City of Thunder Bay Engineering Division shall receive copies of all inspection certificates prior to acceptance of any work.

#### 6.2.3 Buried Wire

Black & white wiring shall be installed in 50 mm polyethylene ducts. Install the bare ground wire outside of and adjacent to the duct. Leave a sufficient length of wires coiled up and above each base.

Protect the wires and top of the new base from damage. Wires shall be continuous without splices between concrete bases. Lubricate wires to be installed in flexible conduit with electrical lubricant, Yellow 77 or equivalent.

Clearly mark and identify the wiring from the hydro transformer pad to the service disconnect pole location.



Approved marker tape shall be laid flat in the backfill at the halfway depth of the trench directly above the wires for the full length of the trench.

Rigid PVC electrical duct (CSA Type II) shall be installed for all road crossings at a minimum 900 mm depth. All wires are to be installed in the rigid duct at the time of the installation.

Continual runs of wire shall be installed between pole locations. Underground splicing will **not** be allowed unless pre-approved by the Engineering Division.

### **6.2.4      Wood Poles**

Wood poles are not to be used for new development and construction projects unless approved by the City Engineer.

Install poles as shown on City of Thunder Bay Standard Drawings E-111.

Suitable backfill material shall be tamped for the full depth of the augured hole. Any curvature in the poles shall be set in line with the roadway.

Rock anchors shall be installed in rock conditions where the minimum 1.60 m bury is not attainable. The rock anchors shall be installed to the manufacturer's specifications.

Use compression style lugs of applicable size for connections between the luminaire wire and the buried wire at top of pole (Burndy brand or approved equal). Securely insulate the connection using Scotch 88 tape (3 M brand or approved equal).

The installation design shall place the wood poles along the opposite side of the roadway as the sidewalk, where possible.

### **6.2.5      Steel Poles**

Steel poles shall be supplied and installed for all new construction projects.

The steel poles shall be set upon the concrete bases, shimmed level and fastened.

Use compression style lugs of applicable size for connections between the luminaire wire and the buried wire at the location of the hand hole (Burndy brand or approved equal). Securely insulate the connection using Scotch 88 tape (3M brand or approved equal).

The installation design shall place the steel poles along the opposite side of the roadway as the sidewalk, where possible.



### 6.2.6 **Reinforced Concrete Base**

Bases shall be precast and/or cast-in-place using a machine auger of applicable size. Construct bases as shown on City of Thunder Bay Standard Drawings E-102 and E-103-2 unless specified in the Contract documents.

All bolting dimensions shall be **verified** with the steel pole manufacturer prior to the concrete base construction.

Tops of bases to be smooth and level and, along with the anchor bolts, duct entries and wiring, suitably protected from damage prior to pole installation.

See City of Thunder Bay Standard Drawing E-107 for construction of bases in rock conditions.

### 6.2.7 **Support Bracket**

Fastened bracket onto the wood pole using a 16 mm galvanized bolt complete with nut and washer and a 12 mm galvanized lag bolt. The center of base plate shall be approximately 300 mm from top of the pole.

### 6.2.8 **Luminaire**

Installed level on the aluminum bracket and/or steel pole level and firmly fastened with all necessary electrical connections complete. Confirm that the socket position is set for the Contract specified I.E.S. Distribution setting.

### 6.2.9 **Ground Wire**

Install from the Hydro transformer pad location to the service disconnect pole for grounding of the service disconnect and the relay/photo control.

For wood pole installations, the ground wire is not required for the remaining poles on that circuit run.

For steel pole installations, the ground wire is required for the length of the circuit. The ground wire shall be bonded to the grounding lug nut on each steel pole.

### 6.2.10 **Grounding**

The system grounding shall consist of one grounding plate or two ground rods at the service disconnect pole.

Install ground rods/plates at a minimum depth of 600 mm in undisturbed soil 1.0 meter from the pole location.



### **6.2.11     Relay/Photocell Controls**

Fasten controls to the wood pole using stainless steel screws with all necessary electrical connections complete.

Band controls to the steel pole just prior to the radius bend using stainless steel banding with all necessary electrical connections complete. All wire access holes drilled into the steel poles shall be complete with strain relief connectors of proper size.

### **6.2.12     Service Disconnect**

Install near the top of the first pole from the hydro transformer location as shown on the Contract drawings and on City of Thunder Bay Standard Drawing E-111.

Install two – 25 mm PVC electrical conduits to carry the necessary line and load wiring.

Install at the radius point of the first steel street light pole from the hydro transformer location as shown on the Contract drawings and fastened with stainless steel bands.

All wire access holes drilled into the steel poles shall be complete with strain relief connectors or grommets of proper size.

### **6.2.13     Junction Box**

Junction boxes shall be direct buried or cast-in-sidewalks. See OPSD 2112.02

### **6.2.14     Fusing**

Inline fuse shall be installed inside each of the luminaire housing.

### **6.2.15     Wire Connections**

Connect the wiring from the luminaire to the buried wiring with a compression type lug of applicable size. (Burnby brand or approved equal). Securely insulate connection using Scotch 88 tape (3M brand or approved equal).

Any approved underground connections to be wrapped with Aqua-Seal, Scotch 88 tape and Scotch-Kote (3M brand or approval equal).



### 6.2.16 Testing

Conduct tests for continuity and tests to measure insulation resistance between each conductor and ground and between each pair of conductors in a circuit. Any circuits which have a phase-to-ground resistance less than 0.5 megohm or a phase-to-phase resistance less than 1.0 megohm shall be replaced.

Results of these tests shall be forwarded to the City of Thunder Bay Engineering Division prior to acceptance of any work. The tests are to be performed prior to final backfilling.



## **7.0 TRANSPORTATION**

### **7.1 TRAFFIC IMPACT STUDY GUIDELINES**

The following guidelines should be followed for the preparation of a Traffic Impact Study:

#### **7.1.1 Project Description**

Project description should include, but not be limited to:

- The purpose and nature of the project.
- Land use type and intensity.
- Development phasing planned.
- Expected completion dates.

#### **7.1.2 Study Area**

The study area should be defined in consultation with the Engineering Division. At a minimum, intersections adjacent to the site will be examined; other intersections to be included will be determined on a site-by-site basis. All major roadways and intersections within the study area shall be shown on a plan.

#### **7.1.3 Background Conditions**

Describe all background conditions, including:

- Current land use of the site and the surrounding area.
- Roadway geometrics.
- Intersection control devices, with details on phasing and cycle lengths.
- Current turning movement traffic volumes.
- Traffic restrictions and speed limits.
- Transit routes (if relevant to the proposed development).
- Pedestrian and cyclists facilities (if relevant to the proposed development).



#### **7.1.4 Design Hours**

Design hours will depend on the type of development proposed and more than one time period may be required for analysis.

- Major retail – weekday p.m. street peak and Saturday afternoon peak hours.
- Small scale retail/restaurant/general commercial – weekday p.m. street peak hour.
- Residential/office/industrial – weekday a.m. and p.m. street peak hours.
- Sports and cultural venues – peak hour of operation.

Daily traffic link volumes will also be required for proposed residential/industrial subdivisions to confirm appropriate street classifications and related right-of-way requirements.

#### **7.1.5 Horizon Year Traffic Scenarios**

Traffic scenarios shall include:

- Existing conditions.
- Opening day.
- Full build out (which may be the same as opening day).
- Full build out plus five years.
- Intermediate stages as requested by the Engineering Division.

#### **7.1.6 Background Traffic**

Current traffic count data may be available from the City or the Ministry of Transportation in the case of provincial roadways within the City. Where current data (no more than five years old, or less than five years if significant development has occurred in the area in recent years) is not available, the proponent will be responsible for collecting traffic data for the two to three hour period surrounding the applicable design hour as noted in the Design Hours section above. If counts are required for signal warrants, they should be based on the criteria set out in the MTO signal warrant procedures.

Background traffic should be documented in the report, stating all assumptions pertaining to future traffic projections. In general, background traffic is described as the traffic that is on the road network prior to the addition of traffic from the proposed development, redevelopment or rezoning. Background traffic growth should be developed from historical traffic counts plus consideration of other planned developments in the area.



Growth factors may be reviewed with the Engineering Division prior to completing the TIS to ensure that they are satisfactory to the City.

Reference should be made to other relevant studies that may assist the proponent in determining future background traffic levels and possible changes in the area transportation system. The City will provide copies to the proponent, as available.

### **7.1.7 Site Traffic Generation**

Ideally, trip generation measured at local comparable sites should be applied. If not available or feasible, trip generation measured at other Canadian cities can be used. If these are not available, the latest version of the Institute of Transportation Engineers (ITE) Trip Generation Manual may be utilized. Trip generation rates, the source, and forecast trip generation should be summarized and documented. The analysis should take into account the following:

- The sources of the trip generation rates.
- The methodology, data collection and analysis procedure of any special trip generation studies being used in the study.
- Identify the trip generation rates for each land use component within the development proposal.
- Identify any variations from the normally accepted generation rates that are being proposed; the reasons for the variation must be fully documented.
- Assumptions on drop-in (pass-by) traffic, internal trips, joint trips, etc. must be identified and the rational for the assumptions provided.

### **7.1.8 Site Traffic Distribution**

The assumed trip distribution must be identified and the rational for the selected distribution provided.

### **7.1.9 Site Traffic Assignment**

Identify the trip assignment used to allocate new trips to the area street system.

### **7.1.10 Development Staging**

Anticipated staging for the development should be identified, as well as the possible timing for full build out.

### **7.1.11 Graphics**

The report should include graphics illustrating:



- Study area.
- Proposed site plan with the full right-of-way width and geometrics of adjacent roadways.
- Existing traffic.
- Development traffic.
- Existing plus development traffic for opening day and full build out.
- Forecast traffic for full build out plus five years and any intermediate stages as requested by the Engineering Division.
- Proposed transportation system modifications.
- Proposed traffic control devices.

### **7.1.12 Capacity Analysis**

Capacity analysis time frames will in part be dependant on the nature of the development and guidance provided by the Engineering Division, as follows:

- Major retail – weekday p.m. street peak and Saturday afternoon peak hours.
- Small scale retail/restaurant/general commercial – weekday p.m. street peak hour.
- Residential/office/industrial– weekday a.m. and p.m. street peak hours.
- Sports and cultural venues – peak hour of operation.

All major arterial and collector roadways and intersections within the study area shall be examined for the specified design hours to ensure that adequate capacity and traffic signal coordination are maintained. The operational performance of all signalized intersections, major unsignalized intersections, and proposed private approaches shall be analysed and documented in the final report. For any roadway section or intersection that is sensitive to weaving, vehicle queuing shall be evaluated.

The type and level of analysis and evaluation will include documentation of levels of service for intersections. Operational analysis will preferably be done using the latest version of Synchro software. Both LOS and ICU should be identified in the report for overall intersection performance (where available). LOS should also be provided for each individual movement. A saturation flow rate of 1750 vehicles per hour should be used, unless field measurements at the study area would indicate a more appropriate value.

If Synchro is deemed not appropriate or applicable in the particular study area, the latest version of Highway Capacity Software can also be utilized.



The key calculations/operational model print outs should be provided in an appendix to the report or in a separately bound technical report.

Along with intersection operational analysis, forecast traffic queues for auxiliary lanes should be identified in order to determine the length of the lanes.

The City has established a preferred LOS of C during peak hours of operation, although LOS D may be accepted if there is no cost effective manner of achieving LOS C. In the case where current LOS levels do not achieve these targets, a lower level of service may be accepted; however, post development LOS should meet or exceed pre-development LOS.

### **7.1.13 Pedestrians and Cyclists**

Pedestrians and cyclists are an integral part of the transportation network and shall be accommodated within the planning process. The TIS shall identify how internal and external pedestrian linkages will be accommodated. In the case of residential developments, bikeway connections shall be identified where existing or planned adjacent bikeway facilities exist.

### **7.1.14 Transportation System Modifications**

All transportation system geometric and operational modifications identified as necessary without and with the proposed development shall be listed along with the timing for implementation. The geometric modifications, as well as proposed private approaches, shall be shown on a functional plan indicating dimensions, radii, required pavement widening, right-of-way needs, traffic control devices and other significant characteristics.

City of Thunder Bay standards shall apply; where specific City standards do not exist, TAC standards may be used. In the case of a need for left turn lanes, the minimum acceptable length is 15 metres.

Private approaches shall be located, and configured, in such a manner as to avoid disruption to the public street system.

If changes to traffic control are proposed, warrants shall be reviewed and documented in the report. MTO warrants will typically apply.

Financial responsibility for geometric and operational modifications shall be identified. The proponent will be responsible for modifications solely required to serve the proposed development. In the case of items that may also be of value to the general travelling public, the City may consider cost sharing. Any cost sharing will be assessed on a site-by-site basis.



**7.1.15 Other Items**

Additional requirements may be required on a site-by-site basis and should be reviewed with Engineering Division staff prior to undertaking the TIS.

**7.1.16 Table of Contents**

The following is a suggested table of contents. Sub-sections may change to suit site-specific report requirements.

**REPORT TABLE OF CONTENTS**

**Executive Summary** (a site plan should be included)

**1.0 Introduction**

1.1 Purpose of the Study

1.2 Site Location

1.3 Study Objectives

1.4 Description of the Proposed Development, Redevelopment or Rezoning

1.5 Study Area

**2.0 Background Conditions**

2.1 Study Area Land Use

2.2 Existing Traffic

2.3 Horizon Year(s) Background Traffic

2.4 Existing Geometrics and Traffic Control

**3.0 Projected Development Traffic**

3.1 Development Staging

3.2 Trip Generation

3.3 Trip Distribution

3.4 Trip Assignment

**4.0 Post Development Traffic**

4.1 Horizon Year(s) Total Post Development Traffic

**5.0 Traffic Analysis**

5.1 Analysis Assumptions

5.2 Capacity Analysis

5.3 Queue Analysis

5.4 Site Access



**6.0 Transportation System Modifications**

6.1 Horizon Year Modifications Without Proposed Development

6.2 Horizon Year Modifications With Proposed Development

**7.0 Conclusions**

**8.0 Recommendations**

**7.2 ROAD CLASSIFICATION AND DESIGN GUIDELINES**

**7.2.1 Transportation Analysis - New Development**

A transportation analysis shall be developed which shall show the classification for all streets in the subdivision draft plan in accordance with Standard Drawing No. R-128.



**8.0     CATHODIC PROTECTION OF WATER DISTRIBUTION PIPING**

**8.1     DESIGN SPECIFICATIONS**

The following shall be used as the minimum standard for the design of cathodic protection systems for use in preventing external corrosion of metallic watermain, metallic fittings, hydrants, and service connections.

Use of materials and procedures other than those specified shall not be permitted unless they are proven to be equivalent or superior. Such substitutions require the prior approval of the Contract Administrator.

Criteria for protection shall be as per the National Association of Corrosion Engineers (NACE), standard RP0169-92.

The Standard Drawings are an integral part of this specification. Should there be a discrepancy between this specification and the Standard Drawings, then the specifications shall be taken as correct.

**8.1.1     New Ductile Iron Watermain**

All new ductile watermain shall be cathodically protected with sacrificial anodes designed for a minimum life of 20 years.

**8.1.1.1     Zinc Anode Requirements  
(soil resistivities less than 2000 ohm-cm)**

Where soil resistivities are less than 2000 ohm-cm packaged zinc anodes shall be used on all metallic fittings, hydrants and metallic service connections.

a) Piping

Packaged 10.9 Kg (24 lb.) zinc anodes shall be installed on all new ductile iron watermain. Anode spacing shall be determined according to pipe diameter as follows:



## SECTION 8.0 – CATHODIC PROTECTION OF WATER DISTRIBUTION PIPING

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### 8.1.1.1 Zinc Anode Requirements Cont'd (soil resistivities less than 2000 ohm-cm)

#### **Zinc Anodes (Soil Resistivity <2000 ohm-cm)**

<u>Pipe Diameter (mm)</u>	<u>Anode Spacing (m)</u>
100	12
150	8
200	6
250	5
300	4
400	3
600	2

#### b) Valves & Fittings

One (1) packaged 10.9 Kg (24 lb.) zinc anode shall be installed on each metallic fitting. Multiple fittings (up to 4 maximum) can be protected by a single anode if they are all located within 3.0m of each other. Valves and fittings that are manufactured with a coating that protects against corrosion do not require an anode.

#### c) Hydrants

At least one (1) packaged 10.9 Kg (24 lb.) zinc anode shall be installed on each hydrant lateral. Additional anodes shall be installed to maintain the anode spacing requirements in 8.1.1.1.a.

#### d) Copper Services

One (1) packaged 10.9 Kg (24 lb.) zinc anode shall be installed on the first 6.0m of every water service. Copper water services longer than 6.0 m in length shall receive one (1) additional anode for each 6.0 m of additional length or fraction thereof.

When replacing a watermain, one (1) packaged 10.9 Kg (24 lb.) zinc anode shall be installed on all exposed copper services.



## SECTION 8.0 – CATHODIC PROTECTION OF WATER DISTRIBUTION PIPING

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### 8.1.1.2 Magnesium Anode Requirements (soil resistivities greater than 2000 ohm-cm)

Where soil resistivities are greater than 2000 ohm-cm packaged magnesium anodes shall be used on all metallic fittings, hydrants and metallic service connections.

#### a) Piping

Packaged 14.5 Kg (32 lb.) magnesium anodes shall be installed on all new ductile iron watermains. Anode spacing shall be determined according to pipe diameter as follows:

#### **Magnesium Anodes (Soils>2000 ohm-cm)**

<u>Pipe Diameter (mm)</u>	<u>Anode Spacing (m)</u>
100	23.0
150	15.0
200	11.0
250	9.0
300	8.0
350	7.0
400	6.0
600	5.0

#### b) Valves & Fittings

One (1) packaged 14.5 Kg (32 lb.) magnesium anode shall be installed on each metallic fitting. Multiple fittings (up to 4 maximum) can be protected by a single anode if they are all located within 3.0m of each other. Valves and fittings that are manufactured with a coating that protects against corrosion do not require an anode.

#### c) Hydrants

At least one (1) packaged 14.5 Kg (32 lb.) magnesium anode shall be installed on each hydrant. Additional anodes shall be installed to maintain anode spacing requirements in 8.1.1.2.a.

#### d) Copper Services

One (1) packaged 14.5 Kg (32 lb.) magnesium anode shall be installed on the first 6.0m of every water service. Copper water services longer than 20 m in length shall receive one (1) additional anode for each 6.0 m of additional length or fraction thereof.



**8.1.1.2    Magnesium Anode Requirements    Cont'd**  
**(soil resistivities greater than 2000 ohm-cm)**

When replacing a watermain, one (1) packaged 14.5 Kg (32 lb.) magnesium anode shall be installed on all exposed copper services.

**8.1.1.3    Test Stations**

- a) Test stations shall be installed for the purpose of monitoring the effectiveness of the cathodic protection.
- b) Test station type may be either flush-mount or post-mount, as specified by the Contract Administrator. Typically, test stations shall be of the post-mount type in residential areas and flush-mount in downtown areas.
- c) Test stations shall be located within 30 metres of each end of the watermain, and at maximum intervals of 300 meters along the watermain route, with no less than one test station per subdivision block.
- d) Test stations shall be located along the hydrant line, at a distance of 2.0 metres from the hydrant.
- e) Post-mount test stations shall be installed where they will not interfere with and/or be a hazard to pedestrian or vehicular traffic.
- f) Test stations shall not be located in asphalt or driveways.

**8.1.2    New PVC Watermains**

All metallic structures associated with new PVC watermains shall be cathodically protected using packaged zinc anodes.

**8.1.2.1    Valves & Fittings**

One (1) packaged 10.9 Kg (24 lb.) zinc anode shall be installed on each metallic fitting. Multiple fittings (up to 4 maximum) can be protected by a single anode if they are all located within 3.0m of each other. Valves and fittings that are manufactured with a coating that protects against corrosion do not require an anode.

**8.1.2.2    Hydrants**

At least one (1) packaged 10.9 Kg (24 lb.) zinc anode shall be installed on each hydrant lateral. Additional anodes shall be installed to maintain the anode spacing requirements in 8.1.1.1.a.



**8.1.2.3     Copper Services**

- a) One (1) prepackaged 10.9 Kg (24 lb.) zinc anode shall be installed on the first 6.0m of every water service.
- b) Copper water services longer than 6.0 m in length shall receive one (1) additional anode for each 6.0 m of additional length or fraction thereof.
- c) When replacing a watermain, one (1) packaged 10.9 Kg (24 lb.) zinc anode shall be installed on all exposed copper services

**8.1.3     Existing Watermains**

Whenever an existing metallic structure associated with the watermain system is being serviced, repaired or replaced, cathodic protection must be employed.

**8.1.3.1     Ductile and Grey Cast Iron Watermains**

- a) One (1) packaged 14.5 Kg (32 lb.) magnesium anode shall be installed at any excavation on existing ductile and cast iron piping systems, including repair/replacement sites of mains, services, valves, and hydrants, and at crossings with new pipes. Additional anodes shall be installed if the exposed section of pipe exceeds the anode spacing requirements specified in 8.1.1.2.a.
- b) All exposed sections of metallic pipe and couplings must be bonded.

**8.1.3.2     PVC Watermains**

- a) Packaged zinc anodes shall be installed at all excavations of previously unprotected metallic components of PVC watermains, according to the requirements of 8.1.2



**9.0 SEPTIC FIELDS**

**9.1 INTRODUCTION**

Approval authority for the construction of septic fields lies with the M.O.E.E. and Thunder Bay District Health Unit. Septic fields constructed under authority of these agencies must adhere to the construction standards produced by these agencies.

Due to the impact of septic fields on groundwater conditions, surface drainage and other infrastructure which is under the jurisdiction of the City of Thunder Bay, the Engineering Division has instituted the following Development requirements for septic fields to be used by developers of suburban and rural subdivisions.

**9.2 DEVELOPMENT REQUIREMENTS FOR ON-SITE SUB-SURFACE  
SEWAGE TREATMENT FACILITIES**

**9.2.1 Lands Developed without Subdivision or Development Agreement**

1. The sewage treatment facilities shall meet all requirements of the Ontario Building Code Act through the designated sewage inspectors under the Thunder Bay District Health Unit.
2. The applicant shall provide a report prepared by a Professional Engineer, specializing in soils engineering (hereinafter referred to as the “Soils Engineer”), which shall include the following:
  - a) log of bore holes and test pits, used as a basis for the report, showing classification of soils and geodetic elevations of the ground water table. The number of individual test pits shall be determined by the M.O.E.E./Health Unit and shall be based on existing soil conditions. A minimum of three test pits shall be provided in any one development.
  - b) results of tests including absorption rates and existing nitrate levels, where applicable.
  - c) confirmation that representatives from the Thunder Bay District Health Unit and the “Soils Engineer” were present during the excavation of test pits and the absorption test.
  - d) estimates of potential variations in the water table.



**9.2.1 Lands Developed without Subdivision or Development Agreement**

Cont'd

- e) lot sizes shall be determined using sewage loading of 3500 litres per day per dwelling unit.
  - f) impact assessments on both ground and surface water quality as a result of the operation of the sewage treatment systems.
  - g) recommended treatment system design for each type of dwelling unit expected in the development.
  - h) any special requirements for field inspection or specialized construction which may be warranted.
  - i) copies of the report shall be provided to the Thunder Bay District Health Unit and to the City of Thunder Bay Engineering Division for approval prior to Engineering Division clearing the condition of severance.
3. The required lot grading and drainage plan shall include the locations and elevations of the septic field and the proposed location reserved for a standby field.
4. Prior to the start of construction of the municipal services or buildings on the severed land the proposed site for the tile field shall be barricaded with snow fencing to protect against compaction from vehicular traffic or construction equipment. This fencing must remain in place during the construction of buildings.
5. No occupancy permit will be issued by the City of Thunder Bay Building Division for any lot in the development until:
- a) The Ministry of Housing/Thunder Bay District Health Unit has issued a use permit for the sewage treatment system for that lot.
  - b) The owner of the dwelling constructed on the lot has certified that the tile fields and area reserved for the standby tile field have been located and graded in accordance with the approved lot grading and drainage plan and that the cover material over the tile field is acceptable.



**9.2.1 Lands Developed without Subdivision or Development Agreement**

Cont'd

6. Thunder Bay District Health Unit personnel will carry out detailed inspection of the sewage treatment facilities during the course of construction of the facilities.
7. The owner of the dwelling constructed on each lot shall maintain the sewage treatment facilities in accordance with the recommendations of the Ontario Ministry of Housing/Thunder Bay District Health Unit.
8. Lots which are served by On-Site Sub-Surface Sewage Treatment Facilities shall not be equipped with in-ground irrigation sprinklers.

**9.2.2 Lands Developed by Subdivision or Development Agreement**

1. The sewage treatment facilities shall meet all requirements of the Ontario Building Code Act through the designated sewage inspectors under the Thunder Bay District Health Unit.
2. The owner shall provide a report prepared by a professional Engineer, specializing in soils engineering (herein after referred to as the 'Soils Engineer') which shall include the following:
  - a) log of bore holes and test pits, used as a basis for the report, showing classification of soils and geodetic elevations of the ground water table. The number of individual test pits shall be determined by the M.O.H./Health Unit and shall be based on existing soil conditions. A minimum of three test pits shall be provided in any one development.
  - b) results of tests including absorption rates and existing nitrate levels, where applicable.
  - c) confirmation that representatives from the Thunder Bay District Health Unit and the "Soils Engineer" were present during the excavation of test pits and the absorption test.
  - d) estimates of potential variations in the water table.
  - e) lot sizes shall be determined using sewage loading of 3500 litres per day per dwelling unit.



**9.2.2      Lands Developed by Subdivision or Development Agreement      Cont'd**

- f) impact assessments on both ground and surface water quality as a result of the operation of the sewage treatment systems.
  - g) recommended treatment system design for each type of dwelling unit expected in the development.
  - h) any special requirements for field inspection or specialized construction which may be warranted.
  - i) copies of the report shall be provided to the Thunder Bay District Health Unit and to the City of Thunder Bay Engineering Division for approval prior to final approval of the Plan of subdivision.
- 3. The lot grading and drainage plan required by the Subdivision Agreement shall include the locations and elevations of the septic field and the proposed location reserved for a standby field.
- 4. Prior to the start of construction of the municipal services within the subdivision the proposed site for the tile field shall be barricaded with snow fencing to protect against compaction from vehicular traffic or construction equipment. This fencing must remain in place during the construction of all buildings in the subdivision.
- 5. The engineering firm which is retained for inspection of the subdivision servicing shall certify that the tile fields and location reserved for the standby tile field have been located and graded in accordance with the approved lot grading and drainage plan and that the cover material over the tile field is acceptable.
- 6. Thunder Bay District health Unit personnel will carry out detailed inspection of the sewage treatment facilities during the course of construction of the facilities.
- 7. No occupancy permit will be issued by the City of Thunder Bay Building Division for any lot in the subdivision until a use permit has been issued for the sewage treatment system by the Ministry of Housing/Thunder Bay District Health Unit, for that lot.



**9.2.2      Lands Developed by Subdivision or Development Agreement      Cont'd**

8. The Subdivision Agreement which will be registered on title to each lot shall require the lot owner to comply with the day to day operational and maintenance sewage recommendations of the Ontario Ministry of Housing/Thunder Bay District Health Unit.
9. The owner of the dwelling constructed on each lot shall maintain the sewage treatment facilities in accordance with the recommendations of the Ontario Ministry of Housing/Thunder Bay District Health Unit.
10. Lots which are served by On-Site Sub-Surface Sewage Treatment Facilities shall not be equipped with in-ground irrigation sprinklers.
11. Prior to the granting of final acceptance for the surface works portion of the subdivision, the developer shall distribute an information package for the operation and maintenance of the septic fields to the owner/occupant of each occupied lot within the development. All costs related to the preparation and distribution of the operation and maintenance package shall be borne by the developer.



### **10.0 CONSTRUCTION SPECIFICATIONS**

#### **10.1 GENERAL**

This section includes Master Specifications to be used in City of Thunder Bay Contract Documents and must be edited specifically for each contract.

Generally the specifications are based on OPSS specifications which were current as of November 2007. As OPSS specifications are updated from time to time the sample documents should be reviewed and updated as necessary.

A Project Specification is:

- part of a legal contract, which spells out what the parties agree to technically
- a description of the material to be supplied and workmanship to be provided
- complementary to the drawings.

#### **10.2 WRITING STYLE**

The writing style to be used in the Specifications is set out in this section.

General procedures are:

- The Tendering Information, Form of Tender and Supplementary Conditions should be written in the indicative style.
- The Project Specifications should be written in the imperative style.
- When editing Specifications, write in the style of the section being used. Styles should not be mixed in any one section.
- An official style of writing for Project Specifications is not necessary from a legal point of view, nor from a grammatical point of view. However, from a clarity, brevity and unambiguous point of view, there is a need. Consistency of style becomes desirable when more than one person writes a contract.

One could write a book trying to define style in the written language. Confining our attention to spec writing helps, as we are concerned primarily with cold facts, not ideas or emotions.



In reviewing previously written specifications three distinct sentence forms can be identified:

1. “The Contractor shall install all accessories.”
2. “All accessories shall be installed.”
3. “Install all accessories.”

You will note that (1) is the longest, and (3) the shortest, and this fact generally holds for these styles: If you eliminate “The Contractor shall” from (1) you get (3).

Style 1 (indicative) suffers from repetition of the phrase “The Contractor shall ...” and this is poor for three reasons:

- (a) The spec gets long and tedious by repetition.
- (b) The General Conditions say that the Contractor will do all the work unless otherwise specified so we don’t need to keep repeating.
- (c) Inconsistent use of the phrase. This could be dangerous.

Style 2 (indicative) can be awkward in some situations especially if the writer gets into long sentences.

Style 3 (imperative) is abrupt, attention-getting, clear and brief. The imperative style (as this is called) in our language is normally reserved for commands: “Sit down”, “Stand up”, “Keep off the grass”. The command style of writing is quite adaptable to specifications.

Because of its brevity and clarity Style 3 has been adopted as a City policy.

1. Imperative style examples are:
  - “Pipes: ASTM C76”
  - “Dig Trenches”
  - “Retaining walls: reinforced concrete ...”
2. To achieve maximum clarity and maximum brevity:
  - (a) Use correct grammar.
  - (b) Keep sentences short and simple.
  - (c) Avoid stilted over-formal language.
  - (d) Use words in their exact meanings.
  - (e) Use simple words in preference to the unfamiliar.



- (f) Use technical terms in such a way as to be understood by lay persons.
- 3. Avoid the following phrases:
  - (a) “The Contractor shall.” Re-arrange sentence as recommended in 1. above. It is possible to write an entire project spec without using the words “Contractor” or “shall”.
  - (b) “To the satisfaction of the Engineer.” Redundant because it is covered in the General Conditions.
  - (c) “At the Contractor’s expense.” This is particularly dangerous because unless used throughout with complete consistency it could, if omitted, be interpreted as “not at the Contractor’s expense”. The General Conditions set out that the Contractor will do the Work, and comply with the contract requirements for his tender price or prices. That is all that is needed. If something is to be done or supplied as an extra, this of course has to be identified.
  - (d) “The Subcontractor.” The contract is between the City and a Contractor. We have no right to require a subcontractor to do anything (he may not even exist).
  - (e) “As Specified.” What you are writing is the specification; this is the place to say what is wanted.
  - (f) “Specified elsewhere.” Not necessary and rather unhelpful unless you say where. We must assume that the Contractor reads the entire document.
  - (g) “All”, “any.” Need not be used. These words are assumed in each case. They are usually used inconsistently.
  - (h) “Same” (as a noun). This is an odd word, with a kind of legal sound to it. It can often lead to ambiguity.
  - (i) “etc.” Too vague to be allowed in a Project Specification. List the items.
  - (j) “As shown on the Drawings.” Unnecessary, because the drawings are part of the Contract Documents or unless “the Drawing” is stated for quick reference.
- 4. In the “Products” part of specifications, when referring to standard specifications, use the following format:
  - “Materials” Conform to the latest edition of reference standards.”
  - “Concrete: CSA A23.”
  - “Asphaltic pavements: OPSS 1101.”



5. When referring to proprietary products, use the following format:

- “Paper towel dispensers – G.H. Wood Cat. No. 20”
- “Manhole covers – Canron Type DS-579”
- “Gate valves up to 2 ½ in. – Jenkins Fig. 470”

### **Conclusion**

Those who have written in the indicative style in the past may have some difficulties with the imperative, but the consensus is that once the imperative style is conquered it is considered to be easier and better.

The Appendix to this article lists some typical clauses, as they have appeared in some contracts, and as they could be re-written.

### **10.3 PITFALLS**

A Specification writer has to make a conscious effort to avoid:

- Making the Specifications too long. The writer has a natural fear of leaving something out. The writer is reluctant to delete something that is in an earlier Specification because he assumes there was a good reason for its being there.
- Inconsistencies between Specification and Drawings.
- Imitating legal jargon. Few Specification writers have any formal training in law, but are aware that what they write is part of a legal document that could end up in Court.
- Jargon. Most writers have considerable technical knowledge and it is too easy for too much technical jargon to appear in Specifications.
- Writing Specifications in too short a time. The all-too-familiar pattern of pulling together a Specification the day before the Tender Call creates an impossible environment for good writing. Specifications should be written along with the design and drawing tasks.

### **Examples of Project Specification Literary Style**

#### **Special Note**

It is easy to criticize and poke fun at others’ efforts, and it should be made clear the following examples were picked more or less at random, not to be critical, but to illustrate writing style, and to show the effects.

In commenting on and re-writing clauses, it was not attempted to correct any errors of fact, or omissions. Taken out of context (and especially without referring to drawings) it cannot be determined whether an isolated clause is adequate.



Long, complicated clauses and areas of technical controversy have been avoided because these examples are not concerned with technical content, and it is difficult to re-write some clauses without making substantial changes to the meaning.

Please note that the word “all” has not been used in the re-write. In the original text it has been used inconsistently; there is no need for it.

### **EXAMPLE 1**

#### **(a) As it appears in a contract**

At the base of all external walls and over lintels to doors, windows and other openings in external walls and to the full thickness of masonry walls, place and build in copper flashings as described, in positions shown on the drawings. The flashings shall be to the full width of the lintels plus 6 in. at either end, and shall be lapped at least 8 in. at all joints, in continuous lengths.

#### **(b) Comment**

The first sentence is imperative, as recommended, based on the verb “place”. Sentence is clumsy and too long. The second sentence is indicative. One wonders how many of the dimensions appear on the drawings. One wonders if there are other walls but “masonry”.

#### **(c) Rewrite (Imperative)**

Provide copper flashings at the base of external walls and over lintels to doors, windows and other openings in external walls. Provide flashings full thickness of wall and extend 6 in. beyond each end of the lintel. Lap at least 8 in.

### **EXAMPLE 2**

#### **(a) As it appears in a contract**

The Contractor shall carry out modifications to existing structures, buildings, pipelines and equipment. All modifications as detailed on the drawings and as specified in the Contract Documents shall be carried out. All work to be performed shall be carried out in accordance with the relevant Sections of the Contract Documents. The major modifications to be made are as listed below:

#### **(b) Comment**

This is much too long and says very little. The second sentence repeats the first. The third sentence is unnecessary.



**(c) Rewrite (Imperative)**

Modify existing structures, buildings, pipelines and equipment as listed below.

**EXAMPLE 3**

**(a) As it appears in a contract**

MTC Form 411 shall, for the purposes of this Contract, be amended in that nursery sod, to be supplied by the Contractor, shall meet the requirements current at the date of Contract, of the Ontario Sod Growers Association for No. 1 Bluegrass Fescue Sod and shall be cut to a minimum thickness of three quarters of an inch.

**(b) Comment**

Sentence structure complicated and thus difficult to follow. “Current at the date of Contract” is unnecessary as it is in the General Conditions.

**(c) Rewrite (Imperative)**

Sod: MTC Form 411, Ontario Sod Growers Association

- No. 1 Bluegrass Fescue
- Cut to a minimum thickness of  $\frac{3}{4}$  in.

**EXAMPLE 4**

**(a) As it appears in a contract**

Under this item and for the price bid per lineal foot, the Contractor shall supply all material, equipment and labour necessary (including excavation and backfill) to place a 2 inch galvanized steel pipe as shown on the Contract Drawings and as directed by the Engineer. These conduits shall be set to a depth of 3 feet below finished grade and shall extend between the outside edges of the prepared shoulder.

The pipe, pipe couplings and pipe caps to be supplied by the Contractor shall be a 2 inch wrought steel galvanized pipe and shall conform to Schedule No. 40 ASTM Specification No. A-120.

The pipe shall be placed in such a manner as to prevent damage to the conduit and to ensure support over its entire length. All pipe ends shall be threaded and all fins and burrs removed from the ends of the pipe and pipe terminations in the shoulder shall be capped. The Contractor shall supply and place through each conduit a No. 10 AWG annealed copper wire; this wire shall be placed so that it will be easily accessible from either end for the purpose of pulling a future cable.



Backfill shall correspond in quality and depth with the roadbed material immediately adjacent. Compaction shall be 95% of the maximum Proctor density for earth backfill, and to 100% for granular backfill.

**(b) Comment**

This is a fairly complicated clause, containing a lot of detail, but poorly arranged so as to be difficult to follow. Many phrases are redundant, such as Line 4.

Without looking at the drawings, we have difficulty deciding how much of the first paragraph is necessary. In any event on this kind of Contract the Engineer does the setting out.

**(c) Rewrite (Imperative)**

**PRODUCTS**

Conduits – ASTM A-120 Schedule 40, 2 in. wrought steel, galvanized, complete with pipe couplings and caps.

**EXECUTION**

Lay pipe to a depth of 3 ft. between outside edges of shoulders of road, and in uniform bedding.

Thread pipe ends and remove fins and burrs. Cap ends. Place annealed copper wire (gauge 10 AWG) in each conduit for pulling through future cables.

For backfill, match adjacent roadbed material as to quality and compaction.

Refer to Item 55 of Form of Tender for payment.

**EXAMPLE 5**

**(a) As it appears in a contract**

The disposal of surplus excavated material shall be the responsibility of the Contract and at its expense. The Contractor shall, at its own expense, be responsible for leveling, grading, compacting and maintaining all dump areas.

The Contractor shall secure the written permission of private property owners before dumping materials on their property. Where spreading or other requirements are stipulated by the Owner of the property, these shall be carried out by the Contractor, and the property shall be left in a condition satisfactory to the property Owner and the City.



**(b) Comment**

The word “Contractor” appears four times, “at his expense” twice. The entire clause is too long.

**(c) Rewrite (Imperative)**

Dispose of surplus excavated material. Obtain written permission from landowners on whose property the material is to be dumped, and fulfill conditions and requirements of the landowner.

### EXAMPLE 6

**(a) As it appears in a contract**

The pipe shall be protected in Etobicoke Creek Crossings as shown on the detail drawings.

The pipe shall be surrounded by a 12 in. thickness of 4,000 psi concrete across the creek bed and 10 feet into each bank.

The trench shall be backfilled with random riprap, to MTC Specification Form 424, bedded on site selected backfill material. The selected backfill shall be compacted to a 1:1 slope in the banks. The riprap shall be a minimum of 5 feet wide at the surface. Open joints in the riprap shall be filled with spalls.

The riprap protection at the banks shall be carried laterally upstream and downstream to the full width of the excavation.

**(b) Comment**

This is not bad. It is typical of a clause written for a special situation. It omits the word “Contractor”. It is clear and unambiguous. It could be shorter, especially if much of the detail is on the drawings.

“Products” and “Execution” are combined but will not be separated for this rewrite.

**(c) Rewrite (Imperative)**

Encase pipes that cross the Etobicoke Creek in a 12 in. thickness of 4,000 psi concrete for the width of the creek plus 10 ft. into each bank. Backfill with random riprap on top of site selected material. Compact backfill 1:1 slopes at the creek banks. Provide a min. 5 ft. width of riprap across the streambed and for the full width at the banks. Riprap: comply with MTC form 424. Fill open joints of riprap with spalls.



**EXAMPLE 7**

**(a) As it appears in a contract**

Liquid Calcium Chloride shall be used if weather conditions do not permit the placing of Bituminous Prime and shall be placed when directed by the Engineer.

The materials, preparation and solution strength shall comply with MTC Specification 415 for Type 'A' solution having a strength of 34% plus or minus 1% and having a minimum specific gravity of 1.351 at 60°F.

Method of Application: The distributors and method of application shall comply with MTC Specification 415. The Rate of application shall be between one quarter and one third Imperial gallons per square yard of road surface as determined by the Engineer.

**(b) Comment**

This clause illustrates (i) too much unnecessary technical detail; (ii) the writer hadn't read MTC 415; (iii) unnecessary and inconsistent use of sub-heading in the third paragraph; (iv) unnecessary duplicate reference to MTC 415.

Again, "Products" and "Execution" are combined.

**(c) Rewrite (Imperative)**

Liquid Calcium Chloride:	Comply with MTC form 415 Type 'A'. Use when weather conditions do not permit the use of bituminous prime.
--------------------------	---

Application Rate:	One Quarter to one third of a gal. per sq. yd. of road surface.
-------------------	---



### EXAMPLE 8

**(a) As it appears in a contract**

The Contractor shall fine grade the base course to provide adequate drainage to catchbasins. If after paving, puddles of water are found to lie along the curb or elsewhere, the Contractor shall correct the drainage at his own expense in a manner satisfactory to the Engineer.

**(b) Comment**

“The Contractor” used twice. “At his own expense in a manner satisfactory to the Engineer” is unnecessary. On line 2 the verb “found” seems sort of quaint, implying that they may be overlooked, or that someone lost them.

**(c) Rewrite (Imperative)**

Grade base courses to drain to catchbasins. Drain finished pavement to catchbasins. Rebuild areas that form puddles to drain correctly.

### 10.4 MASTER PROJECT SPECIFICATIONS

This section includes Sample Documents to be used as templates when preparing Contract Documents. They are maintained electronically in the Engineering Division’s database and can be obtained from the Engineering Clerk(s) or can be downloaded from the City of Thunder Bay Transportation and Works department Engineering Division web page.

Note that not all Sections will be included in every contract.

In preparing a Contract Document it is recommended that the Sample Document be downloaded and edited. Highlight the changes for review by the Project Engineer or, if required, by the Manager of Engineering.

Once the proposed edits have been approved delete the highlights and provide an electronic copy to the clerk to use for the preparation of the final Contract Documents.



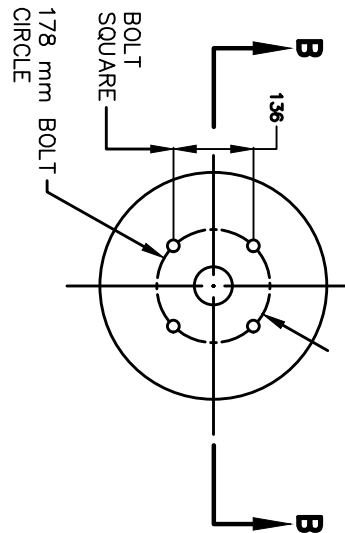
## SECTION 10.0 – CONSTRUCTION SPECIFICATIONS

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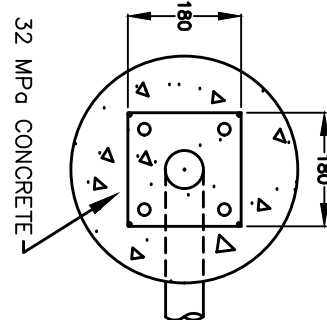
### INDEX – MASTER PROJECT SPECIFICATIONS

SAMPLE DOCUMENT NO.	SECTION NO.	DESCRIPTION
1	01000	General Requirements
2	01561	Environmental Protection
3	02510	Roads, Sidewalks & Appurtenances
4	02515	Hot-In-Place Recycled Mix
5	02520	Excavation and Grading
6	02530	Landscaping
7	02540	Fencing
8	02545	Concrete Barriers
9	02555	Concrete Structures
10	02560	Steel Beam and Cable Guide Rail
11	02570	Excavation and Backfill of Trenches
12	02575	Storm and Sanitary Sewers
13	02580	Watermains
14	02581	Specifications for Cement Mortar Lining of Watermains
15	02585	Cathodic Protection for Watermains
16	02590	Storm and Sanitary Forcemains
17	02595	Installation of Pipelines by Tunneling, Directional Drilling or Boring and Jacking
18	16105	Traffic Control and Street Lighting

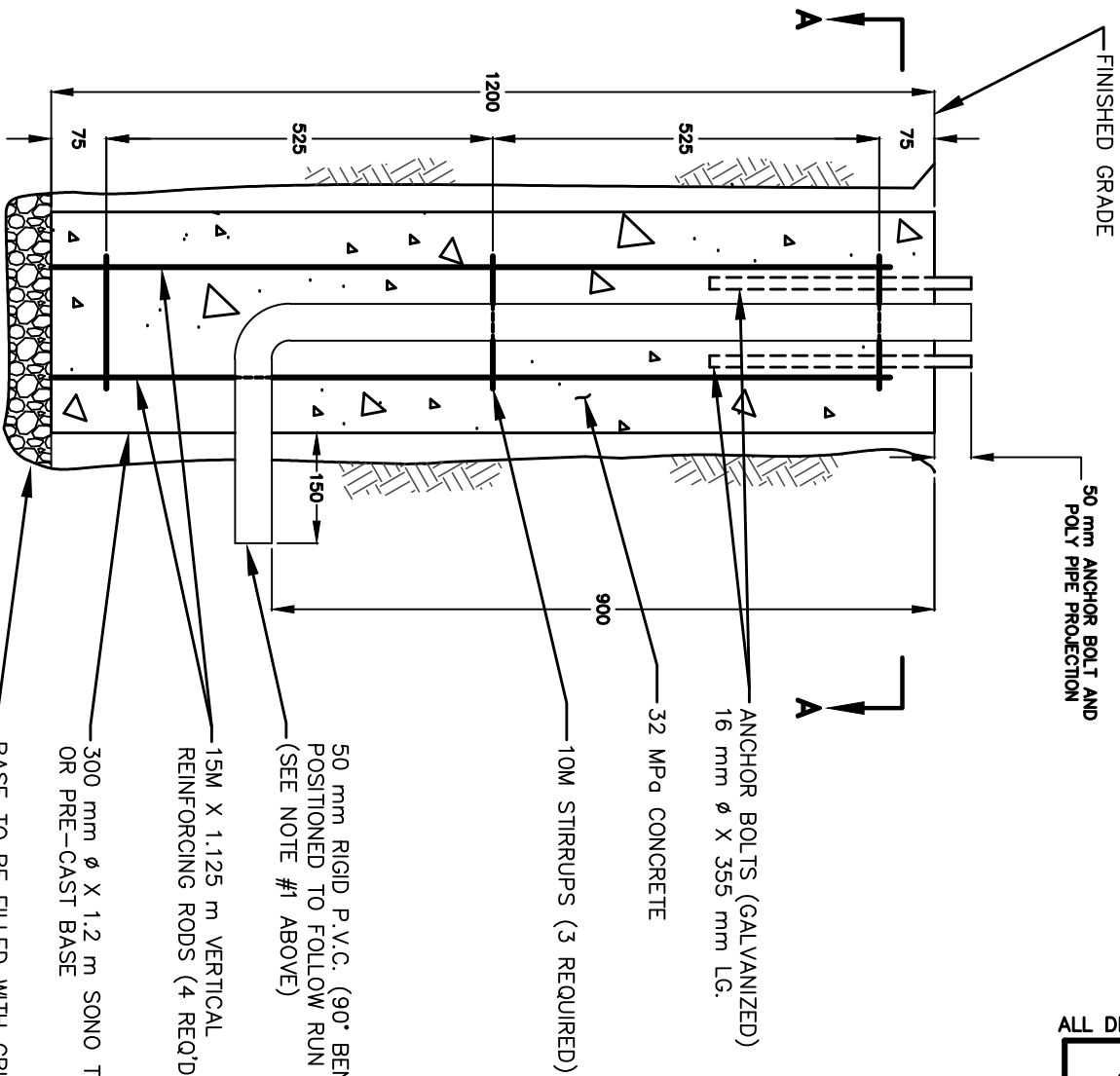




**PLAN**



**SECTION A-A**




**SECTION B-B**

**USES:**

- 1) 3.65M (12') ALUMINIUM POLE
- 2) WITH FLASHER LIGHT FOR TRAFFIC SIGNS

BASE TO BE FILLED WITH CRUSHED ROCK IN THE EVENT OF OVER EXCAVATION OR WET CONDITIONS (300 mm) TO MAINTAIN FINISHED GRADE

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

<div>CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i></div>		<b>ENGINEERING STANDARDS</b>	
TITLE <b>REINFORCED CONCRETE BASE (TYPE "A") FOR TRAFFIC SIGN POLE</b>			
DWN.	L.B.	DATE	 MANAGER, ENGINEERING DIVISION
REVISED:		JAN. 2018	
SCALE		N. T. S.	
Z:\ENG\Standard Drawings\Std Dwgs\E-100.dwg			DWG. NO. <b>E-100</b>



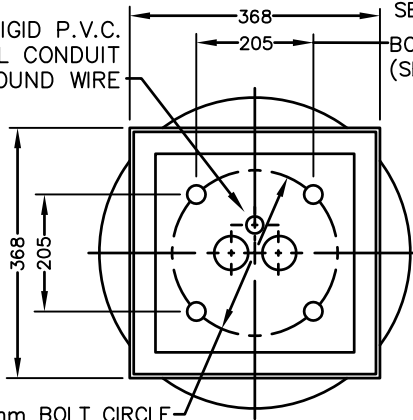




20 mm RIGID P.V.C.  
ELECTRICAL CONDUIT  
FOR GROUND WIRE

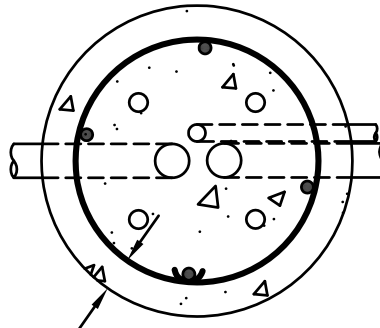
SET BOLT SQUARE AT RIGHT ANGLES TO ROAD EDGE.  
(FOR STREET LIGHT POLES)  
BOLT SQUARE  
(SEE NOTE BELOW)

B



290 mm BOLT CIRCLE  
(SEE NOTE BELOW)

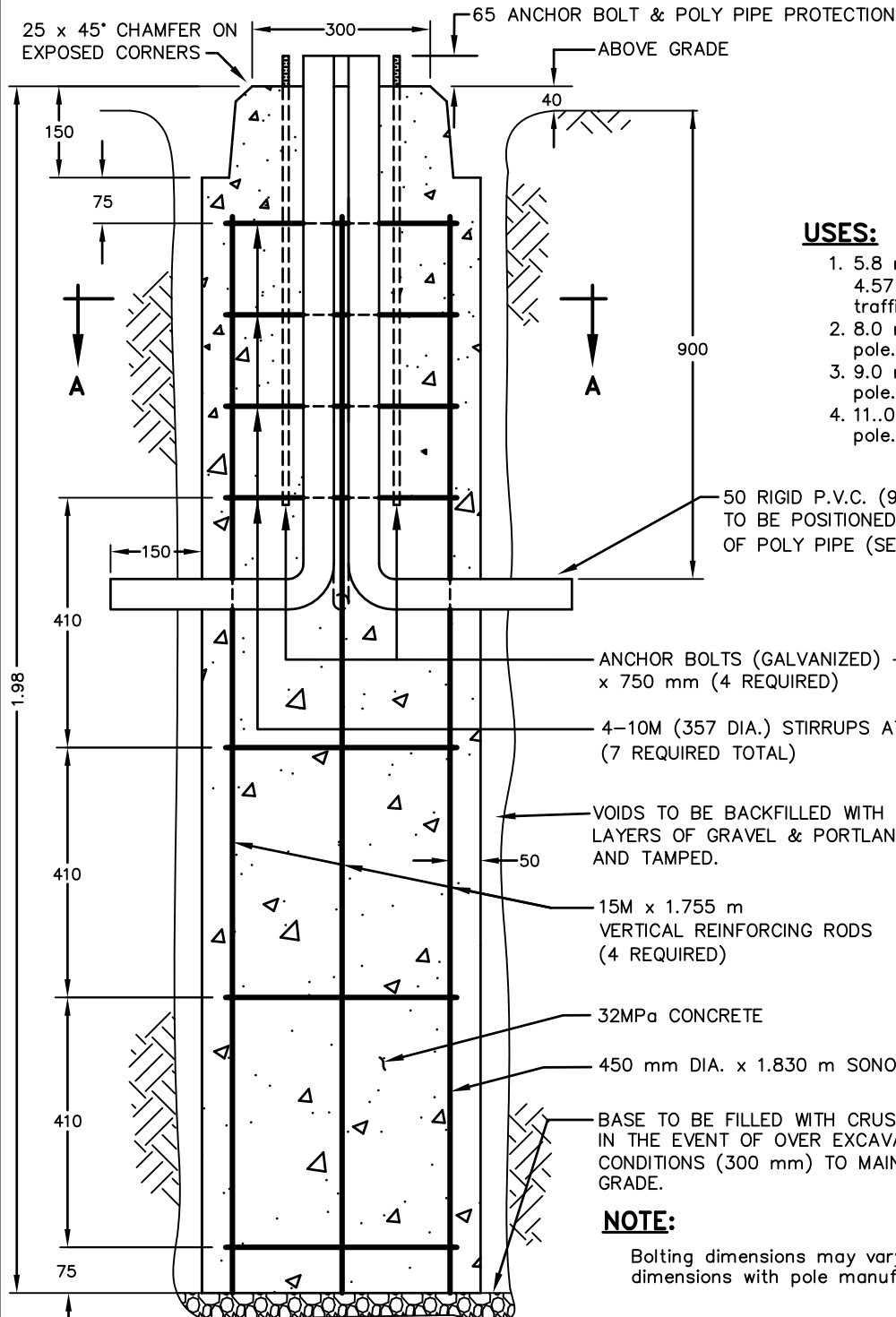
**PLAN**



50

**SECTION A-A**

25 x 45° CHAMFER ON  
EXPOSED CORNERS



**SECTION B-B**

**USES:**

1. 5.8 m (19') aluminum pole with maximum 4.57 m (15') traffic arm and 3.65 m (12') traffic arm at 90°.
2. 8.0 m (27') steel davit style street light pole.
3. 9.0 m (30') steel davit style street light pole.
4. 11.0 m (35') steel davit style street light pole.

50 RIGID P.V.C. (90° BEND)  
TO BE POSITIONED TO FOLLOW RUN  
OF POLY PIPE (SEE NOTE BELOW)

ANCHOR BOLTS (GALVANIZED) – 25 mm DIA.  
x 750 mm (4 REQUIRED)

4-10M (357 DIA.) STIRRUPS AT 150 C/C  
(7 REQUIRED TOTAL)

VOIDS TO BE BACKFILLED WITH ALTERNATED  
LAYERS OF GRAVEL & PORTLAND CEMENT  
AND TAMPED.

15M x 1.755 m  
VERTICAL REINFORCING RODS  
(4 REQUIRED)

32MPa CONCRETE

450 mm DIA. x 1.830 m SONO TUBE OR PRE-CAST BASE.

BASE TO BE FILLED WITH CRUSHED ROCK  
IN THE EVENT OF OVER EXCAVATION OR WET  
CONDITIONS (300 mm) TO MAINTAIN FINISHED  
GRADE.

**NOTE:**

Bolting dimensions may vary. Confirm bolting  
dimensions with pole manufacturer.

ALL DIMENSIONS ARE IN MILLIMETRES OR METRES

CITY OF  
**Thunder Bay**  
Superior by Nature  
ENGINEERING  
STANDARDS

TITLE

**REINFORCED CONCRETE BASE (TYPE "C")  
FOR STREET AND TRAFFIC LIGHT POLE**

DWN.

DATE  
June/81

D.R.

REVISD: **JAN. 2018**

SCALE  
N. T. S.

DWG. NO.

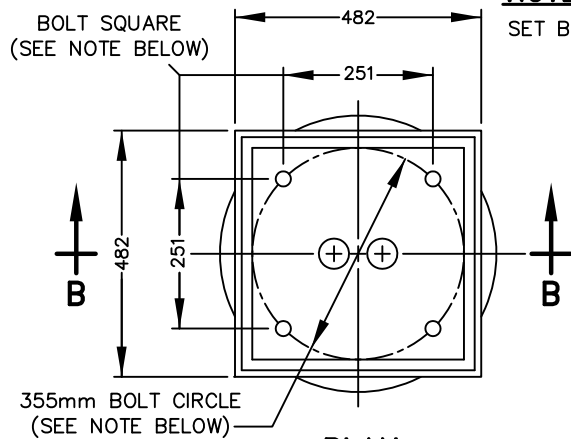
**E-102**

MANAGER, ENGINEERING DIVISION

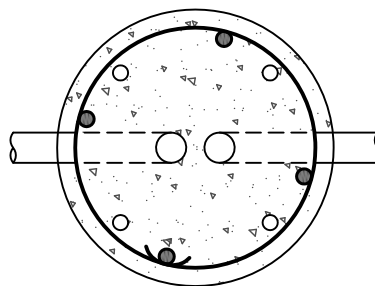
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SET BOLT SQUARE AT RIGHT ANGLES TO ROAD EDGE.



## PLAN



**SECTION A-A**

ALL DIMENSIONS ARE IN MILLIMETERS

# ENGINEERING STANDARDS



CITY OF  
**Thunder Bay**  
Superior by Nature

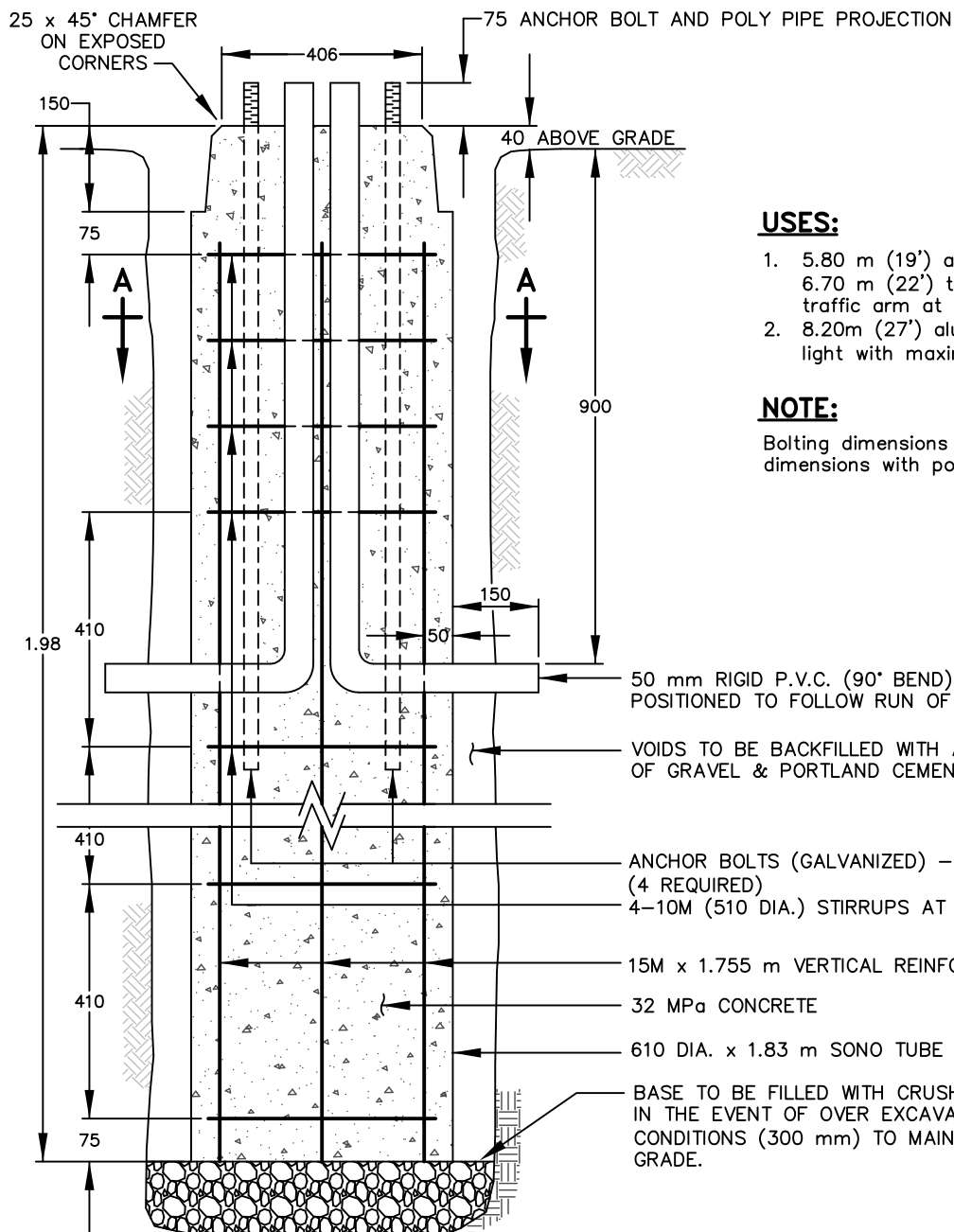
TITLE  
REINFORCED CONCRETE BASE (TYPE "D1")  
FOR TRAFFIC LIGHT POLE

DOWN. D.R./M.P. DATE FEB. 2007

REVISED: JAN. 2018	MANAGER, ENGINEERING DIVISION
DWG. NO.	

**E-103-1**

Z:\ENG\Standard Drawings\Std Dwgs\E-103-1.dwg



**SECTION B-B**

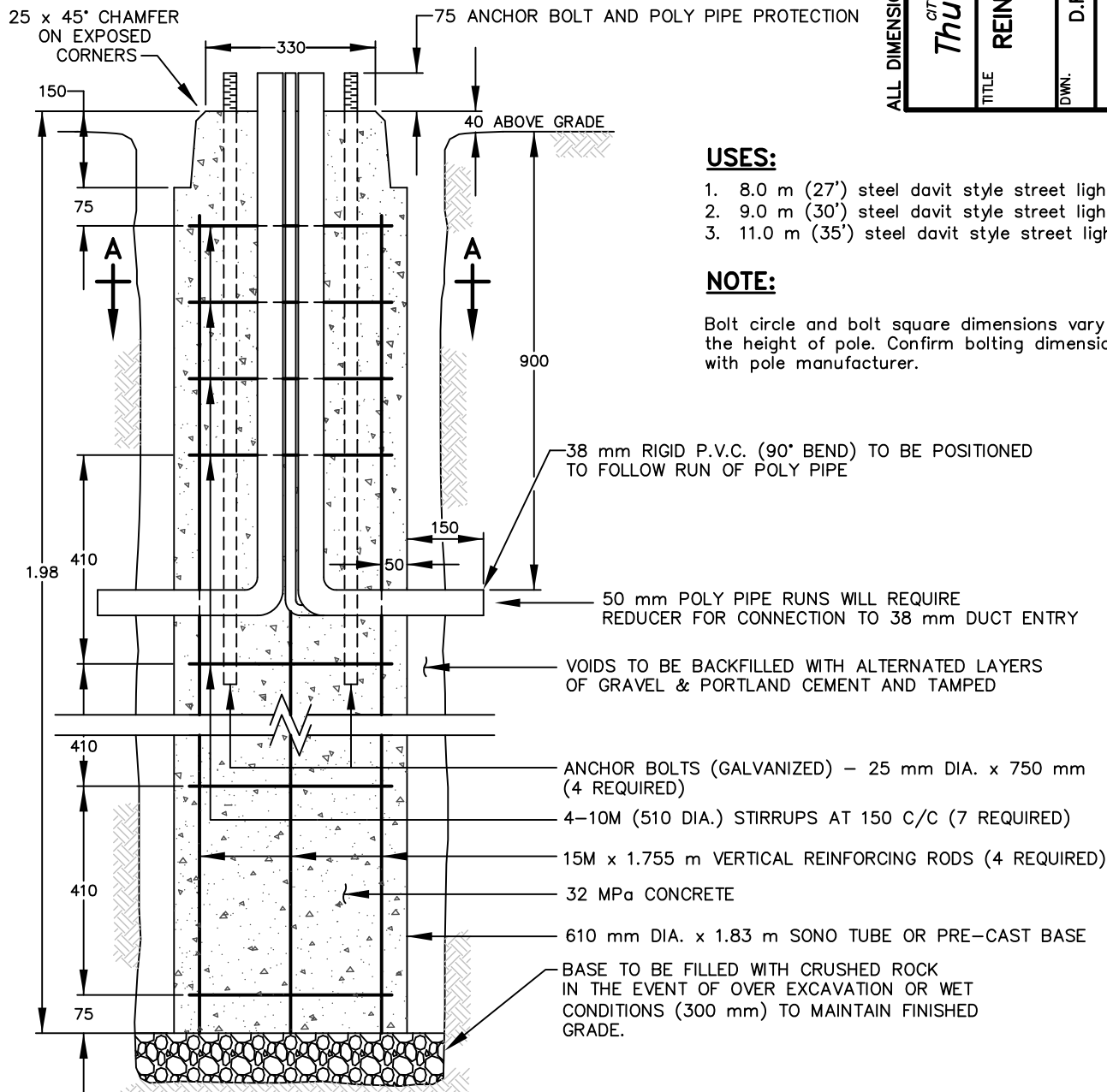
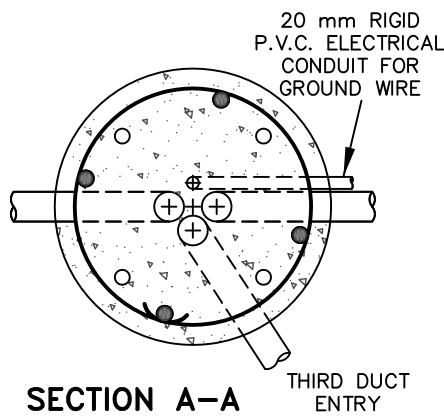
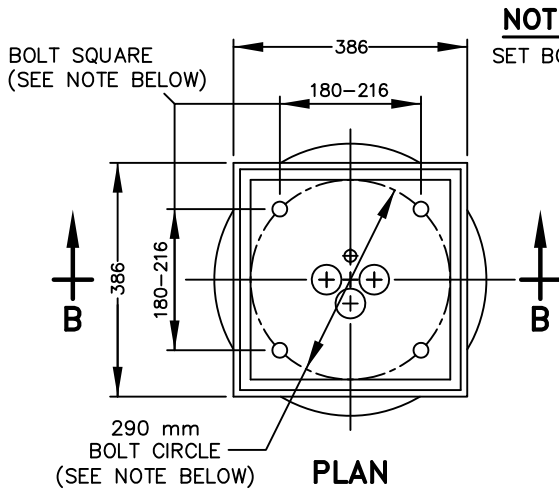
**USES:**

1. 5.80 m (19') aluminium pole with maximum 6.70 m (22') traffic arm and 4.57 m (15') traffic arm at 90°.
2. 8.20m (27') aluminium pole (GR1) C/W street light with maximum 6.70 m (22') traffic arm.

**NOTE:**

Bolting dimensions may vary. Confirm bolting dimensions with pole manufacturer.





### USES:

1. 8.0 m (27') steel davit style street light pole.
2. 9.0 m (30') steel davit style street light pole.
3. 11.0 m (35') steel davit style street light pole.

### NOTE:

Bolt circle and bolt square dimensions vary with the height of pole. Confirm bolting dimensions with pole manufacturer.

ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

CITY OF  
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ENGINEERING  
STANDARDS

TITLE  
**REINFORCED CONCRETE BASE (TYPE "D2")  
FOR STREET LIGHT POLE**

DWN. D.R. DATE FEB. 2007

REVISD: JAN. 2018

SCALE N. T. S.

DWG. NO. E-103-2

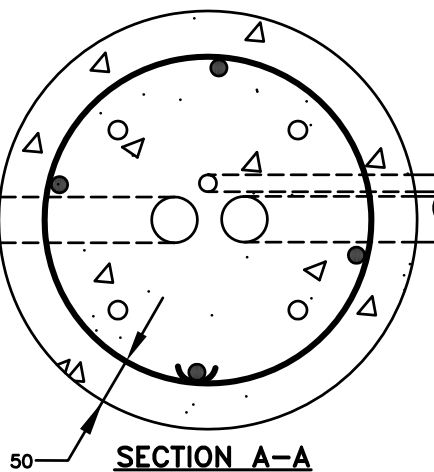
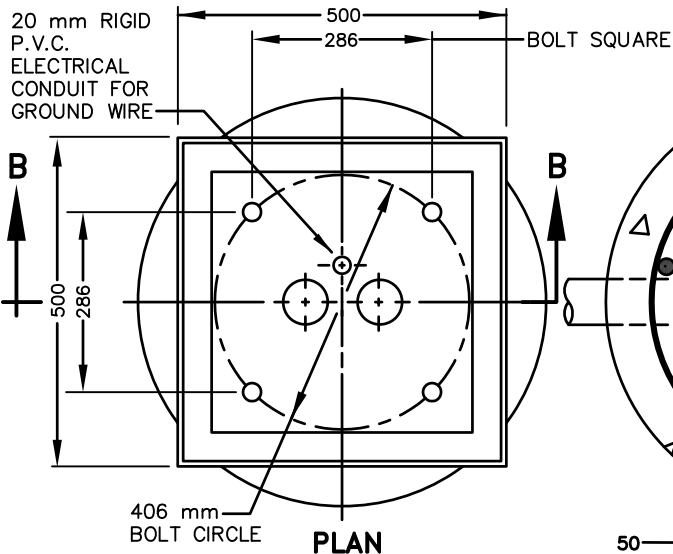
MANAGER, ENGINEERING DIVISION

N. T. S.

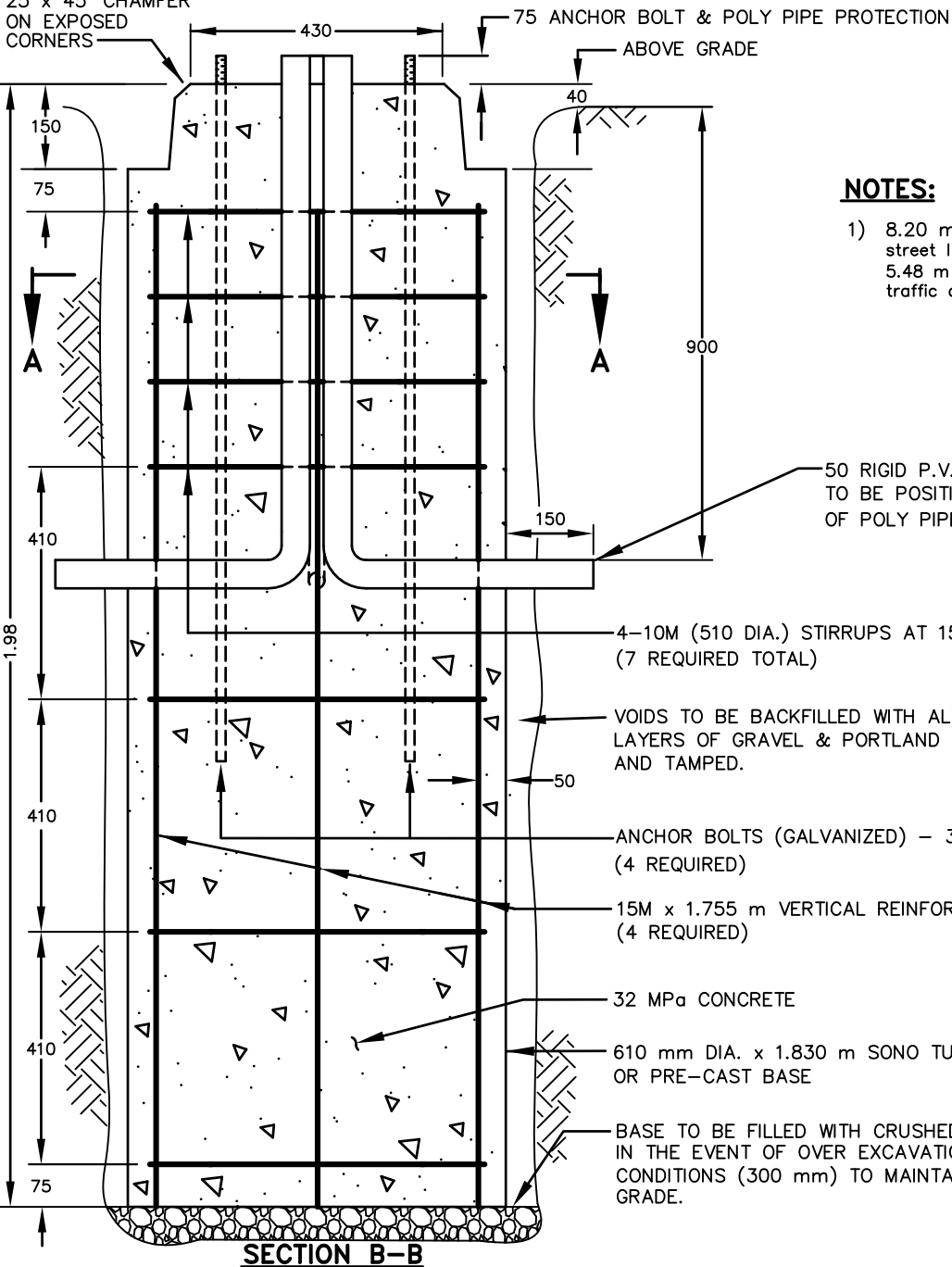
Standard Drawings\Std Dwg\E-103-2.dwg



20 mm RIGID P.V.C. ELECTRICAL CONDUIT FOR GROUND WIRE



25 x 45° CHAMFER ON EXPOSED CORNERS



#### NOTES:

- 1) 8.20 m (27') aluminum pole (gr.2) c/w street light arm with maximum 5.48 m (18') traffic arm and 4.57 m (15') traffic arm at 90°.

50 RIGID P.V.C. (90° BEND) TO BE POSITIONED TO FOLLOW RUN OF POLY PIPE (SEE NOTE BELOW)

4-10M (510 DIA.) STIRRUPS AT 150 C/C (7 REQUIRED TOTAL)

VOIDS TO BE BACKFILLED WITH ALTERNATED LAYERS OF GRAVEL & PORTLAND CEMENT AND TAMPED.

ANCHOR BOLTS (GALVANIZED) - 32 mm DIA. x 1.2 m (4 REQUIRED)

15M x 1.755 m VERTICAL REINFORCING RODS (4 REQUIRED)

32 MPa CONCRETE

610 mm DIA. x 1.830 m SONO TUBE OR PRE-CAST BASE

BASE TO BE FILLED WITH CRUSHED ROCK IN THE EVENT OF OVER EXCAVATION OR WET CONDITIONS (300 mm) TO MAINTAIN FINISHED GRADE.

ALL DIMENSIONS ARE IN MILLIMETRES OR METRES

CITY OF  
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ENGINEERING STANDARDS

TITLE  
**REINFORCED CONCRETE BASE (TYPE "E")  
FOR TRAFFIC LIGHT POLE**

DWN.	G.L. & D.R.	DATE	MANAGER, ENGINEERING DIVISION
		June/81	
REVISD:	JAN. 2018	DWG. NO.	
SCALE	N. T. S.		

**E-104**

Z:\ENG\Standard Drawings\Std Dwgs\E-104.dwg



The technical drawings illustrate the base plate's geometry and internal features. The **PLAN** view shows a circular base with a 320 mm diameter, indicated by a dimension line and the letter 'B' with an arrow. A dashed circle represents the 450 mm bolt circle, and a solid circle represents the 320 mm bolt square. A 20 mm RIGID P.V.C. ELECTRICAL CONDUIT FOR GROUND WIRE is shown entering the base. The **SECTION A-A** view shows the base's profile, with a 50 mm dimension indicating the thickness of the base plate. The section view also shows the internal structure, including the bolt square and the electrical conduit.

## ENGINEERING STANDARDS

The logo for the City of Thunder Bay, featuring a stylized grey bird in flight above the text "CITY OF Thunder Bay" and the tagline "Superior by Nature".

**TITLE**

**REINFORCED CONCRETE BASE (TYPE "G")  
FOR SECTIONAL STEEL POLE**

DWN.	D.R.	DATE
		OCT/88

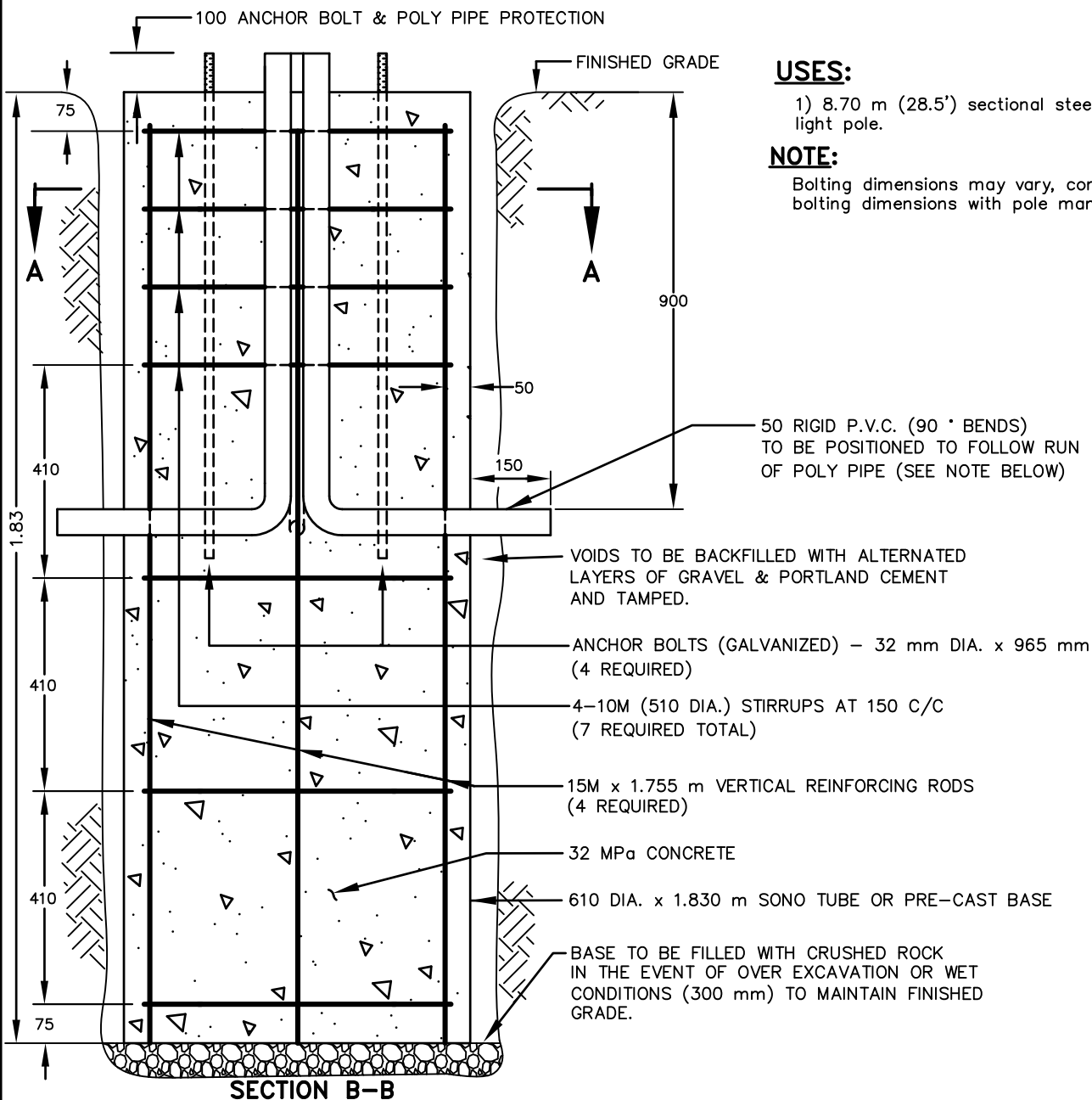
MANAGER, ENGINEERING DIVISION

**DWG. NO.**

**SCALE** **N. T. S.**

Z:\ENG\Standard Drawings\Std Dwgs\E-106.dwg

**E-106**



**USES:**

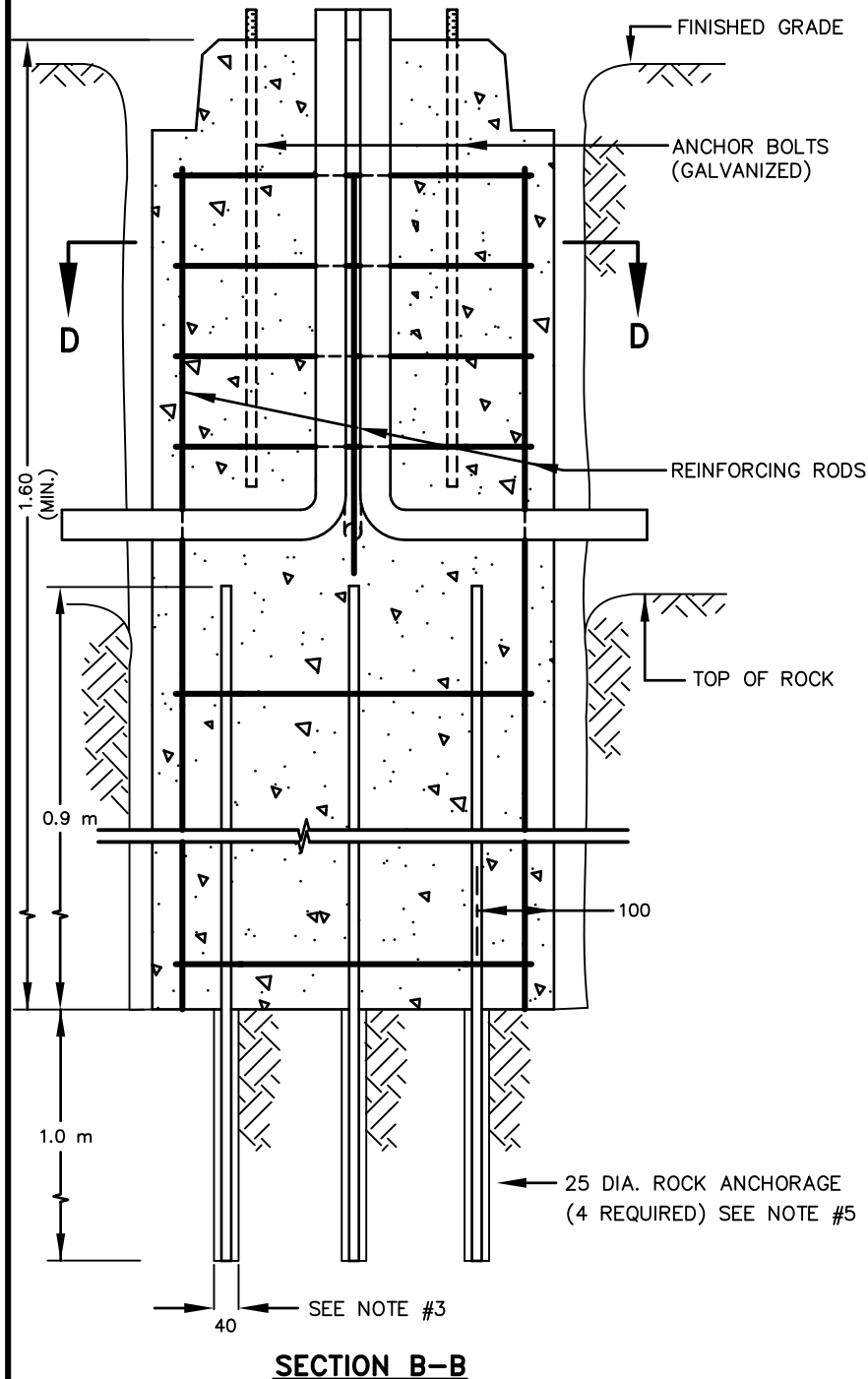
- 1) 8.70 m (28.5') sectional steel street light pole.

**NOTE:**

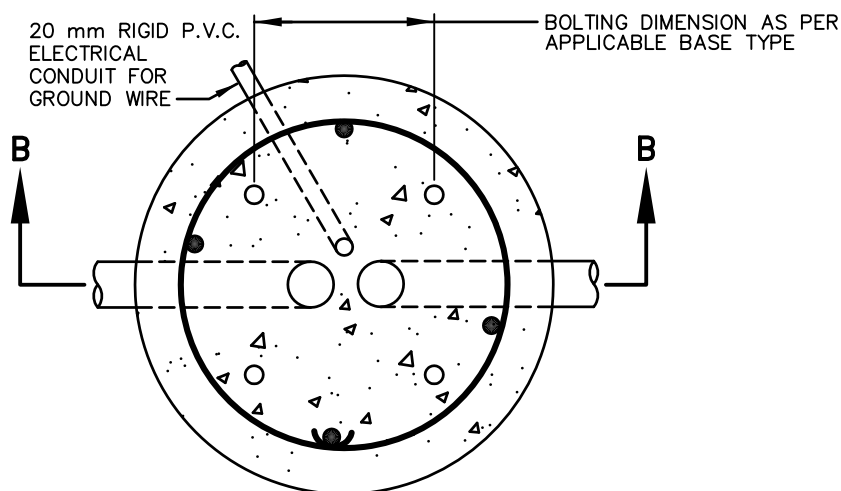
Bolting dimensions may vary, confirm  
bolting dimensions with pole manufacturer.

**ALL DIMENSIONS ARE IN MILLIMETRES OR METRES**





**SECTION D-D**



**SECTION B-B**

**NOTES:**

- 1) Reinforced concrete bases Type 'B' through 'G' to be constructed as shown here when rock is encountered. Contact the Engineering Division for construction details for the Type 'A' base when in rock. Refer to Standard Drawings E-101 to E-106 for additional construction details for the applicable base type.
- 2) Rock to be excavated to minimum 1.60 m high concrete base as shown here.
- 3) Voids to be filled with structural grout and applied as per manufacturers' specifications. (Stenson brand M-Bed Standard or equivalent)
- 4) Excavate rock to 2.0 m below grade in lieu of rock anchors. (Alternative method)

ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

**CITY OF**  
**Thunder Bay**  
*Superior by Nature*

**ENGINEERING**  
**STANDARDS**

**TITLE**  
**REINFORCED CONCRETE BASE**  
**(TYPE 'H') FOR STREET AND TRAFFIC**  
**LIGHT POLES IN ROCK CONDITIONS**

DWG. NO. **G.S.L.** DATE **NOV./94**

REVISD: **DEC. 2007**

SCALE **N. T. S.**

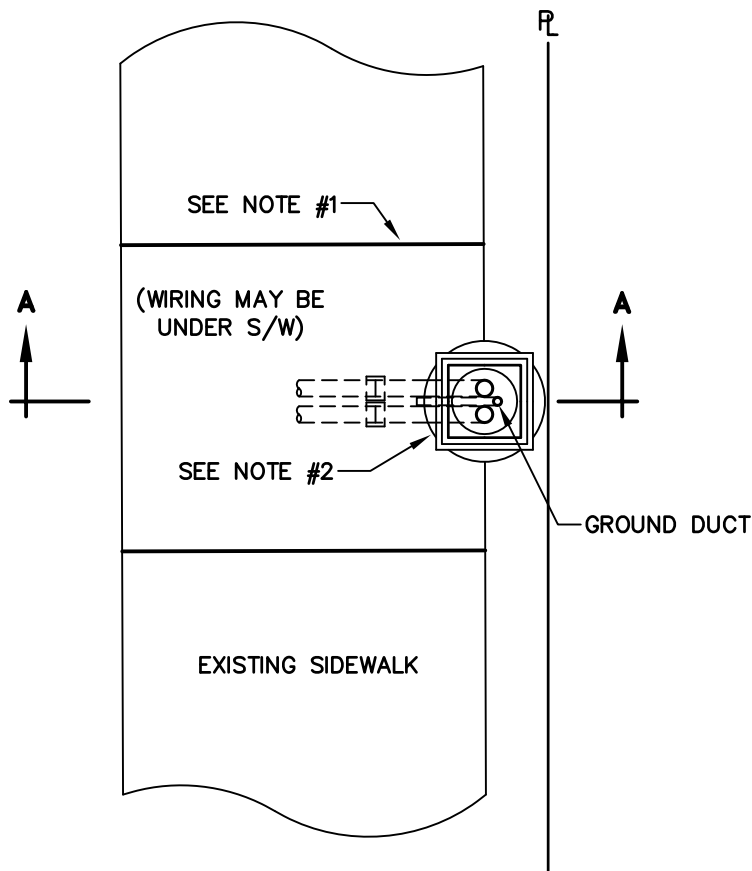
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*Signature*  
MANAGER, ENGINEERING DIVISION

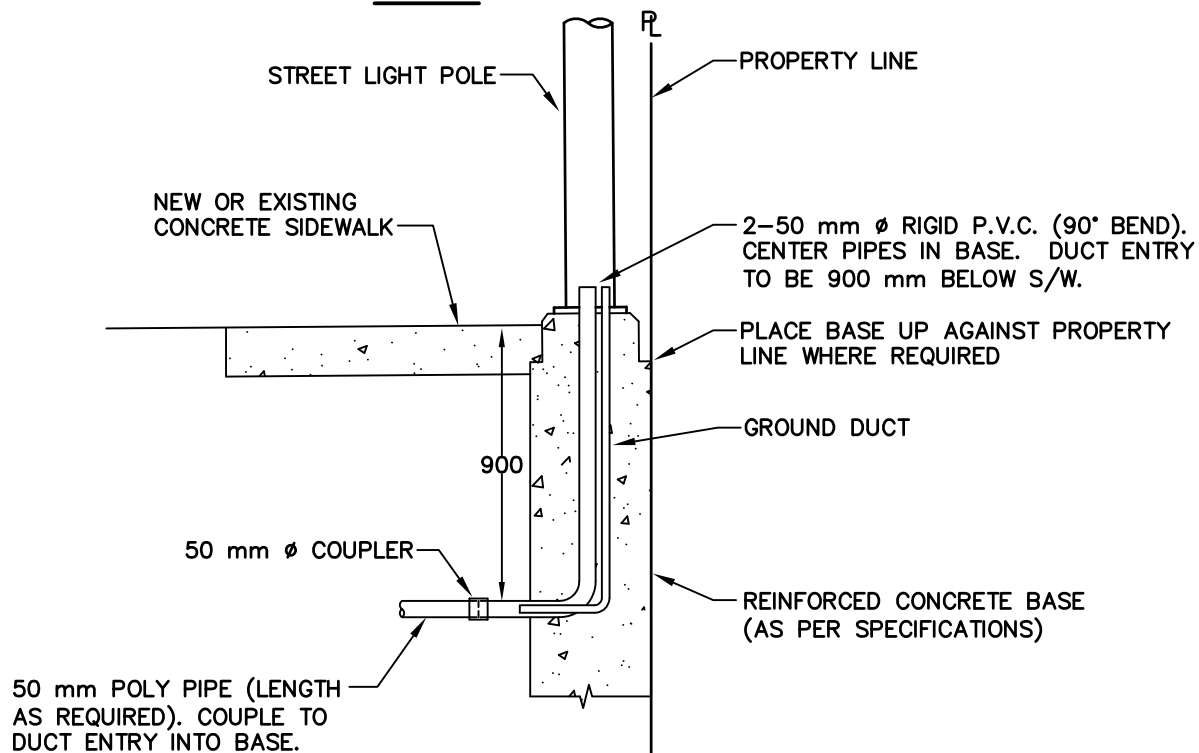
**E-107**

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**PLAN**



**SECTION 'A-A'**

**NOTE:**

- 1) Excavate full panel width of existing sidewalk.  
New concrete surface finish to match existing surface finish.
- 2) Expansion joints of pre-moulded 10 mm thick bituminous material to be placed where sidewalk meets base.

ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

**CITY OF Thunder Bay**  
Superior by Nature  
**ENGINEERING STANDARDS**

TITLE

**REINFORCED CONCRETE BASE  
INSTALLATION BEHIND CONCRETE SIDEWALK**

DWN.

DATE

MAR./04

D.R.

REVISD:

JAN. 2007

SCALE

N. T. S.

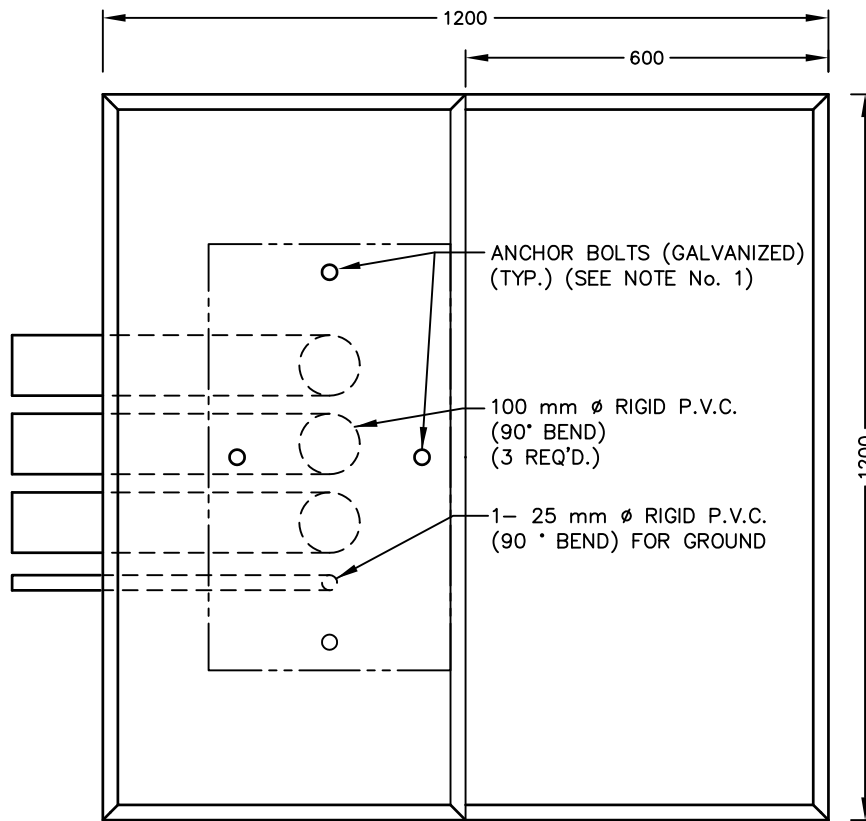
DWG. NO.

MANAGER, ENGINEERING DIVISION

**E-108**

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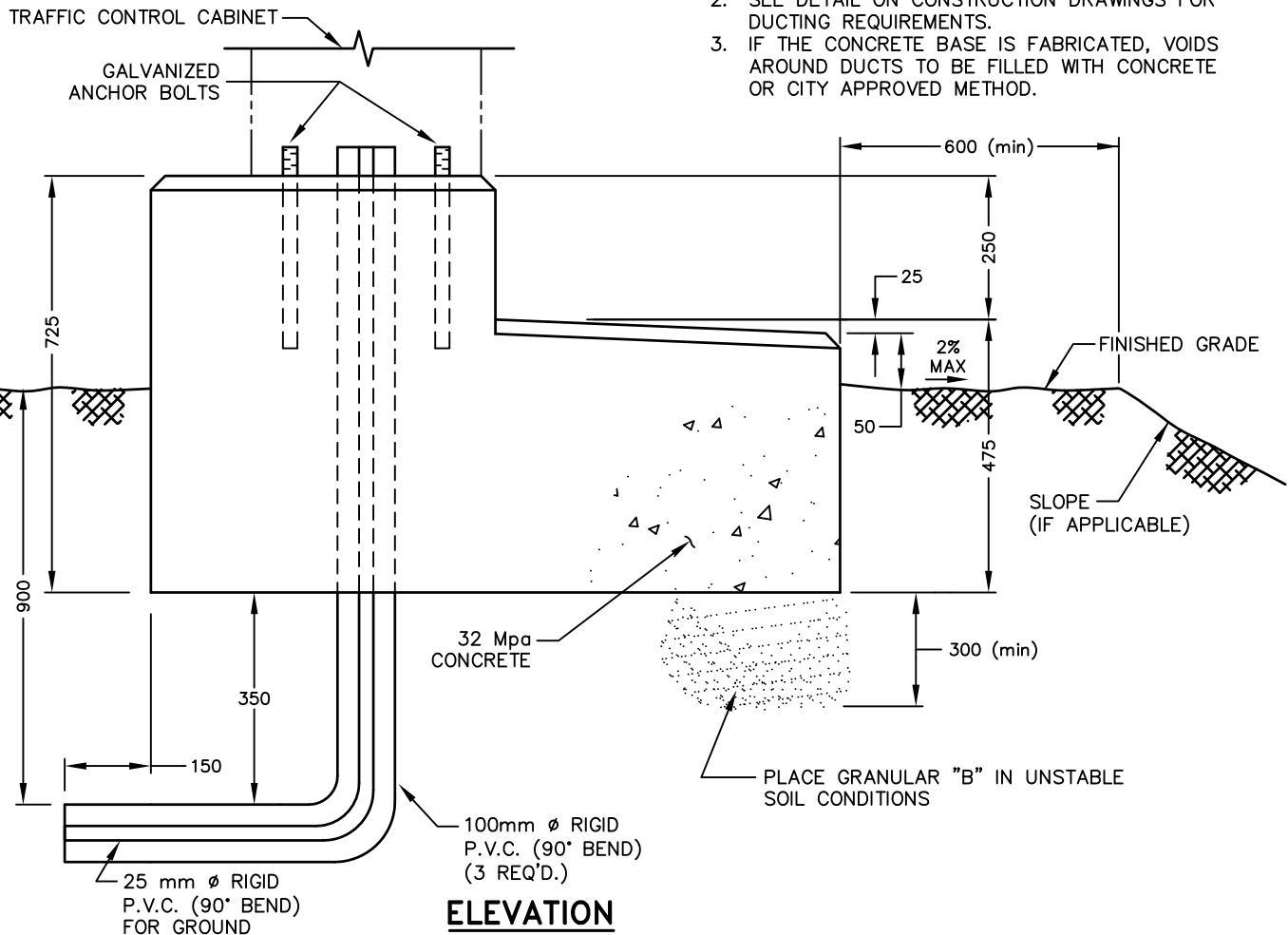




## PLAN

## NOTES:

1. CONTACT TRAFFIC CONTROL AND STREET LIGHTING FOR CABINET BOLTING DIMENSIONS.
2. SEE DETAIL ON CONSTRUCTION DRAWINGS FOR DUCTING REQUIREMENTS.
3. IF THE CONCRETE BASE IS FABRICATED, VOIDS AROUND DUCTS TO BE FILLED WITH CONCRETE OR CITY APPROVED METHOD.



## ELEVATION

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

CITY OF  
**Thunder Bay**  
Superior by Nature

TITLE

CONCRETE BASE FOR  
TRAFFIC CONTROL CABINET

DWN. S.G.

DATE MAY/01

REVISD: JAN. 2018

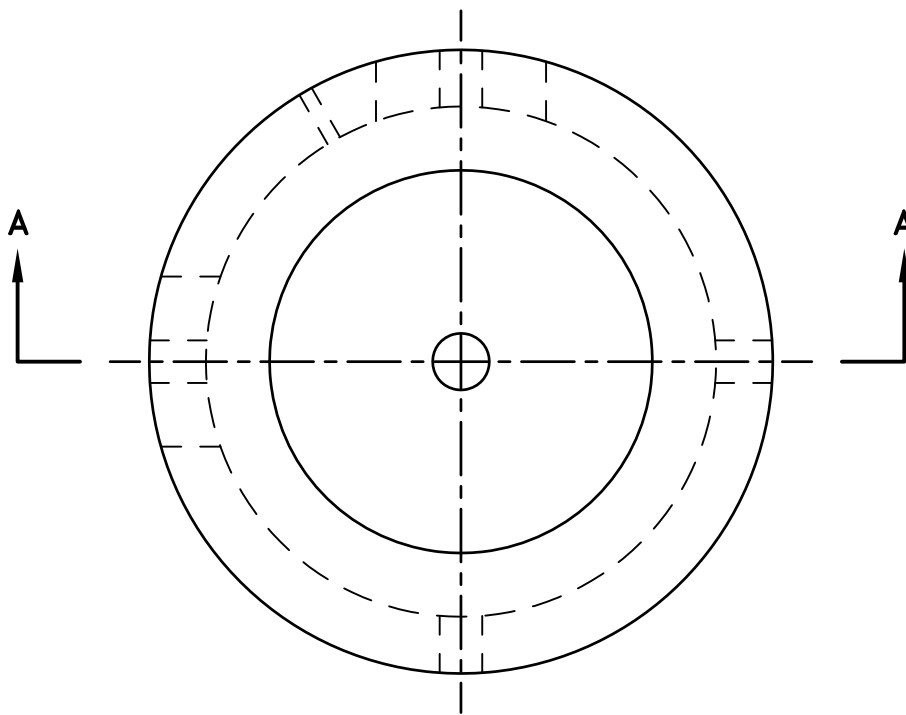
SCALE N. T. S.

MANAGER, ENGINEERING DIVISION  
DWC. NO.

**E-109**

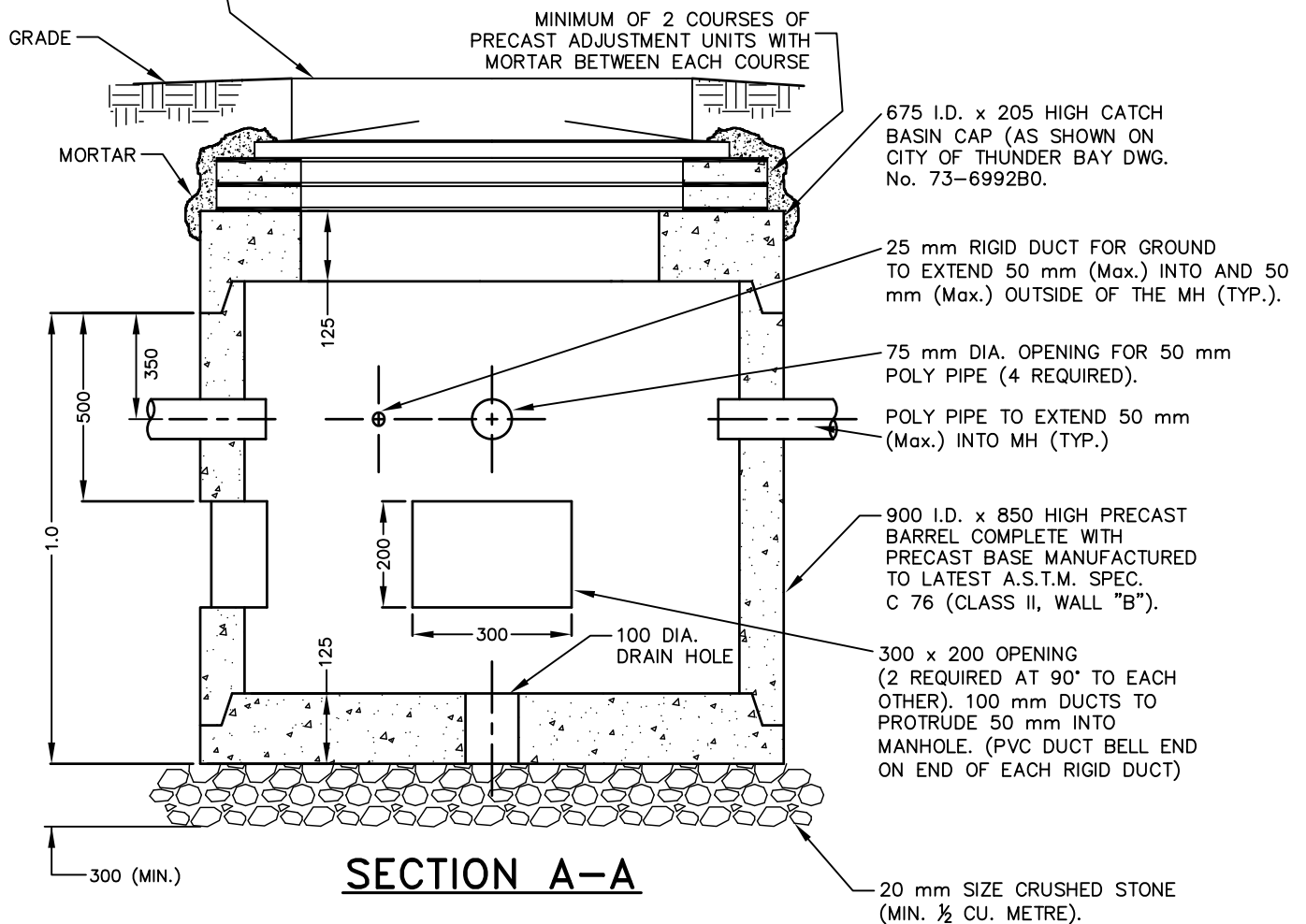
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**PLAN**

MANHOLE FRAME & COVER AS SHOWN ON  
CITY OF THUNDER BAY DWG. NO. 09-0395B.  
(COVER TO HAVE WORD "ELECTRICAL" STAMPED  
ON TOP.)



**SECTION A-A**

**NOTES:**

- 1) Unused openings to be grouted closed.  
Duct work to be grouted into openings.  
(This to be done in field).
- 2) All grounding requirements as per latest  
ESA rules.
- 3) Leave min. 3 m of pull rope out of each  
duct entry.

ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

**ENGINEERING  
STANDARDS**

**CITY OF  
Thunder Bay  
Superior by Nature**

**ELECTRICAL MANHOLE  
(PRECAST BARREL TYPE)**

DWG. NO. **Aug. 1981**

D.R. **Aug. 1981**

DATE **Aug. 1981**

REVISOR **NOV. 2009**

SCALE **N. T. S.**

DWG. NO. **NOV. 2009**

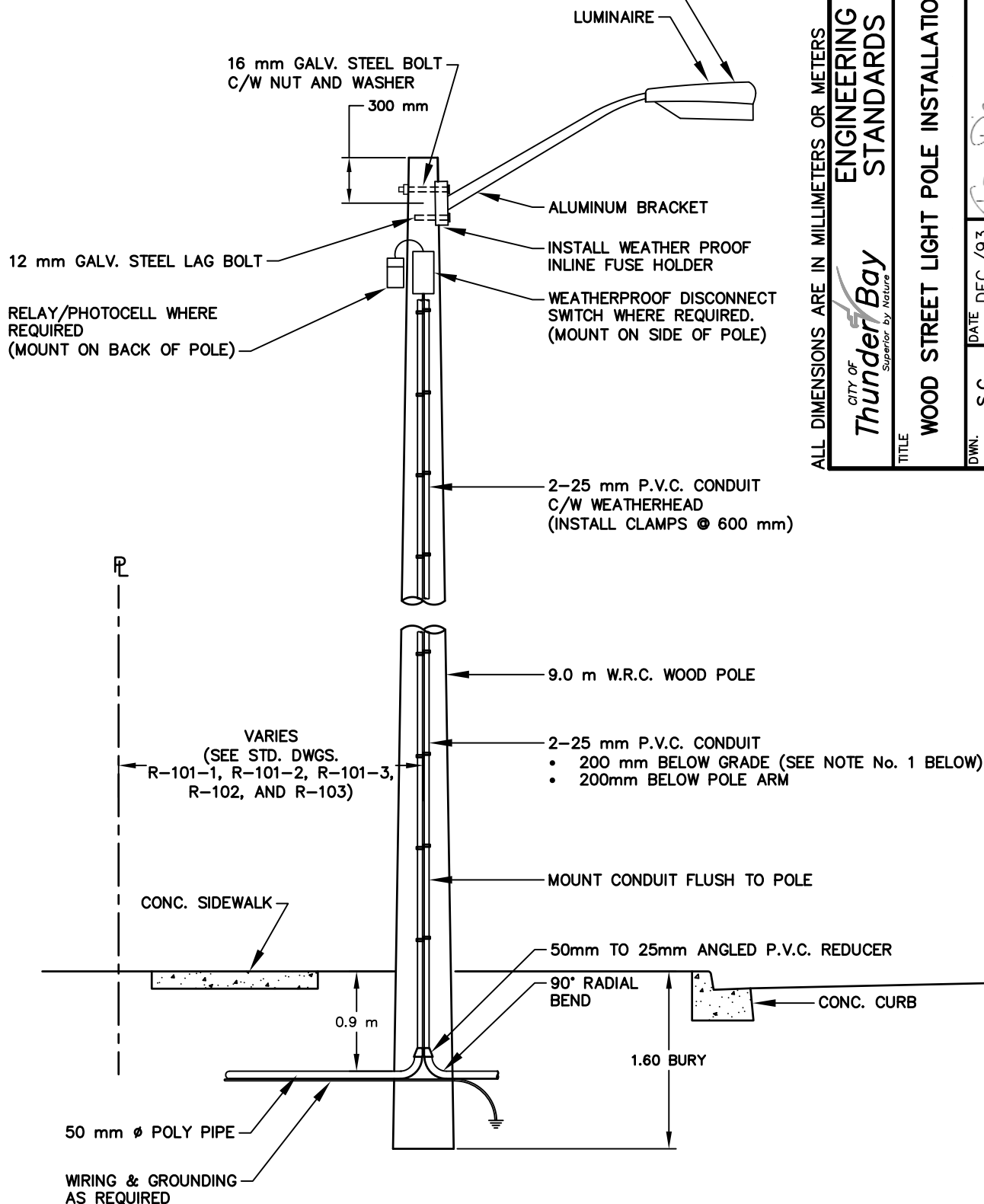
MANAGER, ENGINEERING DIVISION

**E-110**

Z:\ENG\STANDARD DRAWINGS\STD DWGS\E-110



INSTALL LED LUMINAIRES AT 0 DEGREE TILT UNLESS OTHERWISE NOTED



## WOOD POLE INSTALLATION

### NOTES:

- 1) INSTALL 2 RUNS OF 25mm P.V.C. CONDUIT TO TOP SIDE OF POLE.
- 2) ROCK ANCHORS TO BE USED WHEN 1.60m BURIAL IS NOT POSSIBLE DUE TO ROCK CONDITIONS.
- 3) POLE MOUNTED CONDUIT SHALL NOT BE PLACED ON THE SIDE OF THE POLE FACING THE ROAD, SIDEWALK OR LANEWAYS WHERE POSSIBLE. IF THIS IS UNAVOIDABLE INSTALL A 1.8m HIGH GROUNDED METAL MOULDING OVER THE POLE MOUNT CONDUIT.

ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

ENGINEERING  
STANDARDS

CITY OF  
*Thunder Bay*  
Superior by Nature

TITLE

WOOD STREET LIGHT POLE INSTALLATION

DWN. S.G. DATE DEC./93

REVISD: JAN. 2018

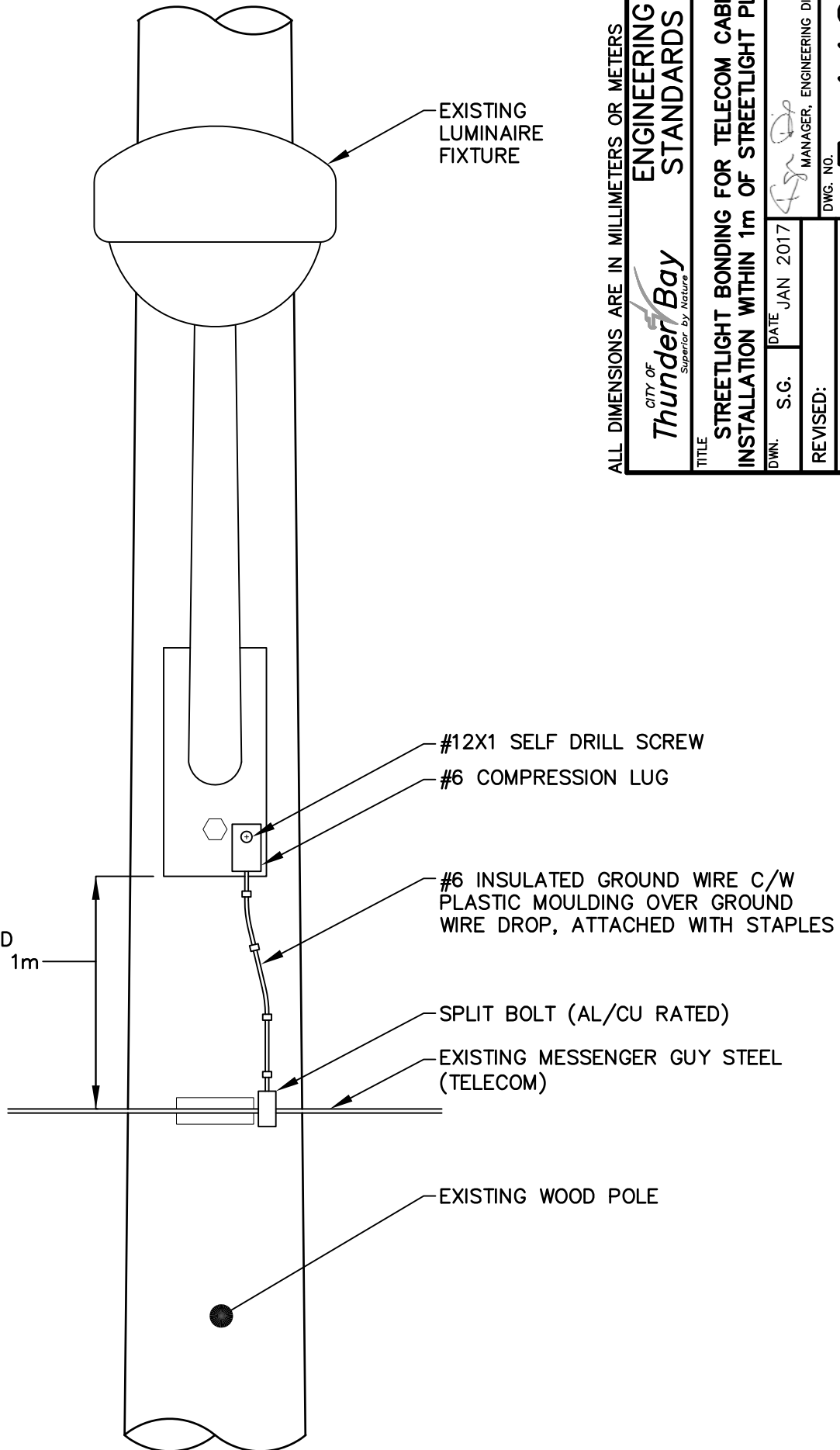
SCALE N. T. S.

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MANAGER, ENGINEERING DIVISION  
DWG. NO.

E-111





ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

CITY OF  
**Thunder Bay**  
*Superior by Nature*

ENGINEERING  
STANDARDS

TITLE

STREETLIGHT BONDING FOR TELECOM CABLE  
INSTALLATION WITHIN 1m OF STREETLIGHT PLANT

DWN.

S.G.

DATE

JAN 2017

REVISED:

MANAGER, ENGINEERING DIVISION

DWG. NO.

SCALE

N. T. S.

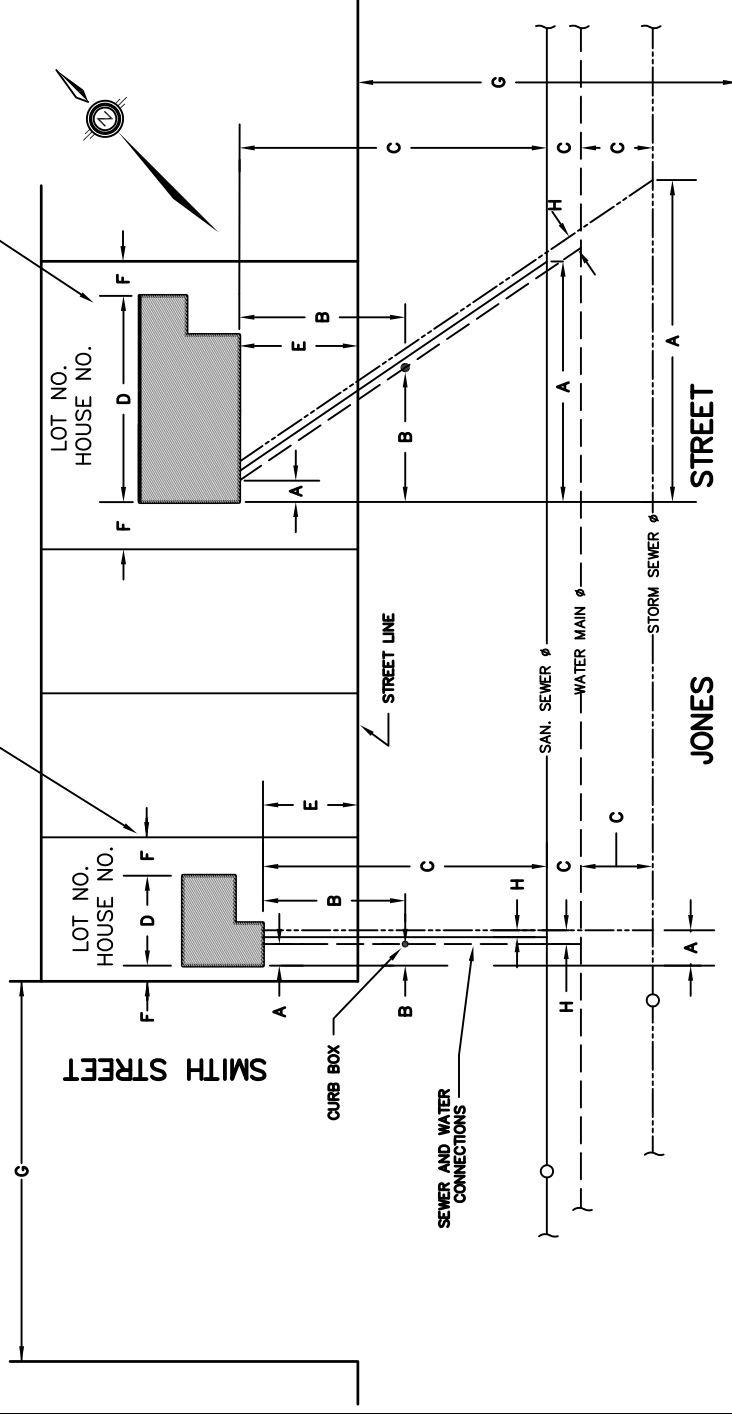
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**E-112**



CASE I CONNECTION  
NORMAL CONDITION

CASE II CONNECTION  
AT AN ANGLE



# INFORMATION REQUIRED ON DRAWING

- (1) Lot and house number.
- (2) Size and description of property.
- (3) Size of connections.
- (4) Dates connections installed.
- (5) Street names.
- (6) North arrow.
- (7) Depth of connections at mains, at streetline and at building.
- (8) Pipe material, type and class.
- (9) Name of Contractor

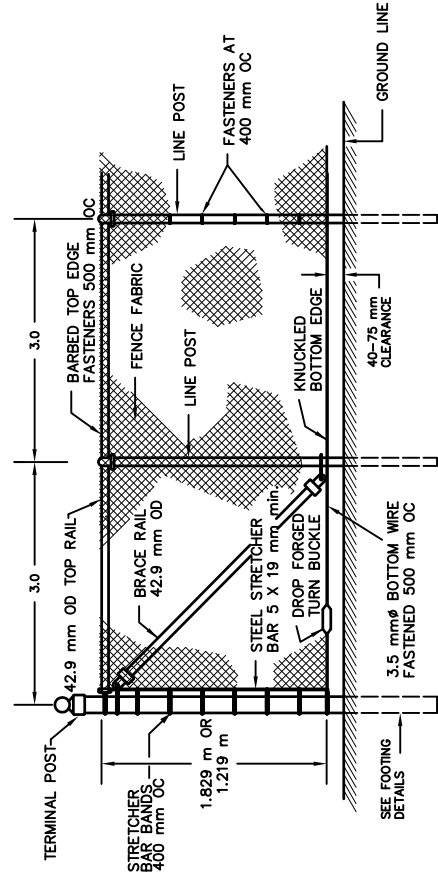
## DIMENSIONS REQUIRED (All dimensions are in millimeters unless otherwise stated).

- (A) Distance from corner of building to point where connection enters building and from corner of building to point where connection enters mains.
- (B) Distance from corner of building to curb box.
- (C) Distance from building to street mains.
- (D) Width of building.
- (E) Distance to building set back from street line.
- (F) Distance from building to side property line.
- (G) Street allowance.
- (H) Distance between connection pipes.

Scale of drawing not to be less than 1:500  
Size of drawing to be 215 mm X 280 mm.

CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE INFORMATION REQUIRED ON ALL SEWER AND WATER CONNECTIONS			
DWN. W. T. H. / S. K. H.	DATE JAN. 18, 1973	MANAGER, ENGINEERING DIVISION	
REVISED:	JAN. 2011	DWG. NO.	
SCALE	N. T. S.	M-101	
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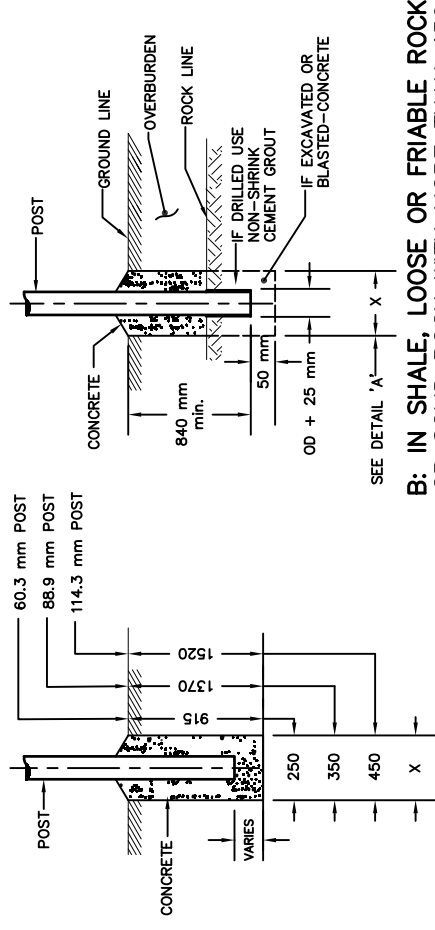


## CHAIN LINK FENCE WITH TOP RAIL

POST DETAILS		LENGTH (m)			
		STANDARD		RETAINING WALL	
DESCRIPTION	O.D. (mm)	WALL THICKNESS (mm)	WT. PR LIN. M. (kg/m)	1.219 m	1.829 m
LINE	60.3	3.912	5.43	1.210	1.56
END, CORNER STRAINING AND GATE WITH MAX. 5.5 OPENING	88.9	5.486	11.28	2.30	2.30
GATE WITH MAX. 10 OPENING	114.3	6.020	16.06	2.30	
TOP RAIL, BRACES	42.9	3.556	3.38	6.4 m LENGTHS (CUT & SPLICE TO FIT)	

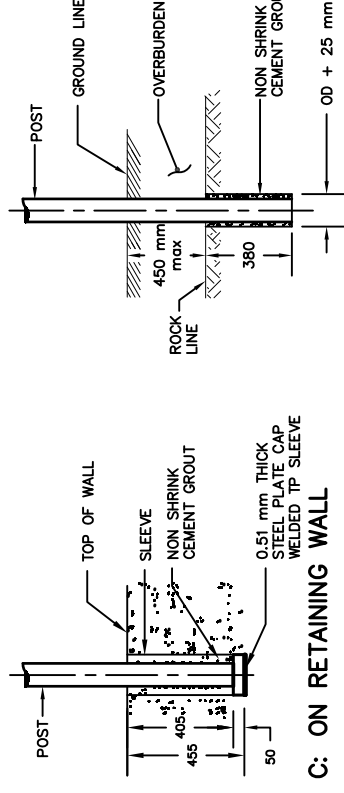
## NOTES:

- All posts, rails, and braces to be ANSI schedule 40 galvanized pipe.
- From OPSPD-972.130.
- See Std. Dwg. M-103-2 for gates.
- See OPSPD-972.101 for barbed wire installation. (where specified)



A: IN EARTH

B: IN SHALE, LOOSE OR FRIABLE ROCK OR SOLID ROCK WITH MORE THAN 450 mm OVERBURDEN



C: ON RETAINING WALL

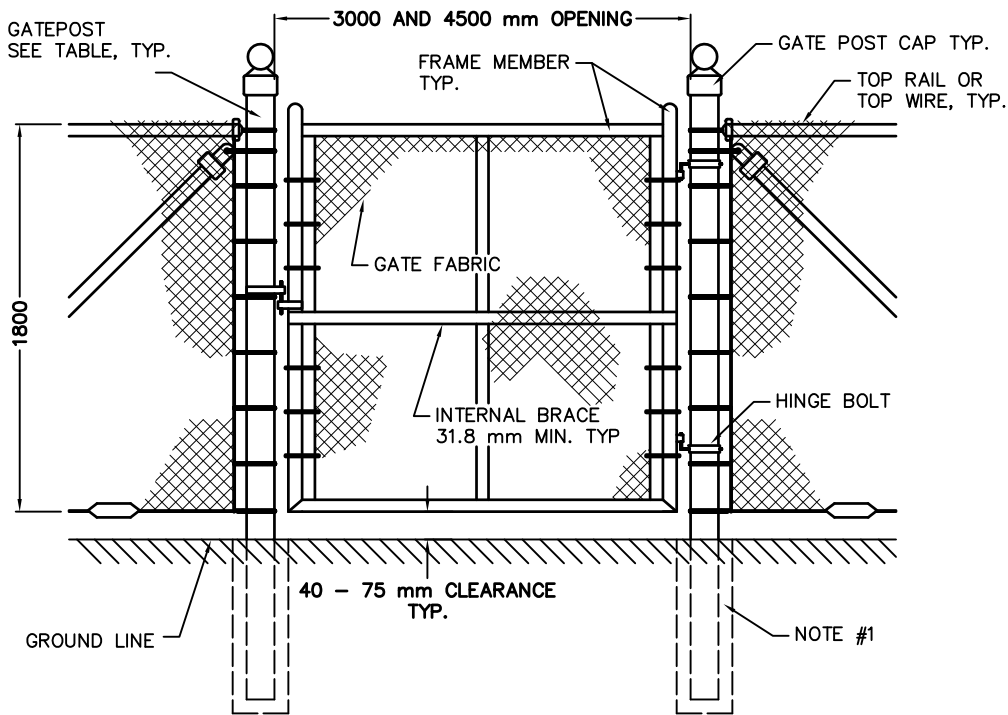
D: IN SOLID ROCK (OVERBURDEN LESS THAN 450 mm)

## FOOTING DETAILS A, B, C, AND D.

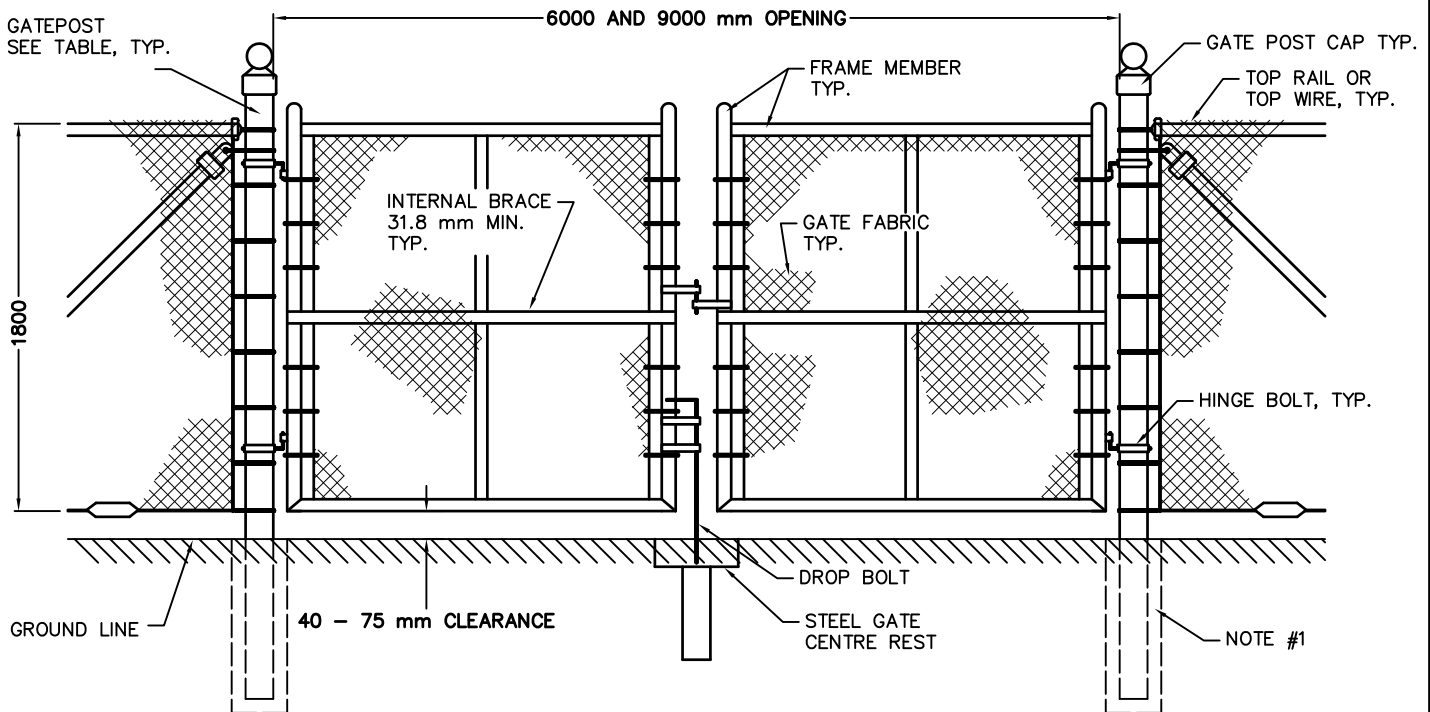
ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

<b>CITY OF</b> <b>Thunder Bay</b> <i>Superior by Nature</i>		<b>ENGINEERING STANDARDS</b>	
<b>CHAIN LINK SECURITY FENCE</b>			
DWN	L.S./S.K.H	DATE	OCT, 1993
<b>REVISD:</b> JAN. 2009		<b>MANAGER,</b> ENGINEERING DIVISION	
<b>SCALE</b> N. T. S.		<b>DWG. NO.</b>	
<b>M-103-1</b>		<b>M-103-1</b>	





**SINGLE SWING GATE OPENING**



**DOUBLE SWING GATE OPENING**

ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

**ENGINEERING  
STANDARDS**

*CITY OF*  
**Thunder Bay**  
Superior by Nature

TITLE

**CHAIN LINK  
SECURITY GATES**

DWN.

DATE

JUNE /81

D.R.

JAN. 2009

SCALE

N. T. S.

REDRAWN:

N. T. S.

DWG. NO.

MANAGER, ENGINEERING DIVISION

M-103-2

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GATE AND GATEPOST DETAILS TABLE			
GATE TYPE AND MAX. OPENING m	FRAME MEMBER MIN. OD	POST DIA. MIN. OD	POST LENGTH STANDARD m
SINGLE SWING 3.0 DOUBLE SWING 6.0	42.9	88.9	2.5
SINGLE SWING 4.5 DOUBLE SWING 9.0	48.3	114.3	2.9

## NOTES:

1. For footing details refer to OPSD 972.130.
2. Gates as viewed from the roadway.



\*THIS DETAIL IS TO BE READ IN CONJUNCTION WITH THE LATEST EDITION OF THE CITY OF THUNDER BAY "PARKS DIVISION STANDARDS AND SPECIFICATIONS".

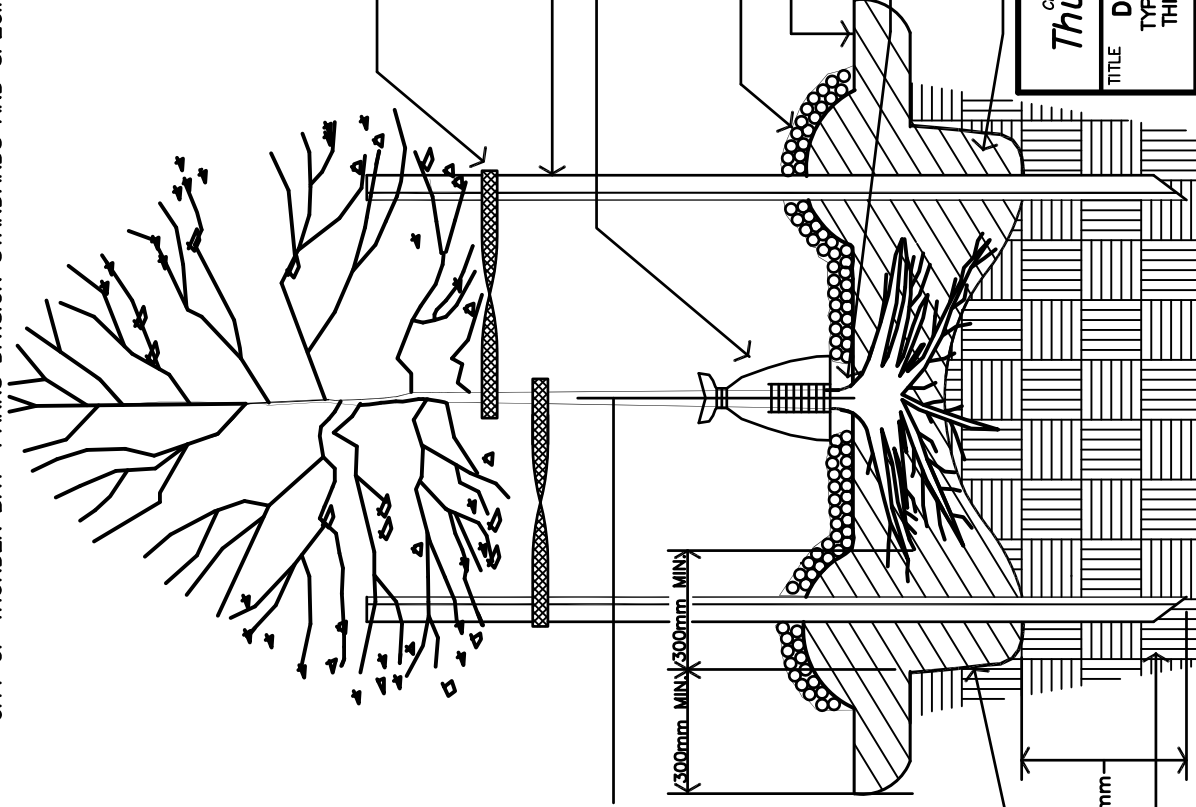
#### NOTES:

- Caliper is measured at 150 mm from soil grade level.
- Prune at planting to carefully remove dead, broken, damaged and interfering branches, double leaders and narrow angle branch unions. Thin head when and where applicable.
- Confirm underground utilities before commencing any excavation.
- Actual hole to be 300 mm wider than around the perimeter of the rootball min.
- Wooden stakes MUST be installed prior to back-filling hole. Hammer stakes into solid footing.
- Spread out roots in hole. Excessively long, broken or frayed roots should be cut cleanly with secateurs. DO NOT curl or jack knife roots in the planting hole.
- In most soils, the tree shall be placed so that the root collar (point of attachment of root to trunk) is exactly at grade. The root collar will coincide with the area of root flare.
- In poorly drained and/or compacted soils, tree shall be placed so that the root collar is 75 – 100 mm above the finished grade. Care should be taken to avoid excessive settlement of roots following planting.
- Remove all labels, twine, flagging tape and wrap from tree.
- All dimensions in millimetres minimum and maximum. Allowances are given.
- All trees to be planted in a min. of 15 m<sup>3</sup> of approved soil. This can be comprised of resident soil, imported soil or a combination of both providing all soils meet topsoil specifications as outlined in section 02921.

SCARIFY, IRRIGATE AND FERTILIZE THE INSIDE OF THE TREE PIT PRIOR TO PLANTING

COMPACTED SUBGRADE BOTTOM OF ROOT SYSTEM TO SIT ON UNDISTURBED SUBGRADE

NOTE: CARE SHOULD BE TAKEN TO AVOID EXCESSIVE SETTLEMENT OF ROOTS FOLLOWING PLANTING.



75 mm JUTE TIES SECURED AROUND TREE TRUNK. ADJUST JUTE UNTIL DRAWN TIGHT AND STAPLE TO STAKES.

2 (38x38x2300mm) WOOD STAKES SECURED INTO SOLID GROUND AND PLACED ON NORTH & SOUTH ASPECTS OF THE TREE WHENEVER POSSIBLE - MIN. 2000 mm LONG. SET TREE STAKES JUST INSIDE TREE PIT AS SHOWN.

RODENT GUARD AND WATERBAG.

CONSTRUCT 100 mm SOIL SAUCER AROUND TREE BASE & COVER WITH 75 mm APPROVED SHREDDED MULCH. KEEP MULCH 150 mm AWAY FROM TREE TRUNK

FINISHED GRADE

IDENTIFY & EXPOSE ROOT FLARE AT GRADE

APPROVED SOIL TO BE TAMPED AND SETTLED WITH WATER BY PROBING WITH HOSE-END TO ELIMINATE AIR POCKETS.

CITY OF  
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ENGINEERING  
STANDARDS

TITLE **DECIDUOUS TREE BARE ROOT PLANTING DETAIL**  
TYPICAL INSTALLATION FOR 45 mm CALIPER TREES OR LESS  
THIS TREE DOES NOT REPRESENT ANY PARTICULAR SPECIES

DWN.

M.D.

DATE FEB./02

*[Signature]*  
MANAGER, ENGINEERING DIVISION

REVISED: DEC. 2013

DWG. NO.

SCALE N. T. S.

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**M-104-1**



**NOTES:**

- CUT AND REMOVE TOP 1/2 OF  
BURLAP & WIRE BASKET INCLUDING  
ALL TIE ROPE

COMPACTED SUBGRADE  
BOTTOM OF ROOT BALL TO SIT ON  
UNDISTURBED SUBGRADE

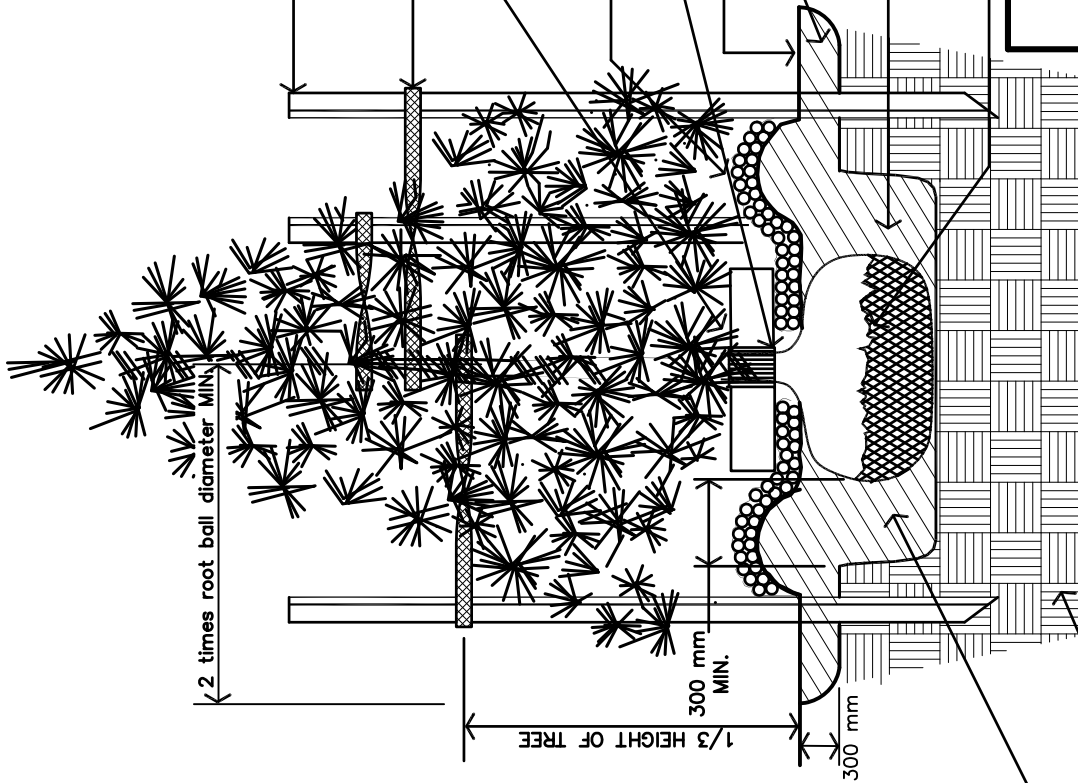


Fig. No. **M-104-2**

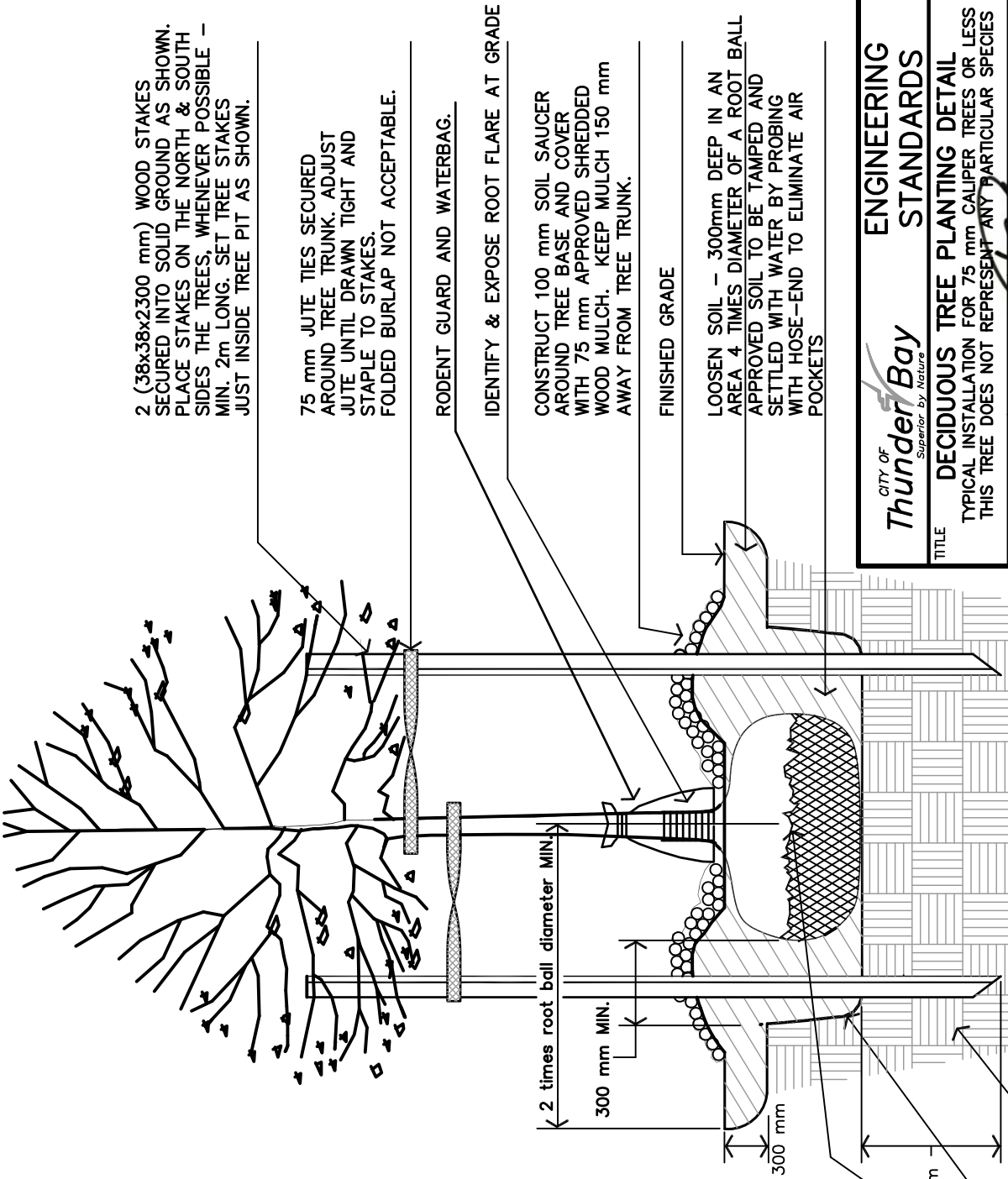
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\*THIS DETAIL IS TO BE READ IN CONJUNCTION WITH THE LATEST EDITION OF THE CITY OF THUNDER BAY "PARKS DIVISION STANDARDS AND SPECIFICATIONS".

NOTES:

- Caliper is measured at 150 mm from soil grade level.
- Prune at planting to carefully remove dead, broken, damaged and interfering branches, double leaders and narrow angle branch unions. Thin head when and where applicable.
- Confirm underground utilities before commencing any excavation.
- Actual hole to be 300 mm wider than around the perimeter of the rootball min.
- Whenever necessary, remove soil from top of rootball to uncover the root collar (point of attachment of root to trunk). The root collar will coincide with the area of root flare.
- In most soils, the rootball shall be set so that the root collar is exactly at grade.
- In poorly drained and/or compacted soils, the rootball shall be set so that the root collar is 75 – 100 mm above the finished grade. This helps to provide sufficient aeration to fibrous roots in the top of the ball by ensuring gravitational drainage of water.
- Remove all labels, twine flagging tape and wrap from tree.
- All dimensions in minimum and maximum. Allowances are given.
- All trees to be planted in a min. of 15 m<sup>3</sup> of approved soil. This can be comprised of resident soil, imported soil or a combination of both providing all soils meet topsoil specifications as outlined in section 02921.



2 (38x38x2300 mm) WOOD STAKES  
SECURED INTO SOLID GROUND AS SHOWN.  
PLACE STAKES ON THE NORTH & SOUTH  
SIDES THE TREES, WHENEVER POSSIBLE –  
MIN. 2m LONG. SET TREE STAKES  
JUST INSIDE TREE PIT AS SHOWN.

75 mm JUTE TIES SECURED  
AROUND TREE TRUNK. ADJUST  
JUTE UNTIL DRAWN TIGHT AND  
STAPLE TO STAKES.  
FOLDED BURLAP NOT ACCEPTABLE.

RODENT GUARD AND WATERBAG.

IDENTIFY & EXPOSE ROOT FLARE AT GRADE

CONSTRUCT 100 mm SOIL SAUCER  
AROUND TREE BASE AND COVER  
WITH 75 mm APPROVED SHREDDED  
WOOD MULCH. KEEP MULCH 150 mm  
AWAY FROM TREE TRUNK.

FINISHED GRADE

LOOSEN SOIL – 300mm DEEP IN AN  
AREA 4 TIMES DIAMETER OF A ROOT BALL  
APPROVED SOIL TO BE TAMPED AND  
SETTLED WITH WATER BY PROBING  
WITH HOSE-END TO ELIMINATE AIR  
POCKETS

CUT AND REMOVE TOP 1/2 OF  
BURLAP & WIRE BASKET FROM  
ROOTBALL INCLUDING ALL TIE ROPE

SCARIFY, IRRIGATE AND FERTILIZE  
THE INSIDE OF THE TREE PIT  
PRIOR TO PLANTING

COMPACTED SUBGRADE  
BOTTOM OF ROOT BALL TO SIT ON  
UNDISTURBED SUBGRADE.

CITY OF  
**Thunder Bay**  
*Superior by Nature*

ENGINEERING  
STANDARDS

TITLE DECIDUOUS TREE PLANTING DETAIL

TYPICAL INSTALLATION FOR 75 mm CALIPER TREES OR LESS  
THIS TREE DOES NOT REPRESENT ANY PARTICULAR SPECIES

DWN: M.D. DATE FEB./02

REVISD: DEC. 2013

SCALE N. T. S.

DWG. NO.

**M-104-3**

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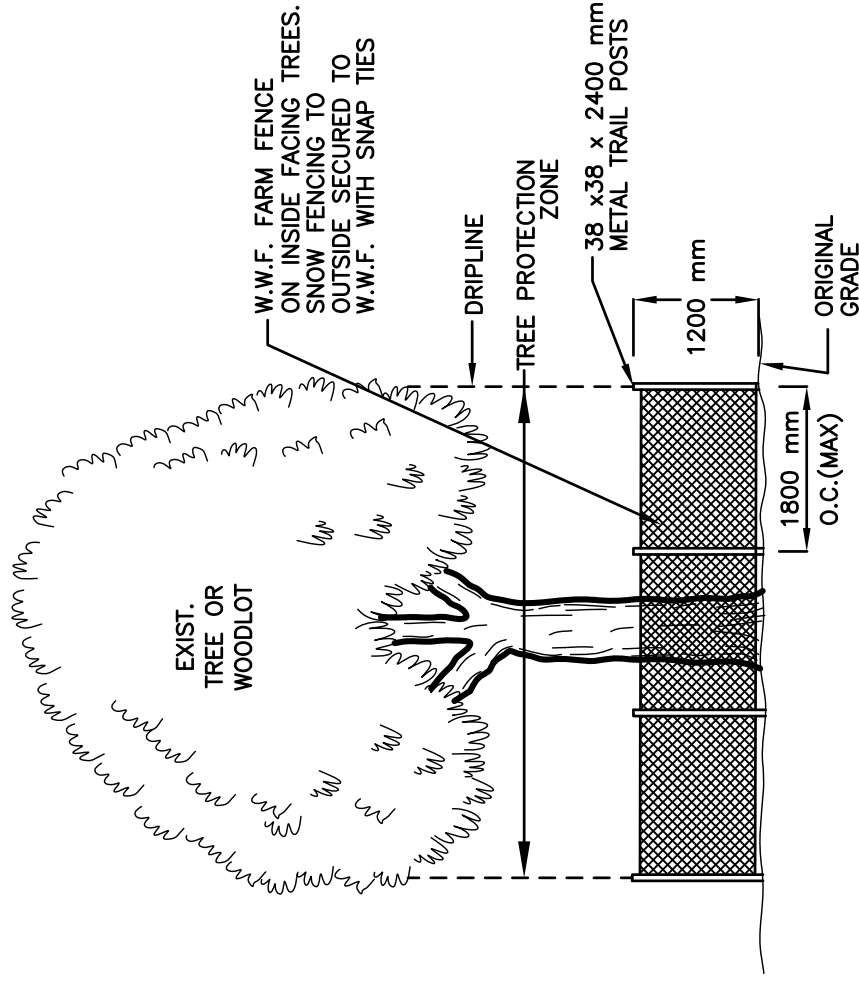




**NOTE:**THE CONTRACTOR WILL BE RESPONSIBLE FOR IMPLEMENTING THE FOLLOWING SPECIFICATIONS IN ORDER TO ENSURE PROTECTION OF EXISTING TREES WITHIN OR ADJACENT TO THE CONSTRUCTION ZONE:

1. FILTER FABRIC TO BE TYPE 1 100% NON WOVEN NEEDLE PUNCHED 2.75 mm THICK, 240 g/m2 MASS.
2. WIRE MESH REINFORCING TO BE MW13.3 X MW13.3 WIRE WITH 152 X 152 mm OPENINGS.
3. RECEIVE APPROVAL OF CITY FORESTER FOR EXTENT OF ROOT CURTAIN.
4. BACKFILL SOIL MATERIAL AS PER SPECIFICATIONS. COMPACTED TO 85% SPD.



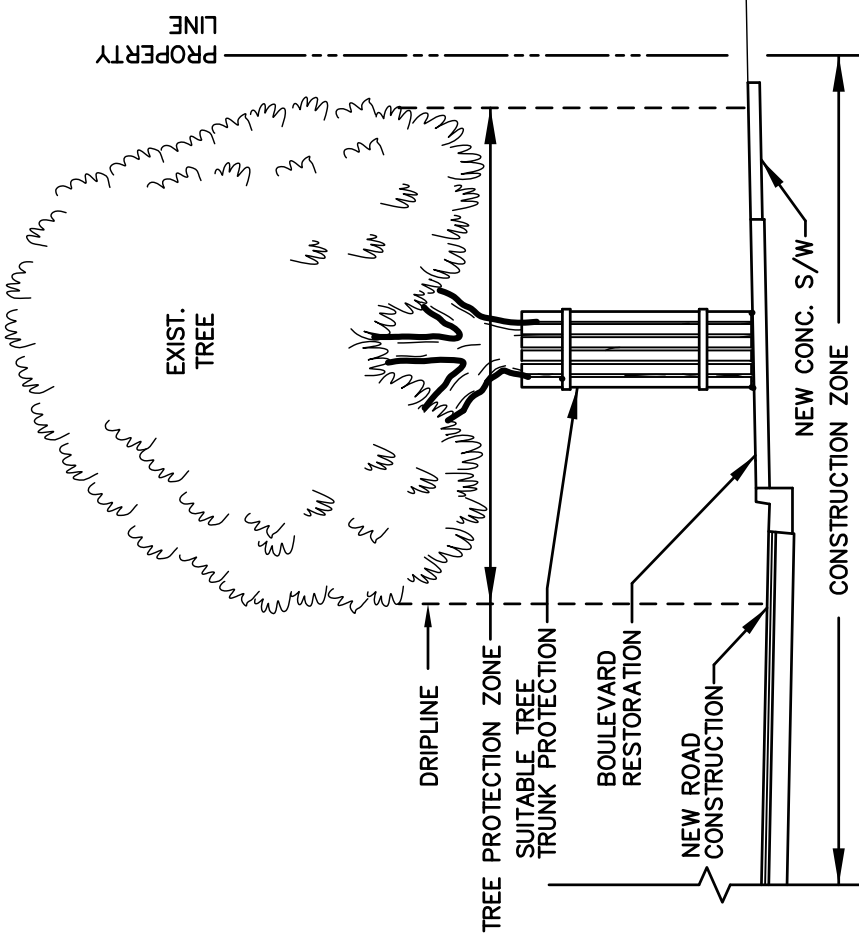


## TREE PROTECTION FENCING

—REQUIRED FOR ALL TREES.

**NOTE:** THE CONTRACTOR WILL BE RESPONSIBLE FOR IMPLEMENTING THE FOLLOWING SPECIFICATIONS IN ORDER TO ENSURE PROTECTION OF EXISTING TREES WITHIN OR ADJACENT TO THE CONSTRUCTION ZONE.

1. THE TREE PROTECTION ZONE IS DEFINED AS AN AREA ON THE GROUND CORRESPONDING TO THE 'DRIP LINE' OF THE TREE OR MINIMUM RADIUS OF 3.0 METRES, WHICHEVER IS LARGER.
2. FINAL LAYOUT OF TREE PROTECTION FENCING TO BE FIELD VERIFIED WITH CITY FORESTER PRIOR TO CONSTRUCTION.
3. WHERE APPROVED, TREE TRUNK PROTECTION SHALL CONSIST OF STRAPPING OR A DOUBLE WRAP OF WOOD SLAT SNOW FENCING, POLYETHYLENE DRUMS OR OTHER SUITABLE WOOD PLANKS STRAPPED TO THE TREE TRUNK TO COMPLETELY PROTECT THE TREE TRUNK FROM IMPACT DAMAGE. THE MINIMUM SIZE OF STRAPPING WILL BE 25 X 150 X 2400 mm.
4. FOR STANDARD TREE PROTECTION NOTES SEE SECTION 3 OF PARKS DIVISION STANDARDS & SPECIFICATIONS.



## TREE TRUNK PROTECTION

— ALTERNATE PROTECTION METHOD WHEN WORK INSIDE DRIPLINE IS REQUIRED. REQUIRES CITY FORESTER APPROVAL.

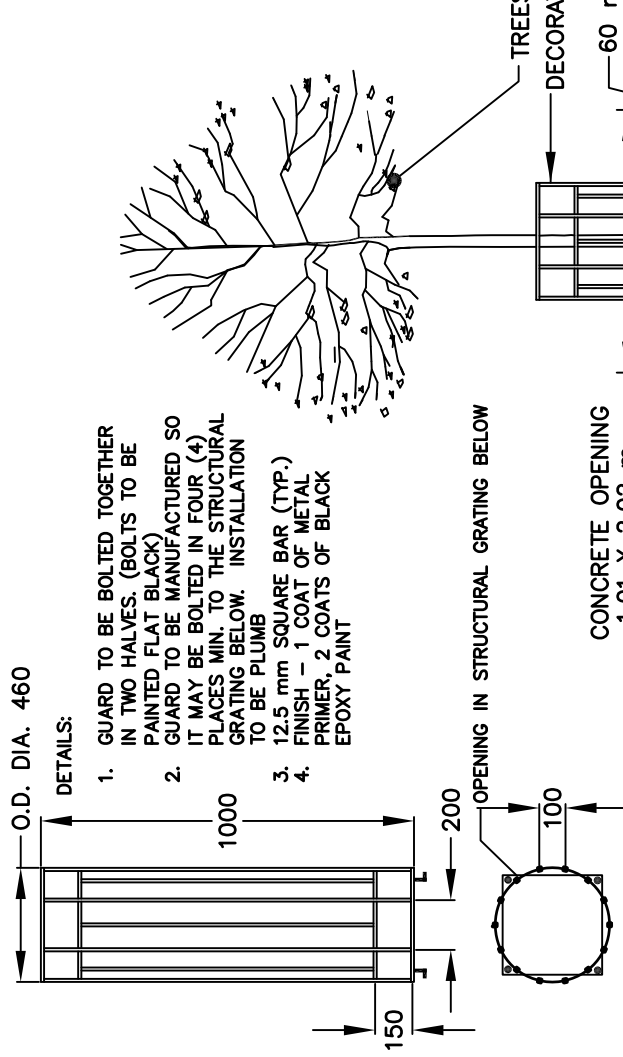
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**Thunder Bay**  
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ENGINEERING  
STANDARDS

## TITLE TREE PROTECTION BARRIERS

DWN.	M.D.	DATE	FEB./02
REVISD:	JAN. 2014	MANAGER, ENGINEERING DIVISION	
SCALE	N. T. S.	DWG. NO.	
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**M-104-4**





DECORATIVE TREE GUARD

I.T.S.

CONTINUOUS CONTROL JOINT

NEW CONCRETE SIDEWALK

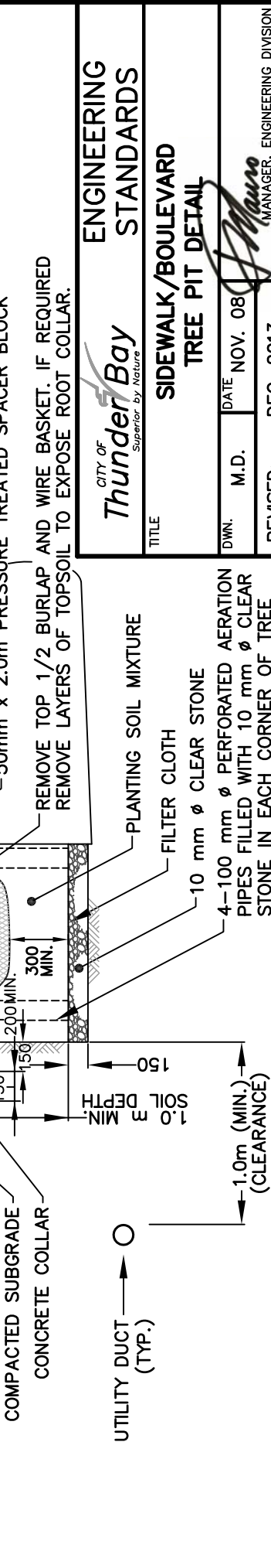
SLOPE 2%

150

75

SWEEP

T



THIS DETAIL IS TO BE READ IN CONJUNCTION WITH THE LATEST EDITION  
OF THE CITY OF THUNDER BAY "PARKS DIVISION STANDARDS AND SPECIFICATIONS".

SCALE	N. T. S.
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DWG. NO. **M-104-5**

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CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE		SIDEWALK/BOULEVARD TREE PIT DETAIL	
DWN.	M.D.	DATE	NOV. 08
REVISED:		DEC. 2013	
SCALE		N. T. S.	
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		MANAGER, ENGINEERING DIVISION	
		M-104-5	



**M-104-6**

SCALE	N. T. S.
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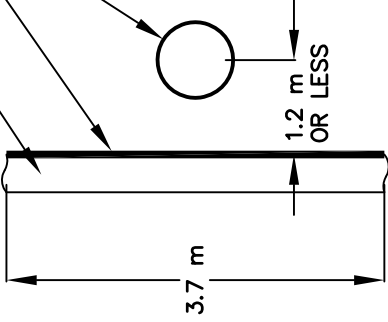


DECIDUOUS TREE  
PLANTING AS PER  
M-104-3

CURB OR  
SIDEWALK

ROOT  
BARRIER

TREE



PLAN VIEW

**NOTES:**

1. ROOT BARRIER IS REQUIRED TO PROTECT CONC. CURBS AND SIDEWALKS FROM ROOT UPHEAVAL. TYPICALLY ROOT BARRIER IS REQUIRED AT BACK EDGE OF CONC. CURB AND/OR AGAINST FRONT AND/OR BACK OF SIDEWALK
2. ROOT BARRIER IS REQUIRED WHEN TREE IS WITHIN 1.2 m OF CONC. CURB
3. ROOT BARRIER IS REQUIRED WHEN TREE IS WITHIN 1.2 m OF SIDEWALK OR WITHIN 2.0 m OF DRIVEWAY.
4. ROOT BARRIER TO BE 3.7 m IN LENGTH AND CENTERED ON THE TREE ADJACENT TO SIDEWALK, CURB AND DRIVEWAY.
5. ROOT BARRIER TO BE A DEEP ROOT U18 OR U24, OR APPROVED EQUAL AND BE CONSTRUCTED OF HDPE.

SIDEWALK/DRIVEWAY

50 mm BELOW GRADE

450 mm

SEE NOTE #3

50 mm  
BELOW GRADE

600 mm

SEE NOTE #2

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

CITY OF  
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*Superior by Nature*

ENGINEERING  
STANDARDS

TITLE

ROOT BARRIER DETAIL

DWN.

M.D.

DATE

JAN. 2012

REVISED: DEC. 2013

SCALE

N. T. S.

DWG. NO.

MANAGER, ENGINEERING DIVISION

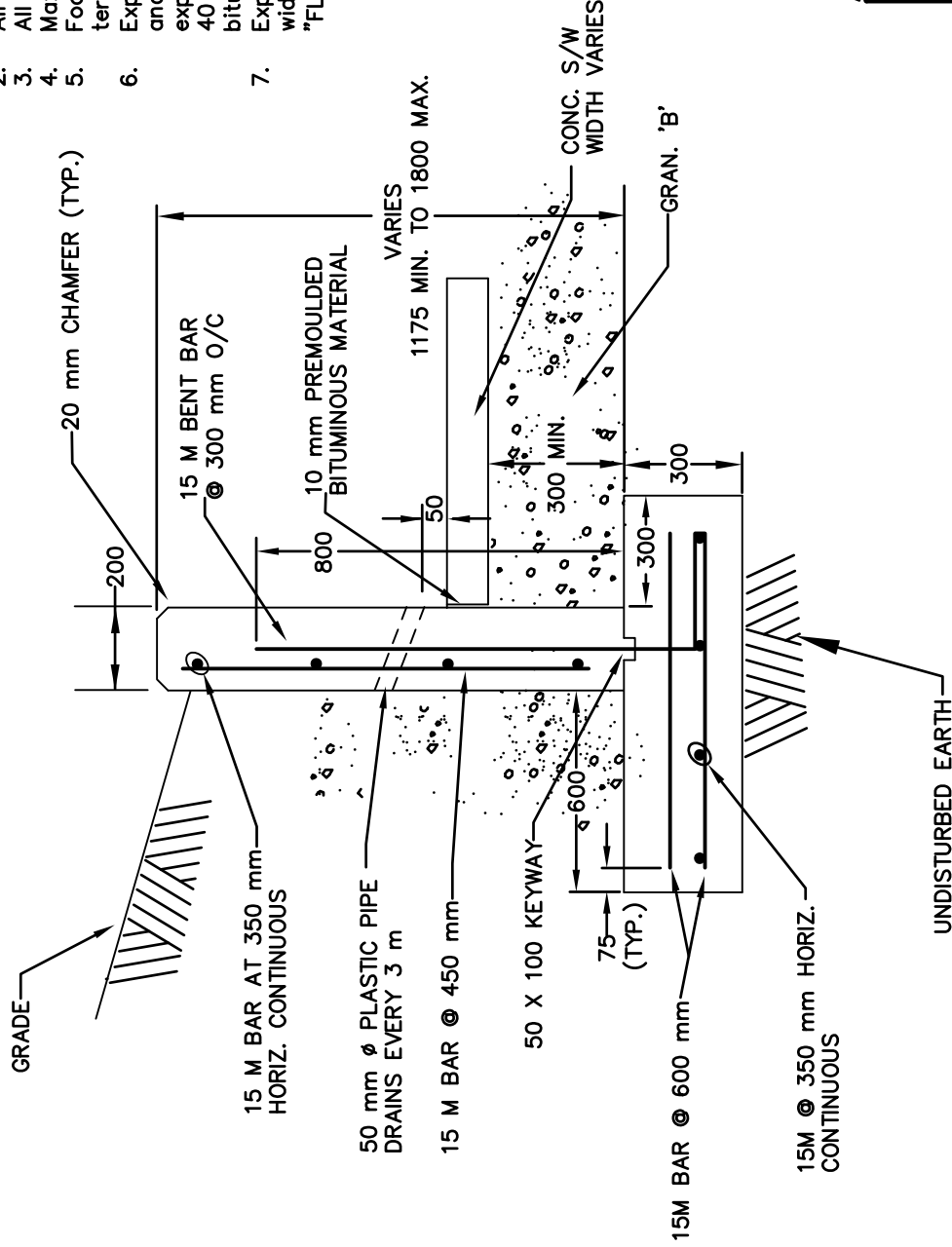
**M-104-7**

\*THIS DETAIL IS TO BE READ IN CONJUNCTION WITH THE LATEST EDITION OF THE CITY OF THUNDER BAY "PARKS DIVISION STANDARDS AND SPECIFICATIONS".





# NOTES:

1. All concrete shall be 32 Mpa with 5%–8% air entrained.
2. All reinforcing steel shall be grade 400 steel.
3. All reinforcing bars to have 75 mm cover.
4. Maximum height of wall to be 1800 mm from footing.
5. Footing shall be stepped as required to suit existing terrain.
6. Expansion/control joints to be provided at 9 m lengths and or at changes in the wall cross section. Provide expansion joints at locations of step footings. Provide 40 mm deep saw cut 3 mm – 5 mm wide and fill with bituminous fiber.
7. Expansion/control joints may also be provided by 12 mm wide formed openings in the wall filled with 13 mm "FLEXALL" (or equivalent) expansion joint material.



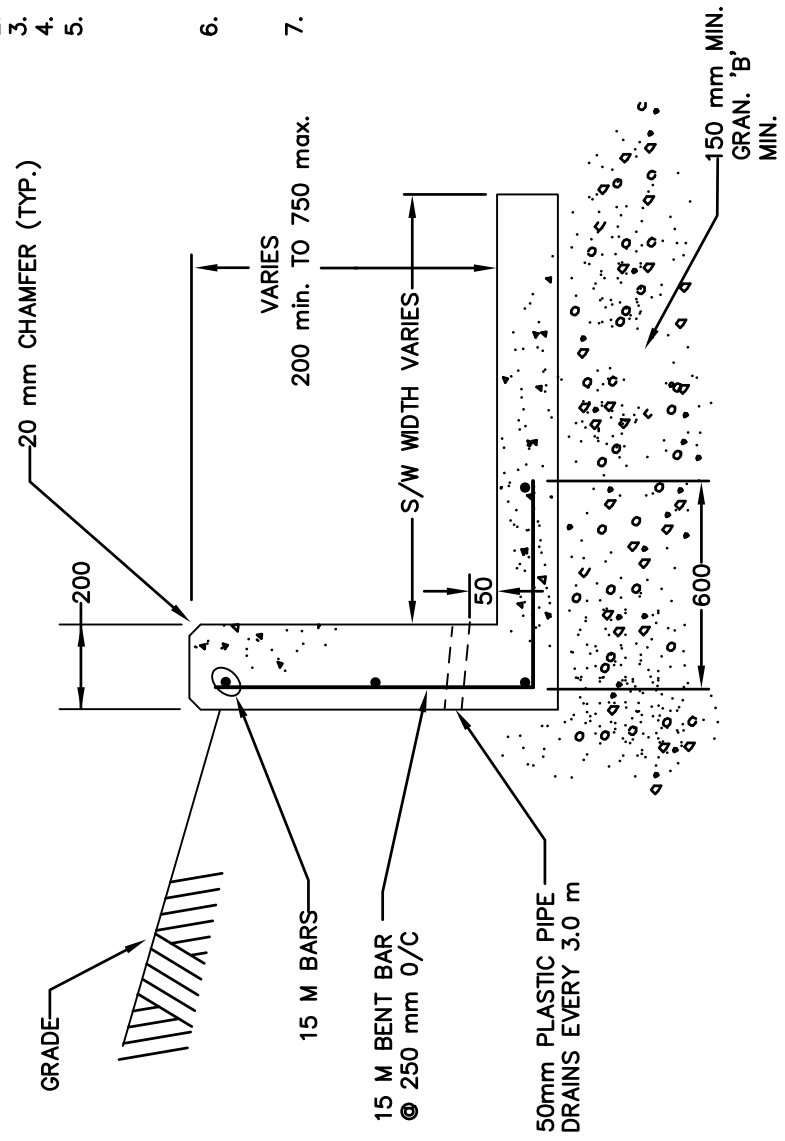
ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED



 <div>CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i></div>		ENGINEERING STANDARDS	
TITLE CONCRETE RETAINING WALL WITH FOOTING			
DWN.	T.M.D.	DATE	Mar./00
REVISED: JAN. 2018		 MANAGER, ENGINEERING DIVISION	
SCALE		DWG. NO.	
		<b>M-105-1</b>	
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**NOTES:**

1. All concrete shall be 32 Mpa with 5%–8% air entrained.
2. All reinforcing steel shall be grade 400 steel.
3. All reinforcing bars to have 75 mm cover.
4. Maximum height of wall to be 750 mm from footing.
5. Expansion/control joints to be provided at 9 m lengths and or at changes in the wall cross section. Provide expansion joints at locations of step footings. Provide 40 mm deep saw cut 3 mm – 5 mm wide and fill with bituminous fiber.
6. Expansion/control joints may also be provided by 12 mm wide formed openings in the wall filled with 13 mm "FLEXALL" (or equivalent) expansion joint material.
7. Expansion/control joints in retaining wall to line up with expansion/control joints in sidewalk.



ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED			
 <div>CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i></div>		ENGINEERING STANDARDS	
TITLE CONCRETE RETAINING WALL ATTACHED TO CONCRETE SIDEWALK			
DWN.	T.M.D.	DATE Mar. / 00	 MANAGER, ENGINEERING DIVISION
REVISED: JAN. 2018		DWG. NO.	
SCALE N. T. S.		M-105-2	
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TOP OF WALL TO FOLLOW SIDEWALK GRADE  
 10 mm PREMOULDED BITUMINOUS MATERIAL  
 CONC. S/W WIDTH VARIES  
 20 mm CHAMFER (TYP.)  
 VARIES 200 MIN. TO 800 MAX.  
 15 M BENT BAR @ 300 mm O/C  
 GRADE  
 50  
 300  
 300  
 600  
 15 M BAR AT 300 mm HORIZ. CONTINUOUS  
 GRAN. 'B'  
 DRAINS EVERY 3 M 50 mm Ø PLASTIC PIPE  
 15 M BAR @ 450 mm  
 50 X 100 KEYWAY  
 75 (TYP.)  
 15M BAR @ 600 mm  
 15M @ 300 mm HORIZ. CONTINUOUS.  
 UNDISTURBED EARTH

1. All concrete shall be 32 Mpa with 5%-8% air entrainment.
2. All reinforcing steel shall be grade 400 steel.
3. All reinforcing bars to have 75 mm cover.
4. Maximum height of wall to be 800 mm from existing ground.
5. Footing shall be stepped as required to suit existing terrain.
6. Expansion/control joints to be provided at 9 m lengths and or at changes in the wall cross section. Provide expansion joints at locations of step footings. Provide 40 mm deep saw cut 3 mm – 5 mm wide and fill with bituminous fiber.
7. Expansion/control joints may also be provided by 12 mm wide formed openings in the wall filled with 13 mm "FLEXALL" (or equivalent) expansion joint material.

**ENGINEERING STANDARDS**

CITY OF  
**Thunder Bay**  
Superior by Nature

**TITLE CONCRETE RETAINING WALL WITH FOOTING (FOR ELEVATED SIDEWALK)**

DWN.	DATE	
G.S.L.	MARCH 2004	

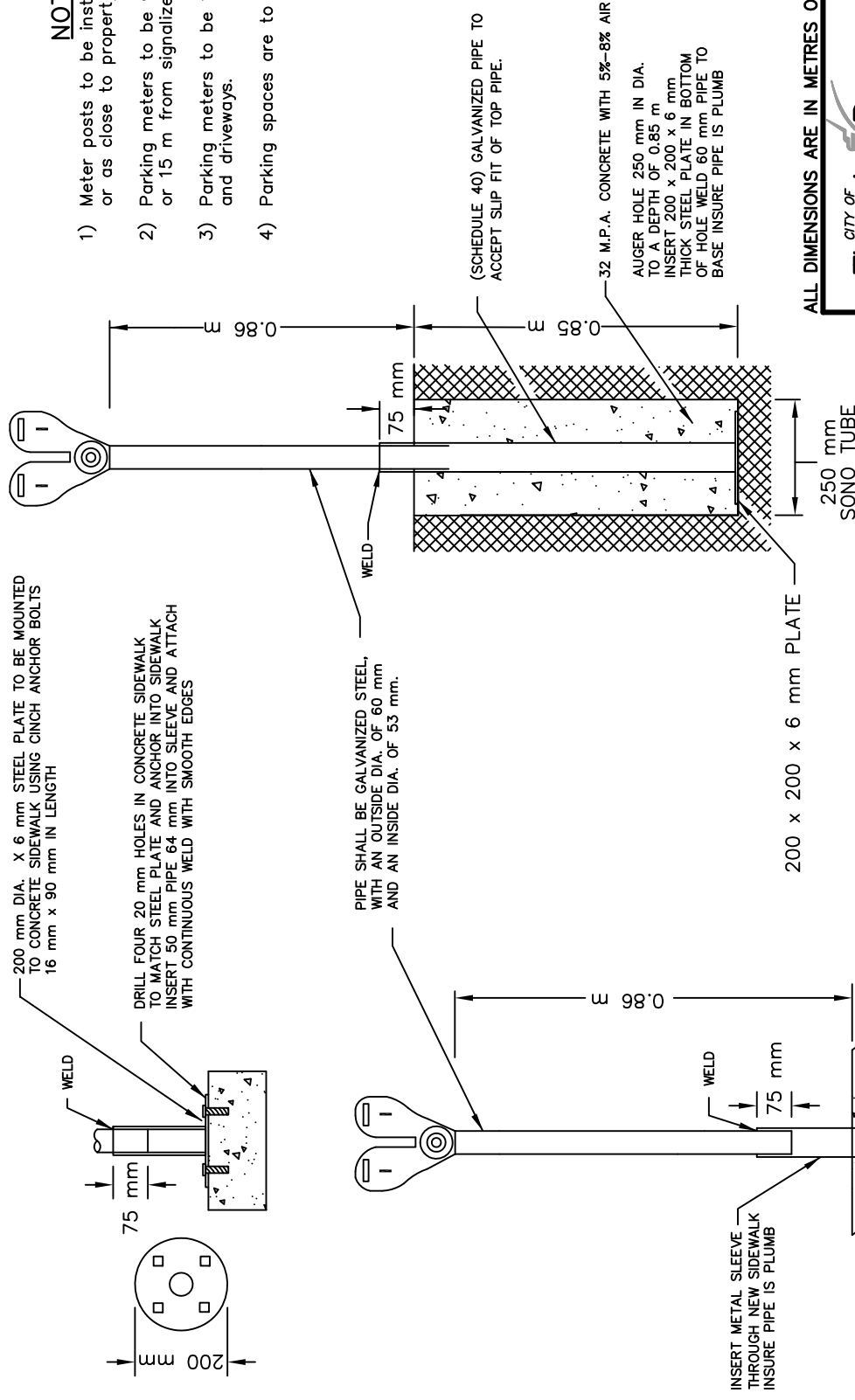
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SCALE N. T. S. M-105-3  
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DETAIL TO ANCHOR PARKING  
METER BEHIND SIDEWALK OR BOULEVARD



- 1) Meter posts to be installed at back of sidewalk or as close to property line as possible.
- 2) Parking meters to be 9.0 m from an intersection or 15 m from signalized intersection.
- 3) Parking meters to be 1.50 m away from lanes and driveways.
- 4) Parking spaces are to be 6.71 m in length.

**CITY OF**  
**Thunder Bay**  
*Superior by Nature*

## PARKING METER INSTALLATION IN CONCRETE & ORIGINAL GROUND

**M-106**

## DETAIL TO ANCHOR PARKING METER INTO NEW CONCRETE



# INTENSITY–DURATION–FREQUENCY (IDF) TABLE FOR THE AIRPORT STATION (6048261)



INTENSITIES ARE IN mm/hr

RETURN PERIOD (YEARS)	DURATION, x (minutes)														
	5	10	15	30	60	120	360	720	1440	2880	4320	7200	14400	43200	86400
	(5-min)	(10-min)	(15-min)	(30-min)	(1-hr)	(2-hr)	(6-hr)	(12-hr)	(1-day)	(2-day)	(3-day)	(5-day)	(10-day)	(30-day)	(60-day)
2	107	65.7	49.5	30.5	18.8	11.5	5.35	3.30	2.03	1.25	0.942	0.659	0.406	0.188	0.116
5	146	90.2	67.9	41.8	25.8	15.9	7.36	4.53	2.79	1.72	1.29	0.906	0.558	0.259	0.159
10	173	106	80.1	49.3	30.4	18.7	8.68	5.35	3.29	2.03	1.53	1.07	0.658	0.305	0.188
25	206	127	95.4	58.8	36.2	22.3	10.3	6.37	3.93	2.42	1.82	1.27	0.785	0.364	0.224
50	230	142	107	65.8	40.5	25.0	11.6	7.14	4.40	2.71	2.04	1.43	0.879	0.408	0.251
100	254	157	118	72.7	44.8	27.6	12.8	7.89	4.86	3.00	2.26	1.58	0.973	0.452	0.278
500	310	191	144	88.7	54.7	33.7	15.6	9.63	5.94	3.66	2.76	1.93	1.19	0.552	0.340
1000	334	206	155	95.6	58.9	36.3	16.9	10.4	6.40	3.94	2.97	2.08	1.28	0.595	0.367

RETURN PERIOD (YEARS)	POWER FUNCTION COEFFICIENTS	
	A	B
2	328.8	–0.6995
5	451.3	–0.6993
10	531.8	–0.6992
25	633.2	–0.6990
50	708.3	–0.6988
100	782.7	–0.6987
500	954.5	–0.6985
1000	1028.2	–0.6984

## NOTES:

1. INTENSITIES CAN BE CALCULATED FOR ANY DURATION USING THE COEFFICIENTS "A" AND "B" IN THE RELATIONSHIP  $y = Ax^B$ , WHERE y IS THE INTENSITY AND x IS THE DURATION IN MINUTES.
2. VALUES AS PER THUNDER BAY STORMWATER MANAGEMENT PLAN FOR SUSTAINABLE SURFACE WATER MANAGEMENT – APRIL 2016, VOLUME II – TABLE 55.

 <b>ENGINEERING STANDARDS</b>			
<b>TITLE</b> RAINFALL INTENSITY– DURATION–FREQUENCY TABLE			
DWN.	S.G.	DATE	12/23/70
REVISED:		01/2017	
SCALE		N. T. S.	
PATH		Z:\ENG\Standard Drawings\Std Dwg\M-106.dwg	
		 MANAGER, ENGINEERING DIVISION	DWG. NO. <b>M-108</b>



# LEGEND

## PROPOSED

## EXISTING

- MANHOLE
- EL ELECTRICAL MANHOLE
- FIRE HYDRANT
- WATER VALVE
- WATER VALVE IN CHAMBER
- CATCH BASIN (INLET TYPE)
- CATCH BASIN (SUMP TYPE)

## OTHER EXISTING FEATURES

- ⊕ POWER POLE
- ⊕ TELE. MANHOLE
- \* \* \* POLE WITH GUY
- ⊕ TREE OR SHRUB
- ⊕ S.I.B. □ I.B. ○ R.I.P.
- ⊕ RAILWAY SWITCH
- VALVE IN GAS MAIN
- CURB BOX IN WATER CONN.
- △ SIGN
- ▲ TEST HOLE (SOIL)
- ⊕ MANHOLE C.B.
- ⊕ RETIRED TELE. M.H.
- ⊕ EXIST. M.H. WITH OLD STYLE FRAME & COVER
- ⊕ TELE. BOX
- ⊕ PM PARKING METER
- ⊕ M MAIL BOX
- SAN ——— SANITARY SEWER
- STM ——— STORM SEWER
- W ——— WATER MAIN
- BURIED TELE. CABLE
- BURIED POWER CABLE
- GAS SERVICE CONN. OR GASMAIN
- DITCH
- TOP OF BANK OR TOE OF SLOPE
- SHLD. OF ROAD
- CONC. CURB & GUTTER
- REMOVE VALVE PROJECT LIMITS
- CONTROL POINT

CITY OF  
**Thunder Bay**  
Superior by Nature

ENGINEERING  
STANDARDS

TITLE

STANDARD DRAWING SYMBOLS

DWN. T.M.D. DATE AUG./81

REVISED: JAN. 2011

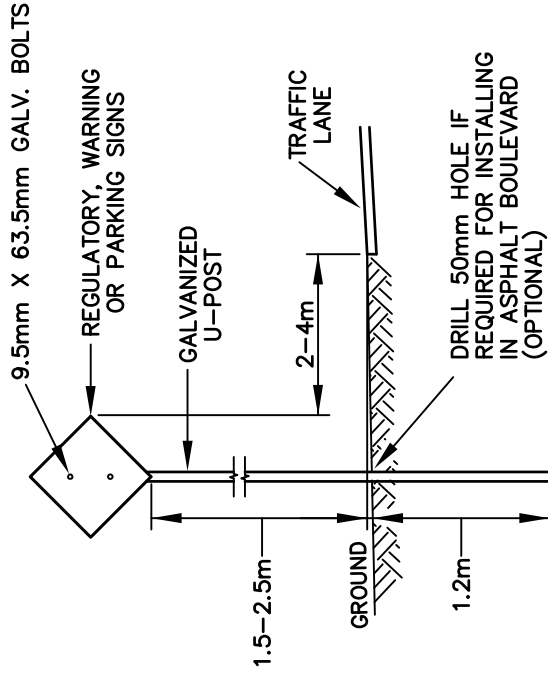
SCALE N. T. S.

DWG. NO. *J. Mauro*  
MANAGER, ENGINEERING DIVISION

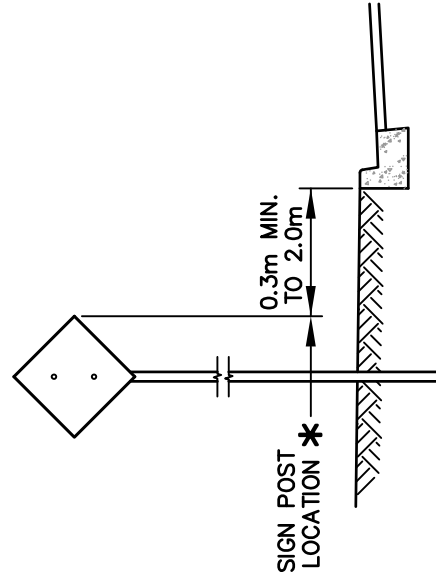
**M-110**

Z:\ENG\Standard Drawings\Std Dwg M-110.dwg



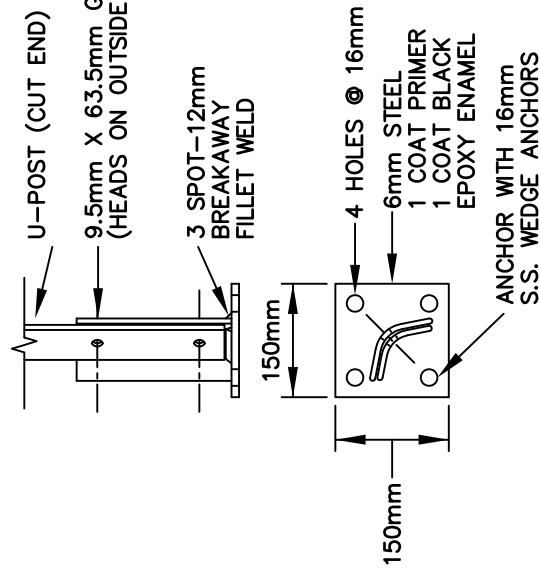


**TYPICAL & ROAD SHOULDER MOUNTING**

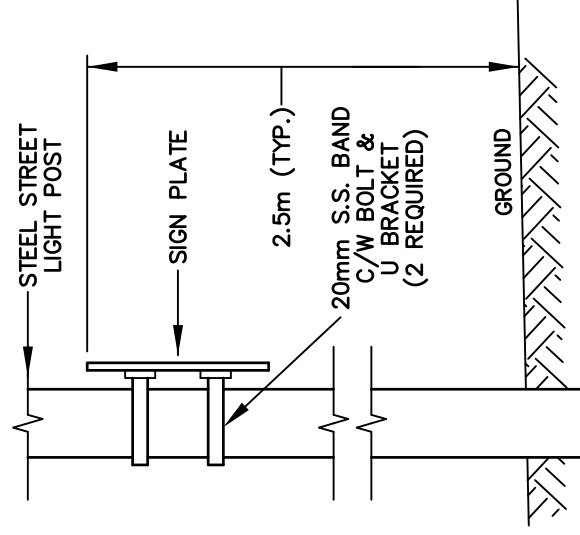


\*NOTE: LOCATIONS IN CURB SIDEWALK AREAS MAY VARY DUE TO SNOW REMOVAL ISSUES.

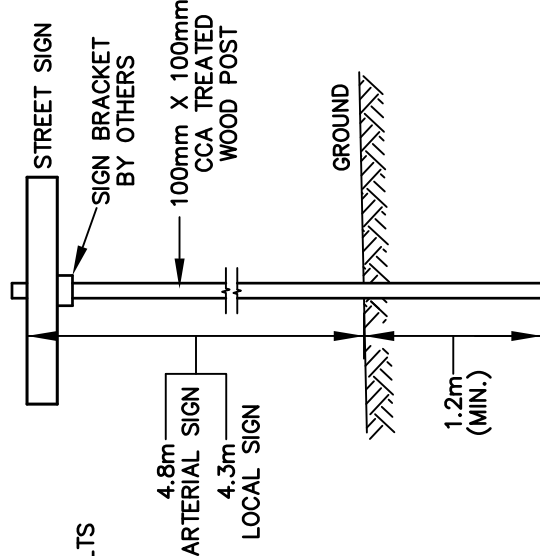
**TYPICAL BOULEVARD & CURB SET BACK FOR ABOVE**



**TYPICAL SIDEWALK ANCHOR FLANGE MOUNTING**




**TYPICAL SIGN MOUNTING FOR STEEL STREET LIGHT DAVIT STYLE POLE**



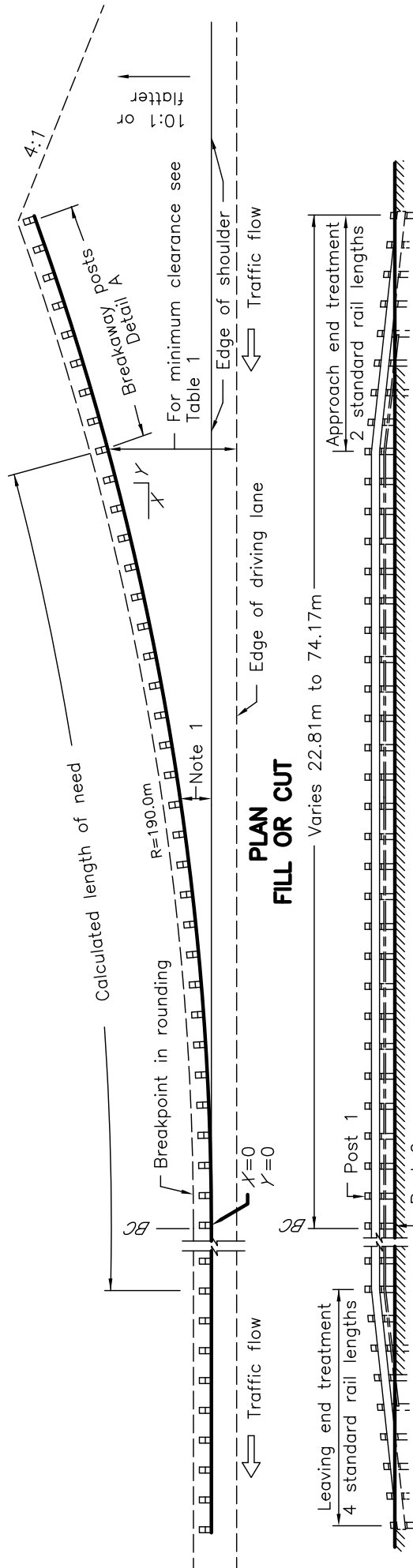
**TYPICAL 4 x 4 STREET SIGN POST**

**NOTES:**

- 1) Sign locations and mounting heights shall be in accordance with the Ontario Traffic Manual. All sign installers shall have a copy of the manuals.
- 2) Obtain underground locates prior to installing signs that require posts into the ground.
- 3) Bent and damaged signs to be reported to City Engineering Division upon removal. Contractor will be held responsible for any bent, damaged or missing signs that are not previously identified at the start of contract.
- 4) No signs to be installed on Thunder Bay Hydro poles.
- 5) Check with Transportation & Works sign installer if there are any questions regarding sign location.

		<b>ENGINEERING STANDARDS</b>	
<b>TYPICAL STREET &amp; TRAFFIC SIGN MOUNTING DETAILS</b>			
TITLE			
DWN.	D.W.	DATE	JAN. 2002
		 MANAGER, ENGINEERING DIVISION	
REVISED:		DEC. 2006	
SCALE		N. T. S.	
PATH		E:\ENG\STD\M-112	
			<b>M-112</b>





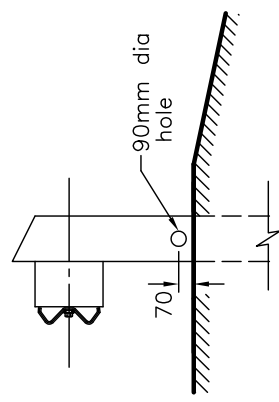
# PLAN FILL OR CUT

## ELEVATION

TABLE 1

DESIGN SPEED km/h	MINIMUM CLEARANCE m
80	5.0
70	4.0
60	3.0

OFFSET TABLE			Posts	X	Y	Posts	X	Y	Posts	X	Y	Posts	X	Y
Posts	X	Y	7	13.32	0.47	16	30.35	2.44	25	47.13	5.94	34	63.52	10.93
			8	15.22	0.61	17	32.23	2.75	26	48.97	6.42	35	65.32	11.58
0	0	0	9	17.12	0.77	18	34.10	3.09	27	50.81	6.92	36	67.10	12.24
1	1.91	0.01	10	19.02	0.95	19	35.98	3.44	28	52.64	7.44	37	68.88	12.93
2	3.81	0.04	11	20.91	1.15	20	37.85	3.81	29	54.47	7.98	38	70.65	13.62
3	5.71	0.09	12	22.81	1.37	21	39.71	4.20	30	56.29	8.53	39	72.42	14.34
4	7.62	0.15	13	24.70	1.61	22	41.57	4.60	31	58.11	9.10	40	74.17	15.08
5	9.52	0.24	14	26.58	1.87	23	43.43	5.03	32	59.92	9.70			
6	11.42	0.34	15	28.47	2.15	24	45.28	5.47	33	61.72	10.31			



## DETAIL A

## NOTES:

- Minimum length to be constructed shall be 22.81m from BC with 1.37m offset.
- All lateral dimensions measured from face of rail.
- This standard to be read in conjunction with OPD-912.140.
- Cross section must be widened to incorporate approach end treatment.
- For undivided highways the flared approach and treatment design is required with minimum clearance distance measured from centre line of highway.

Modified from OPS 912.233

ALL DIMENSIONS ARE IN MILLIMETERS OR METERS



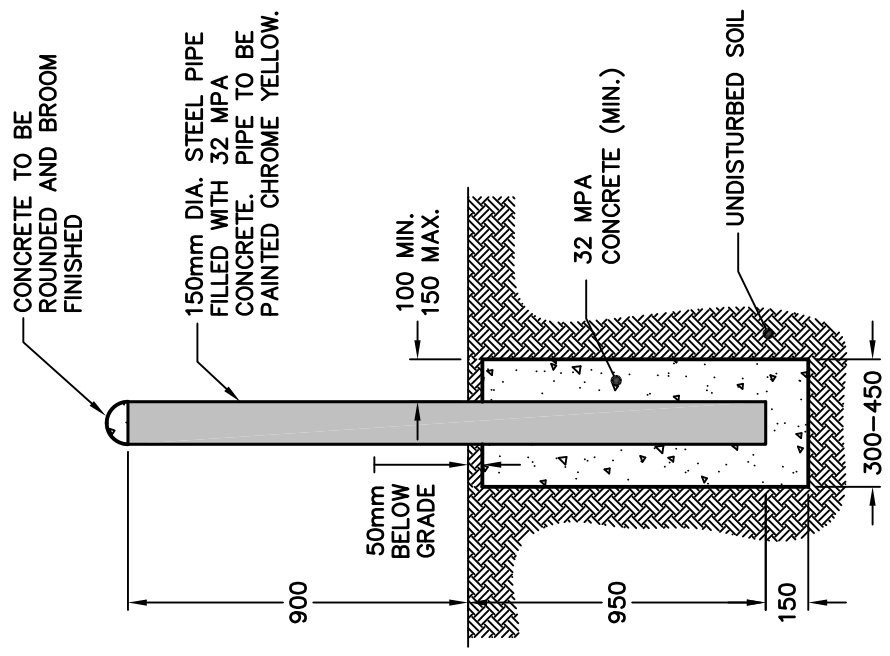
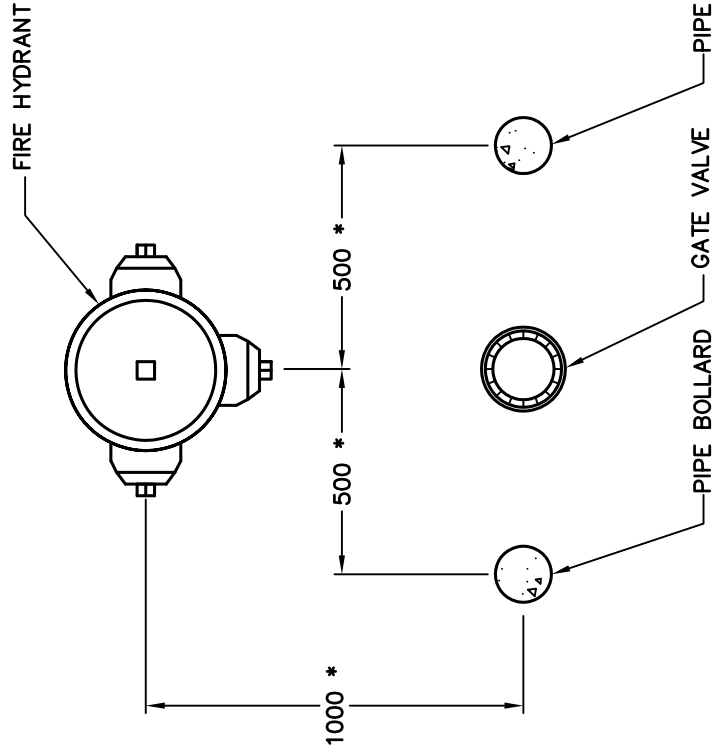
## ENGINEERING STANDARDS

## APPROACH AND LEAVING END TREATMENTS STEEL BEAM GUIDE RAIL

DWN.	M.D.	DATE	MANAGER, ENGINEERING DIVISION
		Mar. / 02	
REVISD:	DEC. 2013	DWG. NO.	
SCALE	N. T. S.		
PATH	E:\ENG\STD	DWG\M-113	

M-113



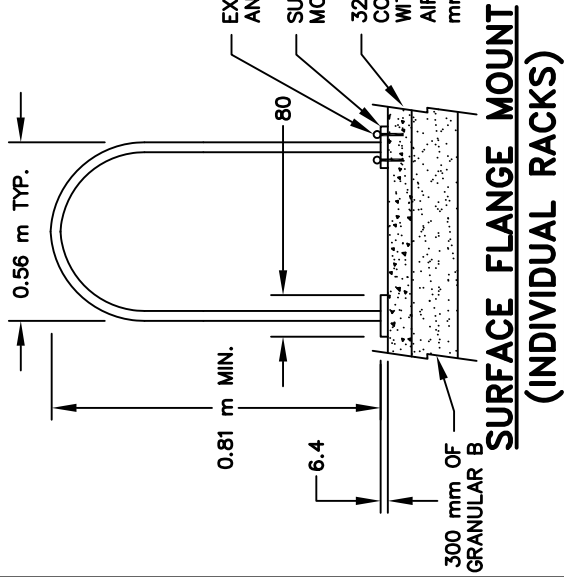


ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED	
CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>	
ENGINEERING STANDARDS	
TITLE <b>PIPE BOLLARD DETAIL FIRE HYDRANT PROTECTION</b>	
DWN.	DATE NOV./08
S.G.	MANAGER, CITY ENGINEERING
REVISED: JAN. 2018	
SCALE	N. T. S.
Z:\ENG\Standard Drawings\Std Dwg\M-114.dwg	
DWG. NO. <b>M-114</b>	

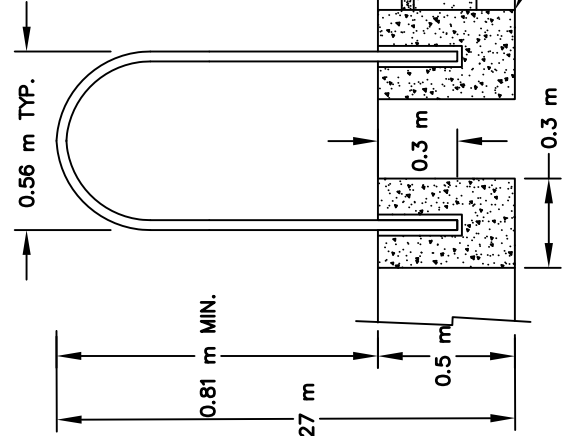
**NOTES:**

1. DIMENSIONS MAY BE REDUCED TO SUIT AVAILABLE SPACE IN BOULEVARD AREA.  
\* DIMENSION - PROVIDED SPACE IS AVAILABLE.
2. WHERE UNDISTURBED SOIL IS TOO LOOSE TO ACHIEVE CONCRETE DIMENSIONS A CONCRETE FORM (SONOTUBE OR EQUIVALENT) SHALL BE USED.
3. BOLLARDS FOR HYDRANT PROTECTION ARE ONLY REQUIRED IN NOTED LOCATIONS.



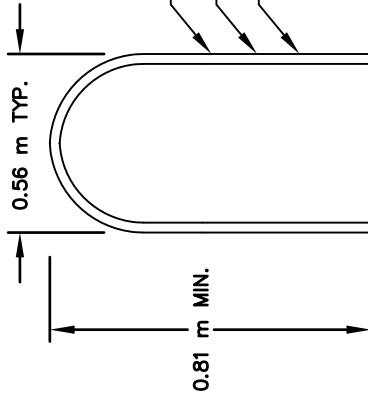


**SURFACE FLANGE MOUNT**  
**(INDIVIDUAL RACKS)**



REFER TO M-115-3, SECTION A-A FOR  
IN-GROUND SOCKET AND RACK DETAILS  
**IN GROUND MOUNT**  
**(INDIVIDUAL RACKS)**

GALVANIZED STEEL SCHEDULE 40 PIPE  
OUTSIDE DIAMETER - 48 mm MIN.  
INSIDE DIAMETER - 38 mm MIN.



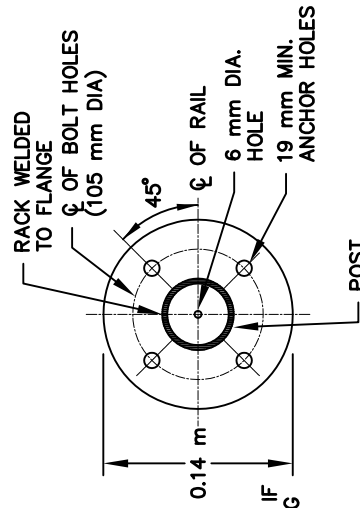
**RACK**

**NOTES:**

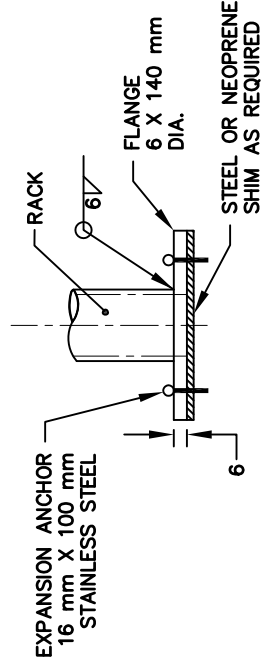
- 1) ANCHORS SHALL BE INSTALLED ACCORDING TO MANUFACTURER'S SPECIFICATIONS
- 2) POSTS SHALL BE HOT DIP GALVANIZED ACCORDING TO CSA G164 AFTER FABRICATION
- 3) POSTS SHALL BE VERTICAL. ALL EXPOSED CORNERS SHALL BE GROUND SMOOTH.
- 4) WELDING SHALL BE ACCORDING TO CSA W59
- 5) ALL JOINTS SHALL BE SHOP WELDED
- 6) PIPE SHALL BE ACCORDING TO ASTM A 53
- 7) LOCATE RACK A MINIMUM OF 0.9 m FROM OBSTACLES PARALLEL TO RACK
- 8) LOCATE RACK A MINIMUM OF 2.5 m FROM MAJOR OBSTACLES (EG. WALLS) ON AT LEAST ONE SIDE TO ALLOW EASY ACCESS FOR CYCLIST
- 9) LOCATE RACK A MINIMUM OF 1.2 m FROM OBSTACLES PERPENDICULAR TO RACK ON SIDES NOT ACCESSED BY CYCLIST

**ANCHORING SURFACE OPTIONS**

- 10) EMBED IN CONCRETE
- 11) ANCHOR TO EXISTING CONCRETE
- 12) POUR CONCRETE PAD AND ANCHOR TO PAD
- 13) INSTALL PAVING STONE AROUND CONCRETE BASE BLOCK (IN-GROUND) OR OVER CONCRETE PAD (SURFACE MOUNT)




**SURFACE MOUNT**  
**FLANGE DETAIL**  
**PLAN VIEW**

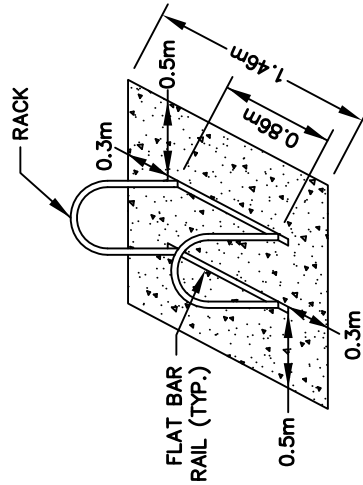


**SURFACE MOUNT**  
**FLANGE DETAIL**  
**SECTION VIEW**

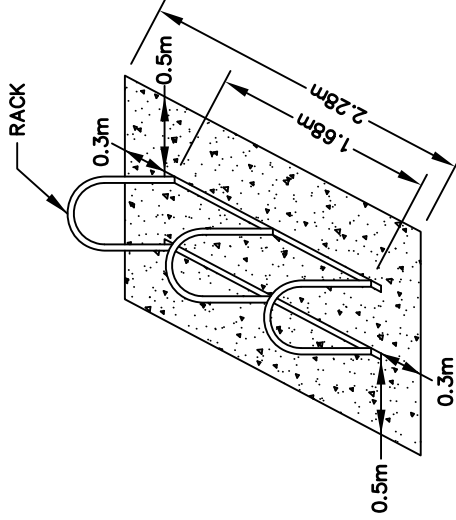
ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

 CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>		<b>ENGINEERING STANDARDS</b>	
TITLE		<b>INVERTED BICYCLE RACK DETAILS &amp; SECTIONS</b>	
DWN.	C.P./M.P.	DATE	JAN. 2011
REVISED:		JAN. 2018	
SCALE		N. T. S.	
z:\ENG\Standard Drawings\Std Dwg\M-115-1.dwg			
		MANAGER, ENGINEERING DIVISION	
		DWG. NO.	
		<b>M-115-1</b>	

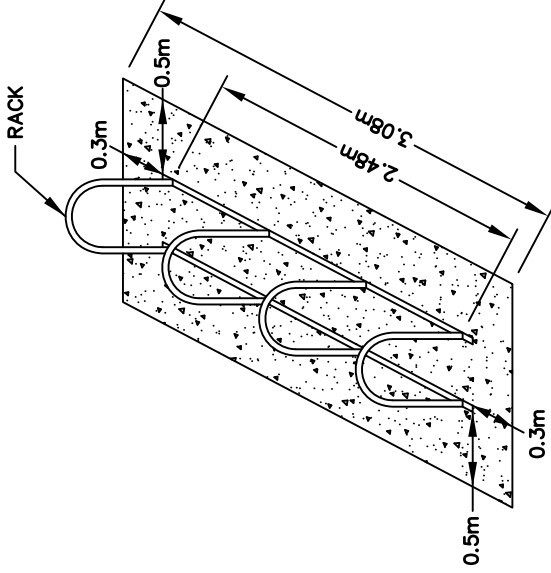




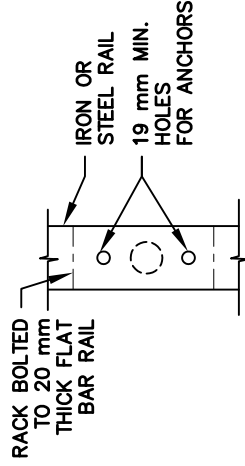
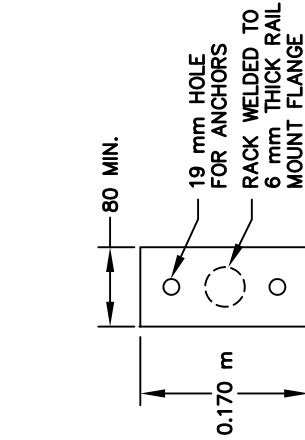
**MAX. 4 BICYCLES**



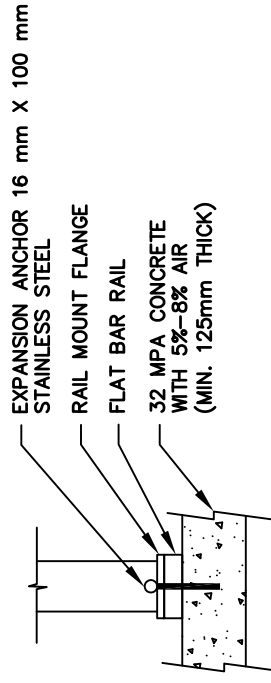
**MAX. 6 BICYCLES**



**MAX. 8 BICYCLES**



**FLAT BAR  
RAIL PLAN**



**FLAT BAR RAIL SECTION**

## NOTES:

- ANCHORS SHALL BE INSTALLED ACCORDING TO MANUFACTURER'S SPECIFICATIONS
- POSTS SHALL BE HOT DIP GALVANIZED ACCORDING TO CSA G164 AFTER FABRICATION
- POSTS SHALL BE VERTICAL. ALL EXPOSED CORNERS SHALL BE GROUND SMOOTH.
- WELDING SHALL BE ACCORDING TO CSA W59
- ALL JOINTS SHALL BE SHOP WELDED
- PIPE SHALL BE ACCORDING TO ASTM A 53
- LOCATE RACK A MINIMUM OF 0.9 m FROM OBSTACLES PARALLEL TO RACK
- LOCATE RACK A MINIMUM OF 2.5 m FROM MAJOR OBSTACLES (EG. WALLS) ON AT LEAST ONE SIDE TO ALLOW EASY ACCESS FOR CYCLIST
- LOCATE RACK A MINIMUM OF 1.2 m FROM OBSTACLES PERPENDICULAR TO RACK ON SIDES NOT ACCESSED BY CYCLIST
- ALTERNATE RAIL (C CHANNEL) METHOD MAY BE USED ONCE APPROVED BY CITY ENGINEER
- RACKS USED SHALL MEET THE ENGINEERING STANDARDS OF M-115-1.

## ANCHORING SURFACE OPTIONS

- EMBED IN CONCRETE
- ANCHOR TO EXISTING CONCRETE
- POUR CONCRETE PAD AND ANCHOR TO PAD
- INSTALL PAVING STONE AROUND CONCRETE BASE BLOCK (IN-GROUND) OR OVER CONCRETE PAD (SURFACE MOUNT)

## RAIL MOUNT (MULTIPLE RACKS)

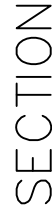
ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

<b>CITY OF</b> <b>Thunder Bay</b> <i>Superior by Nature</i>		<b>ENGINEERING</b> <b>STANDARDS</b>	
<b>TITLE</b> <b>INVERTED BICYCLE RACK</b> <b>MULTIPLE RACK LAYOUT</b>		<b>DWN.</b> S.G. <b>DATE</b> JAN. 2011 <b>REVISD:</b> JAN. 2018 <b>SCALE</b> N. T. S.	
<b>MANAGER, ENGINEERING DIVISION</b> <b>DWG. NO.</b>		<b>M-115-2</b>	



DWG. NO. **M-115-3**





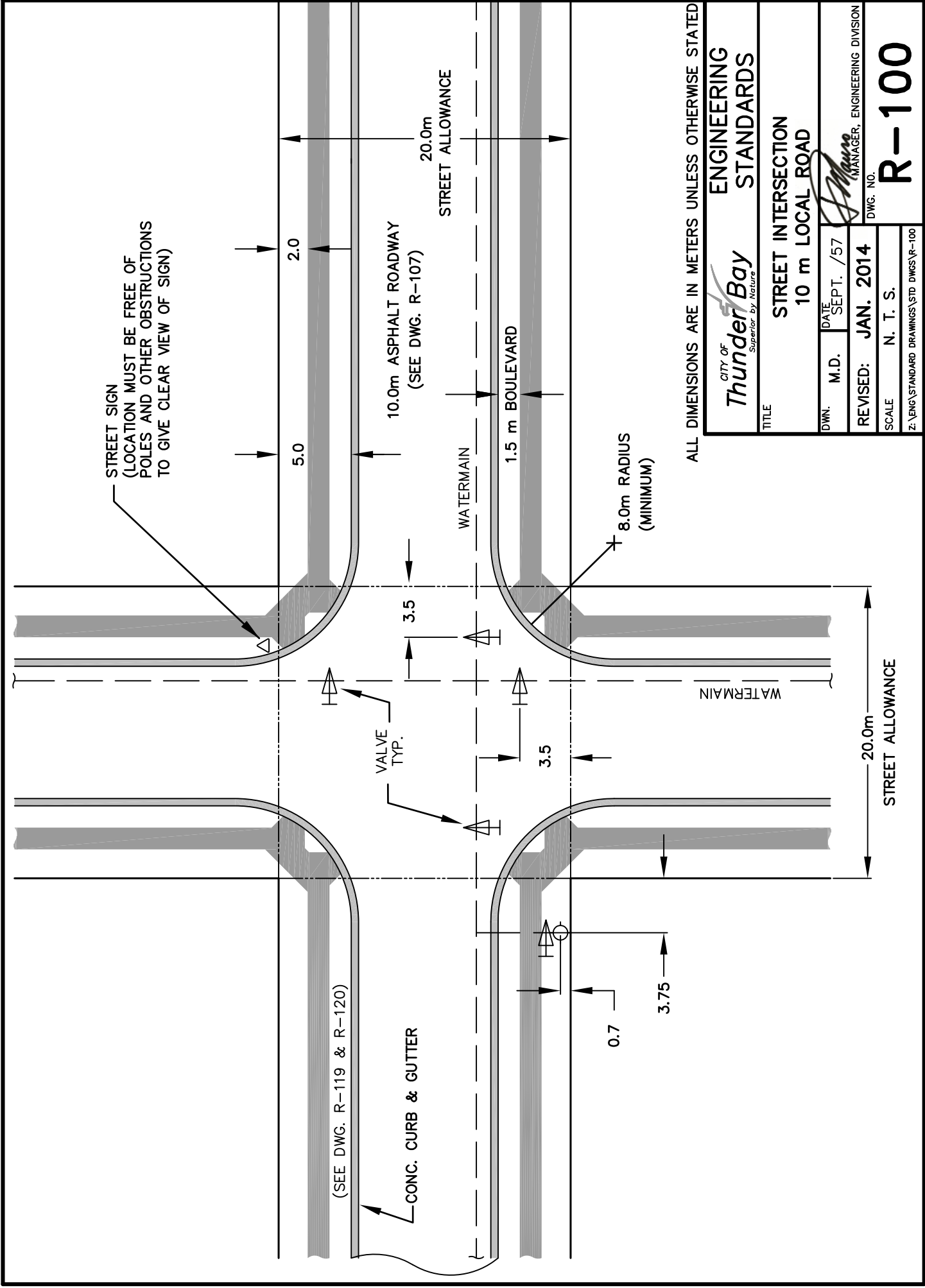
2000MM LONG BAR TYPICAL FOR 3000MM WIDE TRAIL. FOR OTHER TRAIL WIDTHS ADJUST LENGTH OF BAR TO MAINTAIN 200MM DISTANCE TO TRAIL CENTERLINE.

DWN.	W.S./S.G.	DATE	JAN./15
REVISED: FEB. 2019			
SCALE		N. T. S.	
Z: JENG\STANDARD DRAWINGS\STD DWGS\M-116			

- ALL METAL COMPONENTS TO BE PRIMED & EPOXY COATED, PAINT WITH 2 COATS IN SAFETY YELLOW TO CGSB1-GP-40M
- ALL NUTS, BOLTS & WASHERS TO BE GALVANIZED TO ASTM A325
- ALL WELDS TO CSA W59-M1989 & GROUND SMOOTH PRIOR TO PAINTING - ALL STEEL TO BE CSA G40.21-M92 TYPE 300 W +G40.21-M 350W
- CONTRACTOR TO SUBMIT SHOP DRAWINGS TO CITY





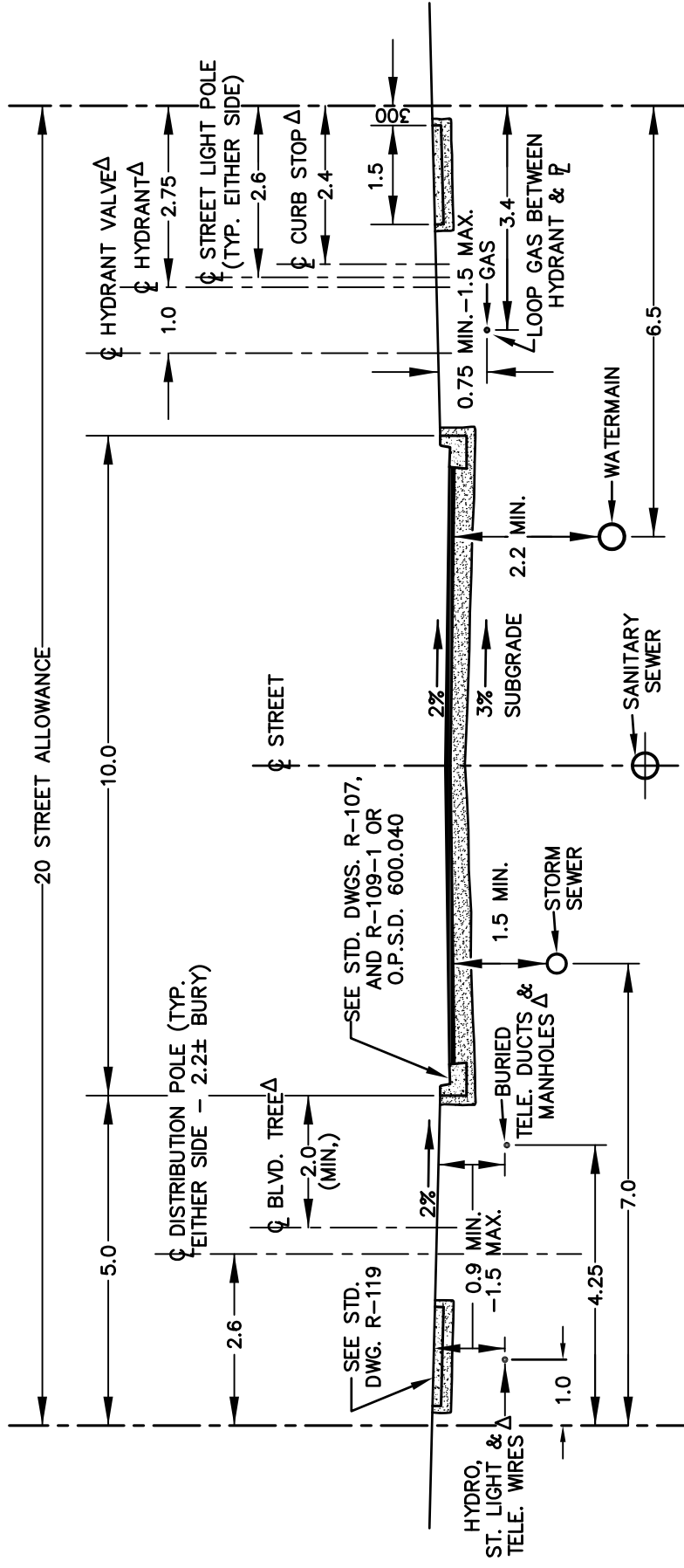


ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE STATED

CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE STREET INTERSECTION 10 m LOCAL ROAD			
DWN.	M.D.	DATE SEPT. /57	DWG. NO.
REVISED: JAN. 2014		MANAGER, ENGINEERING DIVISION	
SCALE N. T. S.		DWG. NO.	
Z:\ENG\STANDARD DRAWINGS\STD DWGS\R-100			

# R-100







**\* THIS STANDARD SHALL APPLY TO THE CONSTRUCTION OF SERVICES ON EXISTING ROADS WHERE THESE SERVICE CORRIDORS ARE EXISTING**

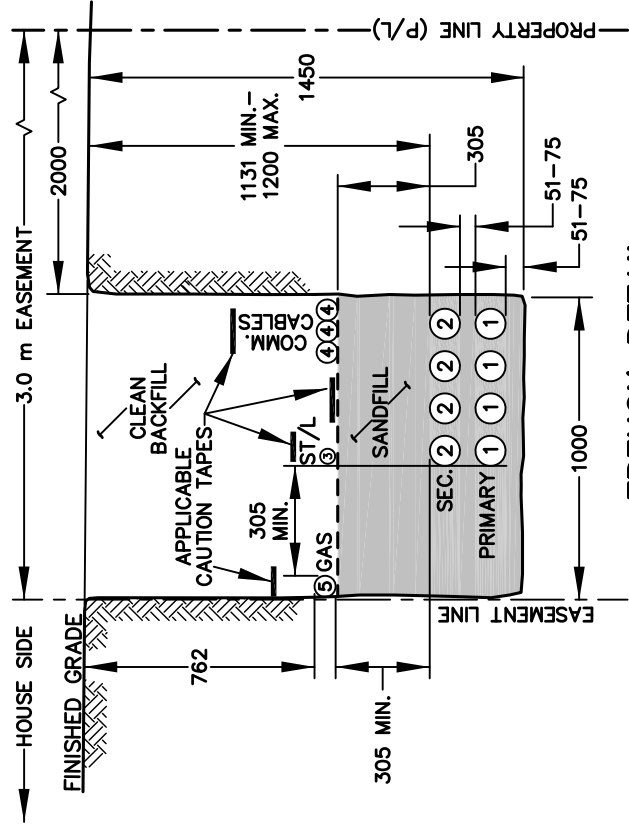
**NOTES:**

- Bottom of Utility duct banks to be maximum 1.5 m deep.
- Δ Denotes underground services that are routinely constructed on both sides of the street.
- Minimum horizontal separation between cable/ducts and sewer and appurtenances shall be 1.0 m.
- All utilities in or crossing the sidewalk corridor are to be 0.9 to 1.5 m below finished grade

ALL DIMENSIONS ARE IN MILLIMETRES OR METRES

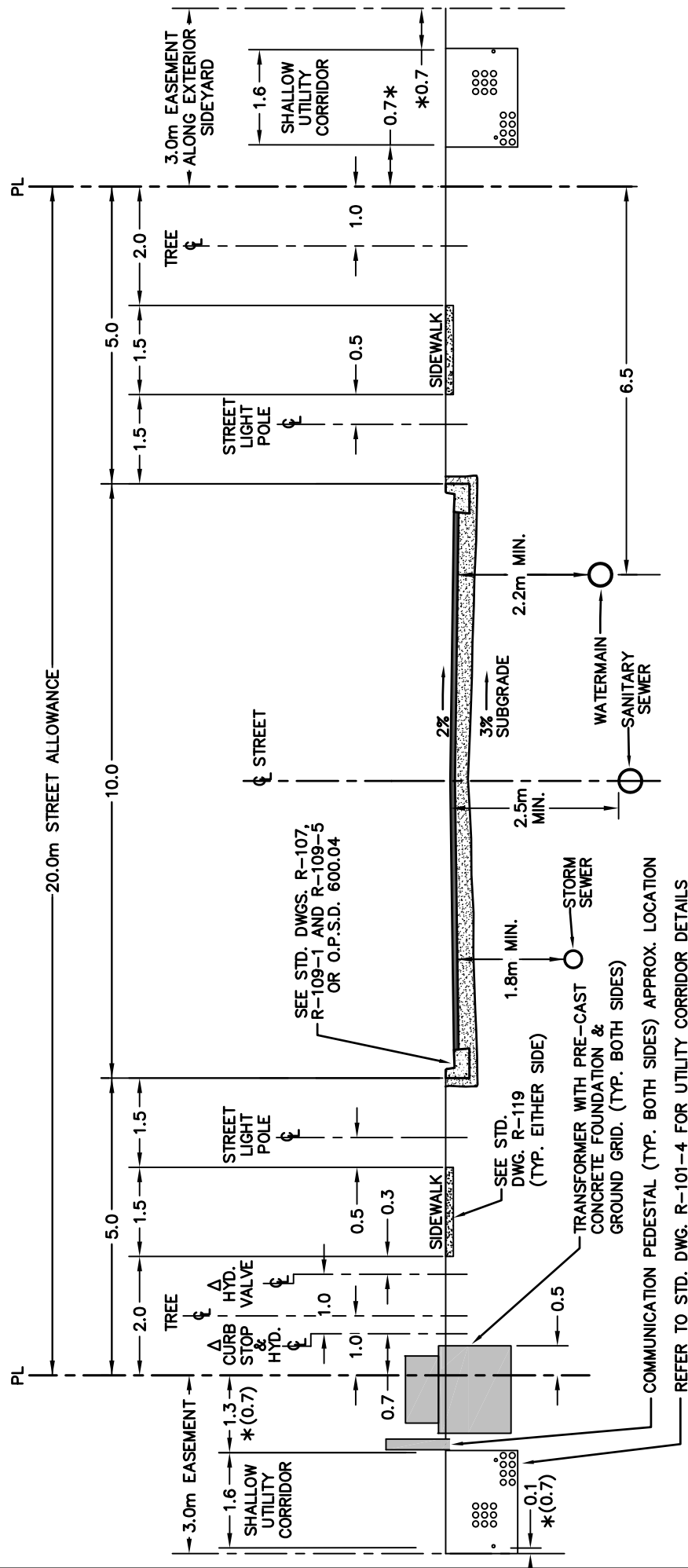
 CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE		SECTION THROUGH LOCAL ROAD	
DWN.	D.R.	DATE SEPT./57	 MANAGER, ENGINEERING DIVISION
REVISED:		JAN. 2007	
SCALE		N. T. S.	DWG. NO.
Z:\ENG\STANDARD DRAWINGS\STD DWGS\R-101-1		R-101-1	





## TRENCH DETAIL



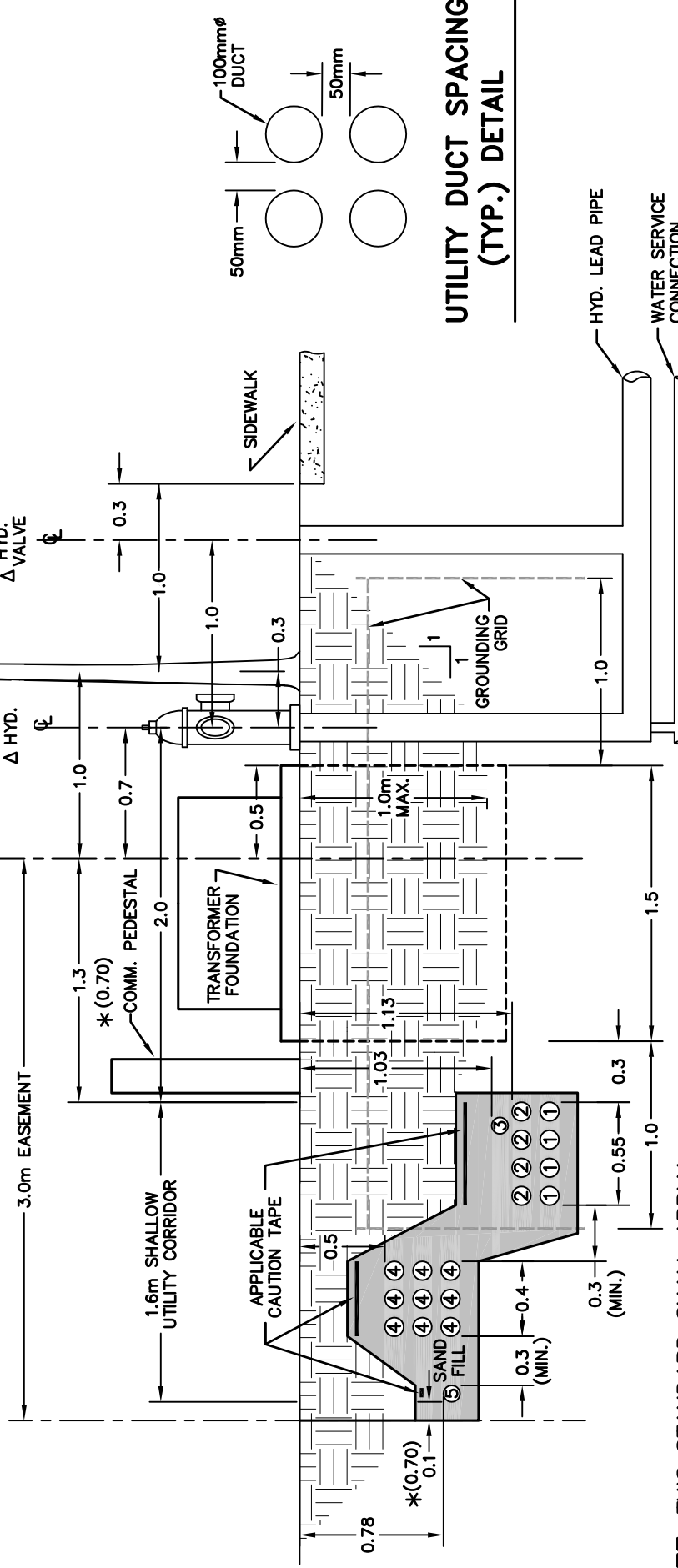


**NOTES:**

ALL DIMENSIONS ARE IN METRES  
UNLESS OTHERWISE STATED



HATCH DENOTES APPROVED SOIL FOR TREE PLANTING



**NOTE: THIS STANDARD SHALL APPLY TO THE CONSTRUCTION OF SERVICES ON NEW ROADS.**


## UTILITY CORRIDOR DETAIL

ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED

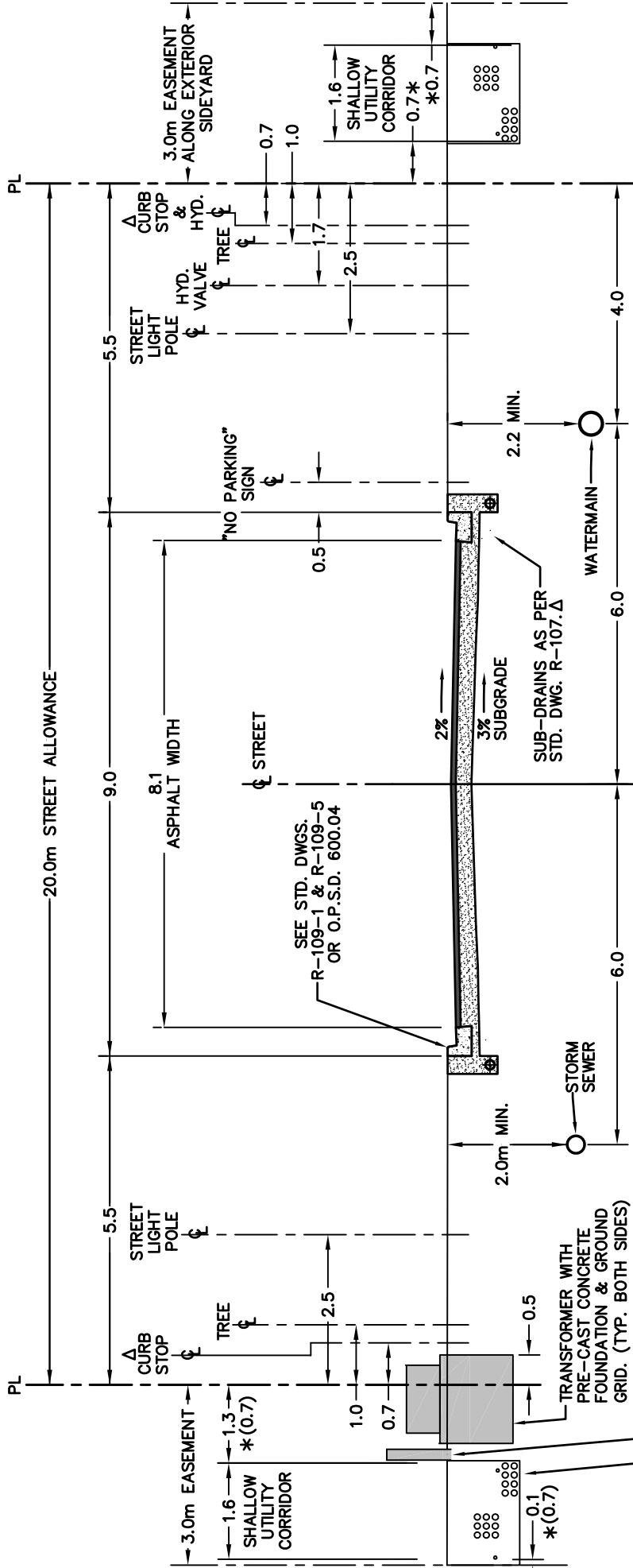
**NOTES:**

- DEPTHS SHALL BE ADJUSTED TO ACCOMMODATE MINIMUM CLEARANCES.
- COMMUNICATION PEDESTAL LOCATIONS MAY VARY SLIGHTLY IN FIELD.
- TRANSFORMERS TO INCLUDE GROUND GRID.
- TRANSFORMERS AND HYDRANTS NOT TO BE LOCATED ON FLANKAGE (SIDE YARD) OF CORNER LOTS.
- CIVIL SERVICE CONNECTIONS (SANITARY, WATER, STORM) TO BE EXTENDED THROUGH THE FRONT YARD ON CORNER LOTS (NOT THROUGH THE FLANKAGE/SIDE YARD).
- SAND FILL BEDDING AND COVER MATERIAL IN UTILITY CORRIDOR TRENCH TO BE AS PER UTILITY SPECIFICATIONS.

THUNDER BAY UTILITY
① HYDRO PRIMARY
② HYDRO SECONDARY
③ STREET LIGHTING
④ COMMUNICATION CABLES
⑤ NATURAL GAS

 <p>CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i></p>		<p><b>ENGINEERING STANDARDS</b></p>	
<p>TITLE</p>		<p><b>SHALLOW UTILITY CORRIDOR DETAIL FOR LOCAL ROAD</b></p>	
<p>DWN.</p>	<p>M.D.</p>	<p>DATE</p>	<p>JAN./14</p>
<p>REVISED: JAN. 2015</p>		<p><i>[Signature]</i> MANAGER, ENGINEERING DIVISION</p>	
<p>SCALE</p>		<p>N. T. S.</p>	
<p>Z:\ENG\STANDARD DRAWINGS\STD DWGS\R-101-4</p>		<p>DWG. NO.</p>	
<p><b>R-101-4</b></p>		<p><b>R-101-4</b></p>	





## NOTES:



- DEPTHS SHALL BE ADJUSTED TO ACCOMMODATE MINIMUM CLEARANCES.
- COMMUNICATION PEDESTAL LOCATIONS MAY VARY SLIGHTLY IN FIELD.
- TRANSFORMERS TO INCLUDE GROUND GRID.
- TRANSFORMERS AND HYDRANTS NOT TO BE LOCATED ON FLANKAGE (SIDE YARD) OF CORNER LOTS.
- CIVIL SERVICE CONNECTIONS (WATER AND STORM) TO BE EXTENDED THROUGH THE FRONT YARD ON CORNER LOTS (NOT THROUGH THE FLANKAGE/SIDE YARD).
- REFER TO M-104 SERIES DRAWINGS FOR TREE PLANTING SOIL DEPTHS AND DIMENSIONS.
- "NO PARKING" SIGN INSTALLED ON SAME SIDE OF ROAD AS FIRE HYDRANTS. SEE DRAWING M-112 FOR MOUNTING DETAILS.

Δ DENOTES UNDERGROUND SERVICES THAT ARE ROUTINELY CONSTRUCTED ON BOTH SIDES OF THE STREET.

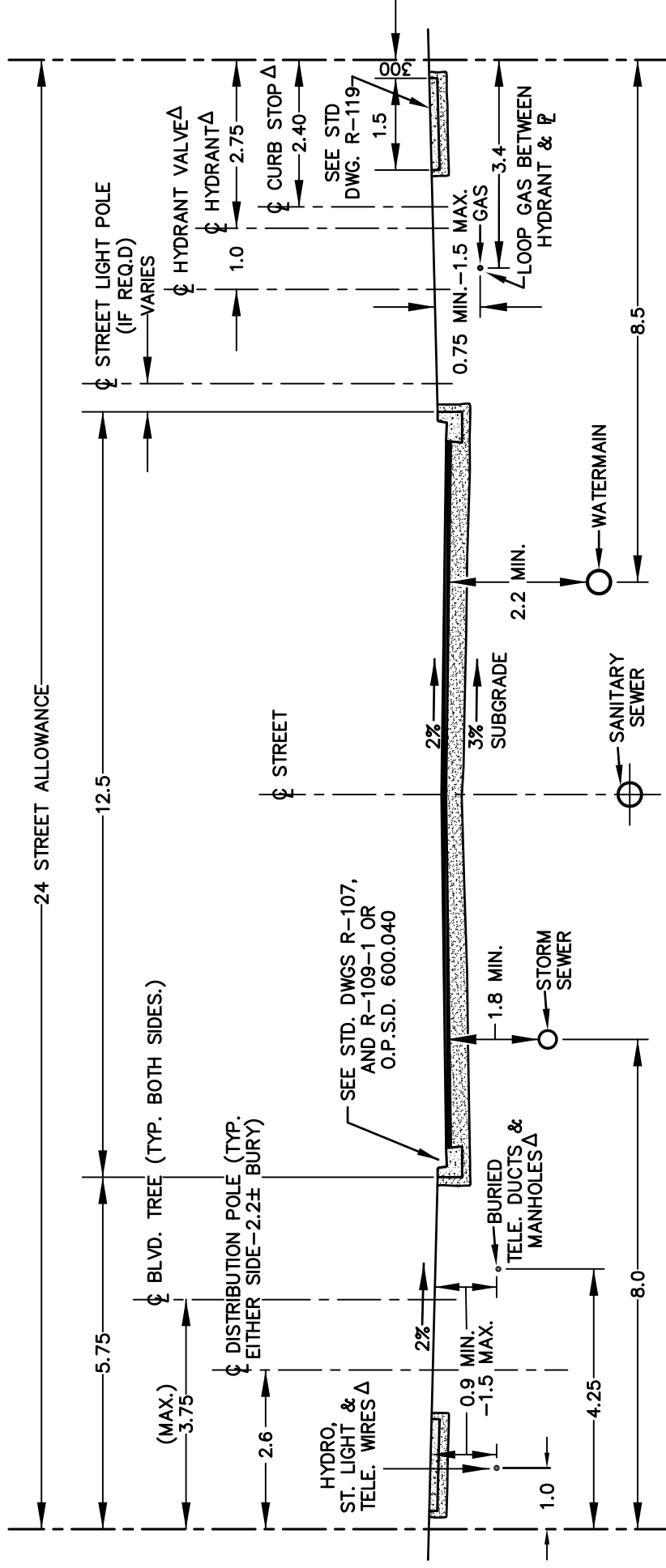
\* DIMENSION APPLIES TO EXTERIOR SIDEYARD EASEMENTS

**NOTE:** THIS STANDARD SHALL APPLY TO THE CONSTRUCTION OF SERVICES ON NEW ROADS IN SUB-URBAN AREAS.

ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED

 CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>		<b>ENGINEERING STANDARDS</b>	
<b>SECTION THROUGH SUB-URBAN LOCAL ROAD WITH SHALLOW UTILITY CORRIDOR</b>			
TITLE			
DWN.	S.G.	DATE	FEB./17
REVISED: MAR. 2018		 MANAGER, ENGINEERING DIVISION	
SCALE		DWG. NO.	
N. T. S.		<b>R-101-5</b>	
Z:\ENG\STANDARD DRAWINGS\STD DWGS\R-101-5			





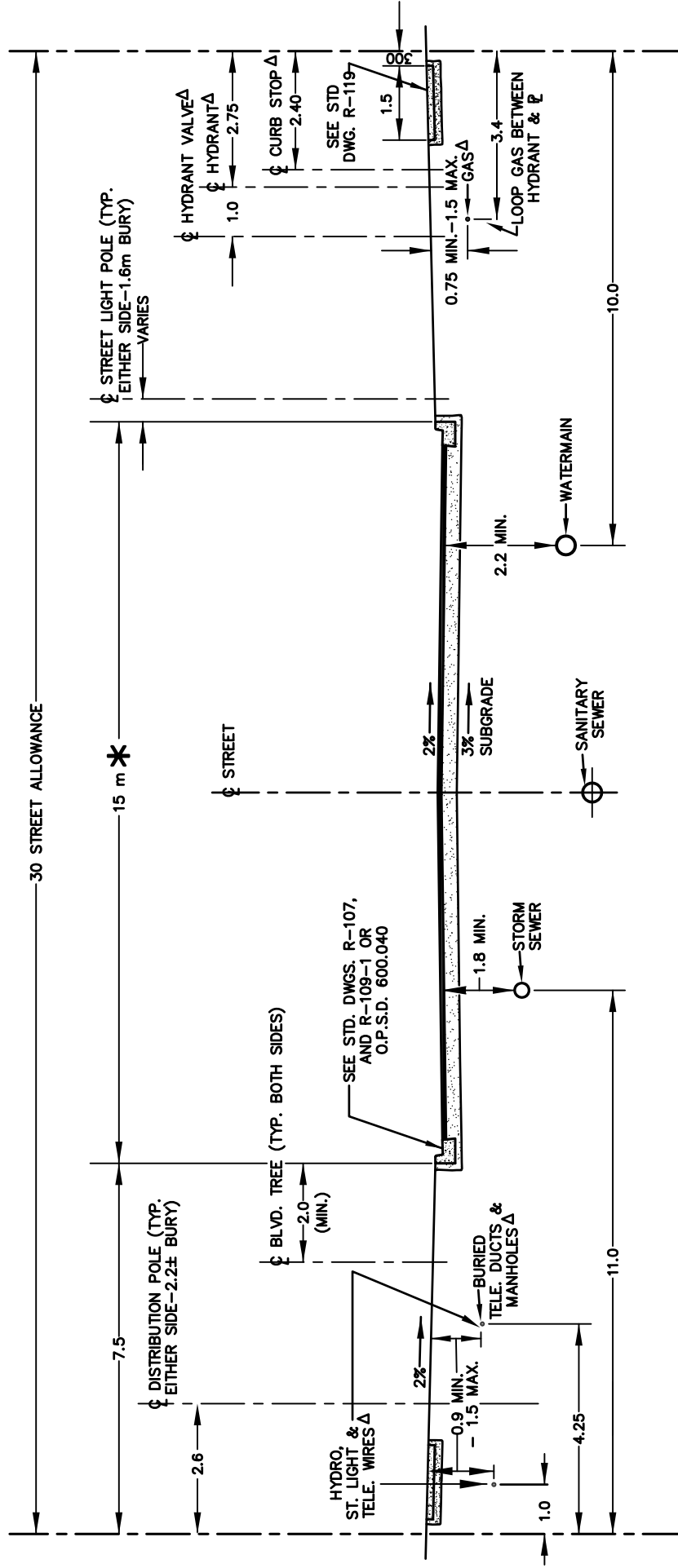
ALL DIMENSIONS ARE IN MILLIMETRES OR METRES

CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE		SECTION THROUGH COLLECTOR ROAD	
DWN.	D.R.	DATE	DEC./70
REVISED: JAN. 2015		MANAGER, ENGINEERING DIVISION	
SCALE		N. T. S.	
Z:\ENG\STANDARD DRAWINGS\STD DWGS\R-102		DWG. NO.	
		<b>R-102</b>	

### NOTES:

- 1) UTILITY LOCATIONS SHOWN RELATE TO EXISTING ARTERIAL ROADS.
- 2) FOR NEW ARTERIALS, COMMON UTILITY TRENCH MAY BE REQUIRED AS PER R-101-4, AT DISCRETION OF CITY ENGINEER.
- 3) Δ DENOTES UNDERGROUND SERVICES THAT ARE ROUTINELY CONSTRUCTED ON BOTH SIDES OF THE STREET.





## NOTES:

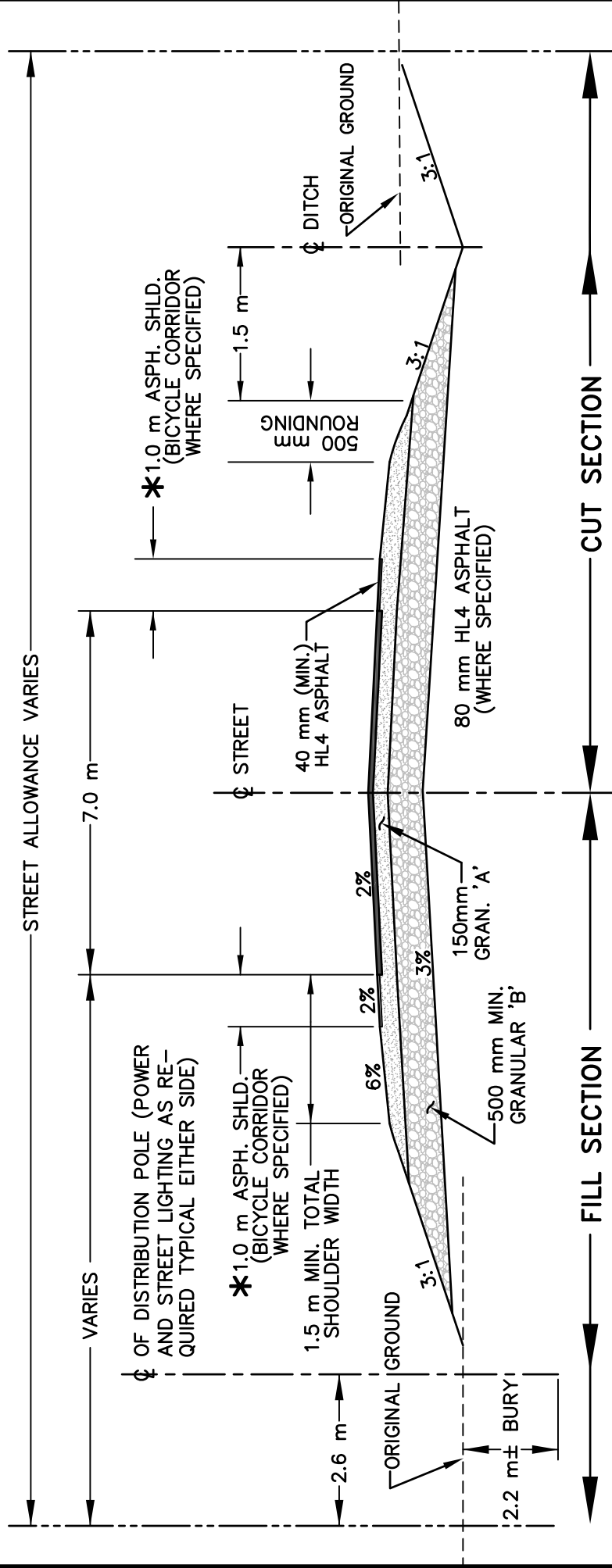
- UTILITY LOCATIONS SHOWN RELATE TO EXISTING ARTERIAL ROADS.
- FOR NEW ARTERIALS, COMMON UTILITY TRENCH MAY BE REQUIRED AS PER R-101-4, AT DISCRETION OF CITY ENGINEER.
- Δ DENOTES UNDERGROUND SERVICES THAT ARE ROUTINELY CONSTRUCTED ON BOTH SIDES OF THE STREET.

\* WIDTH EXTENDED TO 16.0m WHERE REQUIRED FOR ADDITIONAL TRAVELLED LANE WIDTH FOR BICYCLE CORRIDORS.

ALL DIMENSIONS ARE IN MILLIMETRES OR METRES

CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE		SECTION THROUGH ARTERIAL ROAD	
DWN.	D.R.	DATE	DEC. / 70
REVISED: JAN. 2015		DWG. NO.	
SCALE		N. T. S.	
Z: \ENG\STANDARD DRAWINGS\STD DWGS\R-103		MANAGER, ENGINEERING DIVISION	
		R-103	







## "RURAL ROAD"

### NOTES:

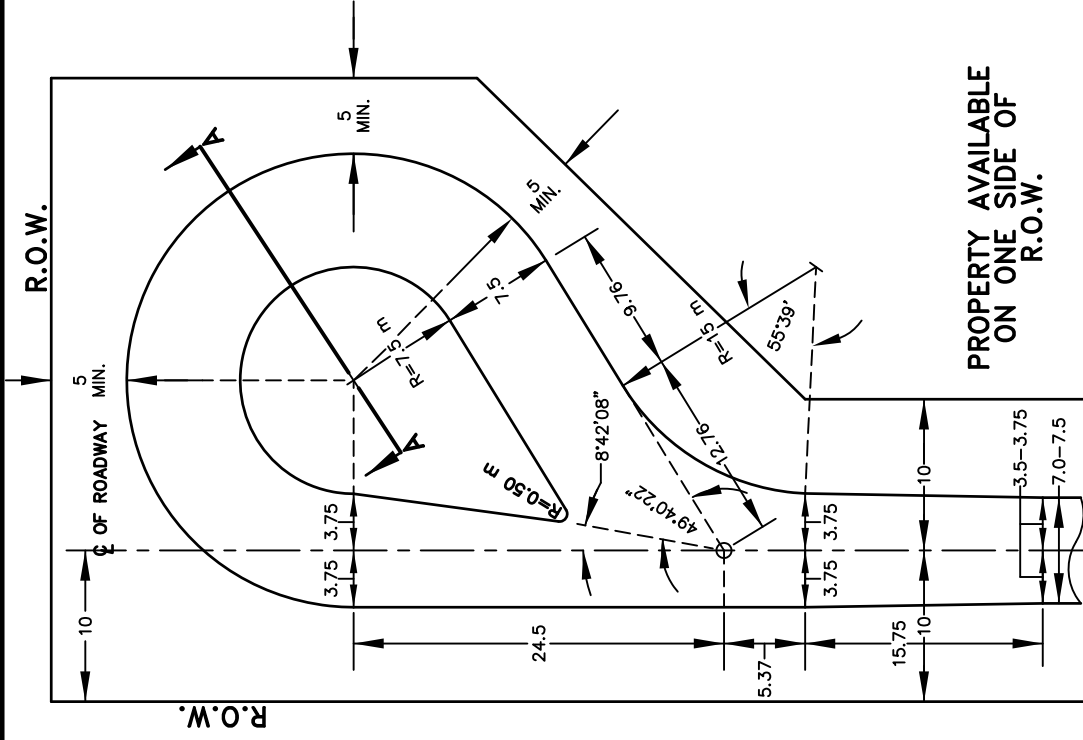
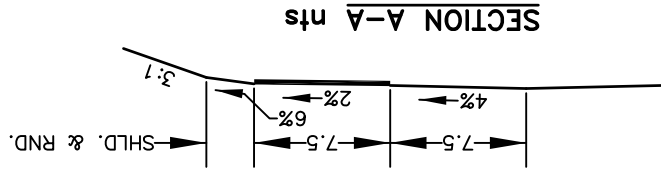
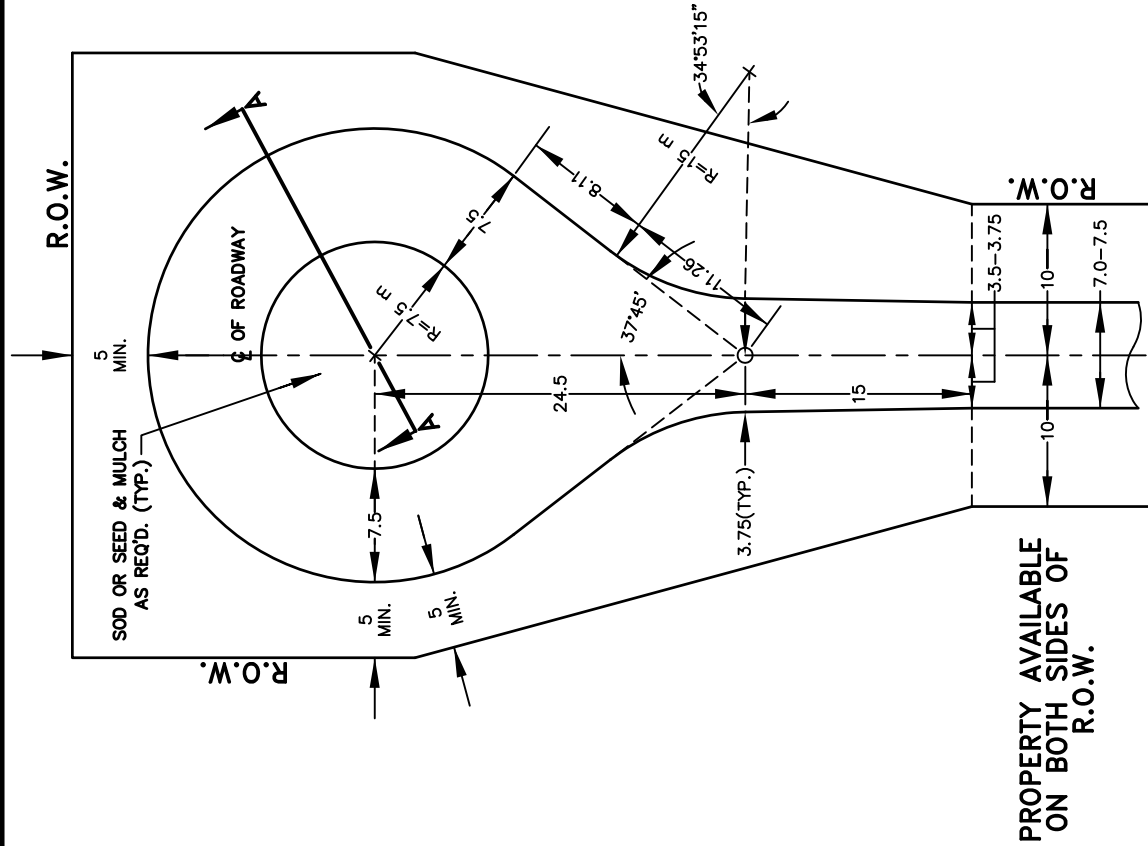
- 1) If concrete curb and gutter is desired, see Std. Dwgs. R-107 and R-109-1.
- 2) Gas main to be 2.1 m from street line (other corridors subject to approval by City Engineer).
- 3) See R-104-2 for typical cul-de-sac layouts for rural road termination.
- 4) Width standard applies to 60 km/hr design speed or less.
- 5) Road base design shall be in accordance with the minimum performance standards detailed in the City Engineering and Development Standards.
- 6) All road designs shall be submitted to the City Engineer for approval.

\* 1.0 m wide asphalt shoulder where required for specified bicycle corridor.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

 CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE RURAL ROAD SECTION			
DWN.	M. P.	DATE	DEC. /70
REVISED:		JAN. 2012	
SCALE		N. T. S.	
DWG. NO.		MANAGER, ENGINEERING DIVISION  R-104-1	
Z: XENG\Standard Drawings\Std Dwg\A-104-1.dwg			





# NOTES:

- 1) Width of shoulder and rounding to match terminated roadway.
- 2) R.O.W.'s shown are minimum requirement.
- 3) When property is on opposite side of R.O.W. to that shown, plan to be reversed.
- 4) See R-104-1 for rural road construction details.
- 5) All dimensions shown are in metres.

CITY OF <b>Thunder Bay</b> <small>Superior by Nature</small>		ENGINEERING STANDARDS	
TITLE RURAL ROAD CUL-DE-SAC LAYOUTS			
DWN.	D.R.	DATE	JUNE 86
REVISED: MAY 2004		CITY ENGINEER	
SCALE	N. T. S.		
PATH	E:\ENG\Std Dwgs\R-104-2		
DWG. NO.		R-104-2	



USE A 8.5 m RAD. TO END NEW RURAL EXTENSIONS  
IN AN EXISTING 20.12 (66') WIDE ROAD ALLOWANCE

+12 m RADIUS

1.5 m

Ø ROAD ALLOWANCE

EQUAL

7.0 m RURAL ROAD

ROAD ALLOWANCE  
20.12 m (66')

EQUAL


NOTE - THIS ROAD MAY BE EXTENDED IN THE FUTURE

EXISTING ROADSIDE DRAINAGE MUST BE MAINTAINED.  
MAY REQUIRE TEMPORARY CULVERT INSTALLATIONS.

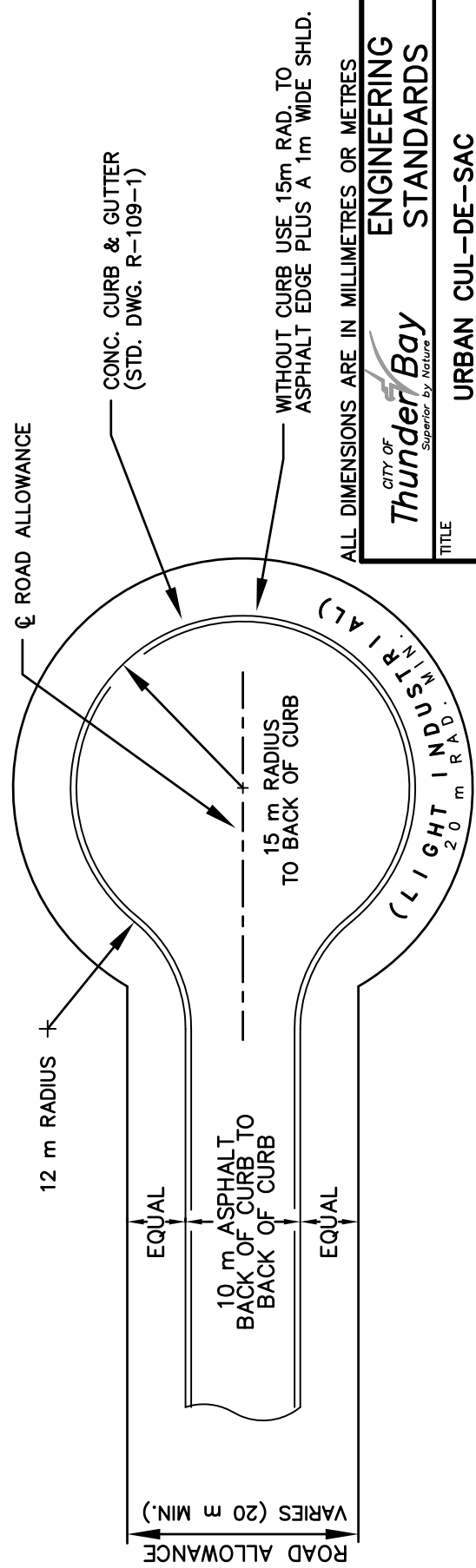
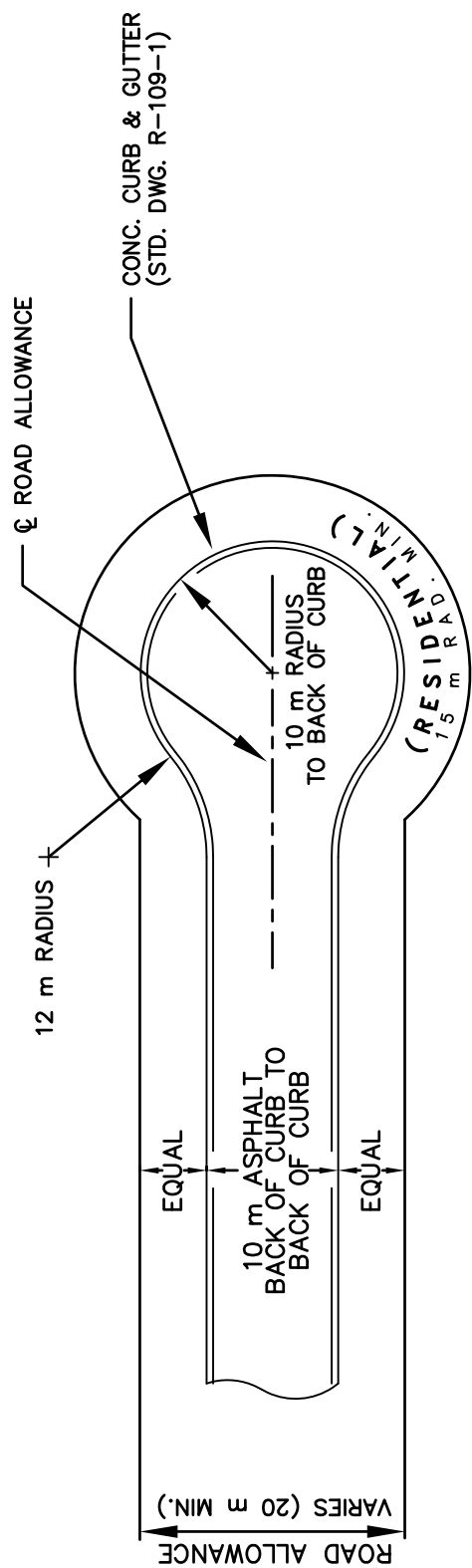
NOTES:

1) SEE R-104-1 FOR ROAD CONSTRUCTION DETAIL.


ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

<div>CITY OF <i>Thunder Bay</i> <small>Superior by Nature</small></div>		ENGINEERING STANDARDS	
TITLE TEMPORARY TURNING BASIN FOR TERMINATED RURAL ROAD EXTENSION			
DWN. G.S.L.	DATE JUNE 86	<div> MANAGER, ENGINEERING DIVISION</div>	
REVISED: JAN. 2011		DWG. NO.	
SCALE N. T. S.		R-105	
Z: \ENG\Standard Drawings\Std Dwgs\R-105.dwg			





ALL DIMENSIONS ARE IN MILLIMETRES OR METRES

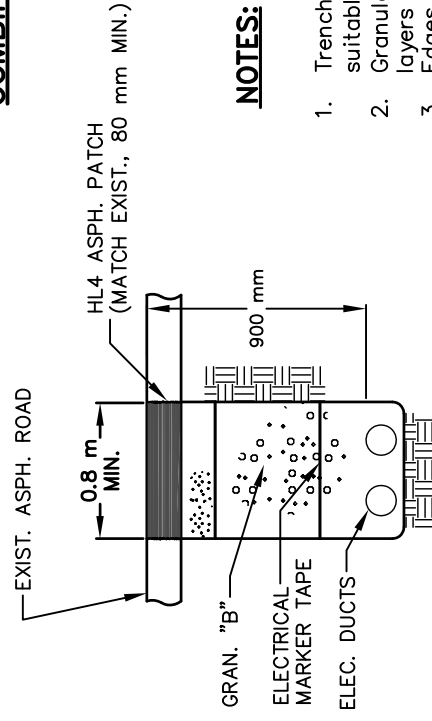
<div>CITY OF <i>Thunder Bay</i> Superior by Nature</div>		ENGINEERING STANDARDS	
TITLE		URBAN CUL-DE-SAC LAYOUTS	
DWN. G.L. & D.R.	DATE MAR./77	<div>CITY ENGINEER</div>	
REVISED: MAY 2004		DWG. NO.	R-106
SCALE N. T. S.			
PATH E:\ENG\STD DRAWING\R-106			







**PATCH FOR ASPHALT  
ROADWAY THAT IS TO  
BE RESURFACED**



# PATCH IN ASPHALT ROADWAY OVER TRENCH RESTORATION REQUIRED FOR ELECTRICAL DUCT INSTALLATION

1. Trenches are to be backfilled with compacted, suitable excavated material, up to the granular, "B".
2. Granular "A" and "B" to be placed in 150 mm layers and compacted to 100% density.
3. Edges of old asphalt to be mopped with hot liquid asphalt.
4. Where specified by the Engineer, non-shrink backfill shall be used in lieu of excavated and granular materials.

**NOTES:**

1. Trenches are to be backfilled with compacted, suitable excavated material, up to the granular, "B".
2. Granular "A" and "B" to be placed in 150 mm layers and compacted to 100% density.
3. Edges of old asphalt to be mopped with hot liquid asphalt.
4. Where specified by the Engineer, non-shrink backfill shall be used in lieu of excavated and granular materials.

ALL DIMENSIONS ARE IN MILLIMETERS OR METERS



# ENGINEERING STANDARDS

TITLE

## PATCHING FOR ROADWAY CUTS

DWN. R.V.G./S.K.H.	DATE AUG. 83
REVISED: JAN. 2018	
SCALE	N. T. S.
Z:\ENG\STANDARD DRAWINGS\STD DWGS\R-	

DWG. NO.

CITY ENGINEER

**No. R-108**




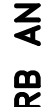
Technical drawing of a bridge deck cross-section. The drawing shows a cross-section of a bridge deck with a central void. The top surface is labeled "A" with a downward arrow. The bottom surface is labeled "A" with an upward arrow. The central void is labeled "32 MPa CONCRETE WITH 5%-8% AIR ENTRAINMENT". The width of the deck is indicated as 500. The height of the deck is indicated as 175. The depth of the central void is indicated as 148. The material specification is "32 MPa CONCRETE WITH 5%-8% AIR ENTRAINMENT". The volume of the concrete is indicated as "VOLUME 0.148 m³/m". The drawing also shows dimensions for the top and bottom flanges: 3 m MIN., 6 m MAX. (RESIDENTIAL DRIVEWAY) and 12 m MAX. (COMMERCIAL DRIVEWAY). The top flange is also labeled "1.0 m (TYP.) \*1 2.0 m MAX. (SEE NOTE BELOW)".

[illegible]

**NOTES:**

- Flat gutter as on R-109-2 to be used to avoid gutter water ponding. (i.e. curbed traffic island at crown of road with no catch basin drainage)
- See also O.P.S.D. 600.04 for reverse slope detail.
- \*<sub>1</sub> - Length may be extended from 1.0 m to 2.0 m max. when sidewalk is adjacent to curb.
- \*<sub>2</sub> - A 25 mm lip may be used at the gutter line to control erosion behind the curb in driveway cuts where high water volumes or velocities are expected. Sidewalk drops shall always be 0 mm at gutter line.

ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED

		<b>ENGINEERING STANDARDS</b>	
<b>ONE PIECE CONCRETE CURB AND GUTTER (SLOPED GUTTER)</b>			
<b>TITLE</b>		<b>MANAGER, ENGINEERING DIVISION</b>	
<b>DWN.</b>	<b>M.D.</b>	<b>DATE</b>	<b>JUNE /81</b>
<b>REVISED:</b>		<b>JAN. 2018</b>	
<b>SCALE</b>		<b>N. T. S.</b>	
<b>Z: \ENG\STANDARD DRAWINGS\STD DWGS\R-109-1</b>		<b>DWG. NO.</b>	
		<b>R-109-1</b>	



Technical drawing of a bridge deck cross-section. The drawing shows a cross-section of a bridge deck with various dimensions and material specifications.

**Dimensions:**

- Overall width: 500
- Top flange width: 12 m MAX. (COMMERCIAL DRIVEWAY)
- Top flange thickness: 3 m MIN., 6 m MAX. (RESIDENTIAL DRIVEWAY)
- Web width: 1.0 m (TYP.)
- Bottom flange width: 2.0 m MAX.



**Material Specifications:**

- 32 MPa CONCRETE WITH 5%–8% AIR ENTRAINMENT
- VOLUME 0.149 m<sup>3</sup>/m

**Notes:**

- (SEE NOTE BELOW)

- This standard is to be used for spot repairs only to match existing profile.
- \*<sub>1</sub> - Length may be extended from 1.0 m to 2.0 m max. when sidewalk is adjacent to curb.
- \*<sub>2</sub> - A 25 mm lip may be used at the gutter line to control erosion behind the curb in driveway cuts where high water volumes or velocities are expected. Sidewalk drops shall always be 0 mm at gutter line.

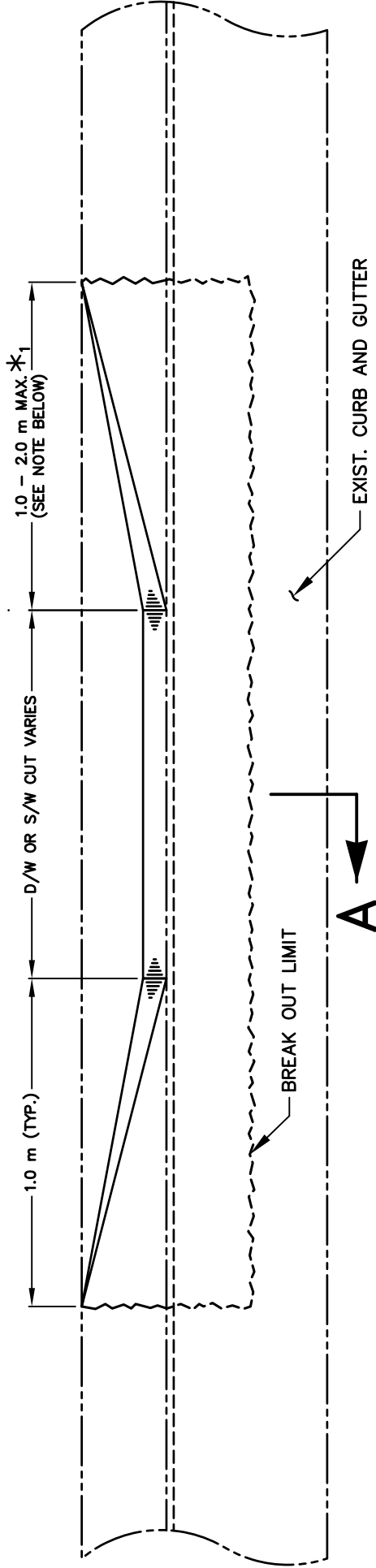
		<b>ENGINEERING STANDARDS</b>	
<b>TITLE</b>		<b>ONE PIECE CONCRETE CURB AND GUTTER (FLAT GUTTER)</b>	
<b>DWN.</b>	<b>M.D.</b>	<b>DATE</b> NOV./84	
<b>REVISED:</b>		<b>JAN. 2018</b>	<b>MANAGER, ENGINEERING DIVISION</b>
<b>SCALE</b>		<b>N. T. S.</b>	<b>DWG. NO.</b>
<b>R-109-2</b>			

Z: YENG STANDARD DRAWINGS STD DWG'S R-109-2

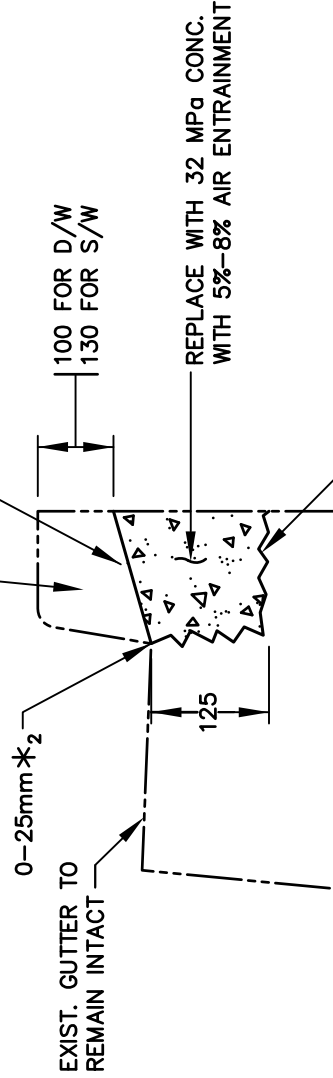
# SECTION A-A



A



RESTORATION METHOD CAN BE USED TO REBUILD FULL BACK OF CURB IF EXIST. BASE CURB IS IN GOOD STRUCTURAL CONDITION




ALL BROKEN EDGES TO BE COATED WITH AN EPOXY BONDING AGENT, MEETING THE LATEST A.S.T.M. SPECIFICATION C-881 OR AS OTHERWISE DIRECTED BY THE ENGINEER.

SECTION A-A

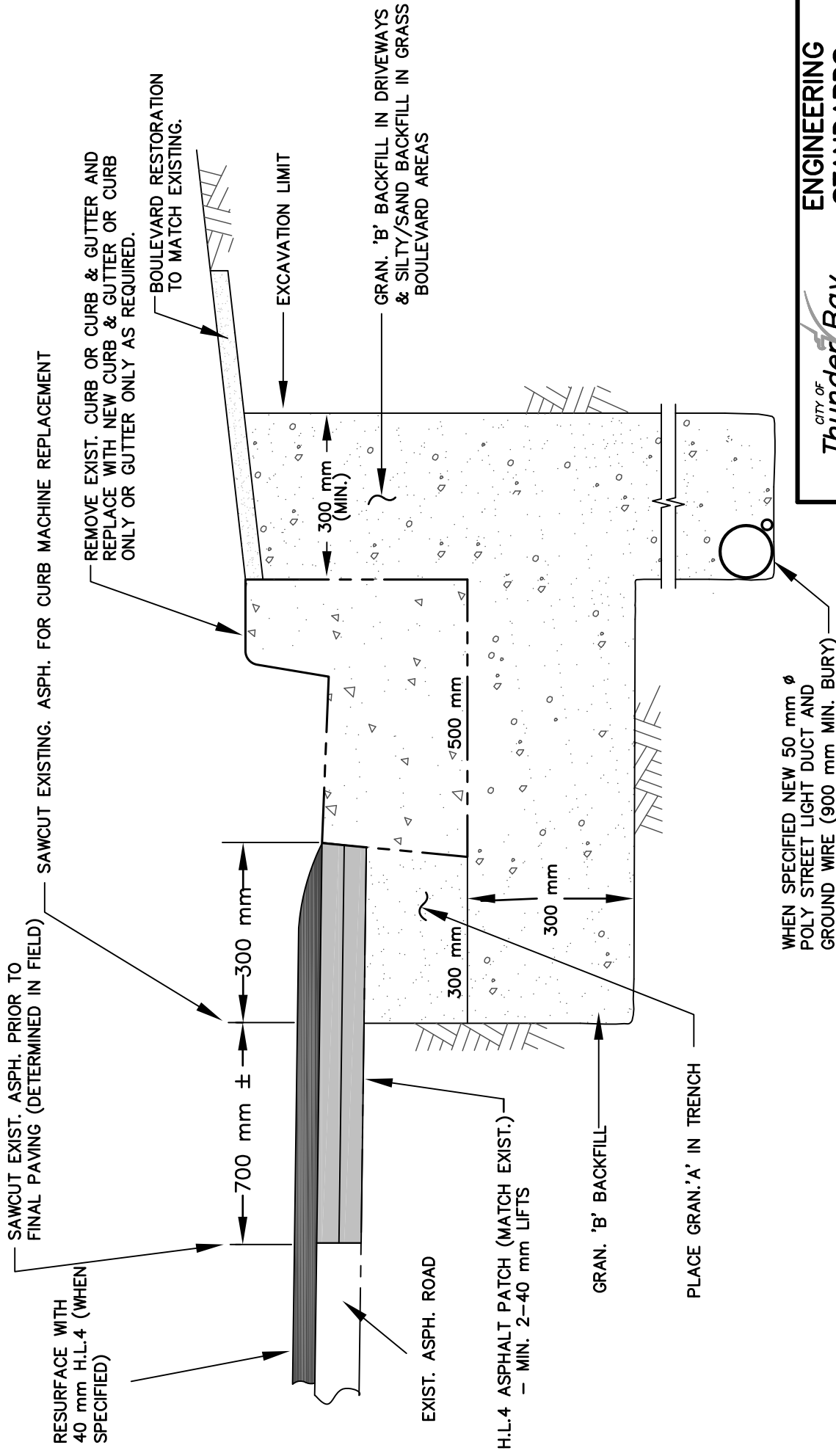
### NOTE:

- \*<sub>1</sub> - Length may be extended from 1.0 m to 2.0 m max. when sidewalk is adjacent to curb.
- \*<sub>2</sub> - A 25 mm lip may be used at the gutter line to control erosion behind the curb in driveway cuts where high water volumes or velocities are expected. Sidewalk drops shall always be 0 mm at gutter line.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

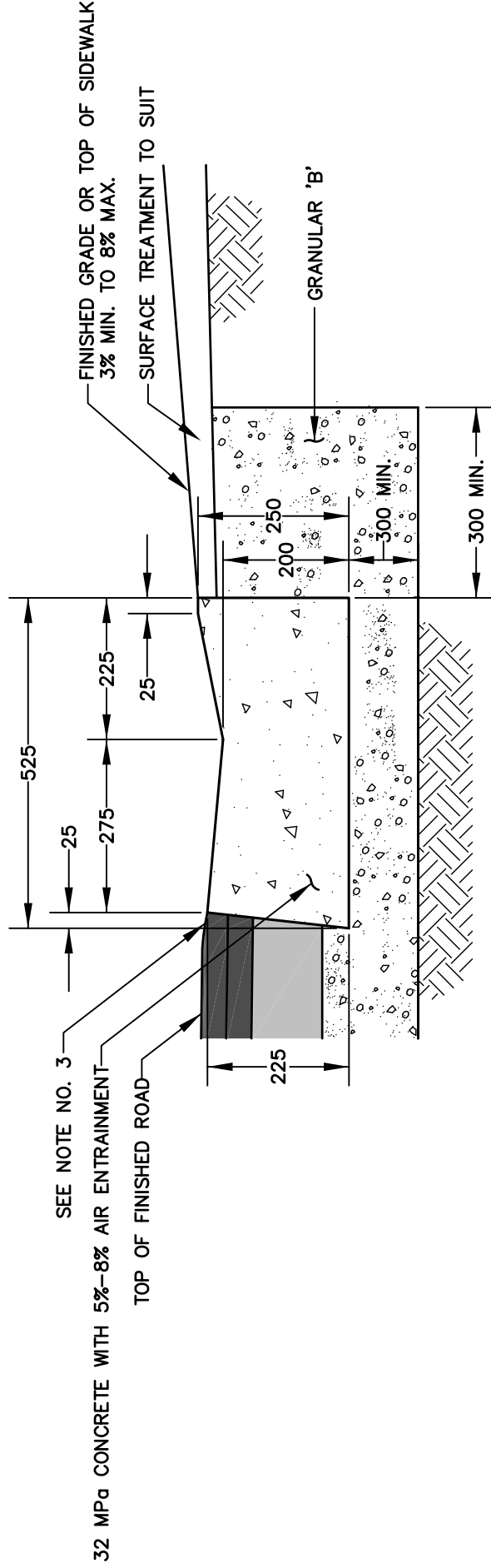
<div>CITY OF <i>Thunder Bay</i> <i>Superior by Nature</i></div>		ENGINEERING STANDARDS	
TITLE CURB RESTORATION AT NEW CUT IN EXISTING CURB & GUTTER			
DWN.	D.R.	DATE	JUNE/81
REVISED:		JAN. 2018	
SCALE		N. T. S.	
Z:\ENG\STANDARD DRAWINGS\STD DWGS\R-109-3		DWG. NO. R-109-3	
		MANAGER, ENGINEERING DIVISION 	





CITY OF <b>Thunder Bay</b> <small>Superior by Nature</small>		<b>ENGINEERING STANDARDS</b>	
TITLE <b>EXISTING CURB AND/OR GUTTER REPLACEMENT</b>		DWN. T.M.D. DATE MAR./98	
		REVISED: DEC. 2007	
		SCALE N. T. S.	
		Z:\ENG\STANDARD DRAWINGS\STD DWGS\R-109-4	
		MANAGER, ENGINEERING DIVISION	
		DWG. NO.	
		<b>R-109-4</b>	





# NOTES:

- 1) The length of transition from one curb type to another shall be 3.0 m.
- 2) Contraction joints to be formed in wet concrete by the use of a "guillotine" knife or saw cut in 6 m (max.) lengths. Joint depth to be 65 mm min. and 3 to 5 mm in width.
- 3) Pavement shall be placed 6 mm above the adjacent edge of concrete.

ALL DIMENSION ARE IN METRES OR MILLIMETRES

		ENGINEERING STANDARDS	
TITLE		CONCRETE MOUNTABLE CURB WITH STANDARD GUTTER	
DWN.	D.R.	DATE	MAR./05
REVISED:		JAN. 2018	
SCALE		N. T. S.	
Z:\ENG\Standard Drawings\Std Dwg\ R-109-5.dwg			
MANAGER, ENGINEERING DIVISION			R-109-5
DWG. NO.			

MODIFIED OPD 600.060



Diagram illustrating the cross-section of a concrete bridge deck, showing dimensions and material specifications:

- Deck Width:** 12 m MAX. (COMMERCIAL DRIVEWAY)
- Deck Thickness:** 3 m MIN., 6 m MAX. (RESIDENTIAL DRIVEWAY)
- Overhang Dimensions:** 1.0 m (TYP.) and 2.0 m MAX. (SEE NOTE BELOW)
- Material Specification:** 32 MPa CONCRETE WITH 5%-8% AIR ENTRAINMENT
- Section Line:** A-A

- This standard is not to be used for new road construction. Use only in special cases like repair of existing curbs and for parking lots if required.
- \*<sub>1</sub>- Length may be extended from 1.0 m to 2.0 m max. when sidewalk is adjacent to curb.
- \*<sub>2</sub>- A 25 mm lip may be used at the gutter line to control erosion behind the curb in driveway cuts where high water volumes or velocities are expected. Sidewalk drops shall always be 0 mm at gutter line.

**ENGINEERING STANDARDS**

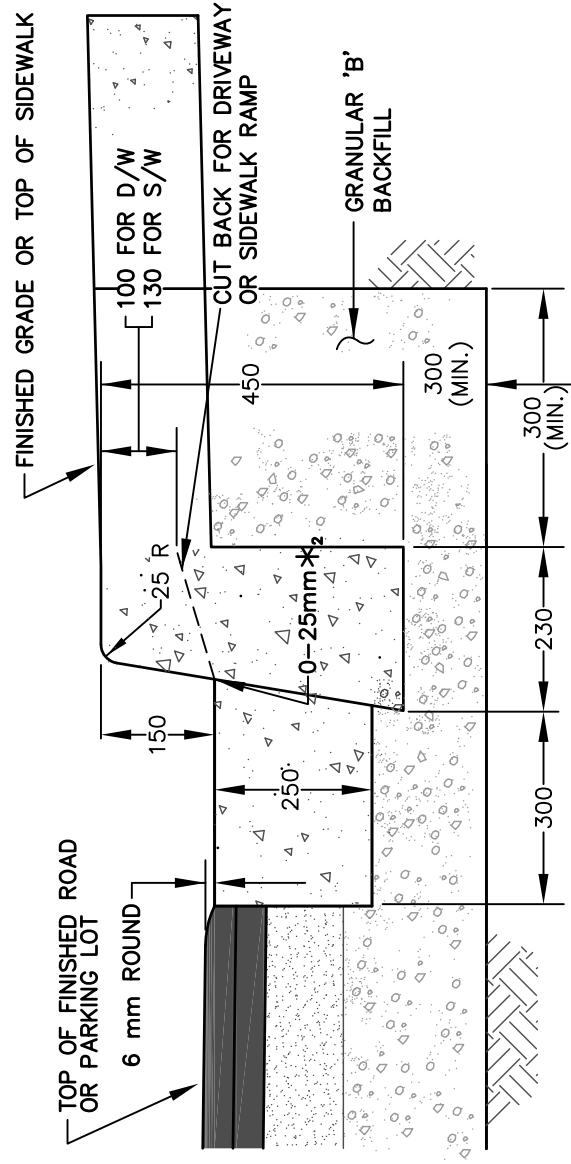
CITY OF  
**Thunder Bay**  
Superior by Nature

TITLE	CONCRETE GUTTER ONLY
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DWN.	M.D.	DATE	FEB. 71
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<b>REVISIONS:</b>	<b>JAN. 2018</b>
<b>DWG. NO.</b>	
<b>MANAGER, ENGINEERING DIVISION</b>	

SCALE	N. T. S.
Z: LENG\STANDARD DRAWINGS\STD DWGS\R-110	



# SECTION A-A



Diagram illustrating the cross-section of a concrete bridge deck, showing dimensions and material specifications:

- Deck Width:** 12 m MAX. (COMMERCIAL DRIVEWAY)
- Shoulder Width:** 3 m MIN., 6 m MAX. (RESIDENTIAL DRIVEWAY)
- Overlap/Offset:** 1.0 m (TYP.)
- Concrete Strength:** 32 MPa CONCRETE WITH 5%-8% AIR ENTRAINMENT
- Section Line:** A-A

Diagram illustrating the cross-section of a road and driveway structure, showing various layers and dimensions:

- Top of Finished Road or Parking Lot:** Indicated by an arrow pointing to the top surface.
- Finished Grad:** Indicated by an arrow pointing to the top surface.
- Dimensions (from left to right):**
  - 175 (width of the top layer)
  - 150 (width of the top layer)
  - 150 (width of the top layer)
  - 25 R (radius of the top layer)
  - 0-25mm \* 2 (thickness of the top layer)
  - 400 (width of the top layer)
  - 300 (MIN.) (width of the top layer)
  - 600 (MIN.) (width of the top layer)
  - 230 (width of the top layer)
- Labels:**
  - CUT BACK FOR DRIVEWAY OR SIDEWALK RAMP
  - GRANULAR 'B' BACKFILL

- This standard is not to be used for new road construction. Use only in special cases like repair of existing curbs and for parking lots if required.
- \*<sub>1</sub>- Length may be extended from 1.0 m to 2.0 m max. when sidewalk is adjacent to curb.
- \*<sub>2</sub>- A 25 mm lip may be used at the gutter line to control erosion behind the curb in driveway cuts where high water volumes or velocities are expected. Sidewalk drops shall always be 0 mm at gutter line.

**ENGINEERING  
STANDARDS**

CITY OF  
**Thunder Bay**  
Superior by Nature

**CONCRETE CURB (ONLY)**

REVISID: JAN. 2018	MANAGER, ENGINEERING DIVISION
	DWG NO

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# SECTION A-A



CURB AND GUTTER

1.5 m MIN. TO PREFERRED 3.0 m

(SEE R-109-1)

GUTTER LINE

175

475

25

PLAN

END VIEW

500

275

25

250

275

ELEVATION

ALL DIMENSION ARE IN METRES OR MILLIMETRES



ENGINEERING  
STANDARDS

TITLE

TERMINATION OF  
CURB AND GUTTER

DWN. G.S.L. DATE JUNE / 81

REVISED: JAN. 2007

SCALE N. T. S.

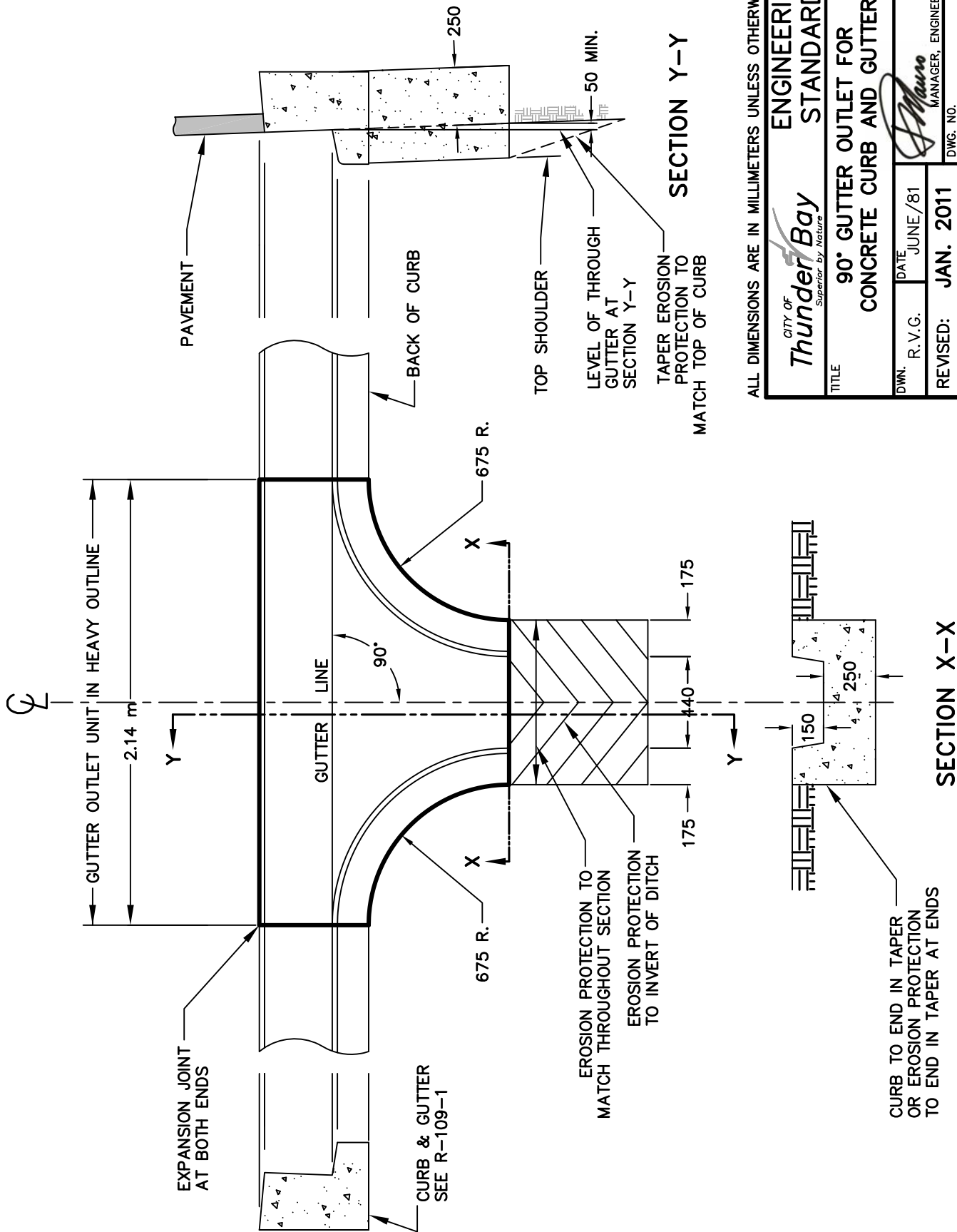
PATH E:\ENG\STD DWG\R-112

*[Signature]*  
MANAGER, ENGINEERING DIVISION

DWG. NO.

R-112






ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

CITY OF <i>Thunder Bay</i> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE		90° GUTTER OUTLET FOR CONCRETE CURB AND GUTTER	
DWN.	R. V. G.	DATE	JUNE /81
REVISED:		JAN. 2011	
SCALE		N. T. S.	
Z:\ENG\STANDARD DRAWINGS\STD DWGS\R-113		MANAGER, ENGINEERING DIVISION <i>[Signature]</i> DWG. NO.	
		R-113	





 CITY OF  
**Thunder Bay**  
*Superior by Nature*

45° GUTTER OUTLET FOR  
CONCRETE CURB AND GUTTER

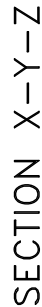
DWN.	DATE
R.V.G.	JUNE/81

REVISED: DEC. 2007	MANAGER, ENGINEERING DIVISION
	DWG. NO.

SCALE N. T. S.

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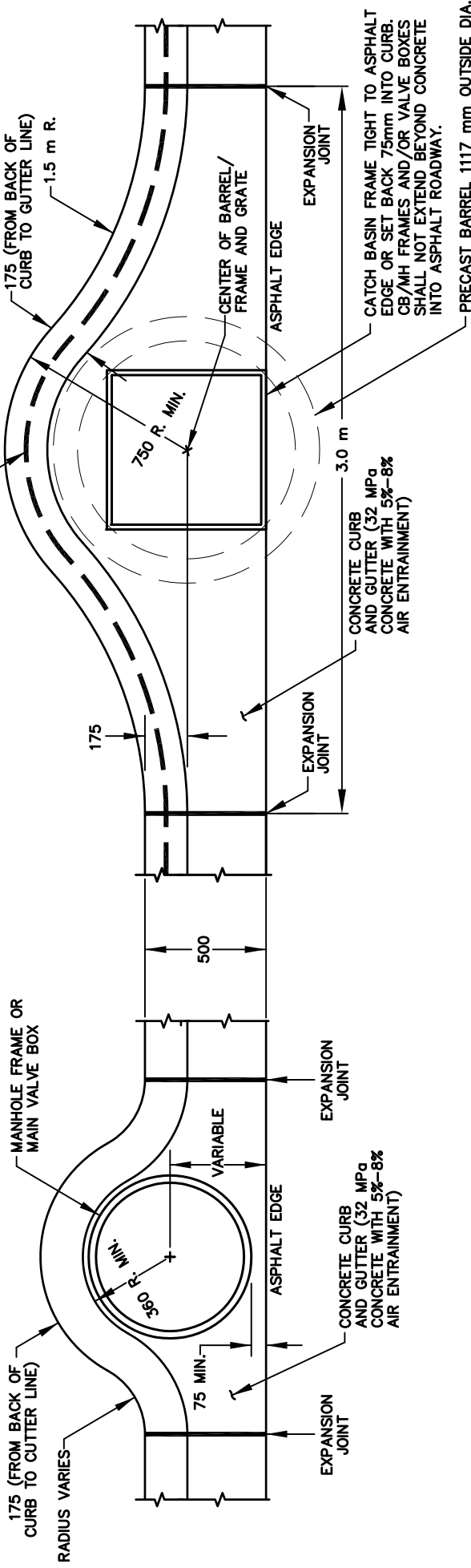
R-114





# **CATCH BASIN ONLY**

2 - 15 M BARS - 6 m LONG PLACED AS SHOWN  
CENTERED ON FIXTURE AND BENT IN FIELD. ALSO  
SEE STANDARD DRAWINGS S-107 AND S-108.





## **TYPICAL CONSTRUCTION OF CURB AND GUTTER AROUND A MANHOLE FRAME OR MAIN VALVE BOX**

## **TYPICAL CONSTRUCTION OF CURB AND GUTTER AROUND A CATCH BASIN**

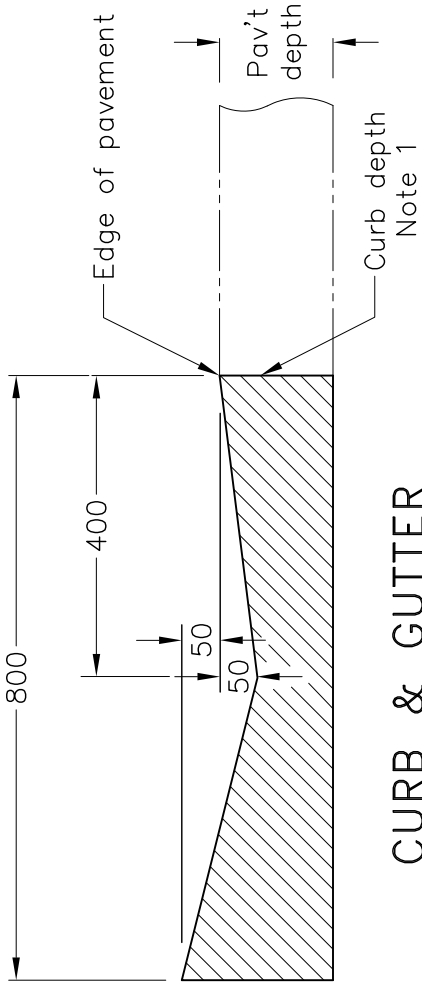
### **NOTES:**

- ALSO SEE STANDARD DRAWING R-109-1

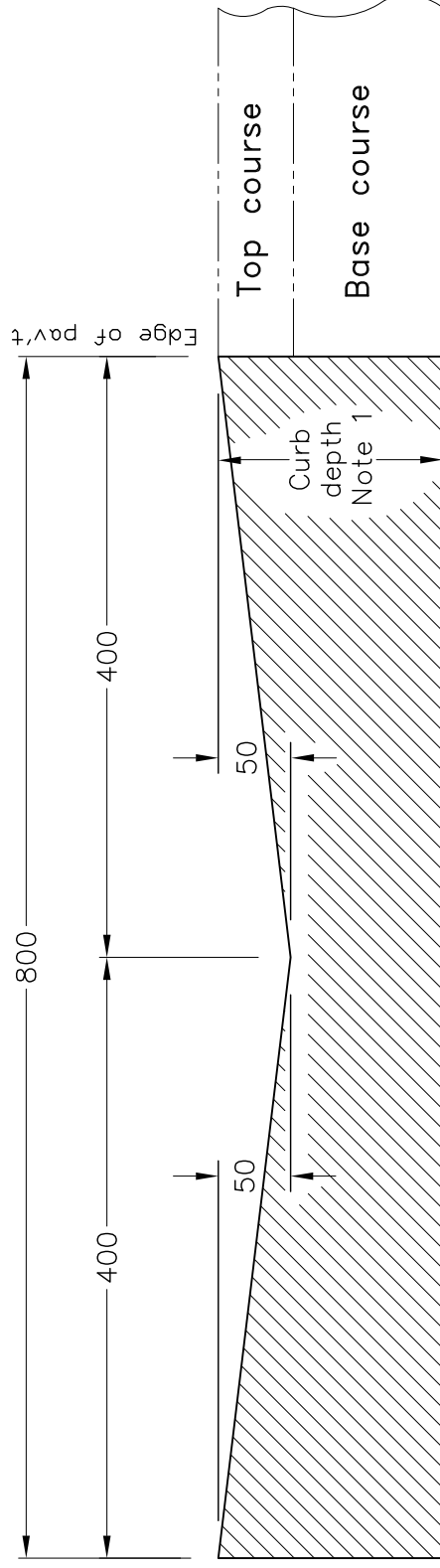
ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

 <div>CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i></div>		ENGINEERING STANDARDS	
TITLE CONCRETE CURB & GUTTER AROUND FIXTURES			
DWN. S.G.	DATE OCT. /73	 MANAGER, ENGINEERING DIVISION	DWG. NO. <b>R-115</b>
REVISED: JAN. 2018			
SCALE N. T. S.			
Z:\ENG\STANDARD DRAWINGS\STD DWGS\R-115			





## CURB & GUTTER



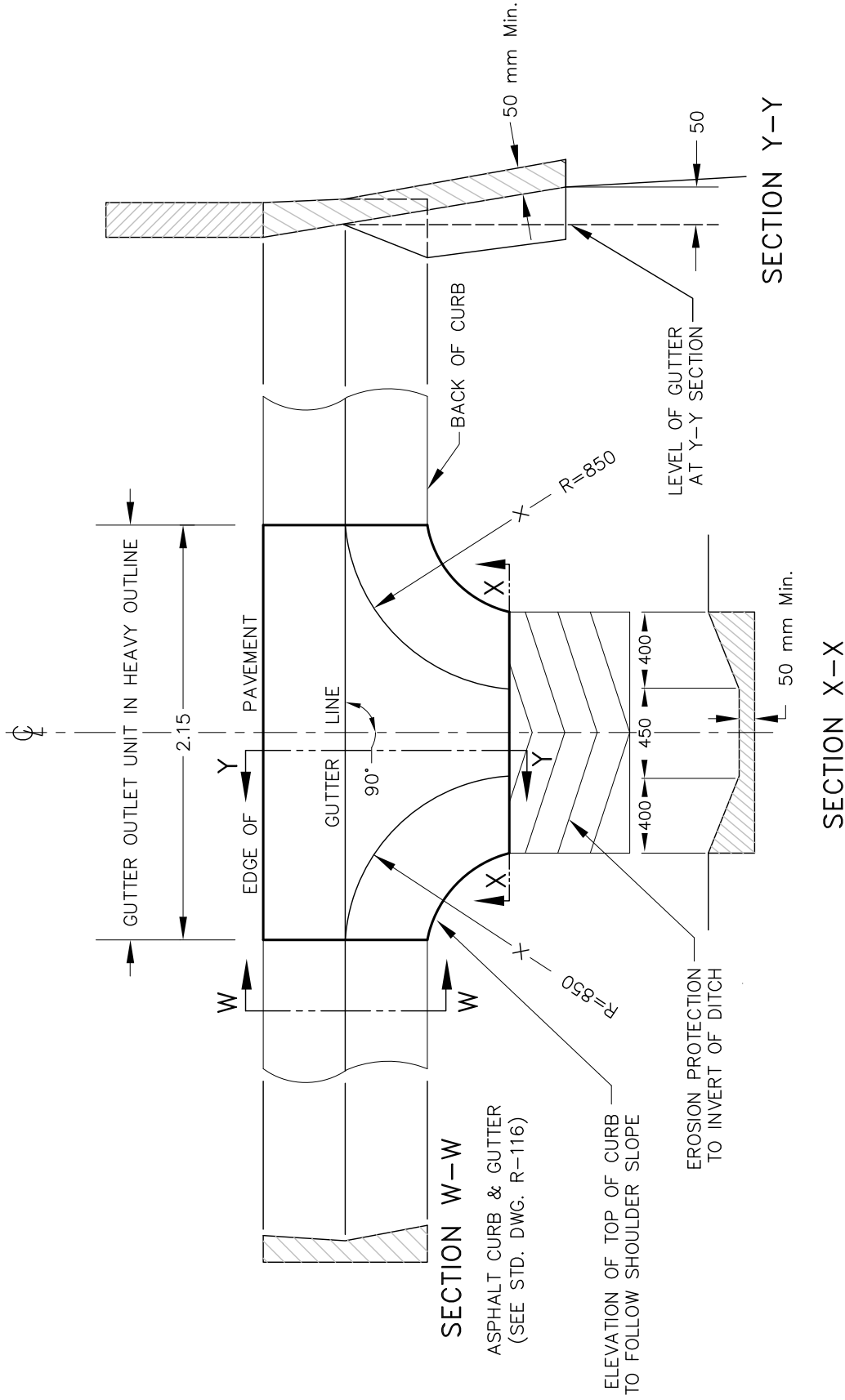
## GUTTER

### NOTES:

- 1) Depth of gutter at pavement edge to equal depth of new pavement but in no case less than 130 mm.
- 2) All existing surfaces to be painted with SS-1 emulsion (undiluted).
- 3) All dimensions are in millimetres or metres unless otherwise specified.
- 4) From O.P.S.D. - 601.010

CITY OF <i>Thunder Bay</i> <small>Superior by Nature</small>		ENGINEERING STANDARDS	
TITLE		ASPHALT CURB AND GUTTER AND ASPHALT GUTTER	
DWN. R.V.G./S.K.H.	DATE JUNE/81	CITY ENGINEER <i>[Signature]</i>	
REDRAWN: JULY, 2003		DWG. NO. R-116	
SCALE N. T. S.		PATH E:\ENG\STD DWG\R-116	





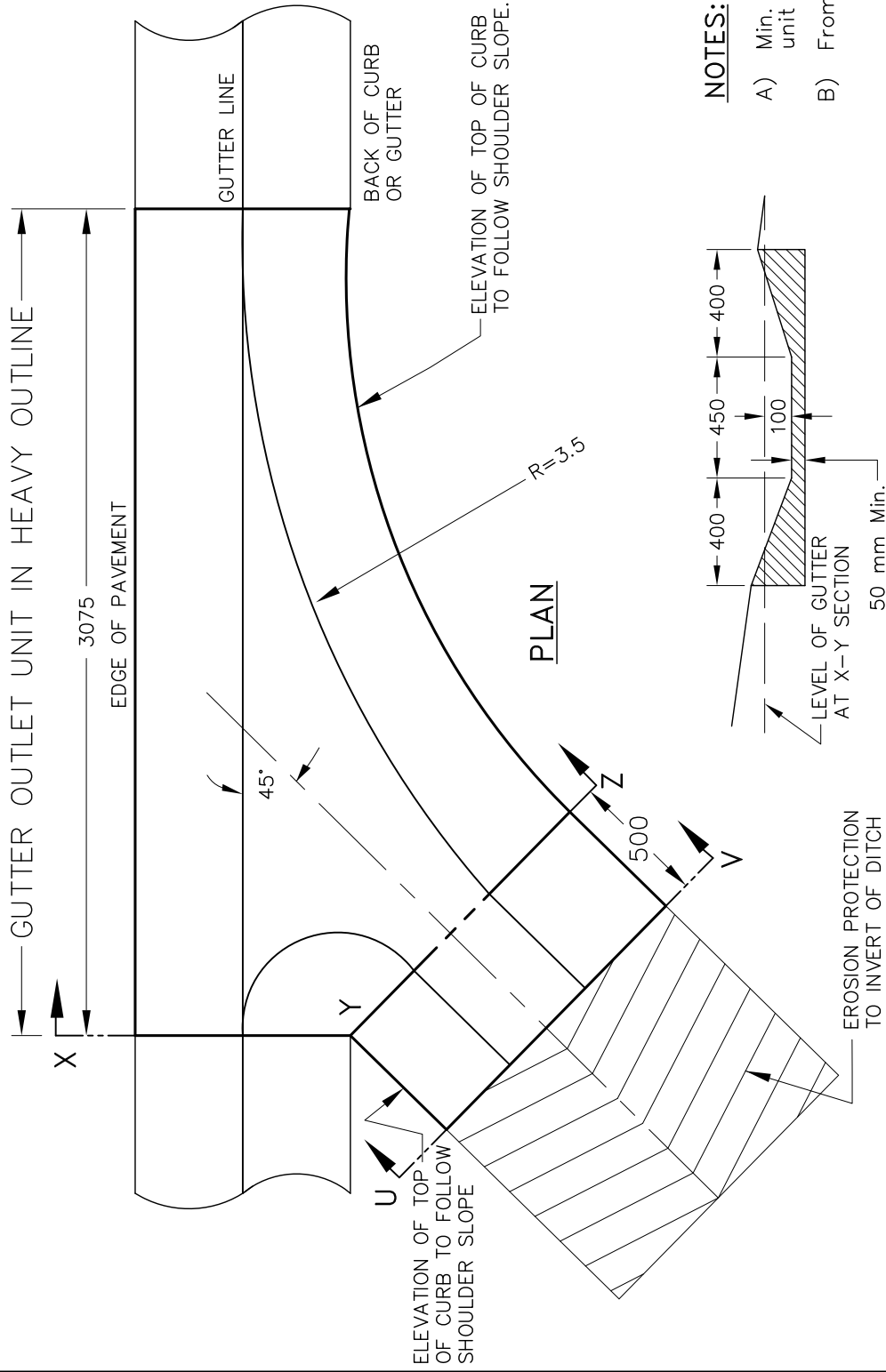
# NOTES:

- A) Minimum thickness of asphalt in setback unit to be 50 mm.
- B) From O.P.S.D. - 604.020.

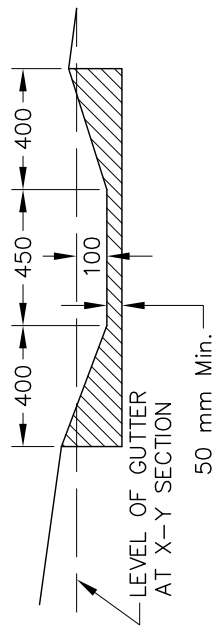
ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE		90° GUTTER OUTLET FOR ASPHALT CURB AND GUTTER	
DWN. R. V. G. / S. K. H.	DATE JUNE / 81	MANAGER, ENGINEERING DIVISION	
REVISED: DEC. 2007		DWG. NO.	
SCALE N. T. S.		R-117	
Z:\ENG\STANDARD DRAWINGS\STD DWGS\R-117			

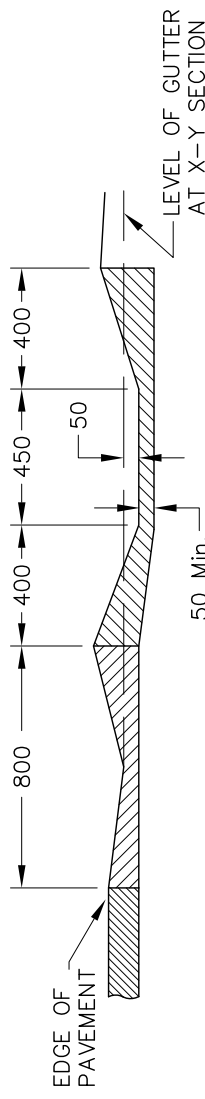




**PLAN**



**SECTION U-V**





**SECTION X-Y-Z**

**NOTES:**

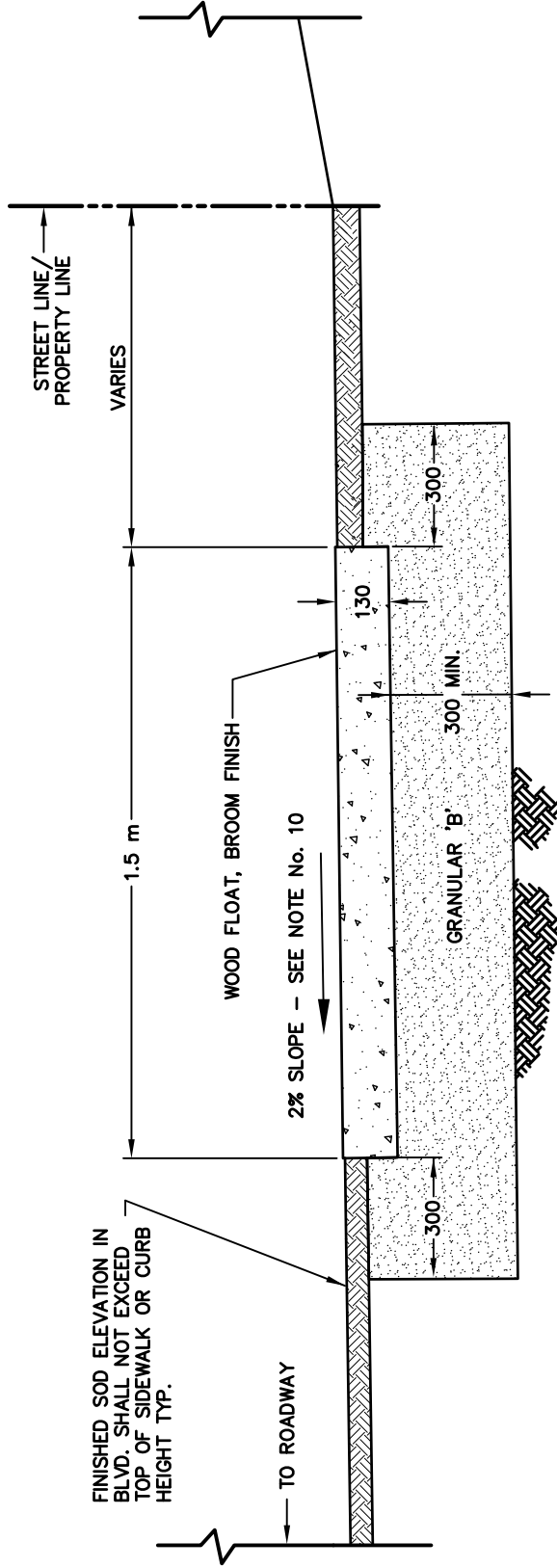
- A) Min. thickness of asphalt in outlet unit to be 50 mm.
- B) From O.P.S.D.-605.020

ASPHALT CURB & GUTTER OR GUTTER (SEE STD. DWG. R-116)

ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

 <div>CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i></div>		ENGINEERING STANDARDS	
TITLE		45° GUTTER OUTLET FOR ASPHALT CURB AND GUTTER	
DWN. R. V. G. / S. K. H.	DATE JUNE / 81	 MANAGER, ENGINEERING DIVISION	
REVISED:	DEC. 2007		
SCALE	N. T. S.		
Z:\ENG\STANDARD DRAWINGS\STD DWGS\R-118		DWG. NO. <b>R-118</b>	





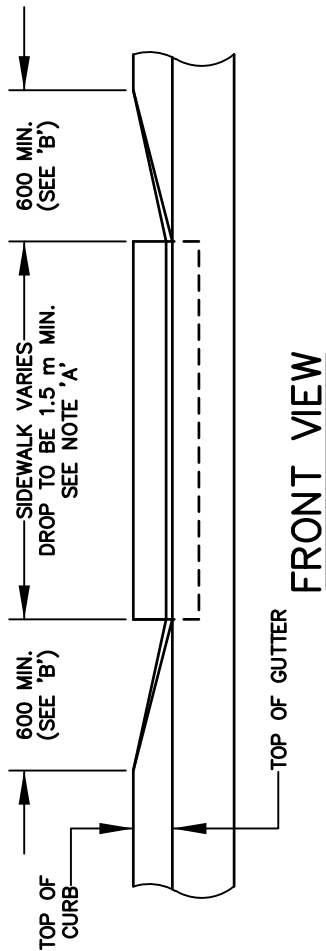
# NOTES:

- 1) CONCRETE TO BE 32 MPA WITH 5%-8% AIR ENTRAINMENT.
- 2) DUMMY JOINTS TO BE AT 1.5 m INTERVALS.
- 3) EXPANSION JOINTS TO BE OF 12 mm PRE-MOULDED BITUMINOUS MATERIAL AND PLACED AT THE INTERSECTION WITH OTHER SIDEWALKS AND WHERE SIDEWALK MEETS THE CURB.
- 4) PROVIDE CONTRACTION JOINT (40 mm DEEP SAW CUT OR A GUILLOTINE KNIFE CUT) AT 6 m INTERVALS.
- 5) SIDEWALKS TO BE WOOD FLOAT FINISHED AND LIGHTLY BROOMED TO PROVIDE A TEXTURED NON-SLIP SURFACE. THE SIDEWALK SHALL BE EDGED WITH 5 mm RADIUS EDGING TOOL, EDGING TO A DEPTH TO MATCH THE BROOM FINISH.
- 6) SIDEWALK TO BE REINFORCED AT ALL DRIVEWAYS, LANE CROSSINGS AND ADJACENT TO CURB WITH MW 13.3 X MW 13.3 WIRE - 152 mm X 152 mm OPENING WIRE MESH.
- 7) ALSO SEE STANDARD DRAWING R-120.
- 8) SIDEWALK TO BE SPRAYED WITH WHITE PIGMENTED RESIN-BASED MEMBRANE CURING COMPOUND MEETING THE LATEST A.S.T.M. SPECIFICATION C-309, OR AS OTHERWISE DIRECTED BY THE CITY ENGINEER.
- 9) VOLUME OF CONCRETE REQUIRED -  $0.195 \text{ m}^3/\text{m}$  OR  $0.130 \text{ m}^3/\text{m}^2$ .
- 10) BACK OF SIDEWALK AND DRIVEWAY SHALL BE LOWERED AS APPROVED BY THE CITY FOR PROBLEM DRIVEWAYS TO ENSURE 4% PREFERRED TO 6% MAXIMUM SLOPE FROM THE FRONT TO THE BACK OF THE SIDEWALK.
- 11) BOULEVARDS TO BE RESTORED WITH 75 mm TOPSOIL AND SOD. (MATCH EXISTING BOULEVARD GRADE)
- 12) DEPTH OF BASE MATERIAL MAY BE INCREASED IN AREAS WHERE THE SUB-BASE MATERIAL IS DETERMINED TO BE UNSUITABLE BY THE INSPECTOR OR CONTRACT ADMINISTRATOR.
- 13) SEE ALSO R-121 FOR CURB SIDEWALK APPLICATION.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>		<b>ENGINEERING STANDARDS</b>	
TITLE		<b>CONCRETE SIDEWALK 1.5 m RESIDENTIAL</b>	
DWN.	M.D.	DATE	DEC/70
REVISED: <b>JAN. 2019</b>		MANAGER, ENGINEERING DIVISION	
SCALE		N. T. S.	
Z:\ENG\Standard Drawings\Std Dwg\R-119		<b>R-119</b>	





**NOTE:**—ALL SIDEWALK RAMPS ARE TO BE A MINIMUM OF 1.5m WIDE AT THE GUTTER. WHEN A CURB SIDEWALK IS USED TWO SEPARATE 1.5m WIDE RAMPS MAY BE USED AS REQUIRED TO PROVIDE SLOPED ACCESS TO THE PEDESTRIAN CROSSINGS. SEE RAMP NOTE "A" BELOW.

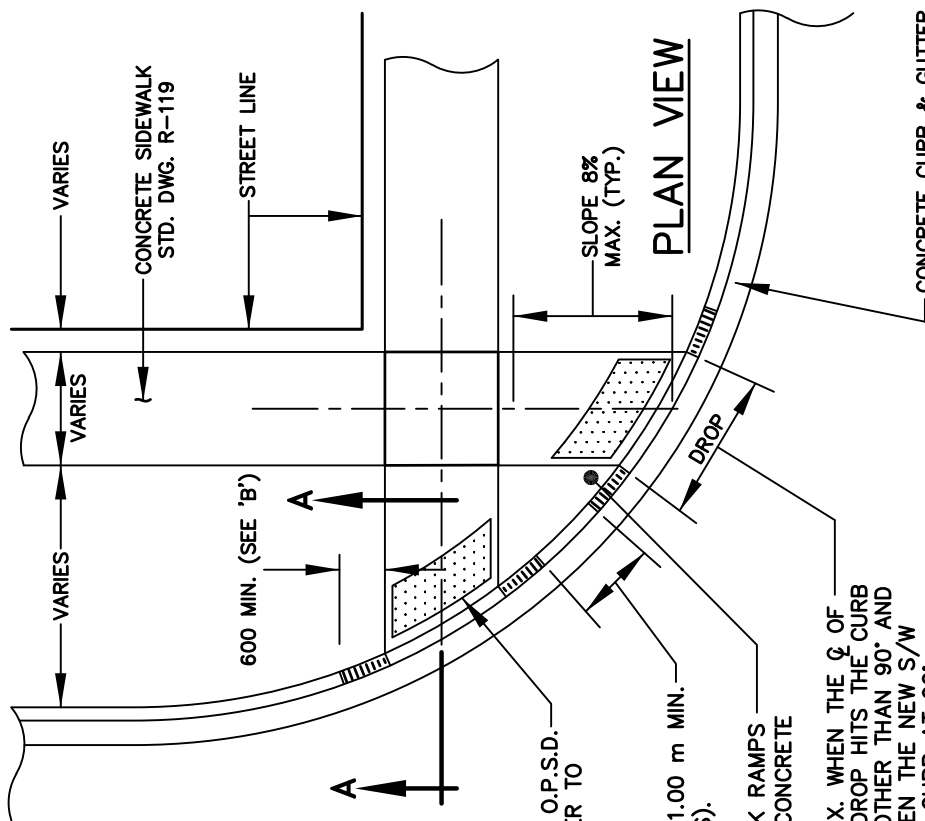
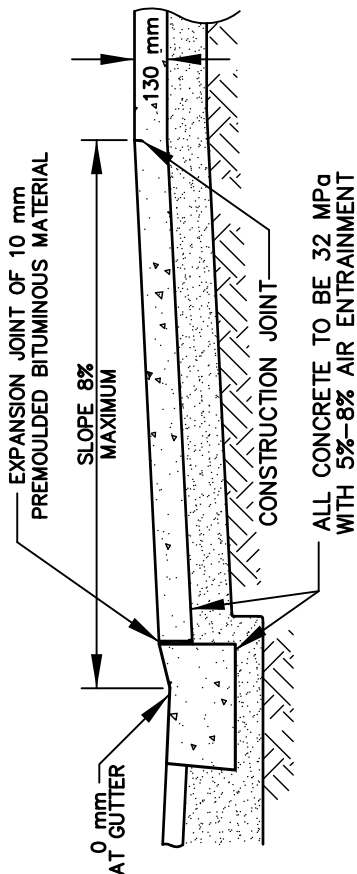
CROSSWALK RAMPS REQUIRE TACTILE WARNING SURFACE PLATES AS PER O.P.S.D. 310.039 THAT EXTEND THE ENTIRE WIDTH OF THE SIDEWALK RAMP. REFER TO O.P.S.D. 310.031 FOR ADDITIONAL LAYOUT ILLUSTRATIONS.

1.50 m MIN. FULL HEIGHT CURB PREFERRED. (1.00 m MIN. ACCEPTABLE ONLY IN CONSTRICTED LOCATIONS).

WHEN FULL HEIGHT CURB IS NOT PROVIDED BETWEEN SIDEWALK RAMPS ADDITIONAL TACTILE PLATES ARE REQ'D HERE IF FINISHED IN CONCRETE



**'A'** 2.0 m WIDE MAX. WHEN THE  $\phi$  OF THE NEW S/W DROP HITS THE CURB AT AN ANGLE OTHER THAN 90° AND 1.5 m WIDE WHEN THE NEW S/W DROP HITS THE CURB AT 90°.

**'B'** USE 1.0 m SLOPE ON CURB SIDEWALK TO AID PEDESTRIANS APPROACHING SLOPE FROM THE SIDE.

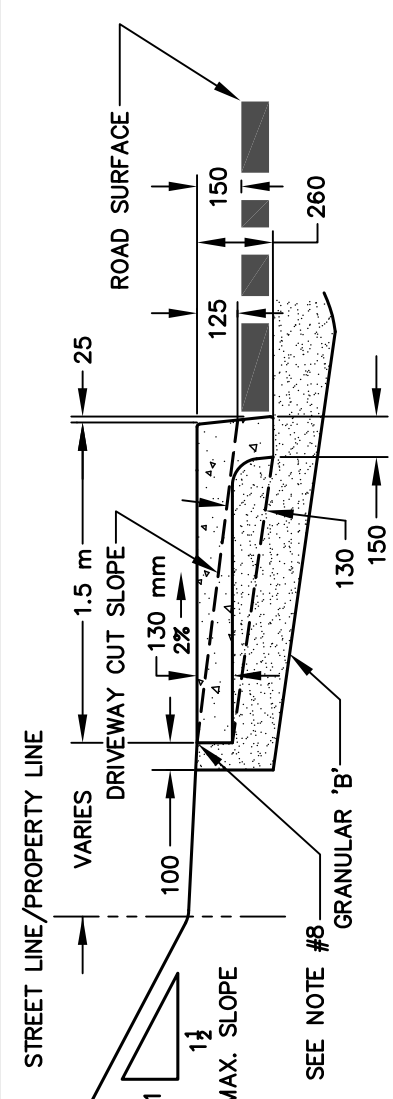
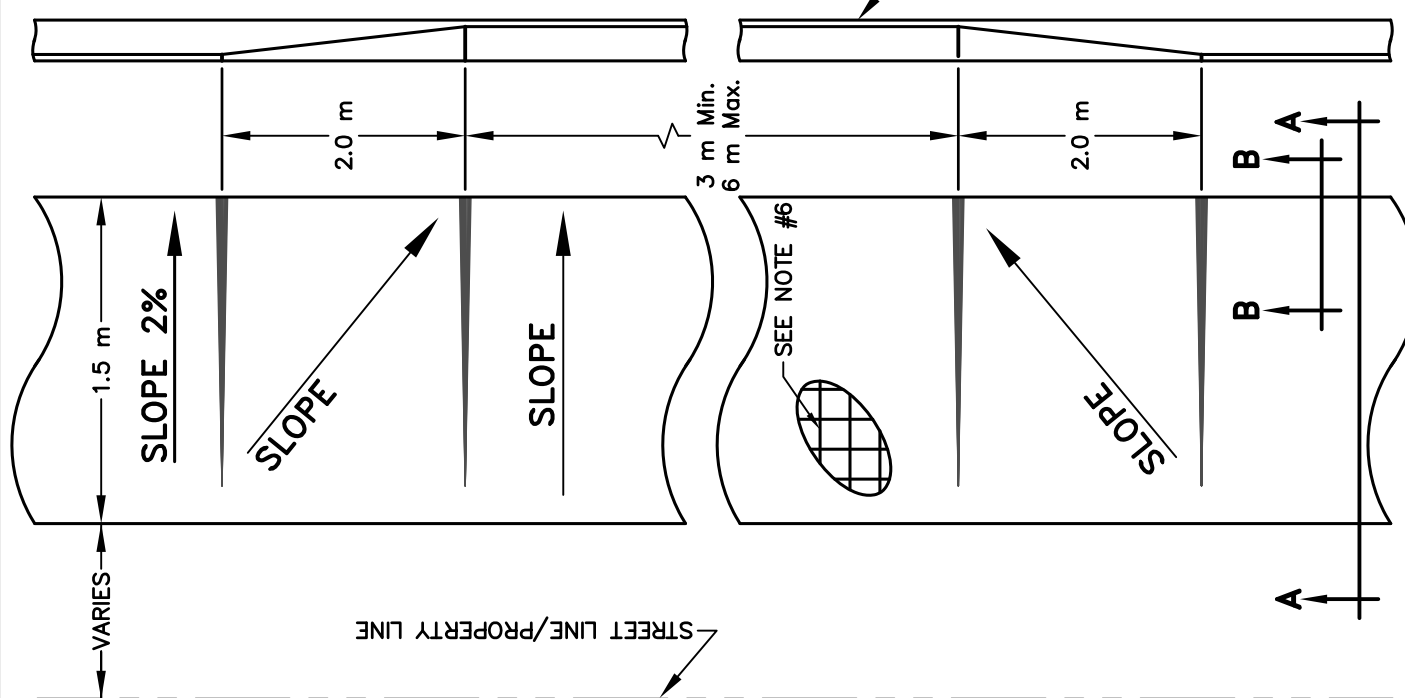


CONCRETE CURB & GUTTER STANDARD DRAWINGS R-109-1, R-109-5, R-110 OR O.P.S.D. 600.040

ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED

 CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE CONCRETE SIDEWALK RAMPING AT CURB			
DWN.	S.G.	DATE FEB. 2004	 MANAGER, ENGINEERING DIVISION
REVISED:		JAN. 2019	
SCALE		N. T. S.	
Z:\ENG\Standard Drawings\Std Dwg\ R-120.dwg			DWG. NO. <b>R-120</b>

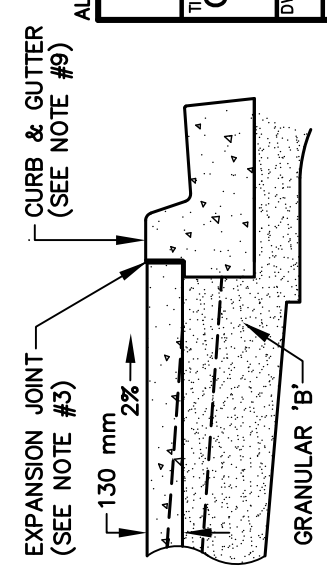





## SECTION A-A

### NOTES:

- 1) Concrete to be 32 MPa with 5%–8% air entrainment.
- 2) Dummy joints to be at 1.5 m intervals.
- 3) Expansion joints to be of 12 mm pre-moulded bituminous material and placed at the intersection with other sidewalks and where sidewalk meets the curb.
- 4) Provide contraction joint (40 mm deep saw cut or a guillotine knife cut) at 6 m intervals.
- 5) Sidewalks to be wood float finished and lightly broomed to provide a textured non-slip surface. The sidewalk shall be edged with 5 mm radius edging tool.
- 6) Sidewalk to be reinforced full length with MW 13.3 x MW 13.3 wire, 152 mm x 152 mm opening wire mesh. Bend mesh down full depth of curb section A-A.
- 7) For commercial sidewalks see standard drawings R-122 and R-123.
- 8) Back of sidewalk and driveway shall be lowered as required for problem driveways to ensure 4% preferred to 6% maximum slope from the front to the back of the sidewalk.
- 9) Concrete curb and gutter as per O.P.S.D. 600.040 and C.T.B. standard drawing R-109-1 with modified lip.

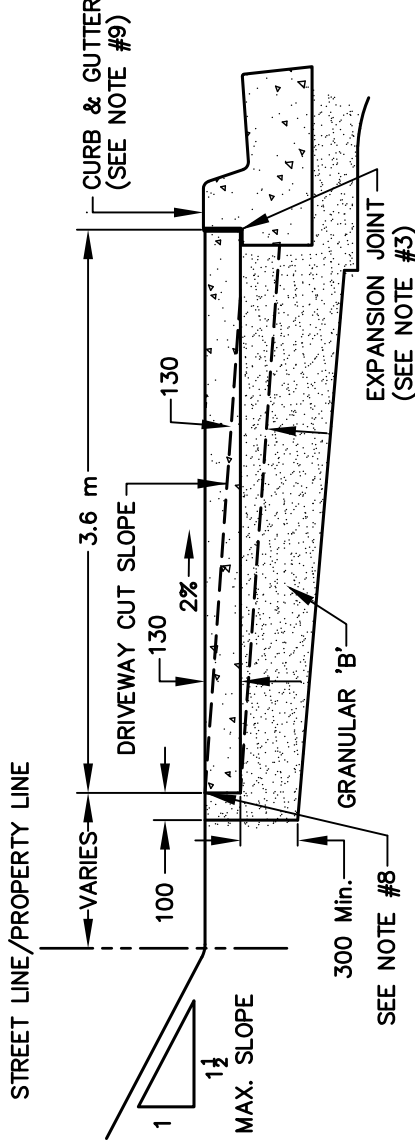
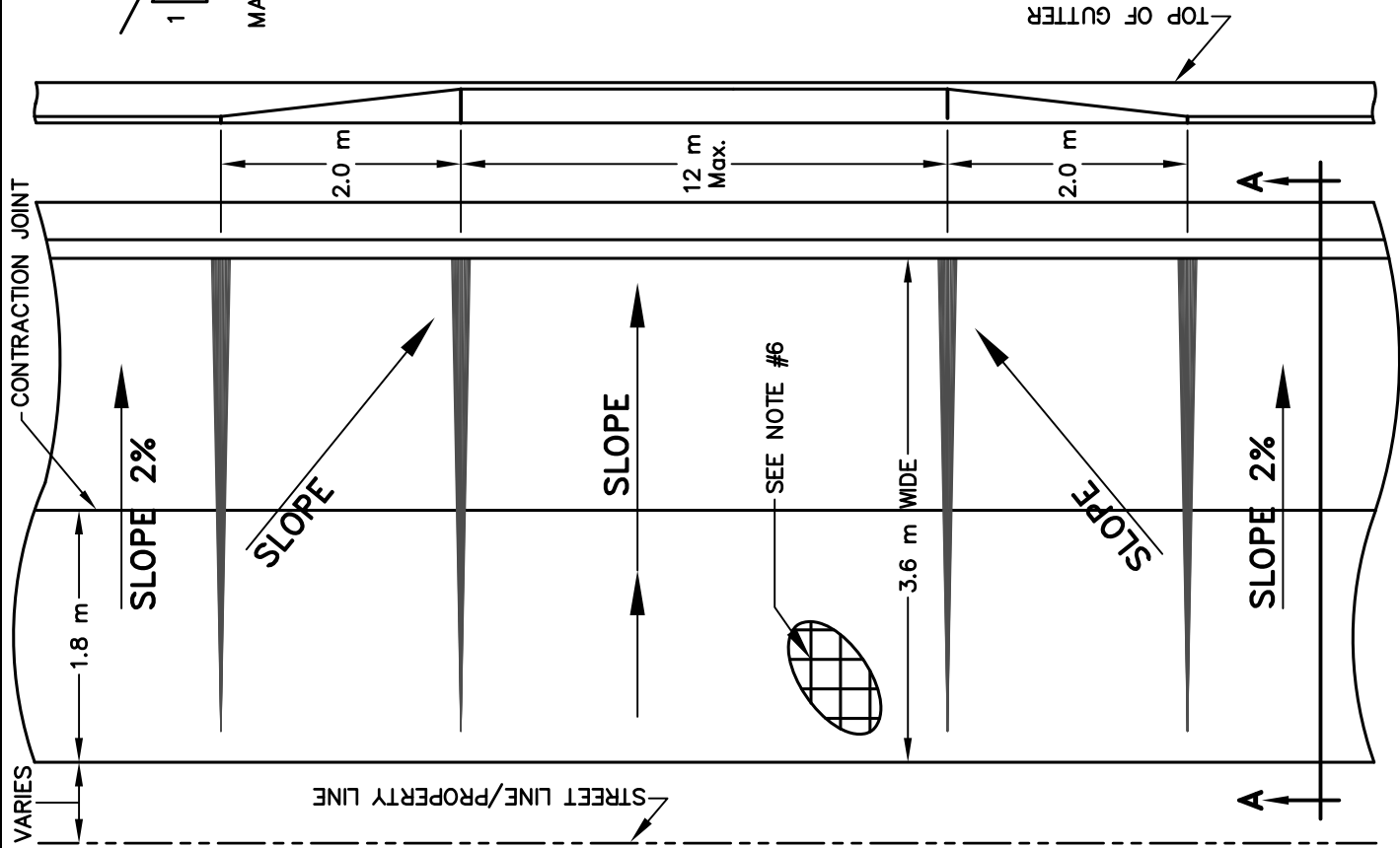


## SECTION B-B

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED				
CITY OF <i>Thunder Bay</i> <i>Superior by Nature</i>		ENGINEERING STANDARDS		
TITLE CONCRETE SIDEWALK – 1.5 m RESIDENTIAL CURB TYPE SHOWING DRIVEWAY CUT		 MANAGER, ENGINEERING DIVISION		
DWN.	M.D.			DATE
JUN / 68				
REVISED: FEB. 2019				
SCALE		DWG. NO.		
N. T. S.		R-121		
Z:\ENG\Standard Drawings\Std Drawg\R-121.dwg				

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED







## SECTION A-A

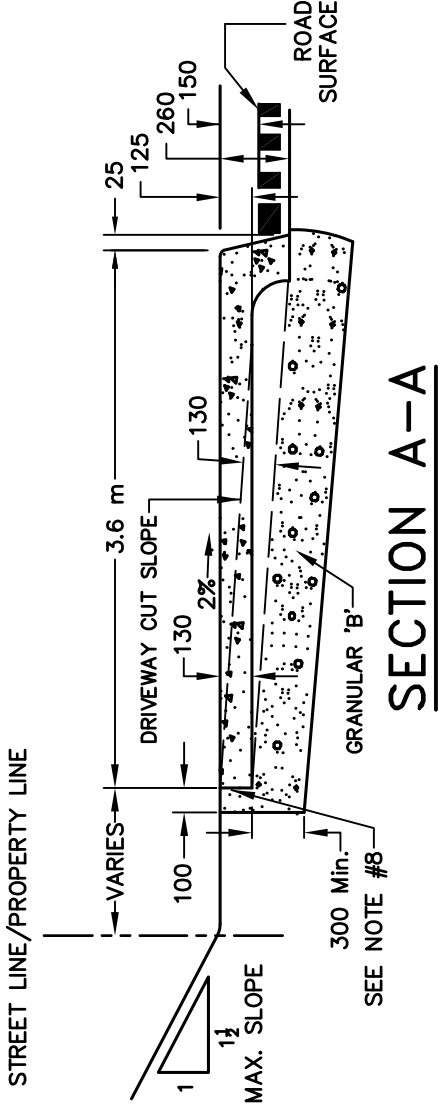
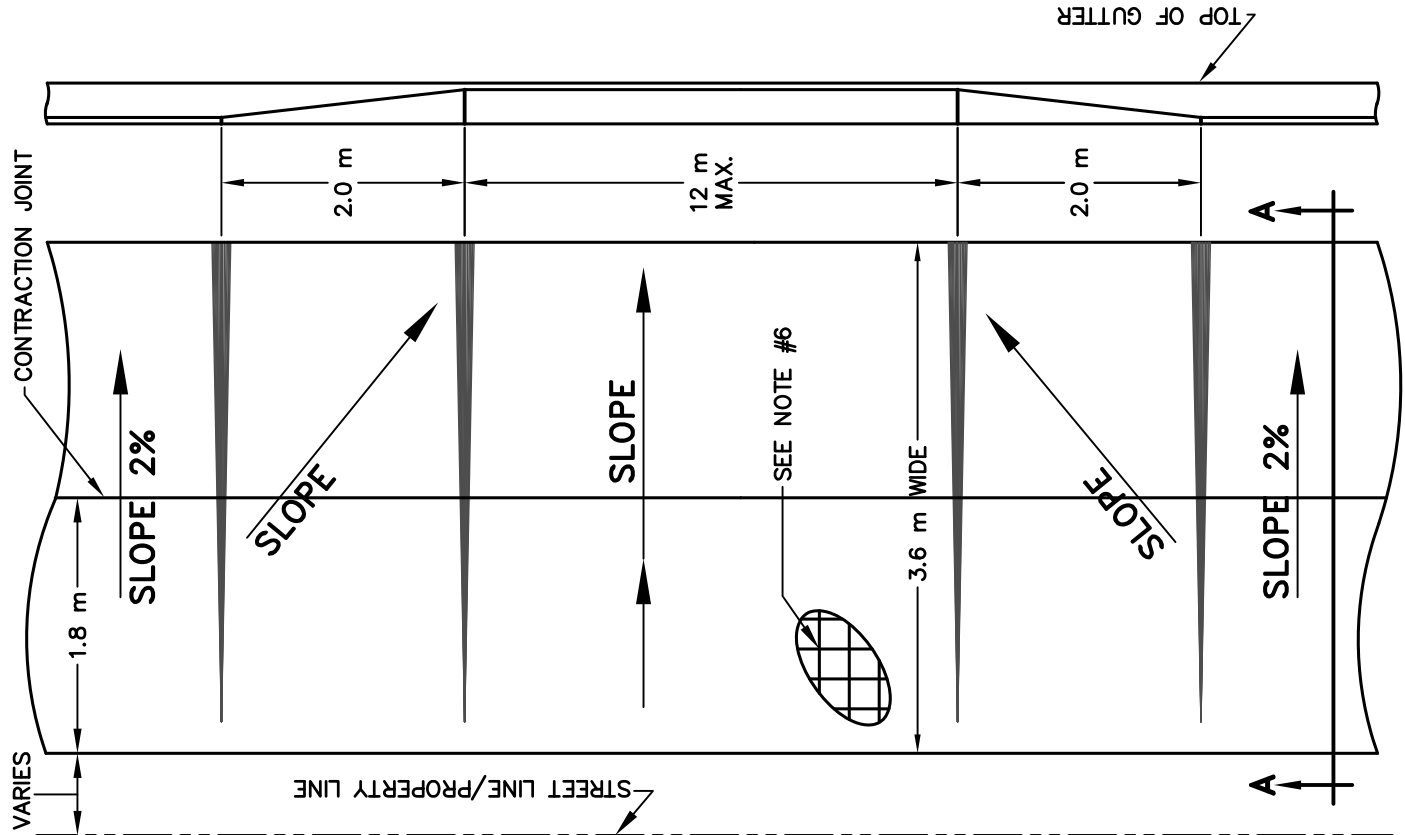
### NOTES:

- 1) Concrete to be 32 MPa with 5%-8% air entrainment.
- 2) Dummy joints to be at 2.0 m intervals.
- 3) Expansion joints to be of 12 mm pre-moulded bituminous material and placed at the intersection with other sidewalks and where sidewalk meets curb.
- 4) Provide contraction joint (40 mm deep saw cut or a guillotine knife cut) at 6.0 m intervals. Provide a longitudinal contraction joint down the center of the sidewalk.
- 5) Sidewalks to be wood float finished and lightly broomed to provide a textured non-slip surface. The sidewalk shall be edged with 5 mm radius edging tool.
- 6) Sidewalks to be reinforced full length with MW 13.3 x 13.3 wire, 152 mm x 152 mm opening wire mesh.
- 7) Type 'B' construction shown on standard drawing R-123.
- 8) Back of sidewalk and driveway shall be lowered as required for problem driveways to ensure 4% preferred to 6% maximum slope from the front to the back of the sidewalk.
- 9) Concrete curb and gutter as per O.P.S.D. 600.040 and C.T.B. standard drawing R-109-1 with modified lip.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

 CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE CONCRETE SIDEWALK – 3.6 m COMMERCIAL "TYPE A" SHOWING DRIVEWAY CUT			
DWN.	M.D.	DATE	 MANAGER, ENGINEERING DIVISION
		JUN /68	
REVISED:	FEB. 2019		
SCALE	N. T. S.		
Z:\ENG\Standard Drawings\Std Dwg\R-122.dwg			R-122



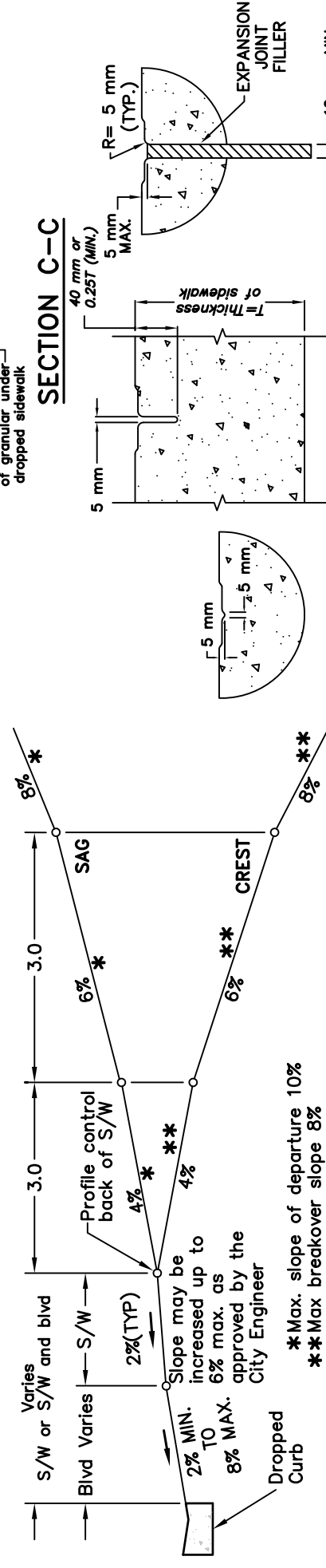
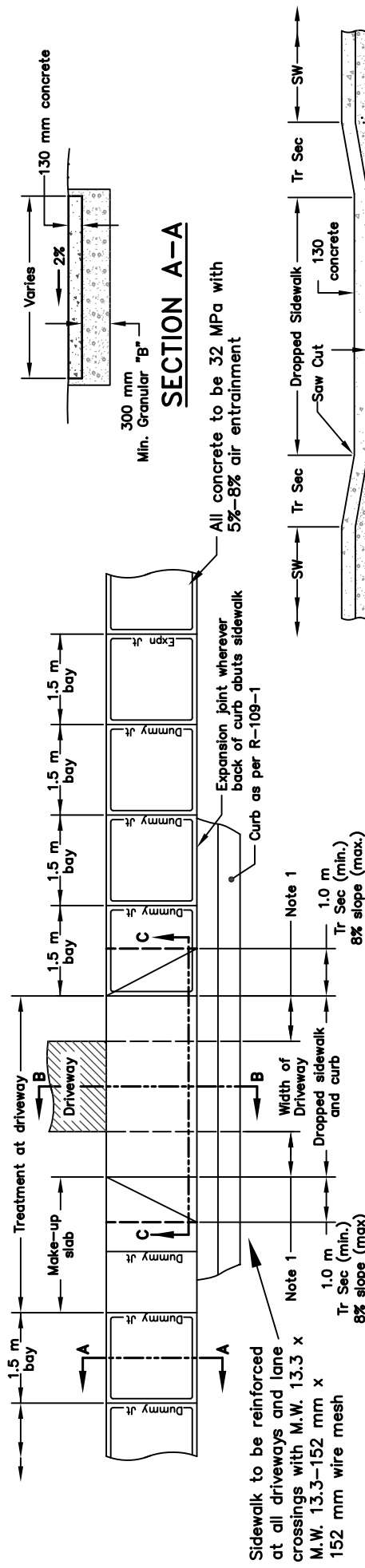


### NOTES:

- 1) Concrete to be 32 MPa with 5%–8% air entrainment.
- 2) Dummy joints to be at 2.0 m intervals.
- 3) Expansion joints to be of 12 mm pre-moulded bituminous material and placed at the intersection with other sidewalks.
- 4) Provide contraction joint (40 mm deep saw cut or guillotine knife cut) at 6.0 m intervals. Provide a longitudinal contraction joint down the center of the sidewalk.
- 5) Sidewalks to be wood float finished and lightly broomed to provide a textured non-slip surface. The sidewalk shall be edged with 5 mm radius edging tool.
- 6) Sidewalks to be reinforced full length with MW 13.3 x 13.3 wire, 152 mm x 152 mm opening wire mesh. Bend mesh down full depth of curb.
- 7) Type 'A' construction shown on standard drawing R-122.
- 8) Back of sidewalk and driveway shall be lowered as required for problem driveways to ensure 4% preferred to 6% maximum slope from the front to the back of the sidewalk.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED	
CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>	
ENGINEERING STANDARDS	
TITLE CONCRETE SIDEWALK – 3.6 m COMMERCIAL "TYPE B" SHOWING DRIVEWAY CUT	
DWN. M.D.	DATE JUN/68
REVISD: JAN. 2018	MANAGER, ENGINEERING DIVISION
SCALE N. T. S.	DWG. NO. R-123
Z: \ENG\Standard Drawings\Std Dwgs\R-123.dwg	





**NOTES:**

- Distance indicated shall be 300 mm for residential driveways and 600 mm for residential parking lots, schools, apartments, etc.
- Expansion joints are required in sidewalk at:
  - Between sidewalk and abutting curb
  - To isolate obstructions from sidewalk (ie. hydrants, light standards buildings etc.)
- Provide a contraction joint (40 mm deep saw cut or a guillotine knife cut) at 6 m intervals. Contraction joints to be provided at both ends of a dropped s/w section and at mid span when length is greater than 6 m.
- Dummy joints shall have standard spacing of 1.5 m, in no case less than 1 m or greater than 2 m.
- All concrete edges of bays to be finished with edgers, 5 mm radius.
- Sidewalk crossfall to be maintained at minimum commensurate with departure or breakdown requirements.
- Back of sidewalk may also be lowered as required for problem driveways but a slope to the front of the sidewalk must be maintained.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

**CITY OF Thunder Bay**  
Superior by Nature

**ENGINEERING STANDARDS**

**DEPRESSED CONCRETE SIDEWALK AT DRIVEWAY**

DWN. M.D. DATE JUN/81

REVISD: JAN. 2018

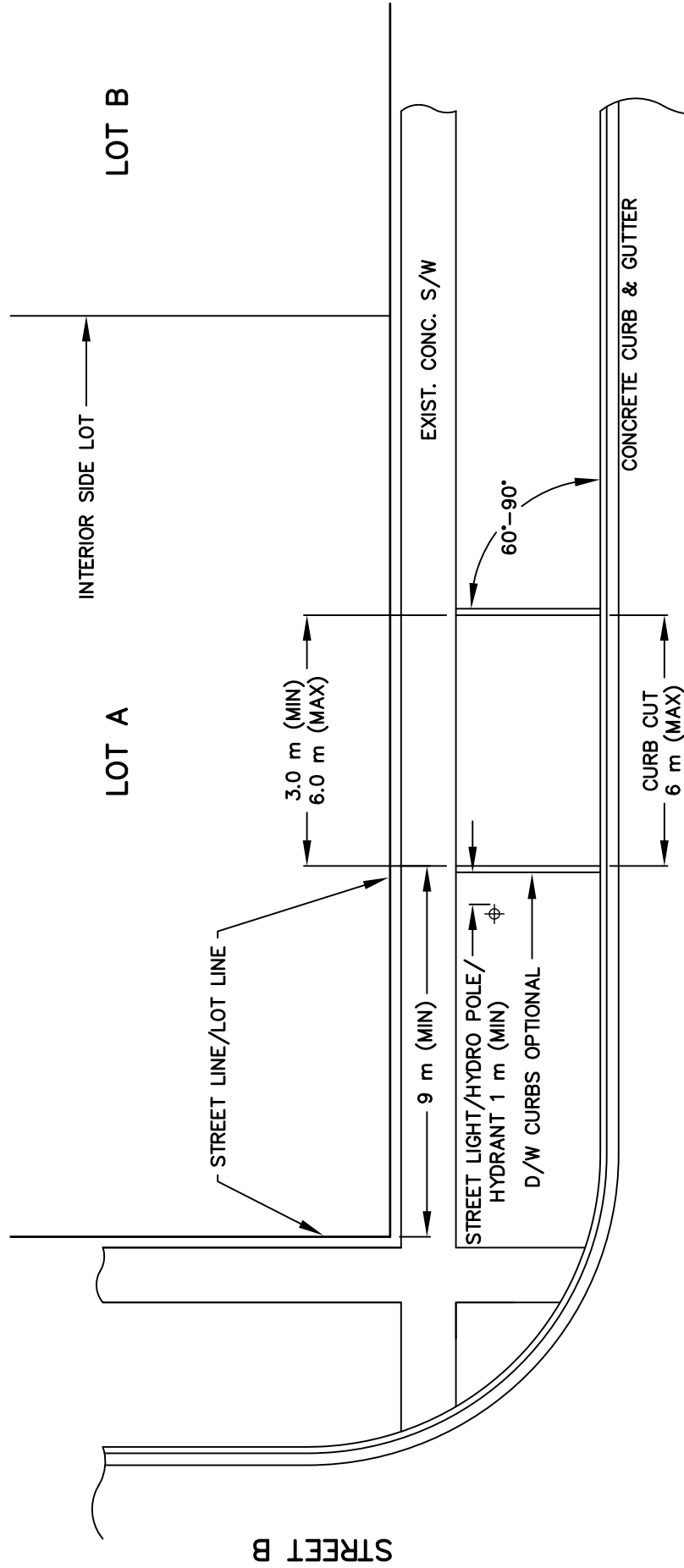
SCALE N. T. S.

DWG. NO. R-124

MANAGER, ENGINEERING DIVISION

Z:\ENG\Standard Drawings\Std Dwgs\R-124.dwg





STREET A

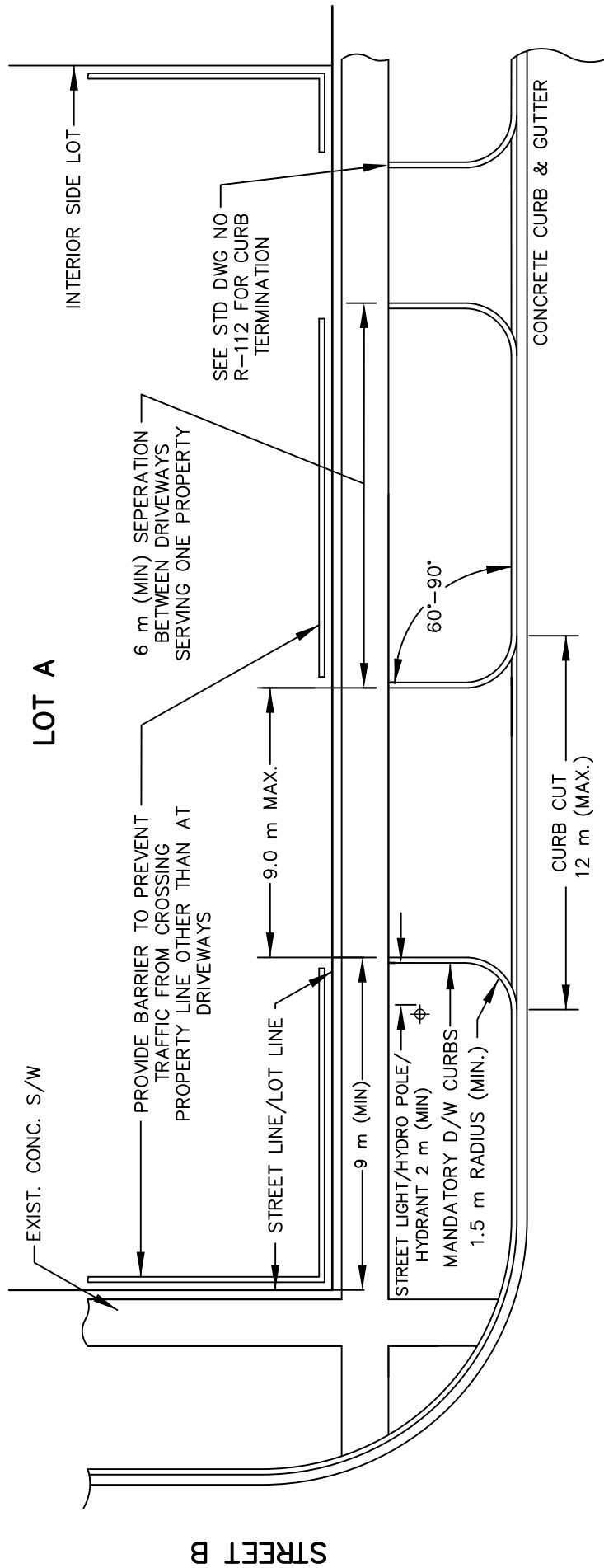
ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

CITY OF <b>Thunder Bay</b> <small>Superior by Nature</small>		ENGINEERING STANDARDS	
TITLE DRIVEWAY CONTROL LAYOUT FOR DWELLINGS			
DWN.	M.D.	DATE	11-15-57
REVISED: JAN. 2015		MANAGER, ENGINEERING DIVISION	
SCALE		N. T. S.	
DWG. NO.		R-125	
Z: \ENG\Standard Drawings\Std Dwgs\R-125.dwg			

**NOTE:**

1. SEE STD. DWG. NO.'S R-109-1 AND R-109-5 FOR CURB CUT DETAILS.
2. SEE STD. DWG. NO.'S R-119, R-121, AND R-124 FOR SIDEWALK DETAILS.






## STREET A

### NOTES:

1. SEE STD. DWG. NO.'S R-109-1 FOR CURB CUT DETAILS.
2. SEE STD. DWG. NO.'S R-119, R-122, R-123, AND R-124 FOR SIDEWALK DETAILS.
3. SEE STD. DWG. NO. R-111 FOR BARRIER CURB DETAILS.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

CITY OF <i>Thunder Bay</i> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE DRIVEWAY CONTROL LAYOUT FOR OTHER USES (NOT DWELLINGS)			
DWN.	M. D.	DATE 11-15-57	 MANAGER, ENGINEERING DIVISION
REVISED:		JAN. 2015	
SCALE		N. T. S.	
Z: \ENG\Standard Drawings\Std Dwg\R-127.dwg			DWG. NO. R-127



## NOTES:

- 1) Backlotting may not be required if traffic analysis concludes there will be no detrimental effects.

CITY OF  
**Thunder Bay**  
Superior by Nature

ENGINEERING  
STANDARDS

TITLE  
ROAD CLASSIFICATION & DESIGN GUIDELINES  
FOR NEW RESIDENTIAL DEVELOPMENT

DWN: D.R. DATE Aug. 1992

REVIS: DEC. 2007

SCALE N. T. S.

Z:\ENG\Standard Drawings\Std Dwg\R-128.dwg

MANAGER, ENGINEERING DIVISION  
DWG. NO.

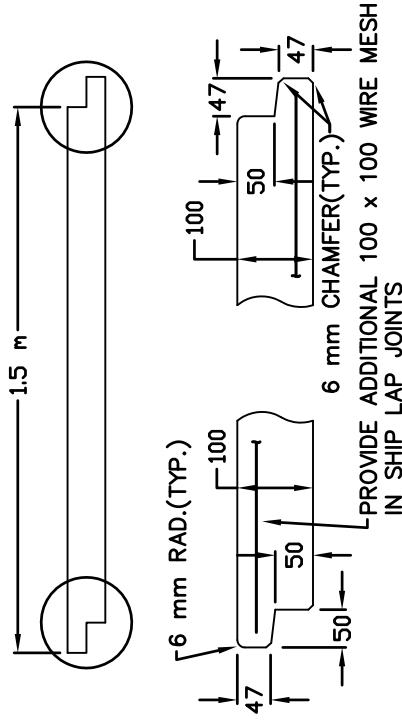
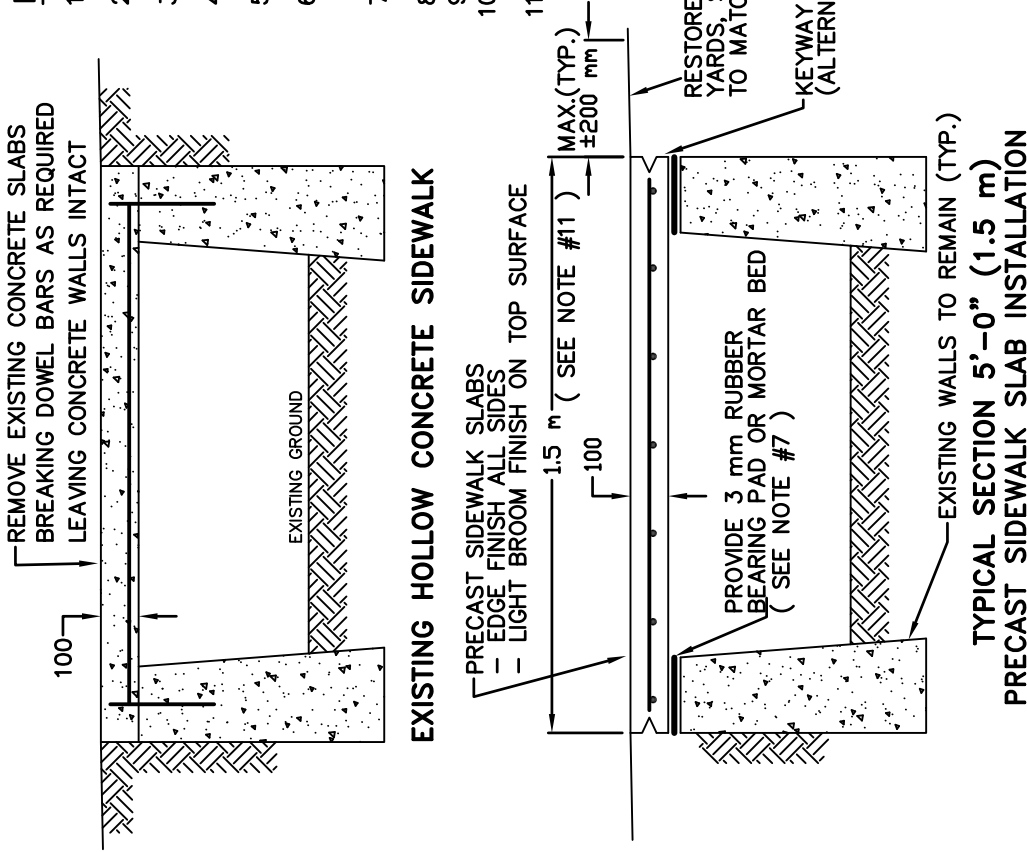
**R-128**

	MAJOR ARTERIAL	MINOR ARTERIAL	COLLECTOR	LOCAL
PRIMARY FUNCTION	traffic movement	traffic movement	traffic movement and land access of equal importance	land access
SECONDARY FUNCTION		land access and active transportation	traffic movement, land access of equal importance, and active transportation	traffic movement and active transportation
DIRECT ACCESS	permitted only when no alternative exists	restrictions on driveway location and spacing	permitted if safety criteria are met	permitted if safety criteria are met
SPEED LIMIT	60 – 80 km/h	50 – 60 km/h	50 km/h	40 – 50 km/h
AVAILABILITY AS TRUCK ROUTE	yes	yes	restricted	prohibited
ON-STREET PARKING	generally permitted	generally permitted	permitted (width permitting)	permitted (width permitting)
RIGHT-OF-WAY WIDTH	24 m (min) 36 m (des)	20 m (min) 30 m (des)	20 m (min) 24 m (des)	20 m (min) 20 m (des)
SIDEWALK	both sides (if required)	both sides (if required)	one side (min) Both sides (des)	if required
NUMBER OF LANES	2 – 4	2 – 4	2	2
APPROXIMATE DAILY TRAFFIC	10,000 – 30,000 vpd	5,000 – 15,000 vpd	3,000 – 5,000 vpd	0 – 3,000 vpd
BACKLOTING	mandatory <sup>1</sup>	mandatory <sup>1</sup>	generally not permitted	generally not permitted




NOTES:

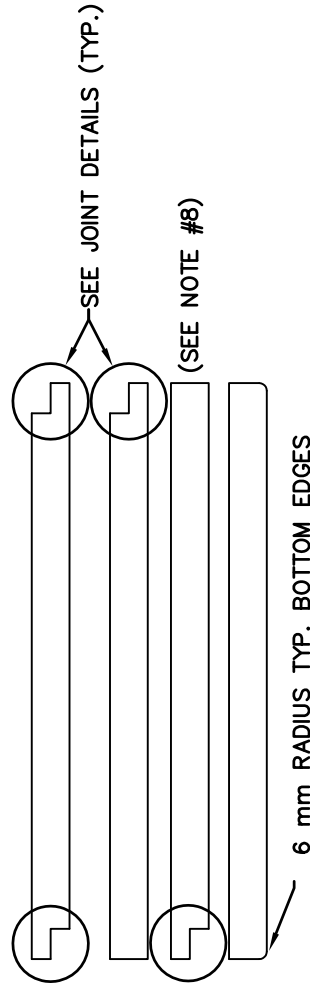
- 1) Precast panels shall be designed to meet the loading of the National Building Code at 12 kPa or greater.
- 2) Suppliers to provide engineering shop drawings prior to fabrication. Standard drawing shown is for general arrangement only.
- 3) All concrete shall be 32 MPa or greater with 5%–8% air entrainment. Surface shall have trowel smooth edges and light broom finish.
- 4) Sidewalk removals and new precast slab installation shall be carried out with minimal disturbance to existing boulevards, private yards, trees, driveways, walkways, etc.
- 5) No large equipment shall be allowed on boulevard. Booms and extended length excavators shall operate from the street pavement.
- 6) Contractor to provide specially measured closure pieces to match or cast in place sections at ramp locations or driveway locations that have been previously replaced with solid concrete sidewalk. Saw cutting of existing solid walk is permitted.
- 7) New precast slabs shall be installed on rubber bearing shims or mortar as required to adjust for unevenness, rocking of slabs, or trip edges.
- 8) Ship lap panels shall be used except where abutting existing or cast in place sections.
- 9) Sidewalk ramps at intersections shall be cast in place as per R-120.
- 10) Precast panels not to be used for hollow sidewalks with club footings or other haunch supports.
- 11) Sidewalk panels may be fabricated for widths other than 1.5 m subject to Note 1.



## DETAIL TAPERED SHIP LAP JOINT

		ENGINEERING STANDARDS	
<h1>PRECAST SLAB REPLACEMENT FOR HOLLOW SIDEWALKS</h1>			
TITLE			
DWN.	G.S.L.	DATE	FEB./02
REVISED:		JAN. 2018	
SCALE		N. T. S.	
PATH		E:\ENG\STD DWGS\R-129	
		CITY ENGINEER	
		DWG. NO.	
		R-129	

**All dimensions are in millimetres or metres unless otherwise specified.**



## TYPICAL PRECAST SLAB CONFIGURATIONS



# SIGN LEGEND



(A)

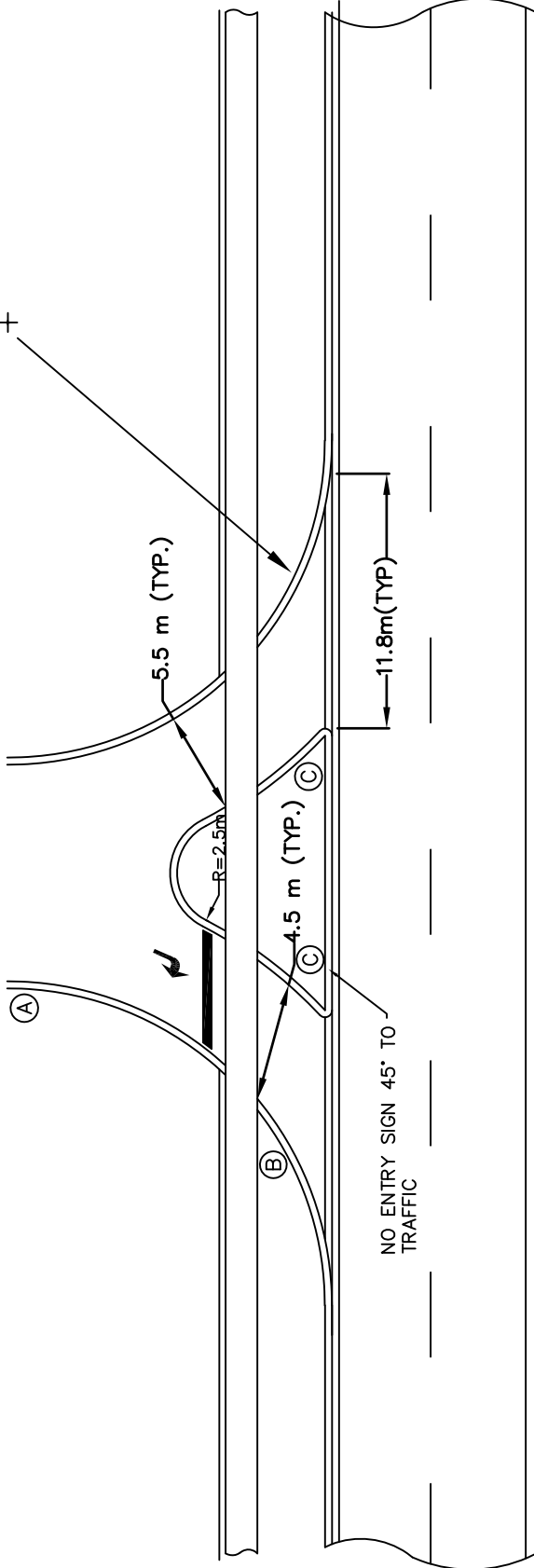


(B)



(C)

15.0m RAD(TYP)



20.12

## NOTES:

- 1) Curb cut at roadway not to exceed 12m.
- 2) Turn radius to be a minimum of 15m.
- 3) Carry curb & gutter through turning lanes.
- 4) Stop bar & arrow on private property to be painted by site developer.



ALL DIMENSIONS ARE IN MILLIMETRES OR METRES

<div>CITY OF <i>Thunder Bay</i> <i>Superior by Nature</i></div>		ENGINEERING STANDARDS	
TITLE			
LEFT TURN RESTRICTED ENTRANCE			
DWN.	J.M	DATE	NOV./07
REVISED:		JAN. 2009	
SCALE		N. T. S.	
Z:\ENG\Standard Drawings\Std Dwgs\R-130.dwg			
		MANAGER, ENGINEERING DIVISION	
		DWG. NO.	
		R-130	



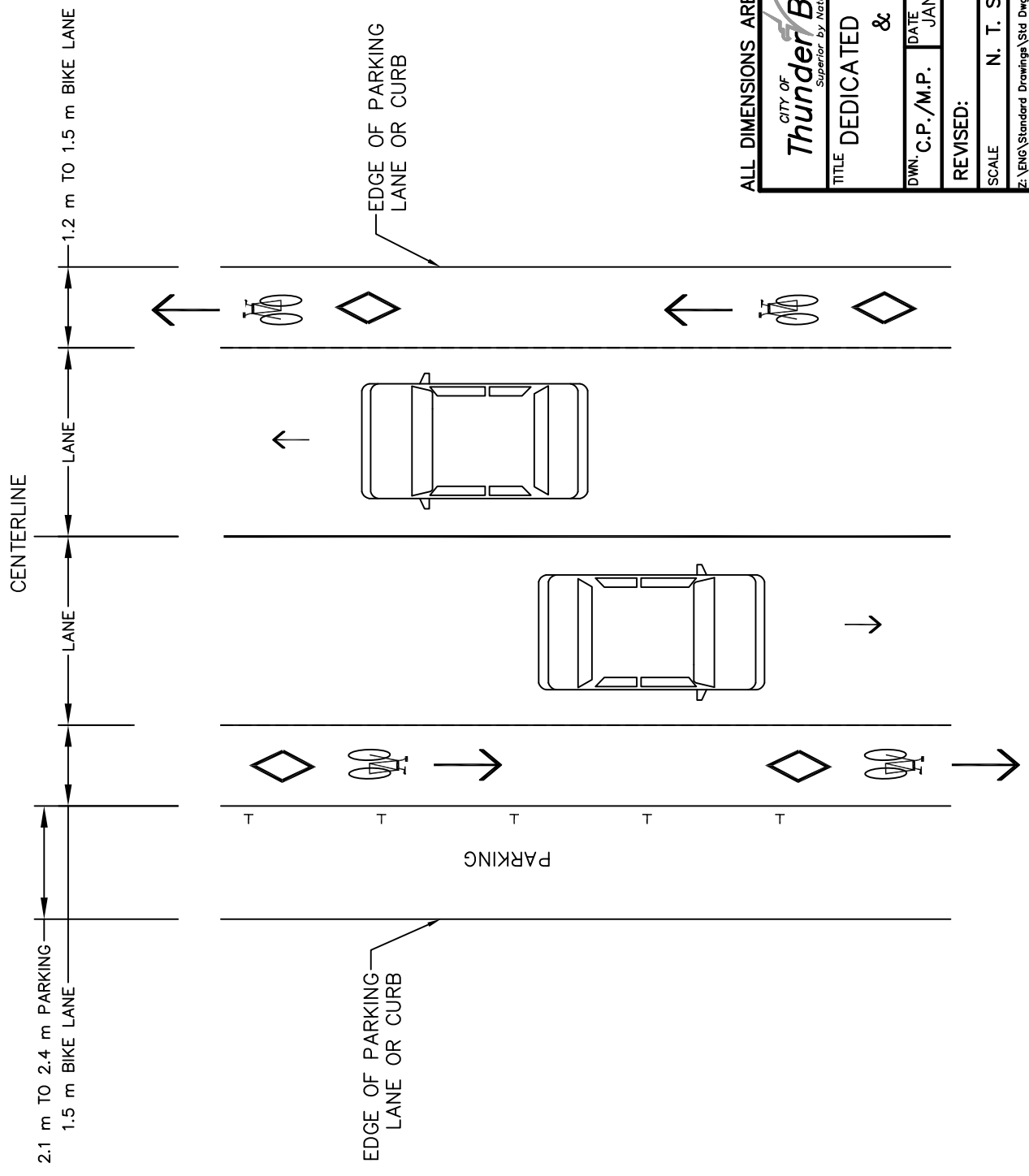
Diagram illustrating a two-lane road with a centerline and a parking lane. The road width is marked as 6.1 m (MIN.). The distance from the centerline to the edge of the parking lane is marked as 3.4 m. A car is shown in the left lane, a bicycle is shown in the right lane, and a truck is shown in the right lane. The centerline is labeled "CENTERLINE". The edge of the parking lane or curb is labeled "EDGE OF PARKING LANE OR CURB".

Diagram illustrating the placement of a 'SHARE THE ROAD' sign (WC-47S) on a two-lane road. The sign is positioned on the right side of the road, adjacent to the curb. The distance from the curb to the signpost is indicated as 0.75 m MIN. - 1.0 m DESIRED. The signpost also displays the code WC-47. The road width is marked as 4.0 m (MIN.). The sign is placed in the right lane, adjacent to the centerline.


		ENGINEERING STANDARDS	
TITLE SHARROWS WITH PARKING & NO PARKING			
DWN.	C.P./M.P.	DATE JAN 2012	 MANAGER, ENGINEERING DIVISION
REVISED:			
SCALE	N. T. S.		
R-131-1			



**DEDICATED BIKE LANE WITH PARKING AND WITHOUT PARKING**



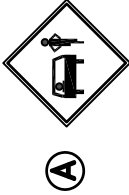
ALL DIMENSIONS ARE IN METERS

CITY OF <i>Thunder Bay</i> <small>Superior by Nature</small>		ENGINEERING STANDARDS	
TITLE DEDICATED BIKE LANE WITH PARKING & WITHOUT PARKING			
DWN. C.P./M.P.	DATE JAN 2012	 MANAGER, ENGINEERING DIVISION	
REVISED:		DWG. NO.	R-131-2
SCALE	N. T. S.		
Z:\ENG\Standard Drawings\Std Dwg\R-131-2.dwg			



# SIGN LEGEND

WC-47



(A)

RB-92



(B)

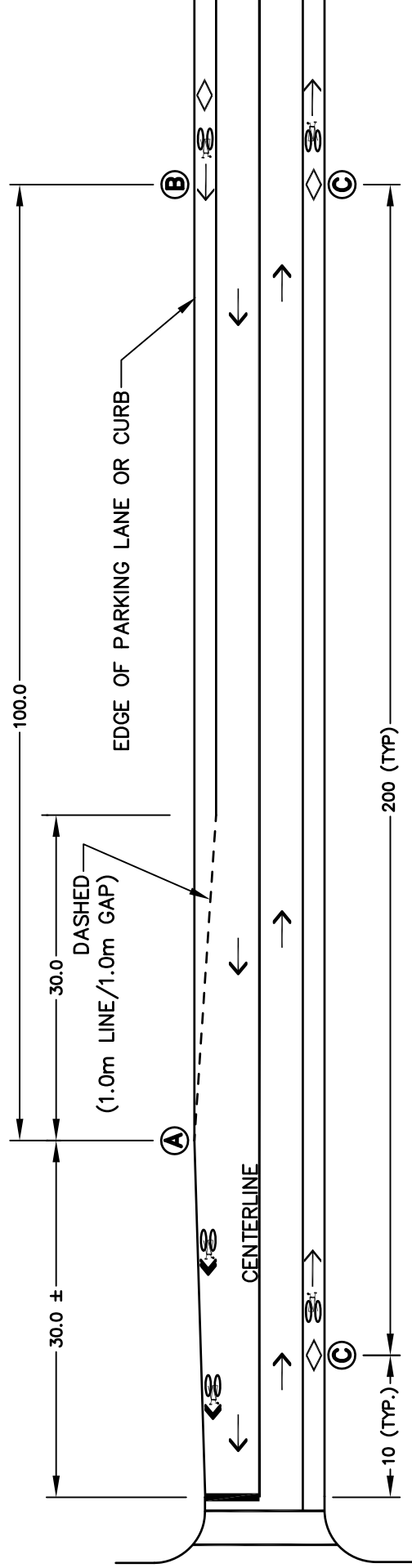
RB-91



(C)



WC-47S

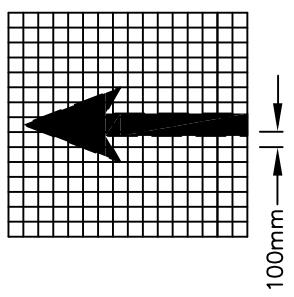


ALL DIMENSIONS ARE IN METERS

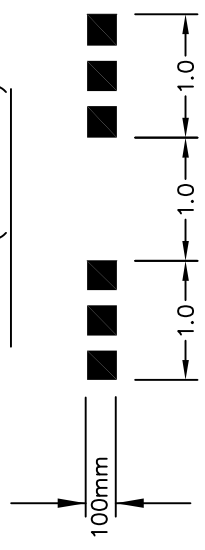
CITY OF <b>Thunder Bay</b> <small>Superior by Nature</small>		ENGINEERING STANDARDS	
TITLE DEDICATED BIKE LANE TO SHARROW THROUGH INTERSECTION		DWN. C.P/M.P.:	
DATE JAN 2012		MANAGER, ENGINEERING DIVISION <i>N. T. S.</i>	
REVISED: JAN 2015		DWG. NO.	
SCALE N. T. S.		R-131-3	
Z:\ENG\Standard Drawings\Std Dwg\R-131-3.dwg			



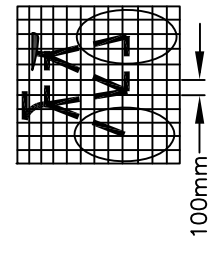
# ARROW SYMBOL FOR RESERVED LANES



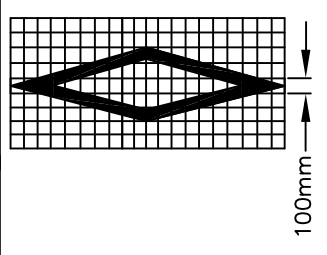
# LANE (DASHED)



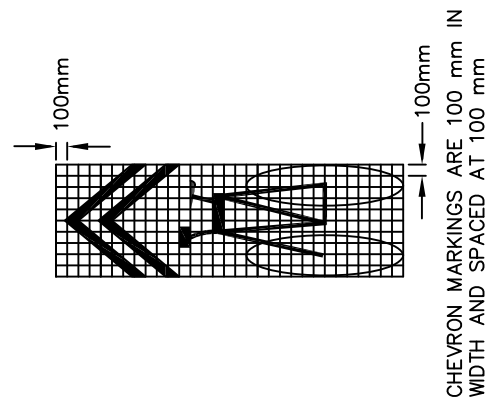
# BICYCLE SYMBOL





# DIAMOND SYMBOL FOR RESERVED LANES



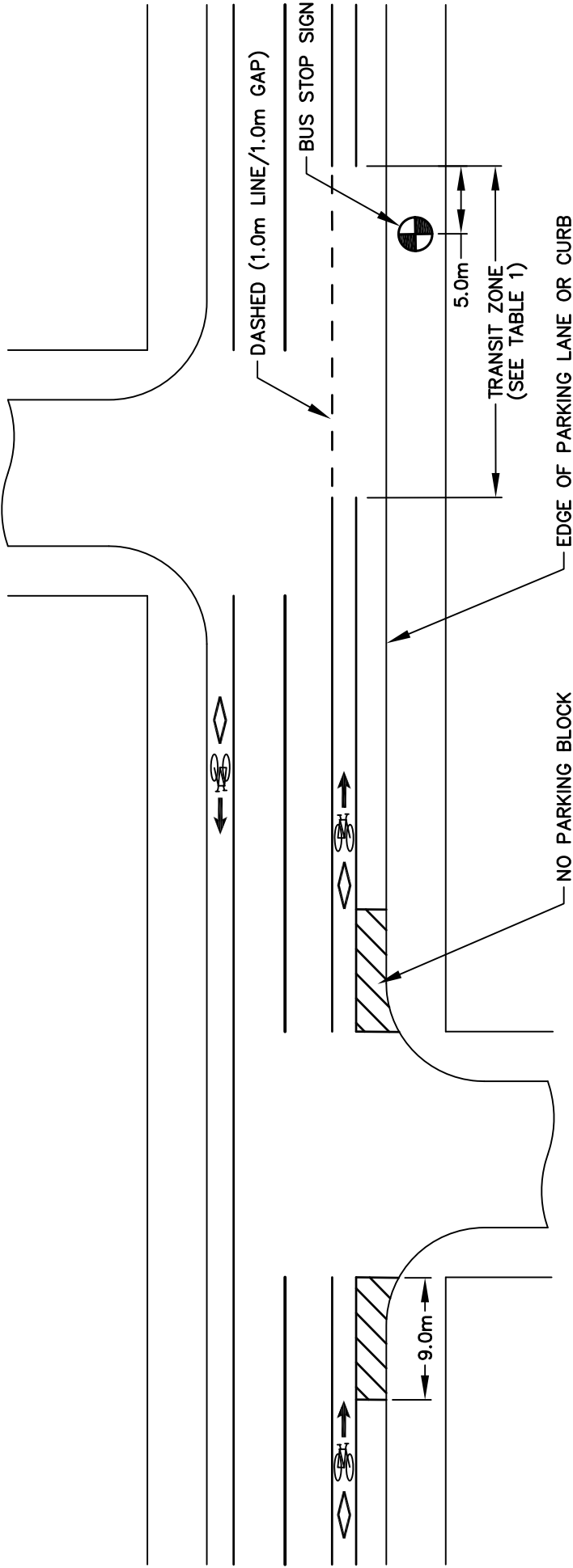
# SHARED USE LANE MARKING - SHARROW



ALL DIMENSIONS ARE IN METERS

 CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE BICYCLE & SHARROW SYMBOLS			
DWN.	M. P.	DATE JAN 2012	 MANAGER, ENGINEERING DIVISION
REVISED:		DWG. NO.	
SCALE		N. T. S.	
Z:\ENG\Standard Drawings\Std Dwg\R-131-4.dwg			
			<b>R-131-4</b>



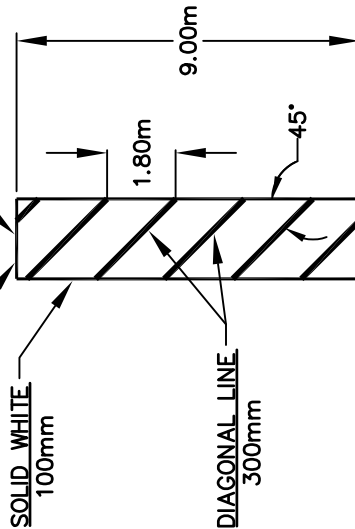


END LINE 200mm

SOLID WHITE 100mm

DIAGONAL LINE 300mm

ADJUST OUTER BOUNDARY OF  
DETAIL TO FILL PARKING LANE



DETAIL 'A' "NO PARKING BLOCK"  
DIAGONAL STRIPING DETAIL

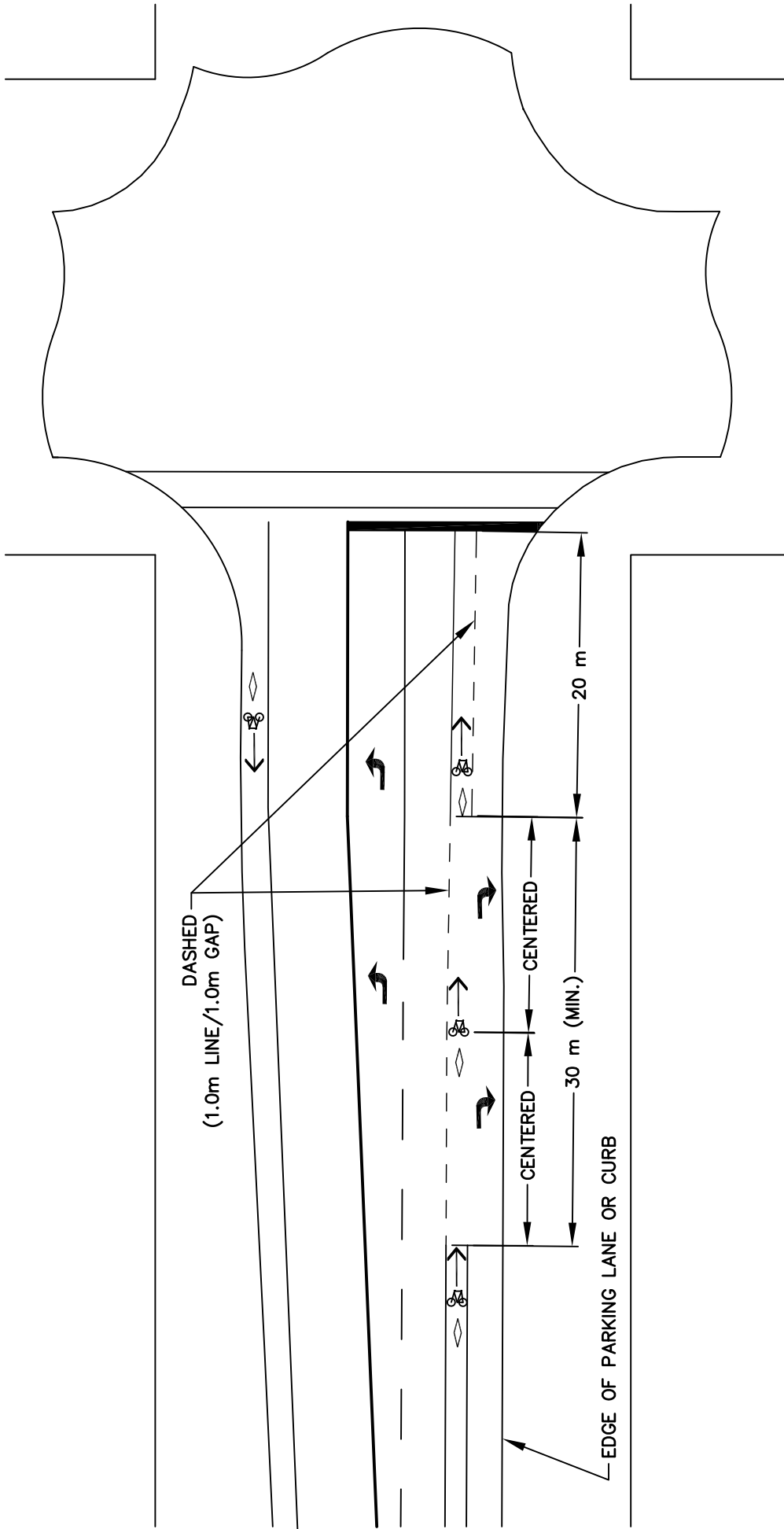
TABLE 1

MID-BLOCK BUS STOP: 35m  
NEAR-SIDE OF INTERSECTION: 30m  
FAR-SIDE OF INTERSECTION: 25m


ALL DIMENSIONS ARE IN METERS


CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE		DEDICATED BIKE LANE WITH PARKING LANE AND BUS STOP	
DWN: M.D./S.G.	DATE	MANAGER, ENGINEERING DIVISION	
	JAN 2015	DWG. NO.	
REVISED:		R-131-5	
SCALE	N. T. S.	Z: \ENG\Standard Drawings\Std Dwg\R-131-5.dwg	





ALL DIMENSIONS ARE IN METERS

 <b>ENGINEERING STANDARDS</b>	
<b>TITLE</b> DEDICATED BIKE LANE TO SHARED RIGHT-TURN LANE	
<b>DWN.</b> M.D.	<b>DATE</b> JAN 2015
<b>REVISED:</b>	
<b>SCALE</b> N. T. S.	
<b>DWG. NO.</b> R-131-6	

  
 MANAGER, ENGINEERING DIVISION

Z: \ENG\Standard Drawings\Std Dwgs\R-131-6.dwg



**NOTES:**

1. LOCATION AND WIDTH OF DRIVEWAYS SHALL CONFIRM TO THE CITY DRIVEWAY CONTROL POLICY.
2. OPTIONAL HEADWALLS TO BE REVIEWED/APPROVED BY CITY ENGINEER.
3. PIPE JOINTS SHALL REQUIRE SOIL TIGHT COUPLERS, INSTALLED AT THE DOWN STREAM END OF THE CULVERT WHEN POSSIBLE.
4. CONSTRUCTION METHODS FOR PIPE CULVERT INSTALLATIONS SHALL BE IN ACCORDANCE TO OPSS 421.
5. DRIVEWAY CULVERTS SHALL BE EITHER ALUMINIZED TYPE 2 CORRUGATED STEEL PIPE (CSP) OR HIGH-DENSITY POLYETHYLENE (HDPE) PIPE AND SHALL MEET THE FOLLOWING SPECIFICATIONS:

**CSP**

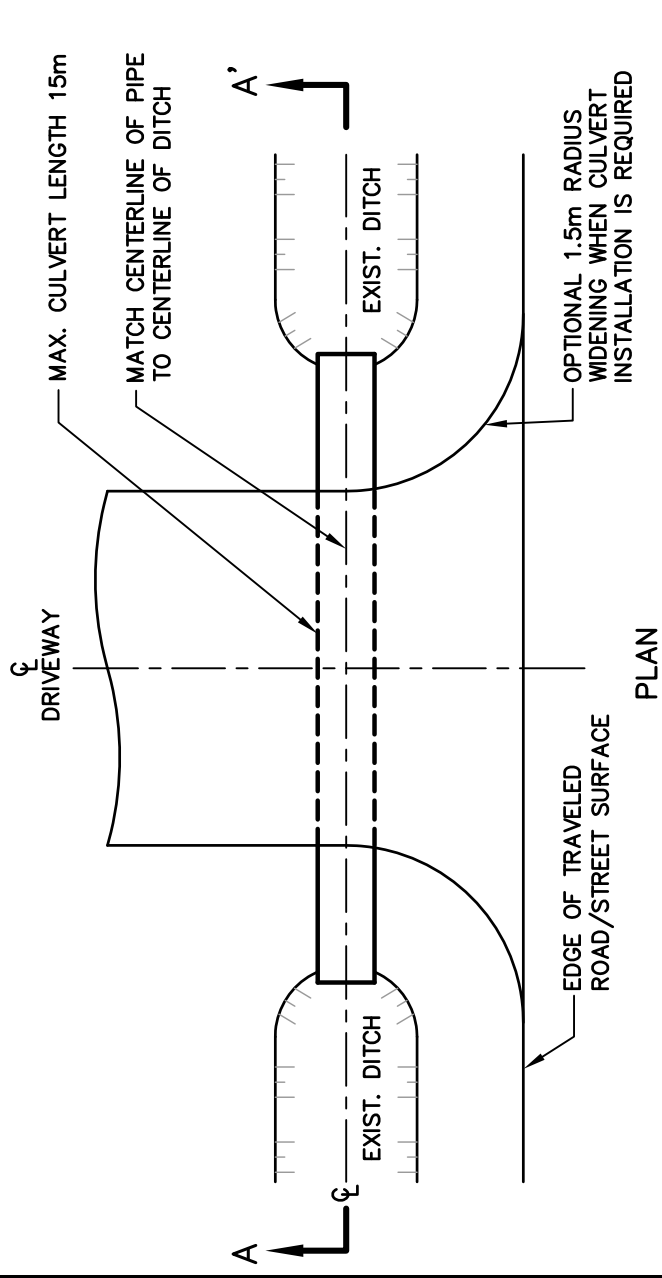
- SHALL HAVE A MINIMUM WALL THICKNESS OF 2.0mm, SUBJECT TO THE FOLLOWING EXCEPTIONS:
- A) DRIVEWAY CULVERTS 300mm $\phi$  OR SMALLER WITH 300mm OR MORE OF EARTH COVER MAY BE 1.6mm WALL THICKNESS.
  - B) THE WALL THICKNESS OF THE DRIVEWAY CULVERTS OF SIZES LARGER THAN 900mm SHALL BE DETERMINED BY THE ENGINEERING DIVISION ON A SITE SPECIFIC BASIS.

**HDPE**

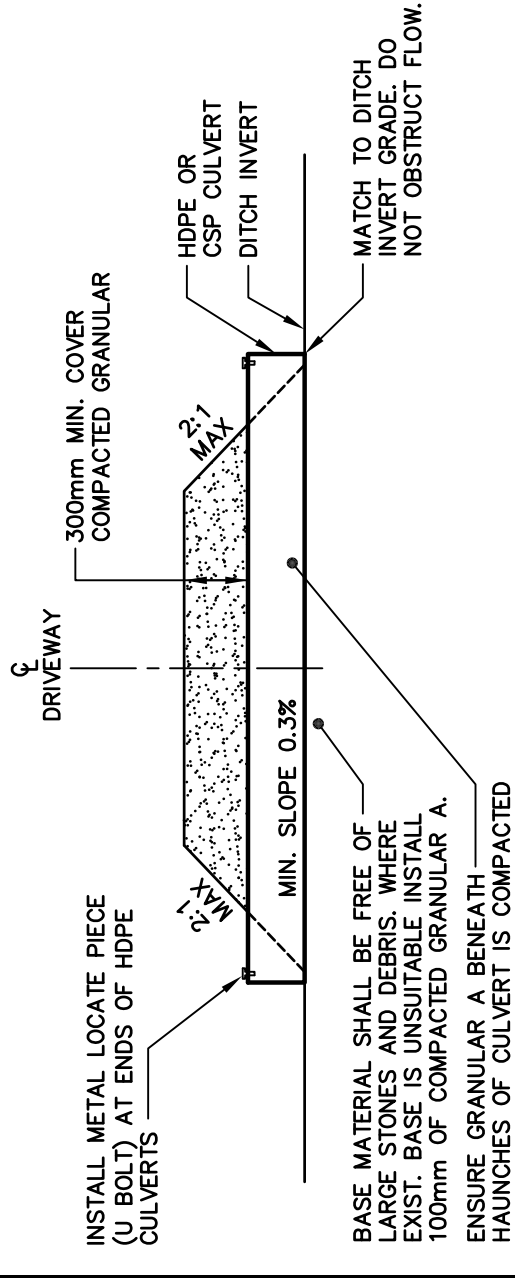
- SHALL BE AN OPEN PROFILE HDPE PIPE (CORRUGATED EXTERIOR WITH A SMOOTH INTERIOR WALL) MANUFACTURED ACCORDING TO CSA B182.8 AND CERTIFIED BY AN INDEPENDENT 3RD PARTY AGENCY AS PER OPSS 1840.
- THE MINIMUM PIPE STIFFNESS SHALL BE 320 kPa AND THE MAXIMUM DIAMETER SHALL BE 900mm.
- PIPE JOINT COUPLERS SHALL BE TYPE 3 (EXTERNAL SPLIT COUPLER) WITH THE EXCEPTION WHERE WATER TIGHT GASKETS ARE SPECIFIED FOR CERTAIN APPLICATIONS.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

<b>CITY OF</b> <i>Thunder Bay</i> <small>Superior by Nature</small>		<b>ENGINEERING STANDARDS</b>	
<b>DRIVEWAY CULVERT INSTALLATION</b>			
TITLE			
DWN.	S.G.	DATE	JAN./15
REVISED:		MANAGER ENGINEERING DIVISION	
SCALE	N. T. S.		
DWG. NO.		R-132	
Z:\ENG\Standard Drawings\Std Dwgs\R-132.dwg			

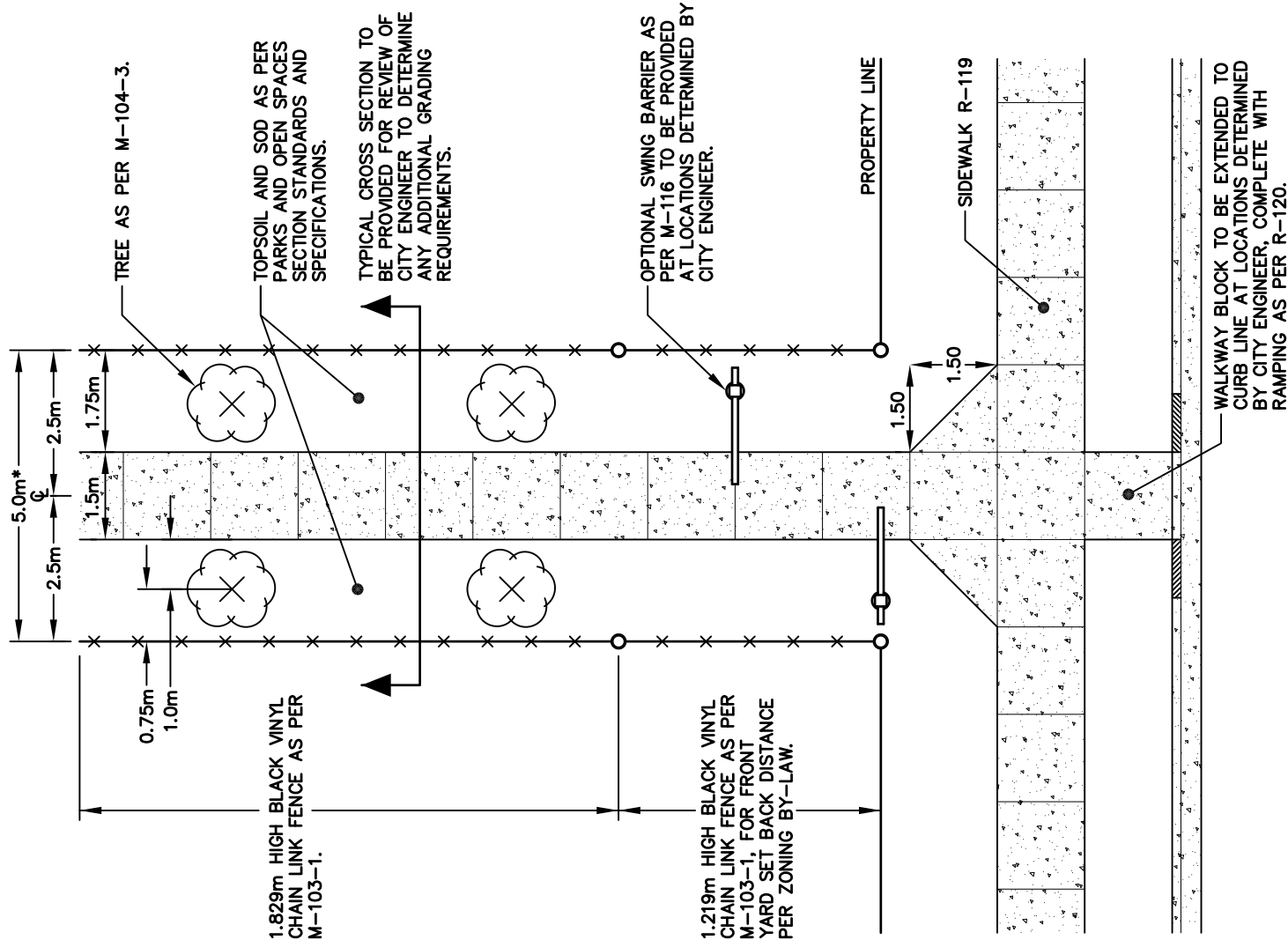


**PLAN**



**SECTION A-A'**





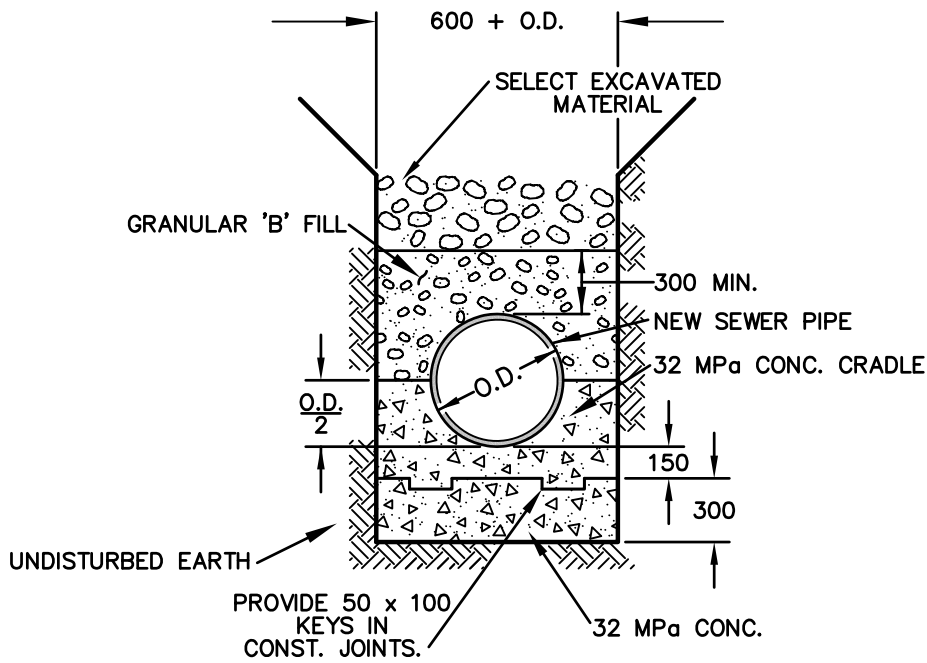
**NOTES:**

1. MAXIMUM WALKWAY SLOPE TO BE 5%. MINIMUM WALKWAY SLOPE TO BE 0.5% MAXIMUM WALKWAY CROSSFALL TO BE 2%.
  2. MINIMUM TWO TREES PER LOT SIDE YARD AS PER PARKS AND OPEN SPACES SECTION STANDARDS AND SPECIFICATIONS.
- \* WIDTH INCREASED TO 6m FOR MULTI-USE TRAIL CONNECTIONS AND FOR VEHICLE MAINTENANCE ACCESS ROUTES.

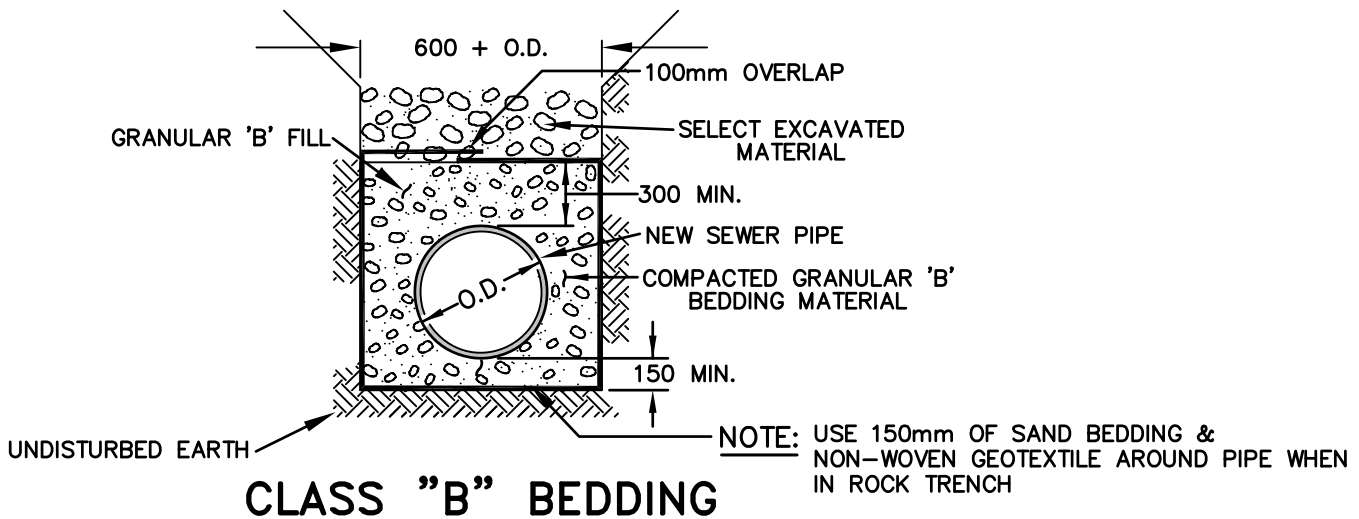
ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE STATED

<b>CITY OF Thunder Bay</b> <i>Superior by Nature</i>		<b>ENGINEERING STANDARDS</b>	
<b>TITLE</b> WALKWAY BLOCK STANDARD (5m WIDTH)			
<b>DWN.</b> S.G.	<b>DATE</b> JAN. 2016	<b>MANAGER, ENGINEERING DIVISION</b>	
<b>REVISED:</b>		<b>DWG. NO.</b>	
<b>SCALE</b> N. T. S.		<b>R-133</b>	
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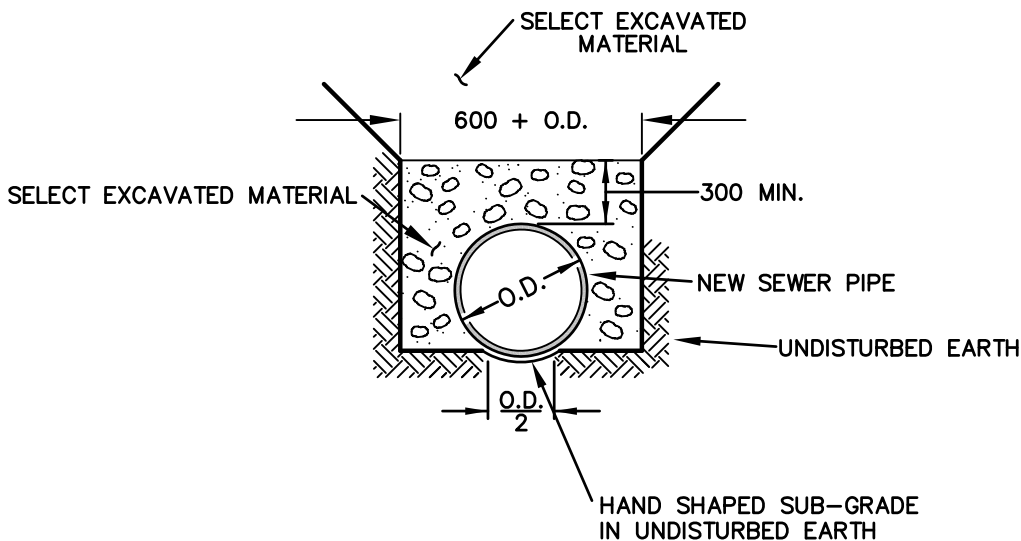




**CLASS "A" BEDDING**



**CLASS "B" BEDDING**



**CLASS "C" BEDDING**

ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

**ENGINEERING  
STANDARDS**

**CITY OF  
Thunder Bay  
Superior by Nature**

TITLE

**BEDDING FOR SANITARY AND  
STORM SEWER PIPE**

DWN: G.S.L. DATE DEC. / 73

REvised: JAN. 2018

SCALE N. T. S.

Z: ENG\STANDARD DRAWINGS\STD DWGS\S-100

MANAGER, ENGINEERING DIVISION  
DWG. NO.

**S-100**

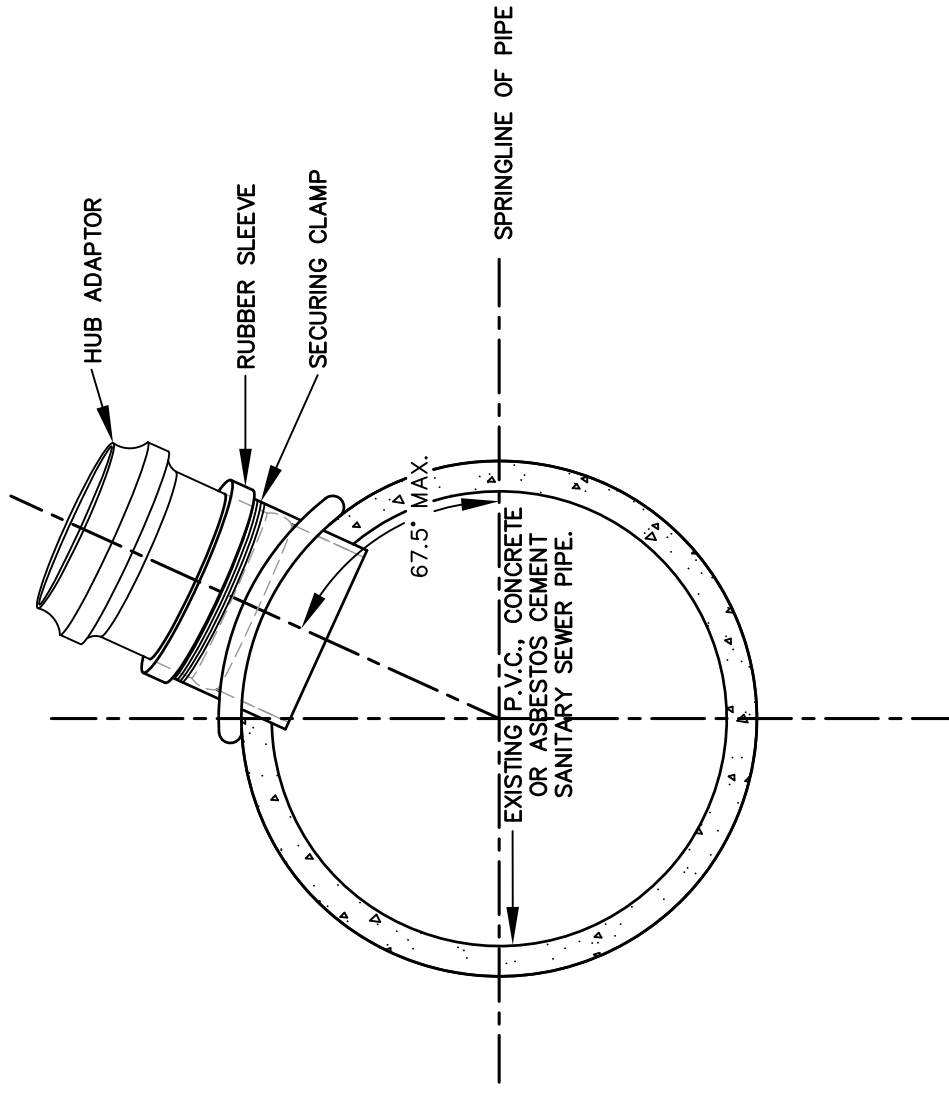
**NOTE:**



- 1) See standard drawing No. W-122 and W-123 for bedding sanitary and watermain in common trench.



## NOTES:

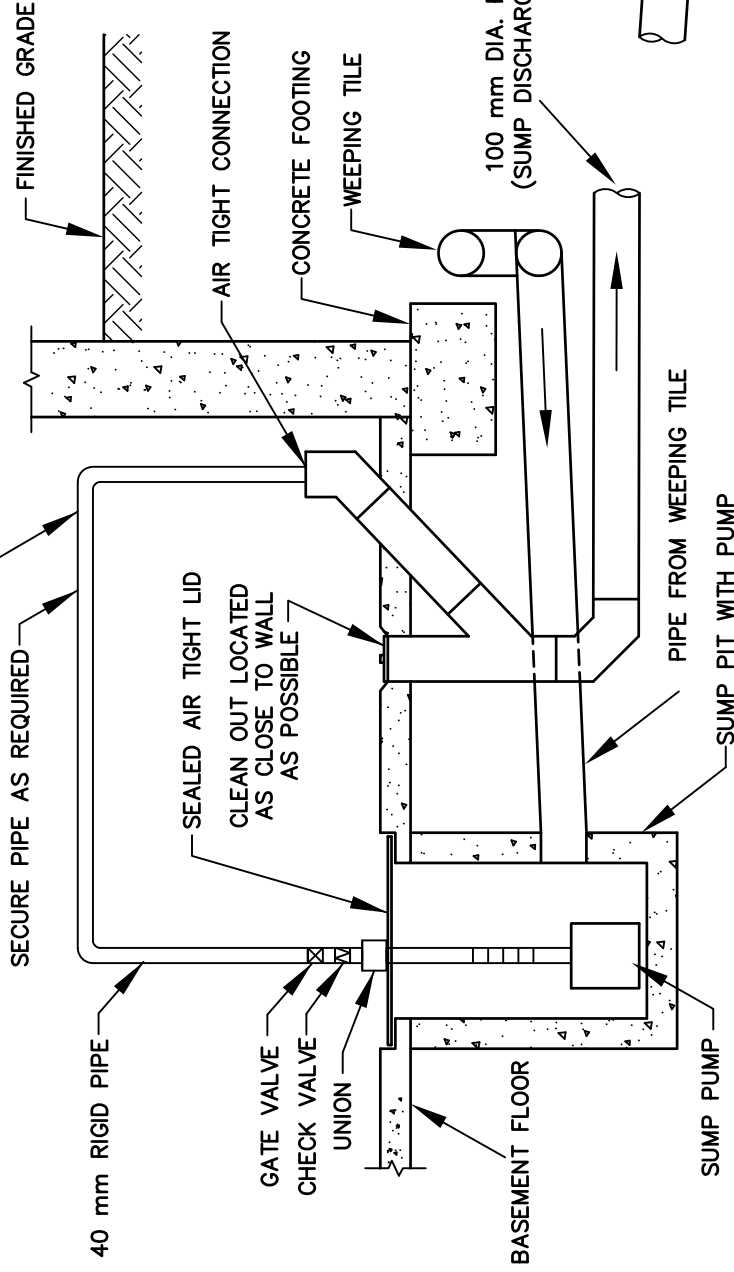
- 1) All single family residential sanitary sewer connection pipe shall be minimum 135 mm diameter S.D.R. 28 P.V.C.. Non residential sanitary sewer connection pipe shall be minimum 150 mm diameter S.D.R. 28 P.V.C..
- 2) Manufactured tee to connect P.V.C. house sanitary sewer connection pipe to existing asbestos cement, concrete or P.V.C. sanitary sewer mains. Use a manufactured tee at connection when constructing a new P.V.C. sanitary sewer main.
- 3) All house sanitary sewer connection holes provided in asbestos cement or P.V.C. sanitary sewer mains shall to be machine cut. Use diamond core bits for concrete sewer main.
- 4) The open end shall be properly capped where connection is not in immediate use and marked with a wire or stake to surface.
- 5) For connection to a trunk sewer, see OPSD-1006.010
- 6) For house storm sewer connection see drawings S-103-1 & 103-2.
- 7) Use manufactured sweeps or radius pipe sections at all times when deflecting sanitary connections.



 <p>CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i></p>		ENGINEERING STANDARDS	
TITLE HOUSE SANITARY SEWER CONNECTION COMMON TYPE			
DWN. D. W.	DATE SEPT 85	 MANAGER, ENGINEERING DIVISION	
REVISED: JAN. 2018			
SCALE N. T. S.		DWG. NO.	
		S-102	
Z:\ENG\STANDARD DRAWINGS\STD DWGS\S-102			

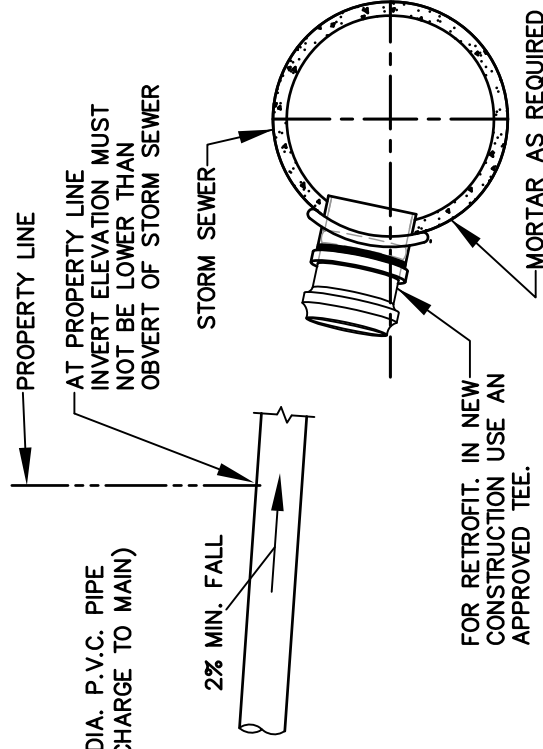


INSTALL HORIZONTAL DISCHARGE PIPE AT SAME ELEVATION AS THE FINISHED GRADE ELEVATION AT THE HOUSE



### CAUTION:

STORM SEWER MAINS ARE SUSCEPTIBLE TO SURCHARGING AND MAY BACK UP IF STORMS OF A HIGH INTENSITY OCCUR. THIS SHOULD BE CONSIDERED WHEN CONNECTING THE WEeping TILES TO THE STORM SEWER. THE ELEVATION OF THE STORM SEWER MAY REQUIRE A MODIFICATION TO THE METHOD OF CONNECTION SHOWN HERE.



FOR RETROFIT. IN NEW CONSTRUCTION USE AN APPROVED TEE.

ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

CITY OF  
**Thunder Bay**  
*Superior by Nature*  
**ENGINEERING STANDARDS**

TITLE

**WEeping TILE CONNECTION TO STORM SEWER**

DWN.	S.G.	DATE
		MAY 94
REVISED:	JAN. 2018	
SCALE	N. T. S.	

MANAGER, ENGINEERING DIVISION  
DWG. NO.

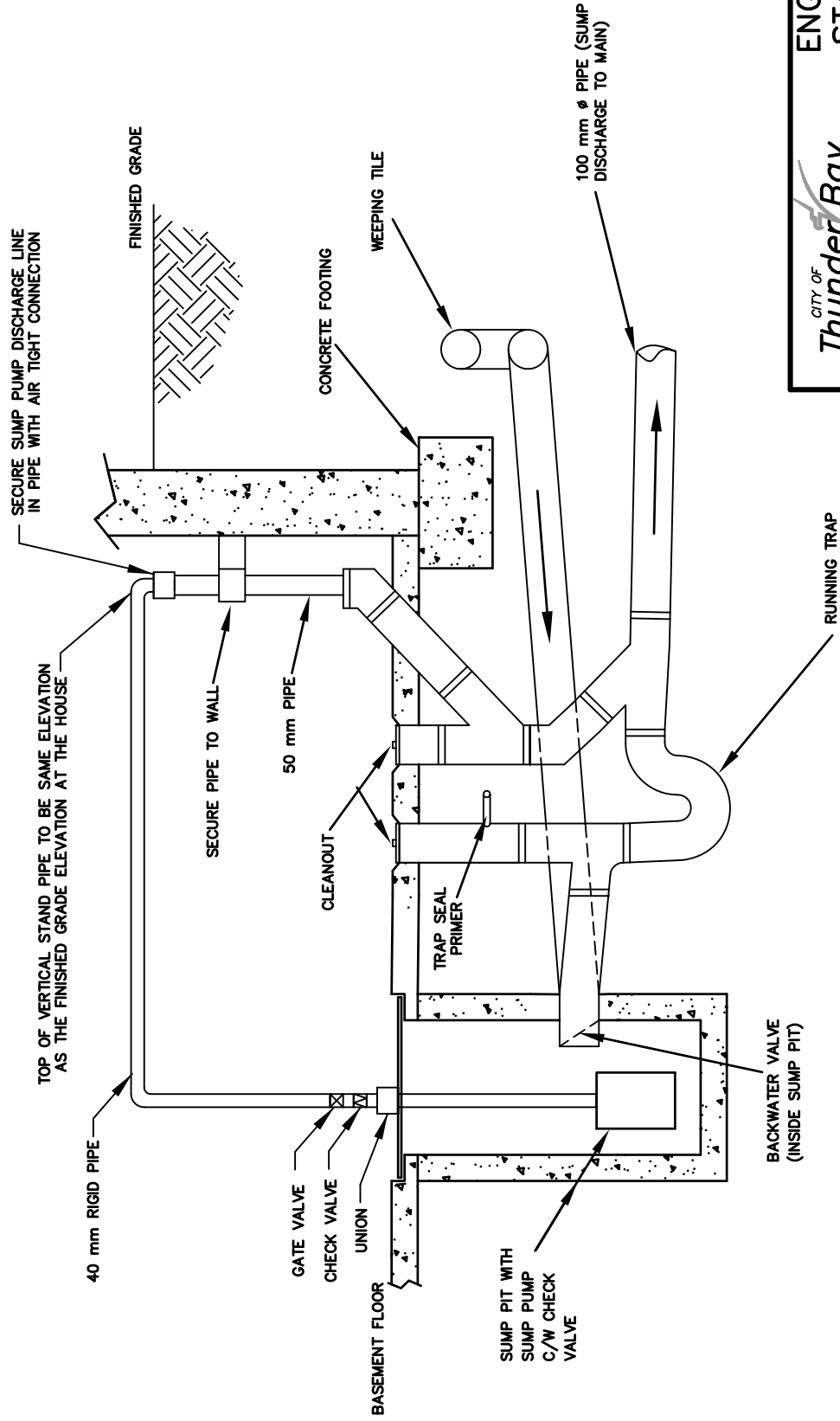
**S-103-1**

Z:\ENG\Standard Drawings\Std Dwg\S-103-1.dwg

### NOTES:

- 1) This method of connection shall be used for all lots serviced by the storm sewers.
- 2) All house storm sewer connection pipe to be 100 mm  $\phi$  (min.).
- 3) Use 100 mm approved Tee Insert to connect house storm sewer connection pipe to storm sewer.
- 4) Tee Insert to be mortared to concrete storm sewer main as required, depending on neatness of hole provided.
- 5) The open end shall be properly capped when connection is not in immediate use and marked with a wire or stake to surface.
- 6) For house sanitary sewer connection see drawing S-102.
- 7) House storm sewer connection to be laid at min. fall of 2%.
- 8) All piping inside the building shall conform to the Plumbing Code.
- 9) Separate storm sewer connections from the building to the sewer main must be provided to all portions of buildings which may be held in separate ownership.
- 10) Storm sewer connection piping with less than 1.8 meters earth cover beneath the roadway traveled portion shall be insulated with DOW HI-35 Styrofoam insulation 50 mm thick and 600 mm wide.





NOTE : SEE DRAWING S-103-1 FOR ADDITIONAL CONSTRUCTION INFORMATION

CITY OF  
**Thunder Bay**  
*Superior by Nature*

ENGINEERING  
STANDARDS

TITLE  
**ALTERNATIVE WEEPING TILE CONNECTION  
TO STORM SEWER**

DWN. HBW DATE MAY 94

REvised: JAN. 2007

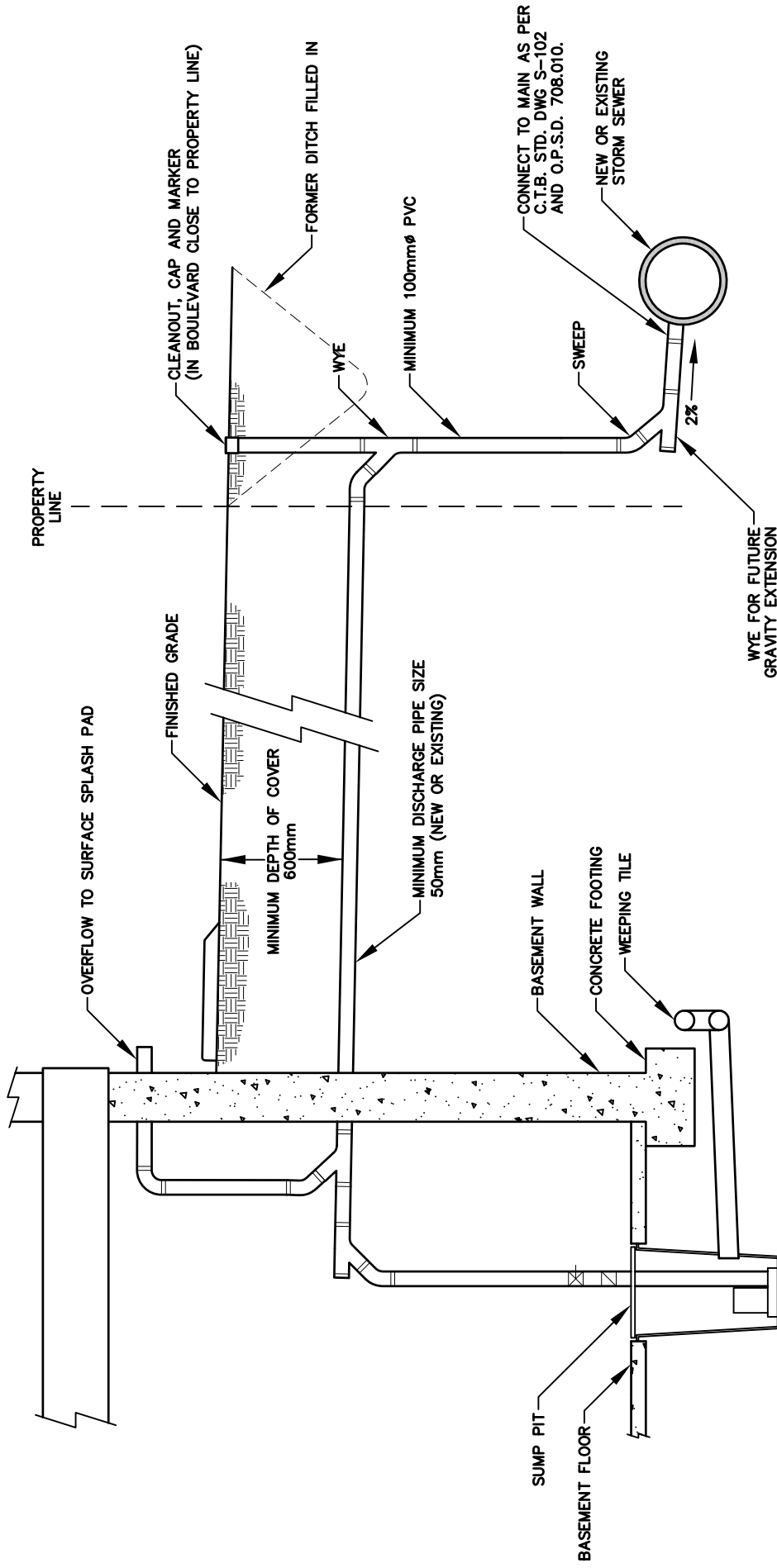
SCALE N. T. S.

Z: \ENG\Standard Drawings\Std Dwgs\S-103-2.dwg

DWG. NO.  
**S-103-2**

MANAGER, ENGINEERING DIVISION  
*J. Mauro*





# **NOTES:**

1. PRIVATE PROPERTY DISCHARGE PIPE TO BE EITHER INSULATED TO OBC 7354.(1) OR ELECTRIC HEAT TRACED TO PROVIDE PROPER FROST PROTECTION.
2. ELECTRICAL INSTALLATION ARE GOVERNED BY THE ELECTRICAL SAFETY AUTHORITY AND ALL PRODUCTS MUST BE TO THE PROPER STANDARDS AND INSTALLED ACCORDING TO MANUFACTURERS SPECIFICATIONS.
3. THIS DETAIL MAY BE UTILIZED AS A RETROFIT IN NEW STORM SEWER AREAS WHERE DISCHARGE TO EXISTING MUNICIPAL DITCHES IS NO LONGER FEASIBLE AND/OR GROUND CONDITIONS NOT CONDUCTIVE TO DRY PIT INSTALLATIONS.

ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

CITY OF  
**Thunder Bay**  
*Superior by Nature*

**ENGINEERING  
STANDARDS**

TITLE  
**RETRO FIT EXISTING STORM CONNECTION  
TO NEW OR EXISTING STORM SEWER**

DWN. S.G. DATE JAN. 2018

REVISD: N. T. S.

SCALE N. T. S.

Z:\ENG\Standard Drawings\Std Dwg\S-103-3.dwg

DWG. NO. S-103-3  
MANAGER, ENGINEERING DIVISION



CONCRETE CURB TYPE SIDEWALK  
(SEE STANDARD DWGS. R-121 AND R-123)

CATCH BASIN FRAME  
AND GRATE

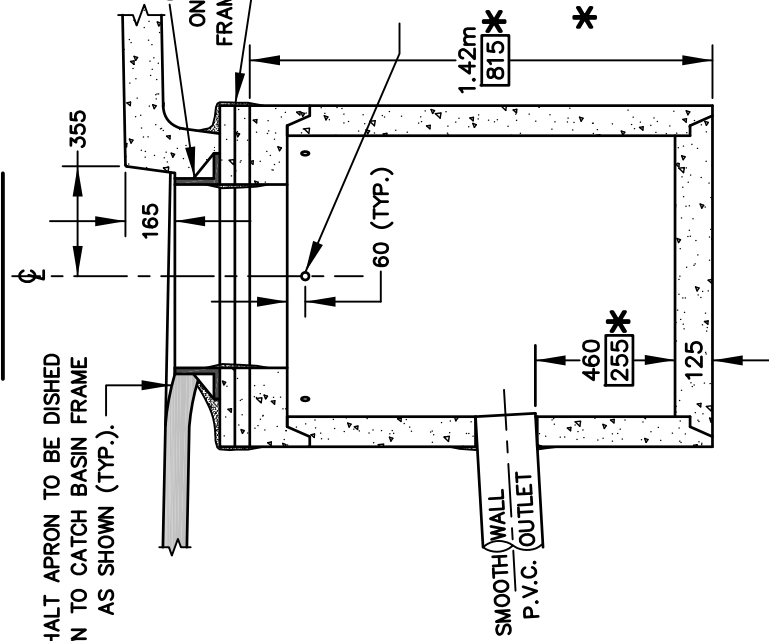
WEEP HOLES (TYP.)

### NOTES:

- ALL CATCH BASINS ARE TO BE BACKFILLED WITH GRANULAR 'B', 300 mm (MIN.) FROM BARREL
- PLACE PRECAST ADJUSTMENT UNITS ON BED OF MORTAR AND APPLY MASTIC AS PER SPECIFICATIONS
- REINFORCED STEEL TO BE INSTALLED SIMILAR TO DETAIL 'C', STANDARD DRAWING NO. S-109, EXCEPT 15M BARS X 6 m LONG ARE NOT TO BE INCLUDED IN EITHER DETAIL 'H' OR DETAIL 'J'

## DETAIL 'H'

ASPHALT APRON TO BE DISHED DOWN TO CATCH BASIN FRAME AS SHOWN (TYP.).



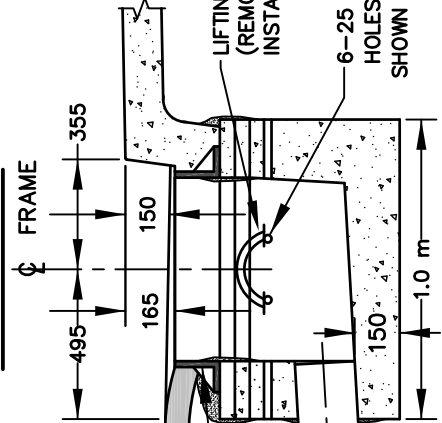
## SECTION A-A

THIS CATCH BASIN TO BE CONSTRUCTED SIMILAR TO DETAIL 'A',  
STANDARD DWG. NO. S-107 EXCEPT AS SHOWN HERE.

CONCRETE CURB TYPE SIDEWALK  
(SEE STANDARD DWG No.'s R-121 AND R-123)

LIFTING RINGS  
(REMOVED AFTER INSTALLATION)  
CATCH BASIN FRAME  
AND GRATE

## DETAIL 'J'



## SECTION B-B

THIS CATCH BASIN TO BE CONSTRUCTED SIMILAR TO DETAIL 'C',  
STANDARD DWG. NO. S-109 EXCEPT AS SHOWN HERE.  
ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

\* SHALLOW TYPE CATCH BASIN

CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE <b>CATCH BASINS (FOR CURB TYPE SIDEWALK INSTALLATIONS)</b>			
DWN. L.B.	DATE	MAR./77	
REVISED:	JAN. 2015		
SCALE	N.T.S.		
DWG. NO.		S-105	
MANAGER, ENGINEERING DIVISION			
Z:\ENG\Standard Drawings\Std Dwg\S-105.dwg			



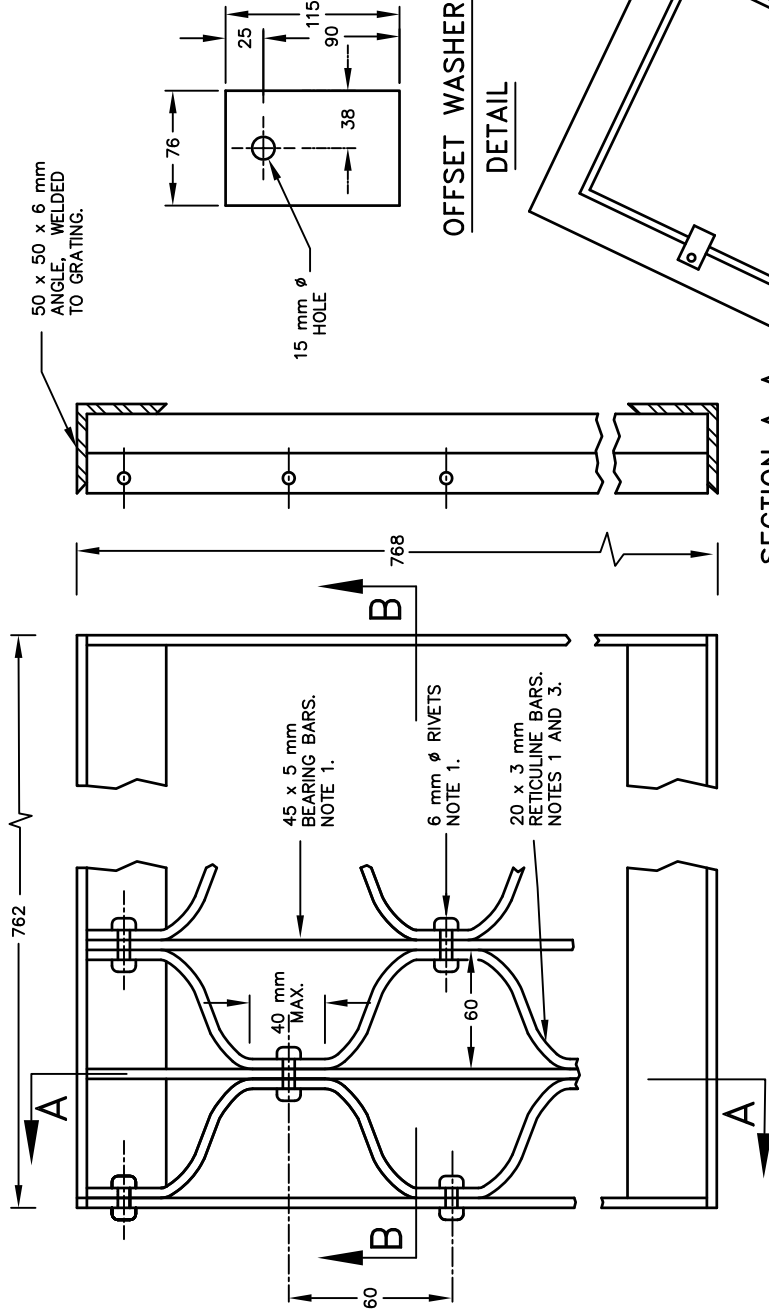
[illegible]

- # SECTION A-A

SLOPE OF GRATING	DIMENSIONS	
	A	B
2:1	680	45
3:1	640	65
4:1	630	70

		ENGINEERING STANDARDS	
TITLE			
CATCH BASIN WITH SLOPED TOP (FOR DITCH INSTALLATION)			
DWN.	HBW	DATE	NOV. 12/85
REVISED:		JAN. 2018	
SCALE		N. T. S.	
		MANAGER, ENGINEERING DIVISION	
		DWG. NO.	
		S-106-1	

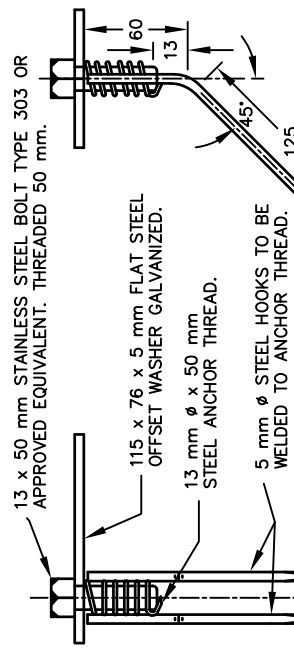
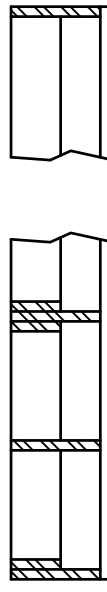




PLAN OF GRATE

SECTION A-A

SECTION B-B



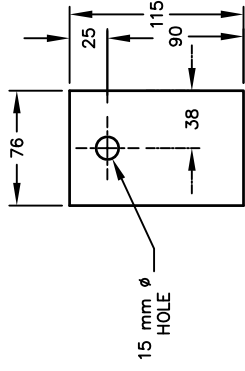
FRONT VIEW

SIDE VIEW

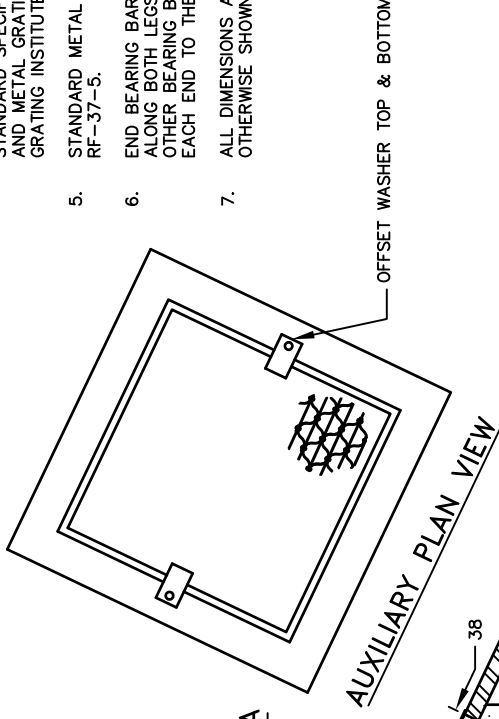
FASTENER DETAIL

NOTE 2

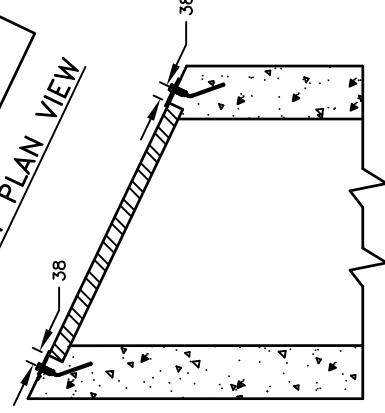
50 x 50 x 6 mm  
ANGLE, WELDED  
TO GRATING.



OFFSET WASHER  
DETAIL



AUXILIARY PLAN VIEW




DITCH INLET CROSS-SECTION

## NOTES

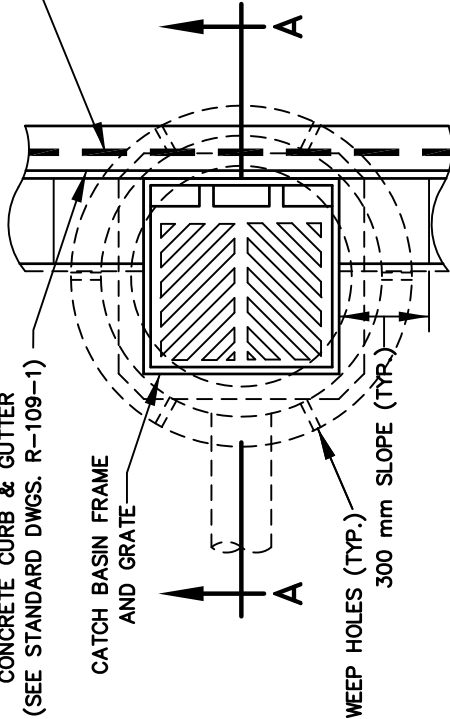
1. MATERIALS:
  - a) BEARING BARS—WELDING QUALITY STEEL HAVING THE MINIMUM TENSILE STRENGTH OF SAE-1015.
  - b) RETICULATE BARS—WELDING QUALITY STEEL HAVING THE MINIMUM TENSILE STRENGTH OF SAE-1010.
  - c) RIVETS FLAT HEAD TO SAE-1015.
2. AFTER MANUFACTURE, THE GRATE AND ASSEMBLY (EXCEPT BOLT) SHALL BE HOT-DIPPED GALVANISED IN ACCORDANCE WITH CSA STANDARD G164. ONLY THE SCREW IS TO RECEIVE A LIBERAL COATING OF WHITE NON-STAINING GREASE.
3. RETICULATE BARS MAY BE CRIMPED OR STRAIGHT, MAX. LENGTH OF THE RETICULATE BAR PARALLEL TO THE BEARING BAR IS 40 mm AT EACH RIVET.
4. TOLERANCE SHALL BE AS SHOWN IN THE STANDARD SPECIFICATION FOR METAL GRATING AND METAL GRATING THREADS OF THE METAL GRATING INSTITUTE.
5. STANDARD METAL GRATING INSTITUTE MARKING: RF-37-5.
6. END BEARING BARS TO BE WELDED TO ANGLE BAR ALONG BOTH LEGS WITH A 5 mm FILLET WELD. OTHER BEARING BARS TO BE SPOT WELDED ON EACH END TO THE ANGLE BAR.
7. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.

PARTIALLY COPIED FROM O.P.S.D.—403.01

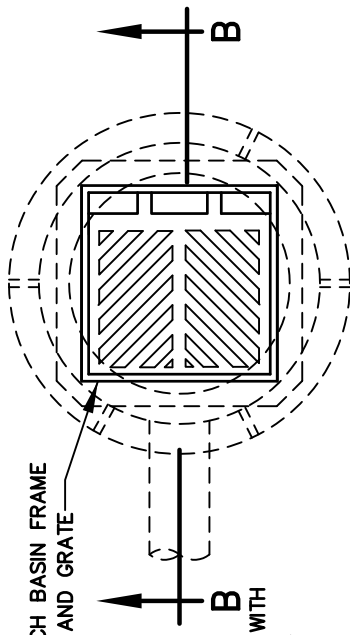
CITY OF <i>Thunder Bay</i> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE GRATE FOR CATCH BASIN WITH SLOPED TOP			
DWN.	HBW	DATE NOV. 4/85	 CITY ENGINEER
REVISED:		04/04	
SCALE		N. T. S.	
PATH		E:\ENG\Std Dwg\S-106-2.dwg	
		DWG. NO. S-106-2	



CONCRETE CURB & GUTTER  
(SEE STANDARD DWGS. R-109-1)



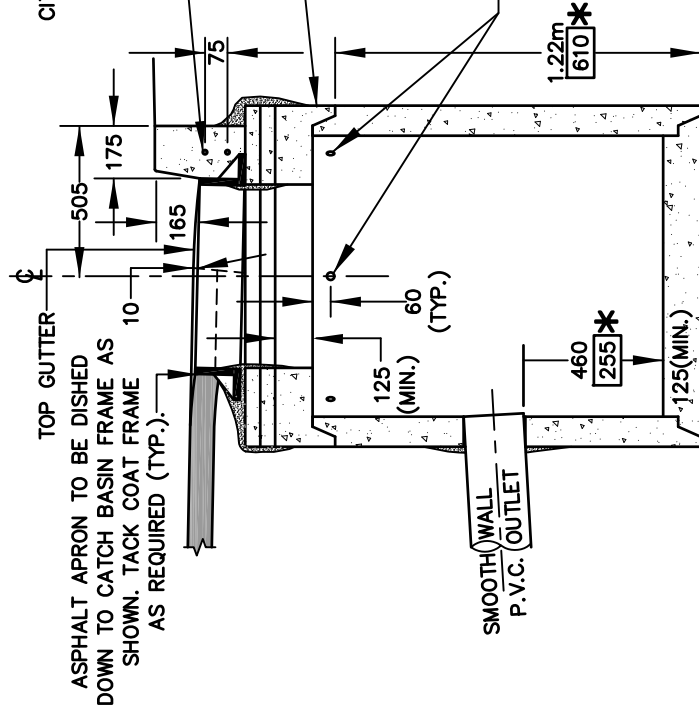
2 - 15 mm BARS, 6 m LONG,  
PLACED AS SHOWN (CENTERED  
ON CATCH BASIN)



### NOTES:

- ALL CATCH BASINS ARE TO BE BACK FILLED WITH GRANULAR 'B', 300 mm (MIN.) FROM BARREL.
- PLACE PRECAST ADJUSTMENT UNITS ON BED OF MORTAR AND APPLY MASTIC AS PER MANUFACTURER'S SPECIFICATIONS.
- SLOPE GRATE WITH HINGE ON LOW SIDE TO PREVENT BLOCKAGE. MIN SLOPE 50 mm. DOES NOT APPLY TO BIRDCAGE GRATE (STND FRAME AND GRATE ONLY).

### DETAIL 'A'



CATCH BASIN FRAME AND GRATE AS SHOWN ON  
CITY OF THUNDER BAY DWG. NO. 13-0569 B (TYP.).

PRECAST ADJUSTMENT UNITS (100  
mm MIN. TO A MAX. OF 300 mm),  
MORTAR AROUND & BETWEEN  
ADJUSTMENT UNITS AS REQUIRED.

2 - 15 mm BARS, 6 m LONG, PLACED AS SHOWN  
(CENTERED ON CATCH BASIN)

900 mm I.D. x 1.22 m HIGH PRECAST CATCH  
BASIN BARREL COMPLETE WITH PRECAST BASE,  
MANUFACTURED TO LATEST A.S.T.M. SPEC. C76  
(CLASS II, WALL B). OUTLET PIPE HOLE TO BE AS  
SHOWN (SEE CITY OF THUNDER BAY DWG. NO.  
73-6992 B). INLET PIPE HOLES TO BE PROVIDED  
IN THE FIELD. SHALLOW BARREL IS 610 mm HIGH.

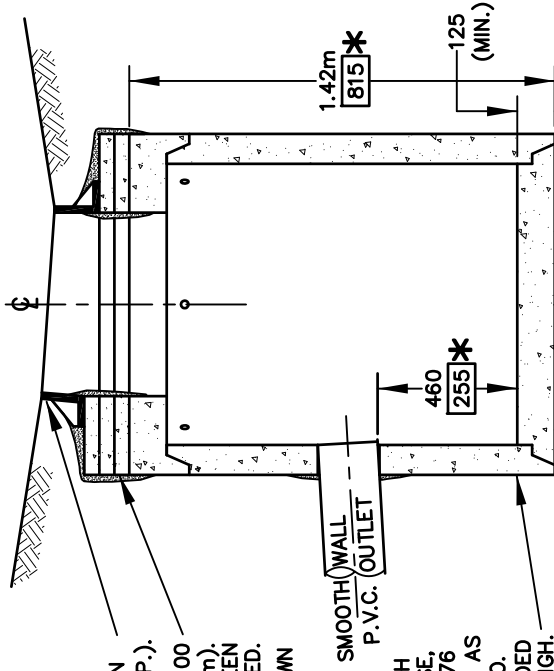
6-25 mm  $\phi$  WEEP HOLES EQUALLY  
SPACED AROUND BARREL COVERED WITH  
LAYER OF NON WOVEN GEOTEXTILE (TYP.).  
IF THE INVERT OF THE CATCH BASIN LEAD  
IS AT OR ABOVE THE ELEVATION OF THE  
WEEP HOLES, THE WEEP HOLES SHALL BE  
MORTARED(PLUGGED) AND NO GEOTEXTILE  
IS REQUIRED

### SECTION A-A

CATCH BASIN INSTALLED IN CONCRETE GUTTER  
NOTE: WHEN INSTALLING MID BLOCK ON FOUR LANE ARTERIAL ROAD  
USE TYPICAL CONSTRUCTION OF CURB AND GUTTER AROUND A  
CATCH BASIN, CITY OF THUNDER BAY STANDARD DWG. R-115

\* SHALLOW TYPE CATCH BASIN

### DETAIL 'B'



### SECTION B-B

CATCH BASIN INSTALLED IN DITCH  
ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

CITY OF  
**Thunder Bay**  
Superior by Nature  
ENGINEERING  
STANDARDS

TITLE

CATCH BASIN  
(PRECAST BARREL TYPE)

DWN.	M.D.	DATE	OCT. /73
REVISED:	JAN. 2015	DWG. NO.	
SCALE	N. T. S.		
Z:\ENG\Standard Drawings\Std Dwg\S-107.dwg			

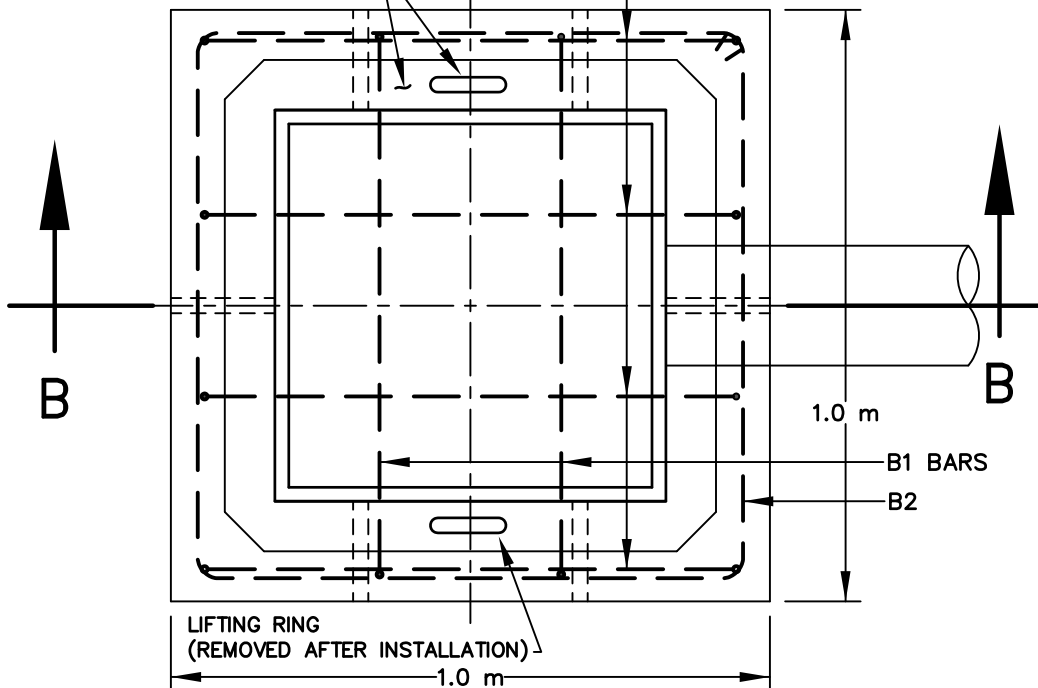
*Ed. Hume*  
MANAGER, ENGINEERING DIVISION

S-107



LIFTING RING  
(REMOVED AFTER INSTALLATION)  
CATCH BASIN FRAME AND GRATE

B1 BARS 10M @ 285 O.C.



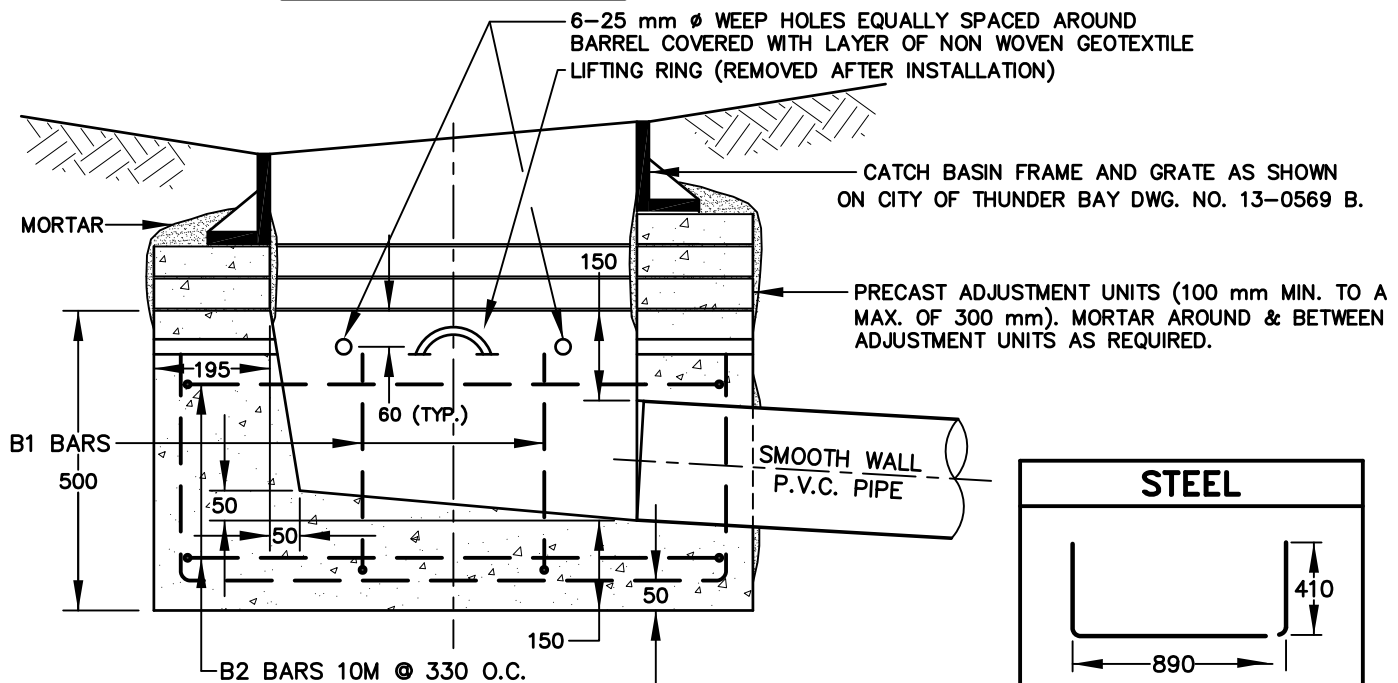
LIFTING RING  
(REMOVED AFTER INSTALLATION)

1.0 m

1.0 m

B1 BARS  
B2

## DETAIL 'D'



## SECTION B-B

### NOTES:

1. STEEL TO BE PLACED AS SHOWN, USE 32 MPa CONCRETE.
2. BOTTOM OF INLET TO BE SLOPED TOWARDS OUTLET PIPE.
3. CATCH BASIN INLET CAN BE PRECAST OR POURED IN PLACE.
4. ALL CATCH BASINS TO BE BACK FILLED WITH GRANULAR 'B' TO 300 mm FROM BARREL.
5. PLACE PRECAST ADJUSTMENT UNITS ON BED OF MORTAR AND APPLY MASTIC AS PER MANUFACTURER'S SPECIFICATIONS.
6. SLOPE GRATE WITH HINGE ON LOW SIDE TO PREVENT BLOCKAGE. MIN SLOPE 50 mm. DOES NOT APPLY TO BIRDCAGE GRATE (STND FRAME AND GRATE ONLY).

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

CITY OF  
**Thunder Bay**  
Superior by Nature

ENGINEERING  
STANDARDS

TITLE

CATCH BASIN INLET  
(FOR DITCH INSTALLATION)

DWN. L.B. DATE OCT. 11/73

REVISD: JAN. 2018

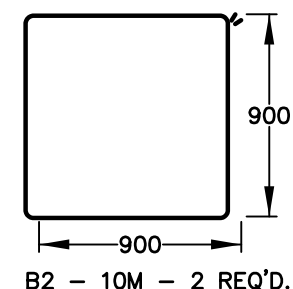
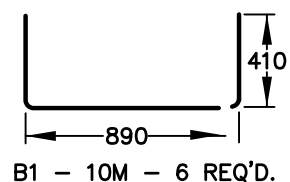
SCALE N. T. S.

Z: ENG\Standard Drawings\Std Dwgs\S-108.dwg

MANAGER, ENGINEERING DIVISION  
DWG. NO.

**S-108**

### STEEL



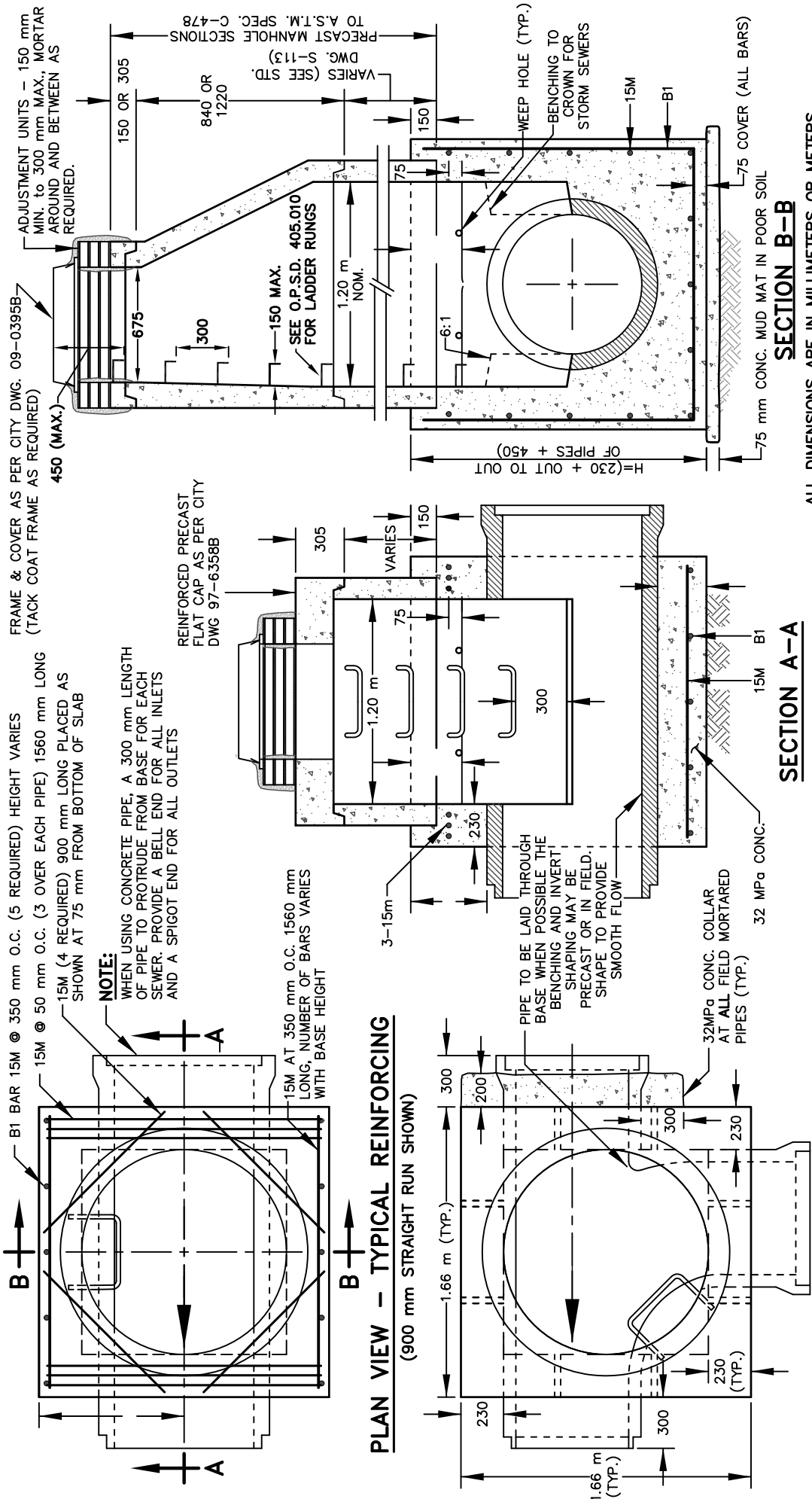










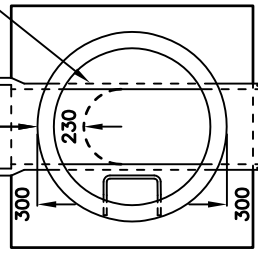


CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>				ENGINEERING STANDARDS	
TITLE				MANHOLE FOR 900 mm DIA. PIPE AND SMALLER MAY HAVE CAST-IN-PLACE OR PRECAST BASE	
DWN.	D.R.	DATE	MANAGER, ENGINEERING DIVISION		
REVISED: JAN. 2018		SEPT./81	DWG. NO.		
SCALE		N. T. S.			
Z:\ENG\Standard Drawings\Std Dwgs\S-112.dwg					

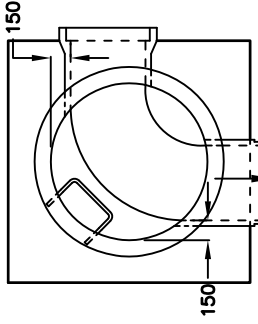
**S-112**



PIPE TO BE LAID THROUGH ALL M.H. BASES WHEN POSSIBLE FOR DEAD END M.H.

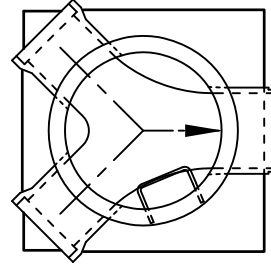


**STRAIGHT RUN**



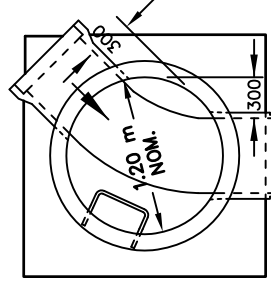
**90° BEND**

(INLET MAX. 375 mm & OUTLET MAX. 525 mm, OR BOTH)



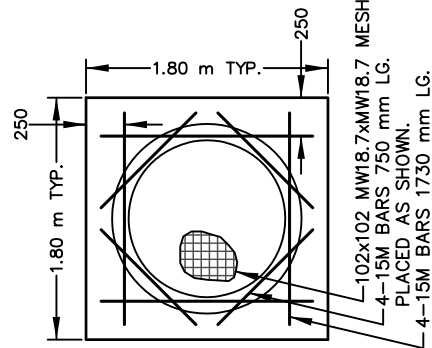
**'Y' CONNECTION**

(INLET MAX. 375 mm & OUTLET MAX. 525 mm)

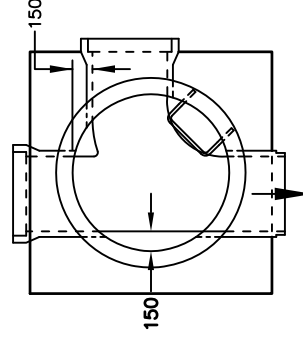


**45° BEND**

(MAX. 600 mm)

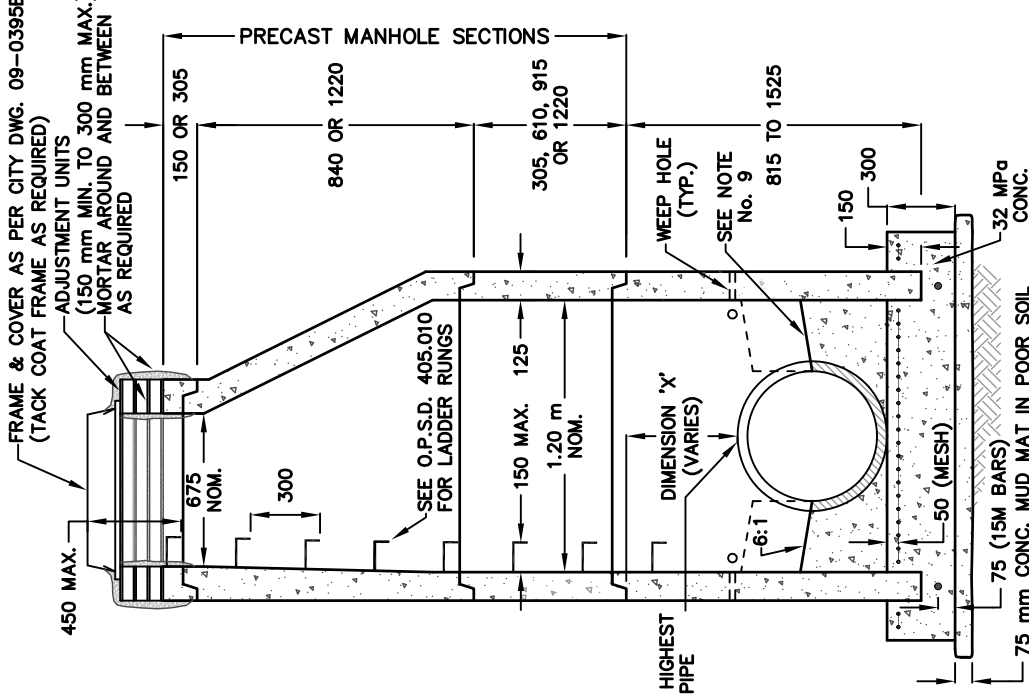


**BASE REIN. STEEL**



**JUNCTION**

(NO PIPE OVER 450 mm)



**TYPICAL SECTION**

**NOTES:**

1. When using concrete pipe, a 300 mm length of pipe to protrude from precast base for each sewer. Provide a bell end for all inlets and spigot end for all outlets.
2. When using asbestos cement pipe, a flexible coupling must be provided for each inlet or outlet at 300 mm from outside wall or precast base.
3. When using P.V.C. pipe, flexible rubber connector boots must be cast or cored into the precast base.
4. Provide approved watertight gaskets at precast section joints and mortar all joints and lifting holes with a 1:3 mortar mix inside and out.
5. All manholes to have frost strapping in accordance with opad 701.100.
6. All manholes to be backfilled with granular 'B' to 300 mm from barrel.
7. Storm manholes to have 8-25 mm weep holes equally spaced at top of benching.
8. Invert shaping and benching may be precast or in field. All invert shaping to provide smooth flow.
9. For storm sewer, benching to crown unless otherwise specified.
10. Precast manhole sections to A.S.T.M. specifications C-478.
11. First rung to be 450 mm (max.) below top of frame; last rung to be 300 mm above benching.
12. For junction chamber, the invert drop and pipe angle shall be as per drawings.

ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

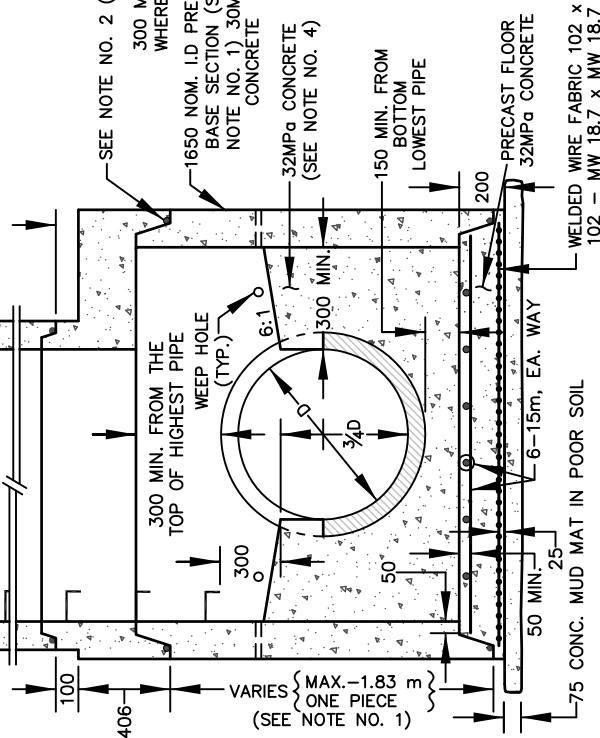
<div>CITY OF <i>Thunder Bay</i> <small>Superior by Nature</small></div>		ENGINEERING STANDARDS	
TITLE PRECAST MANHOLE FOR 750 mm DIA. PIPE AND SMALLER			
DWN.	D.R.	DATE SEPT./81	<div> MANAGER, ENGINEERING DIVISION</div>
REVISED: JAN. 2018			
SCALE N. T. S.		DWG. NO. S-113	
Z:\ENG\Standard Drawings\Std Dwg\S-113.dwg			



FRAME & COVER AS PER CITY DWG. 09-0395B  
(TACK COAT FRAME AS REQUIRED)  
ADJUSTMENT UNITS - 150 mm  
MIN. TO 300 mm MAX.  
MORTAR AROUND AND  
BETWEEN AS REQUIRED

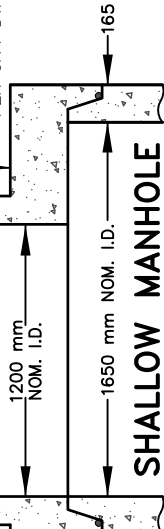
PRECAST MANHOLE SECTIONS  
TO A.S.T.M. SPEC. C-478  
(HEIGHT VARIES - SEE STD  
S-113)

SEE OPD 405.010  
FOR ALUMINUM  
LADDER RUNGS

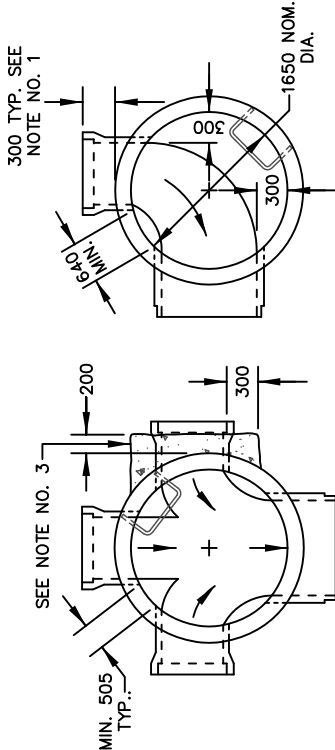


### TYPICAL SECTION

1200 NOM. I.D. REINFORCED PRECAST FLAT CAP, AS PER CITY DWG. 67-6358 B  
1650 NOM. I.D. TO 1200 NOM. I.D. REINFORCED PRECAST REDUCING CAP (OR 1650 NOM. I.D. REINFORCED PRECAST FLAT CAP) - BOTH AS PER CITY DWG. 86-8621 B

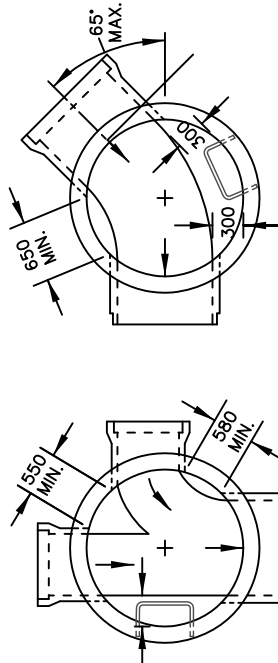


### SHALLOW MANHOLE



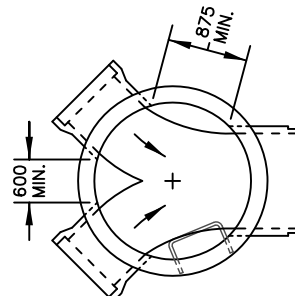
### CROSS CONNECTION

(INLET MAX. 2-450 mm & 1-600 mm OUTLET MAX. 900 mm)



### TEE CONNECTION

(INLET MAX. 2-600 mm OUTLET MAX. 900 mm)

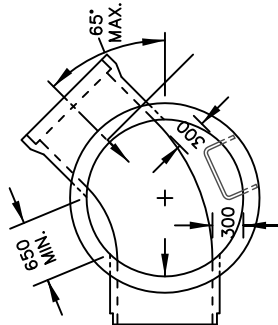


### Y' CONNECTION

(INLET MAX. 600 mm & OUTLET MAX. 900 mm)

### 65°-90° BEND

(INLET MAX. 600 mm & OUTLET MAX. 900 mm, OR BOTH 750 mm)



### STRAIGHT RUN TO 65° BEND

(MAX. 900 mm)

### NOTES:

- 1650 mm nominal precast base section (to latest A.S.T.M. Spec. C-478) Class III, Wall 'B', may come with or without pipes cast in place. When base section and pipes are precast together, a length of pipe is to protrude 300 mm from outside of base for each sewer, provide a groove end for all inlets and tongue end for all outlets. Where precast base section height exceeds 1.83 m, use two sections.
- Provide approved watertight gaskets on all precast section joints and mortar all joints and lifting holes with a 1:3 mortar mix, inside & out.
- Provide 32MPa concrete collar at all field mortared joints (typical).
- Invert shaping and benching may be precast or poured in field, provide smooth flow.
- For junction chamber, the invert drop and pipe angles shall be as shown on the construction drawings.
- When using P.V.C. pipe, flexible rubber connector boots must be cast or cored into the precast base.
- All manholes to have frost strapping in accordance with OPD 701.100.
- All manholes to be backfilled with granular 'B' to 300 mm from barrel.
- Storm manholes to have 8-25 mm weep holes equally spaced at top of benching.
- First rung to be 450 mm (max.) below top of frame; last rung to be 300 mm above benching.

ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

CITY OF  
**Thunder Bay**  
*Superior by Nature*

ENGINEERING  
STANDARDS

TITLE  
**PRECAST MANHOLE FOR 900 mm  
DIAMETER PIPE AND SMALLER**

DWN. D.R. DATE NOV./86

REvised: DEC. 2018

SCALE N. T. S.

Z:\ENG\Standard Drawings\Std Dwgs\S-114.dwg

MANAGER, ENGINEERING DIVISION  
DWG. NO.

**S-114**

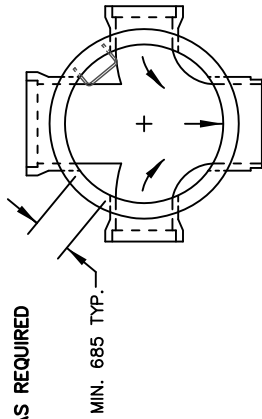


—FRAME & COVER AS PER CITY DWG. 09-0395B  
(TACK COAT FRAME AS REQUIRED)

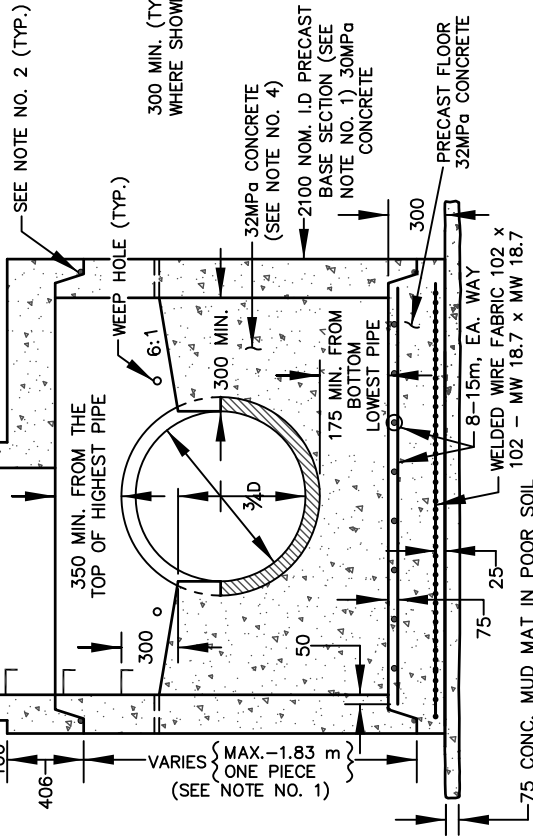
450 (MAX.)

ADJUSTMENT UNITS - 100 mm MIN. TO 300 mm MAX.

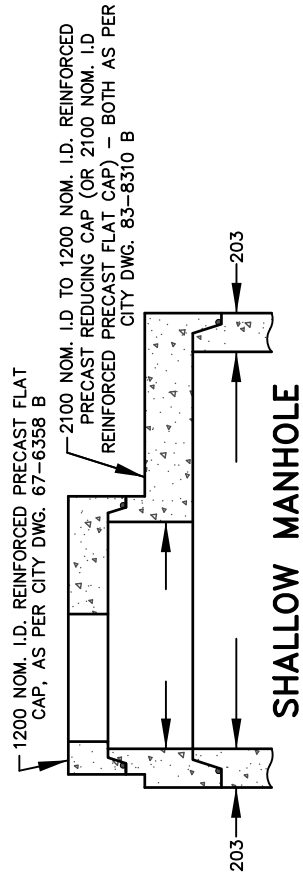
MORTAR AROUND AND BETWEEN AS REQUIRED



**CROSS CONNECTION**  
(MAX. 900 mm SS STRAIGHT RUN  
& MAX 600 mm CROSS)



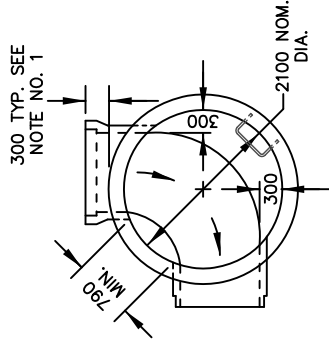
## TYPICAL SECTION



**'Y' CONNECTION**  
(INLET MAX. 750 mm &  
OUTLET MAX. 1200 mm)

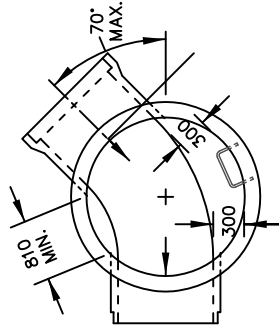
**NOTES:**

1. 2100 mm nominal precast base section (to latest A.S.T.M. Spec. C-478) may come with or without pipes cast in place. When base section and pipes are precast together, a length of pipe is to protrude 300 mm from outside of base for each sewer, provide a groove end for all inlets and tongue end for all outlets. Where precast base section height exceeds 1.83 m, use two sections.
2. Provide approved watertight gaskets on all precast section joints and mortar all joints and lifting holes with a 1:3 mortar mix, inside & out.
3. Provide 32MPa concrete collar at all field mortared joints (typical).
4. Invert shaping and benching may be precast or poured in field, provide smooth flow.
5. For junction chamber, the invert drop and pipe angles shall be as shown on the construction drawings.
6. When using P.V.C. pipe, flexible rubber connector boots must be cast or cored into the precast base.
7. All manholes to have frost strapping in accordance with OPSD 701.100.
8. All manholes to be backfilled with granular 'B' to 300 mm from barrel.
9. Storm manholes to have 8-25 mm weep holes equally spaced at top of benching.
10. First rung to be 450 mm (max.) below top of frame; last rung to be 300 mm above benching.

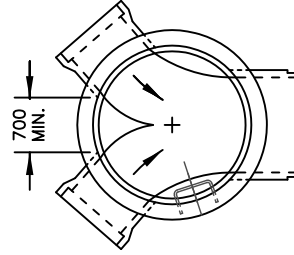


## 70°-90° BEND

**(INLET MAX. 900 mm & OUTLET MAX.  
1200 mm, OR BOTH 1050 mm)**



**STRAIGHT RUN**  
**TO 70° BEND**  
(MAX. 1200 mm)



**ALL DIMENSIONS ARE IN MILLIMETERS OR METERS**

 CITY OF  
**Thunder Bay**  
Superior by Nature

**TITLE**  
**PRECAST MANHOLE FOR 1200 mm**  
**DIAMETER PIPE AND SMALLER**

DWN.	DATE
D.R.	DEC./86

REVISÉ: DEC. 2018

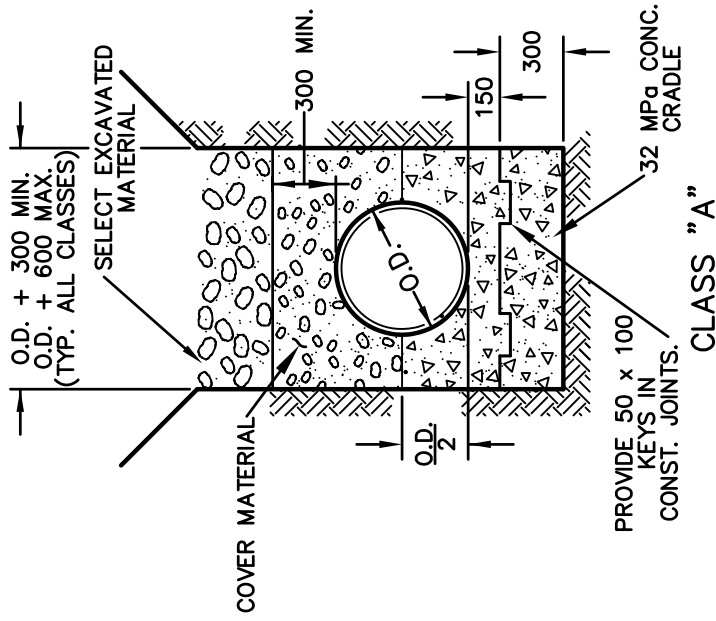
SCALE N. T. S.

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MANAGER, ENGINEERING DIVISION

NO. S-115





CLASS "A"

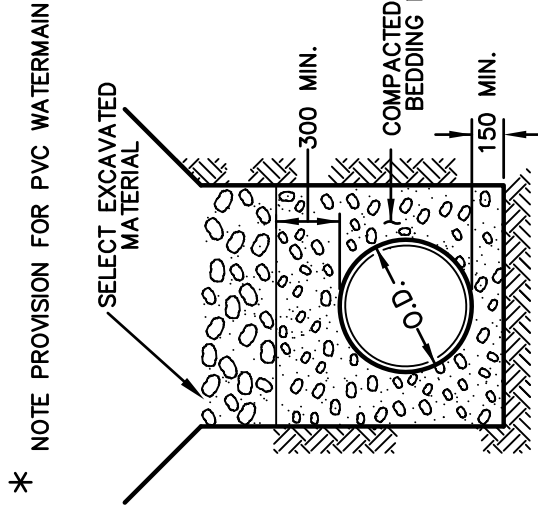
## GENERAL REQUIREMENTS

Class "A" Bedding – To be used where bottom of trench is unstable.

Class "B" Bedding – To be used for all PVC watermain.

\* A provision for crushed stone bedding will be considered in field situations as directed by the City Engineer.

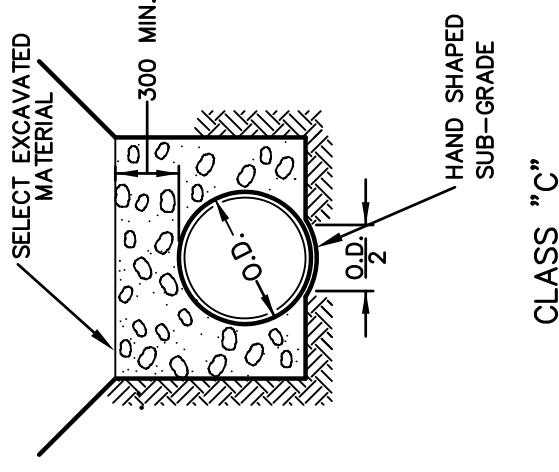
Class "C" Bedding – To be used for all ductile iron and reinforced concrete watermain.



CLASS "B"


## NOTES:

- 1) See standard drawings No. W-122 & W-123 for bedding when water and sanitary sewer are installed in common trench.

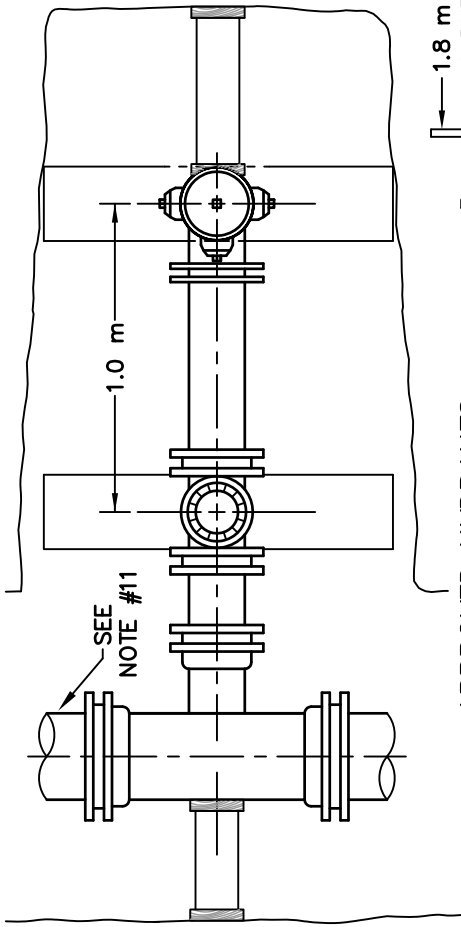


CLASS "C"

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

 CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE <b>BEDDING FOR WATERMAINS</b>			
DRAWN	D. R.	DATE	JULY 1981
REVISED:		JAN. 2018	
SCALE		N. T. S.	
Z:\ENG\Standard Drawings\Std Dwgs\W-100.dwg		MANAGER, ENGINEERING DIVISION	
		DWG. NO.	
		<b>W-100</b>	





## NOTES:

- 1) **HYDRANT SPACING AND COVERAGE**  
Residential Areas – 15,000 m per hydrant or approximately 150 m spacing.  
Mercantile Areas – 10,000 m per hydrant or approximately 90 m spacing.
- 2) Where thrust blocks are not against undisturbed rock, hydrants shall be tie rodded in accordance with W-111 and W-112.
- 3) Valve and hydrant to be set plumb and braced with backfilling.
- 4) All underground exterior surfaces to be painted with tar pitch varnish.
- 5) Hydrant to be installed 0.7 m off street line unless otherwise stated.
- 6) All hydrants barrels shall be wrapped with 50 mm thick DOW HI – 35 Styrofoam held in place by steel bands, to satisfaction of City Engineer.
- 7) For Bonding and Cathodic protection see W-126.
- 8) Like materials to be used for hydrant lead piping.
- 9) Hydrant ports to be parallel to street with pumper port facing the street.
- 10) Any hydrant extensions shall be installed at the hydrant boot.
- 11) Like materials to be used for watermain tie in. Where existing watermain is metallic use ductile iron pipe for the tie in.

## APPROVED HYDRANTS

- Century Model Hydrant manufactured by Canada Valve Ltd., Kitchener, Ont.
- Model M67 Hydrant as manufactured by McAvity Division of Crane Canada

1.8 m LG. P.E. PIPE HYD. MARKER (INSTALL ON OPP. SIDE OF PUMPER PORT)

130 ABOVE GROUND

SET TO FINISHED GRADE

150 GATE VALVE (SEE STD. W-103)

Mechanical Joint Type

PLUG HYDRANT DRAIN

20 mm CRUSHED STONE OR GRANULAR



150 MIN.

50 x 200 x 1.0 LG. TREATED WOOD SUPPORT (TREAT CUT ENDS TYP.)

MECHANICAL JOINT HYDRANT BOOT

TREATED WOOD THRUST BLOCKING (TREAT CUT ENDS TYP.)

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

 CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE <b>INSTALLATION OF FIRE HYDRANT WITH GATE VALVE</b>			
DWN.	M.D.	DATE	 MANAGER ENGINEERING DIVISION
REVISED:	JAN. 2015		
SCALE	N. T. S.		
DWG. NO.			W-101
Z: \ENG\Standard Drawings\Std Dwg\W-101.dwg			



VALVE BOX COVER, BIBBY FOUNDRY LTD.  
NO. VB 825 OR EQUAL

FINISHED GRADE OR  
SURFACE OF PAVEMENT

RUN TRACE/THAW CABLE UP  
INSIDE OF VALVE BOX  
TO SURFACE

VALVE BOX UPPER, BIBBY  
FOUNDRY LTD. NO. VB 650  
OR EQUAL

VALVE BOX EXTENSION,  
BIBBY FOUNDRY LTD. NO.  
VB 755 (450 mm); NO. VB 750  
(300 mm); OR EQUAL

BACKFILL WITH GRAVEL OR COARSE  
SAND FOR 300 mm AROUND VALVE BOX

VALVE EXTENSION STEM  
(THUNDER BAY SOUTH AS NEEDED)  
INSTALL TO 500 mm  
BELOW FINISHED GRADE

VALVE BOX BASE, BIBBY FOUNDRY  
LTD. NO. VB 900, NO. 6 OR EQUAL  
(FOR VALVES UP TO 300 mm)

SUPPORT VALVE BOX ASSEMBLY WITH  
TIMBERS SO THAT NO WEIGHT IS  
EXERTED ON VALVE

WHEN INSTALLING ON EXISTING  
WATERMAINS USE LIKE PIPE  
MATERIAL. IF METALLIC USE  
DUCTILE IRON PIPE.

50 X 200 X 1.0 LG. TREATED  
WOOD SUPPORT. TREAT CUT ENDS (TYP.)

**NOTE:**

Valves Open LEFT - All Wards

COMPLETE ASSEMBLIES

ASS'Y NO.	'L' LENGTH IN METRES	
	NOMINAL	RANGE
VB 3000	1.52	1.22 - 1.68
VB 3100	1.83	1.52 - 1.95
VB 3200	2.13	2.08 - 2.23
VB 3300	2.44	2.13 - 2.44
VB 3400	2.74	2.59 - 2.90
VB 3500	3.05	2.90 - 3.20
VB 3600	3.35	3.20 - 3.50
VB 3700	3.66	3.50 - 3.81

ALL 133 mm SCREW VALVE BOXES

VALVE BOX TO BE ADEQUATELY  
BRACED WHILE BACKFILLING AND  
MUST REMAIN PLUMB

VALVE BOX LOWER, BIBBY FOUNDRY LTD.  
NO. VB 550 (600 mm) LONG OR  
NO. VB 555 (860 mm) LONG OR EQUAL

COMBINATION STONE DISC  
AND OPERATING NUT  
DUCTILE IRON TO A.S.T.M. A536  
GR 65-45-12

25 mm M.S. SQUARE  
STRUCTURAL STEEL TO CSA G40.21

PIN OR WELD

50 mm OPERATING SOCKET

A.W.W.A. C509 RESILIENT SEAT,  
MECH. JOINT OR PUSH-ON GATE  
VALVE WITH 'O' RING SEALS AND  
50 mm SQUARE OPERATING NUT.

SEE STD. DWG. W-116  
FOR CLAMP DETAILS

WATERMAIN

**NOTE:** - Valves on dead end mains or branches  
to be tie rodged back two lengths of  
pipe  
- Denso tape shall be applied to all  
non-stainless fittings.

ENGINEERING  
STANDARDS

CITY OF  
**Thunder Bay**  
*Superior by Nature*

TITLE

INSTALLATION OF  
GATE VALVE

REDRAWN  
S.G.

DATE  
Mar. / 97

REVISOR:  
JAN. 2018

SCALE  
N. T. S.

MANAGER, ENGINEERING DIVISION  
DWG. NO.

**W-103**

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED



# NOTES:

- 1) ALL WATER SERVICE CONNECTIONS ON PRIVATE PROPERTY SHALL BE INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF THE LATEST REVISIONS OF ONTARIO BUILDING CODE AS AMENDED, PART 7.
- 2) ALL WATER SERVICE CONNECTIONS SHALL BE INSTALLED IN CONTINUOUS LENGTHS BETWEEN THE CORPORATION STOP, CURB STOP, AND WATER METER WITHOUT THE USE OF COUPLERS UNLESS APPROVED BY THE CITY ENGINEER.
- 3) ALL BRASS FITTINGS SHALL BE NO LEAD TYPE.
- 4) WATER CONNECTION REPLACEMENTS SHALL ONLY USE FLARE TYPE BRASS CORPORATION/MAIN STOPS AND CURB STOPS. COMPRESSION TYPE COUPLERS MAY BE USED BUT WILL REQUIRE A JUMPER CONNECTION AS PER W-130. APPROVED COUPLERS INCLUDE: MUELLER A319 AND H15403, CAMBRIDGE 118NL AND FORD C22-NL, C44-Q-NL, C24(LEAD TO COPPER) AND C34(LEAD TO COPPER)
- 5) WATER CONNECTIONS IN NEW SUBDIVISIONS/DEVELOPMENT MAY USE COMPRESSION TYPE OR FLARE TYPE BRASS FITTINGS.

FOR 40 MM AND 50 MM USE: MUELLER NO. A728 WITH 300 MM ADJ. TELESCOPIC BOX AND MUELLER NO. A800 RIBBED COVER AND MUELLER STATIONARY ROD "OR" CANADA BRASS ECLIPSE PATTERN SERIES 161-1 AND MIN 300 MM ADJ. TELESCOPIC BOX AND SERIES 163 RIBBED COVER WITH BRONZE PENTAGON COVER PLUG AND STATIONARY ROD OF APPROPRIATE LENGTH.

ALL BUILDING SERVICES SHALL BE INSTALLED MIN. 2.15m AND MAX. 2.5m DEPTH

SEE STD. DWG. W-130 FOR THAW/TRACER CABLE INSTALLATION  
SEE STD. DWG. W-127 FOR CATHODIC PROTECTION  
SEE STD. DWG. W-104-2, 3, & 4 FOR CONNECTION SIZING

ALL DIMENSIONS ARE IN MILLIMETERS.

CITY OF  
**Thunder Bay**  
*Superior by Nature*

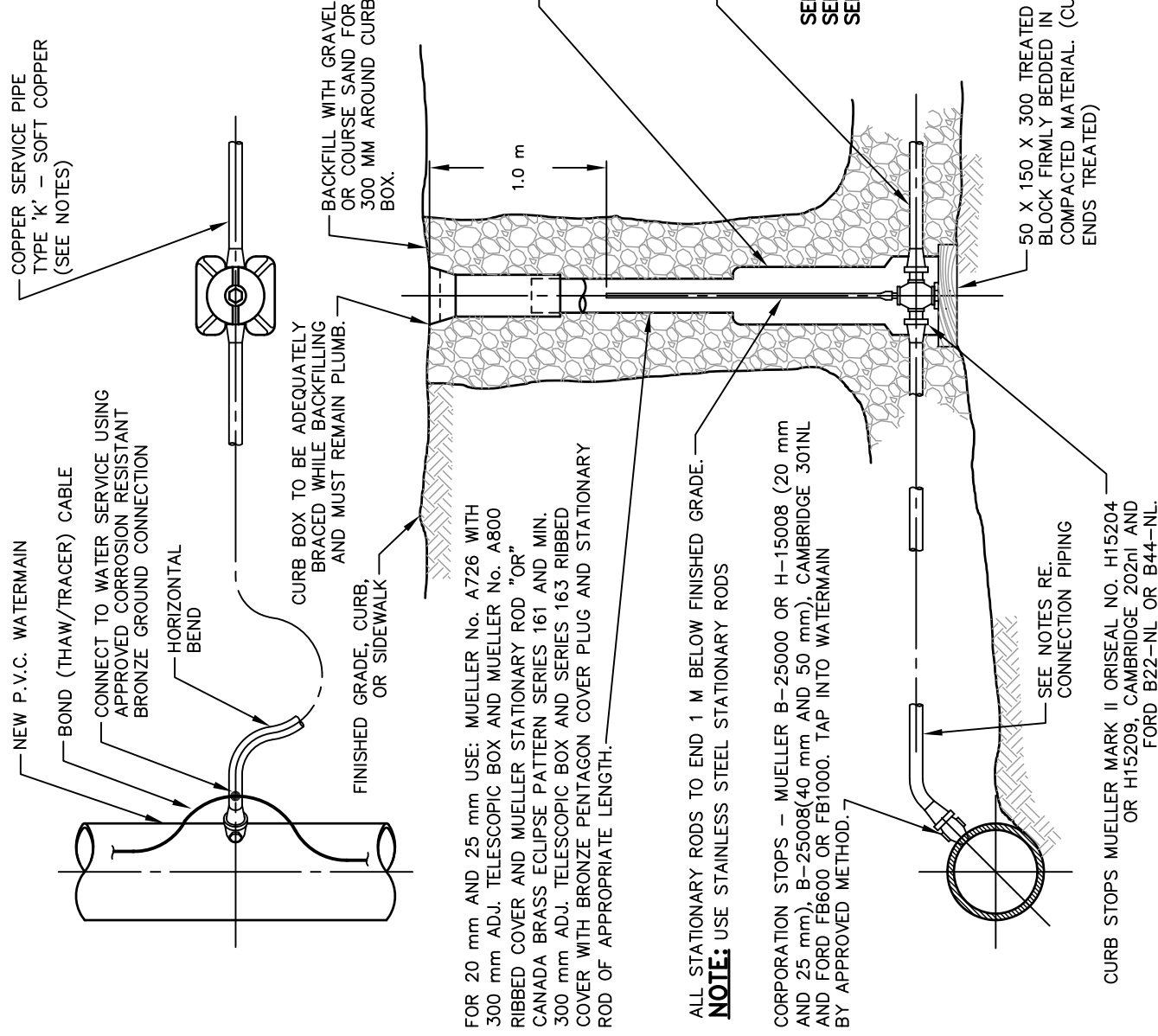
**ENGINEERING  
STANDARDS**

TITLE  
**WATER CONNECTION INSTALLATION  
& SIZING & THAW/TRACER CABLE  
INSTALLATION FOR P.V.C. WATERMAIN**

DRAWN	S.G.	DATE	JULY 1981
REVISED:	JAN. 2016		
SCALE	N. T. S.		
DWG. NO.			

**W-104-1**

Z:\ENG\STANDARD DRAWINGS\STD DWGS\W-104-1



FOR 20 mm AND 25 mm USE: MUELLER No. A726 WITH 300 mm ADJ. TELESCOPIC BOX AND MUELLER No. A800 RIBBED COVER AND MUELLER STATIONARY ROD "OR" CANADA BRASS ECLIPSE PATTERN SERIES 161 AND MIN. 300 mm ADJ. TELESCOPIC BOX AND SERIES 163 RIBBED COVER WITH BRONZE PENTAGON COVER PLUG AND STATIONARY ROD OF APPROPRIATE LENGTH.

ALL STATIONARY RODS TO END 1 M BELOW FINISHED GRADE.  
**NOTE:** USE STAINLESS STEEL STATIONARY RODS

CORPORATION STOPS - MUELLER B-25000 OR H-15008 (20 mm AND 25 mm), B-25008(40 mm AND 50 mm), CAMBRIDGE 301NL AND FORD FB600 OR FB1000. TAP INTO WATERMAIN BY APPROVED METHOD.



PLUMBING	FIXTURE	VALUE
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9
10	10	10
11	11	11
12	12	12
13	13	13
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96	96	96
97	97	97
98	98	98
99	99	99
100	100	100

(SIZING FOR OLDER EXISTING FIXTURES GREATER THAN LOW FLOW REQUIREMENTS)

## Bath tub

Dental Unit  
Dental Laboratory

- Lavatory**

- Wall or  
Trough  
Wash Sink (Each)  
Water Closet  
Dishwasher  
Washing Machine  
Hose Connections  
Hose 15 m (50')

**NOTE:**  
These plumbing fixture

## assessing existing

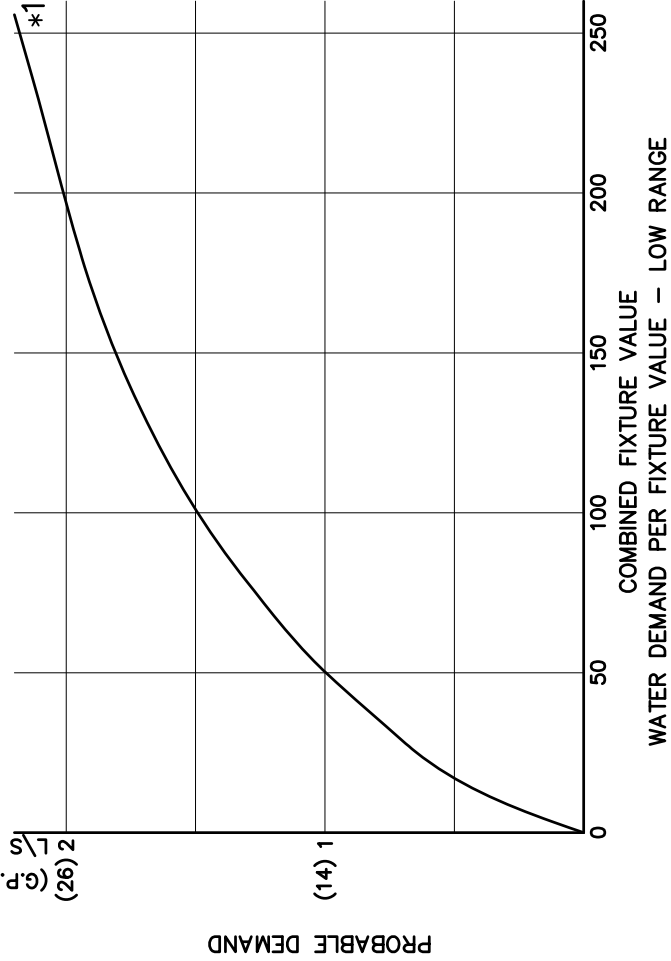
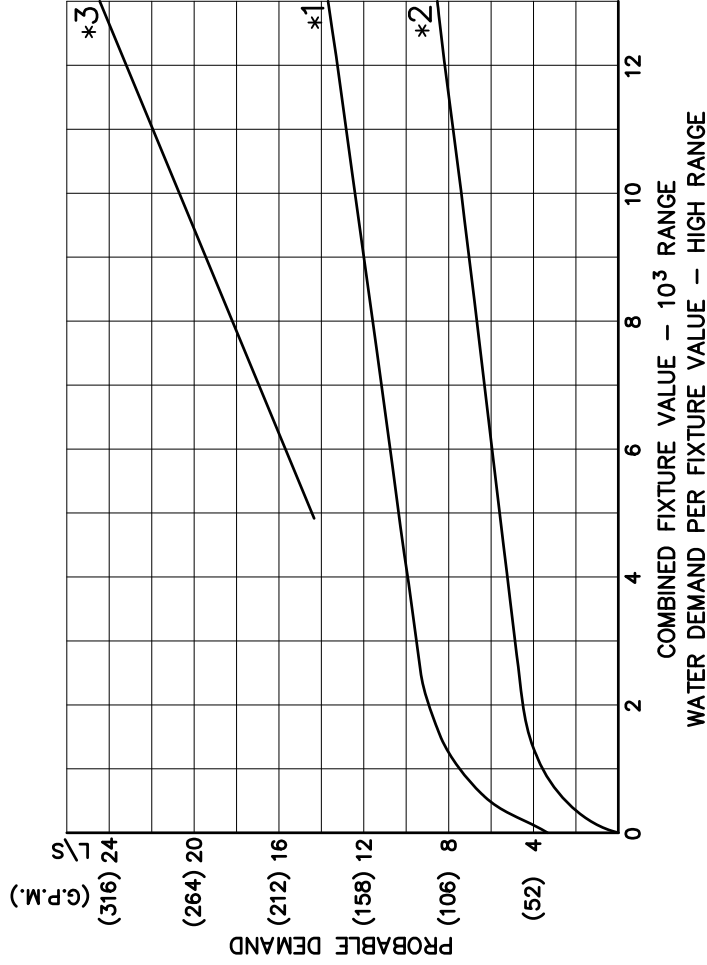
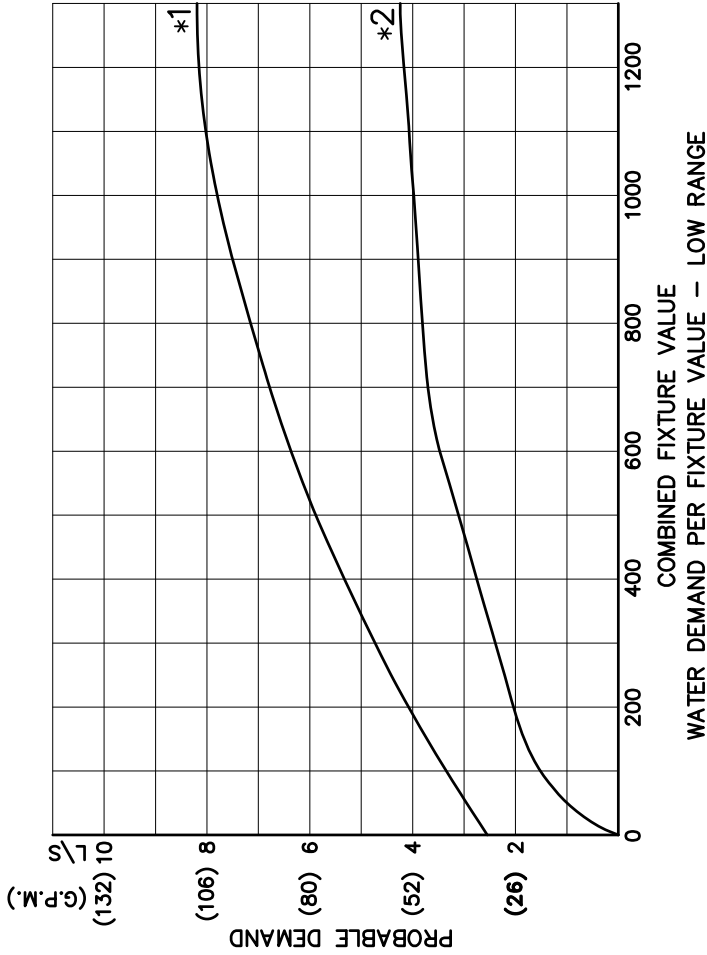
developments or for existing developments that are replacing their

# CLINICAL

ENGINEERING  
WARDS  
VICE  
ENGINEERING DIVISION

ENGINEERING DIVISION  
**04-2**





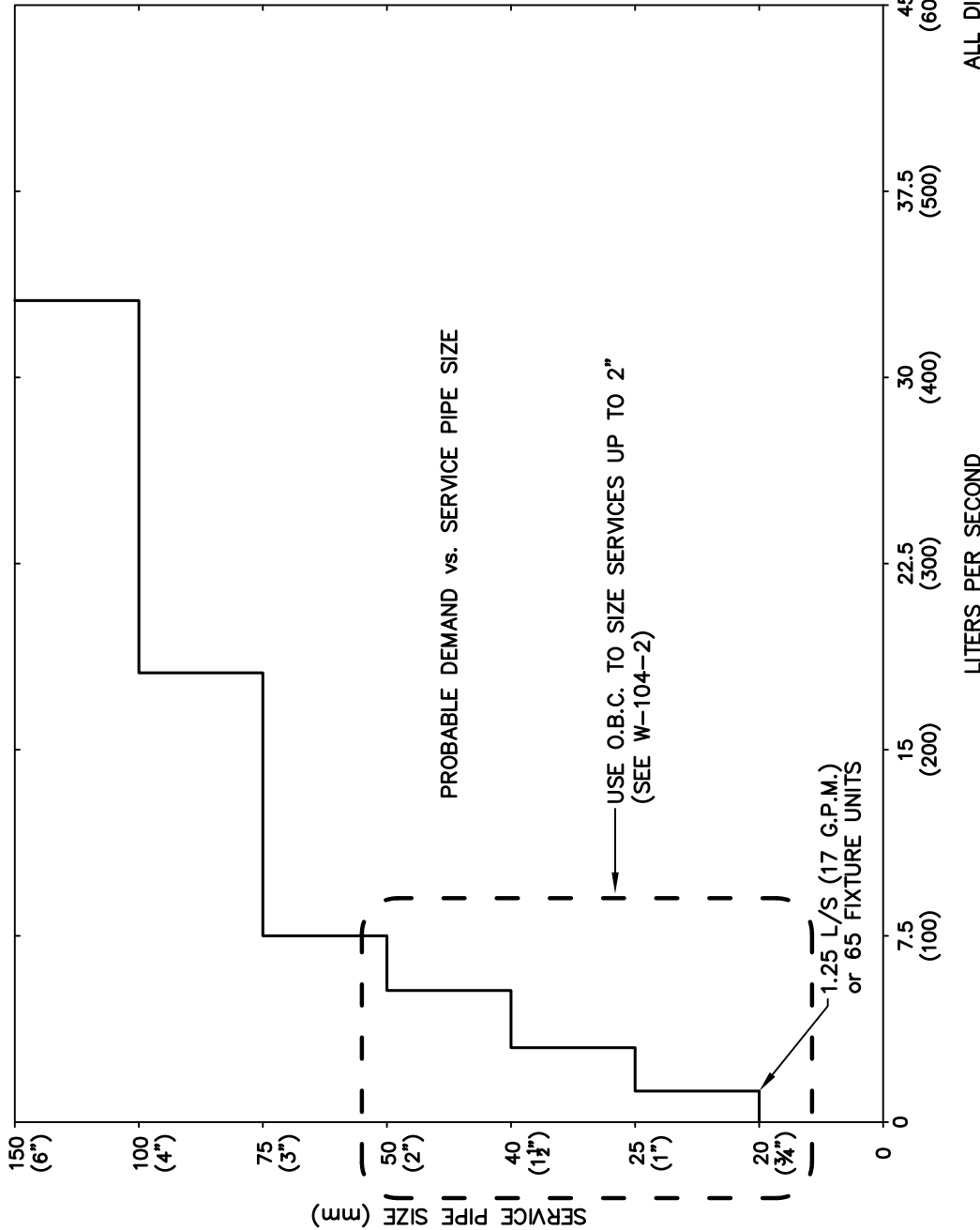
# NOTES:

- \*1 HOTELS, SHOPPING CENTERS, RESTAURANTS, PUBLIC SCHOOLS, PUBLIC BUILDINGS, HOSPITALS.
- \*2 HOUSES, APARTMENTS, CONDOMINIUMS, MOTELS, TRAILER PARKS.
- \*3 RESIDENTIAL SUBURBS – DOMESTIC USE ONLY – NO IRRIGATION

ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE WATER CONNECTION INSTALLATION & SIZING			
DWN.	BM	DATE SEPT /84	MANAGER, ENGINEERING DIVISION <i>[Signature]</i>
REVISED: JAN. 2018		DWG. NO.	
SCALE N. T. S.		W-104-3	
Z:\ENG\Standard Drawings\Std Dwg\W-104-3.dwg			





**MINIMUM SIZE BASED ON TYPE & LENGTH**

- Min. size servicing for residential – 20 mm
  - Min. size servicing for commercial – 25 mm
  - For length > 30 m – increase by one size
  - For length > 45 m – use 40 mm piping
  - For length > 60 m – use 50 mm piping
- ACTUAL SIZING TO BE CALCULATED USING O.B.C.

ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

**Thunder Bay**  
CITY OF  
*Superior by Nature*

**ENGINEERING STANDARDS**

**WATER CONNECTION  
INSTALLATION & SIZING**

DWN: BM DATE: SEPT /84

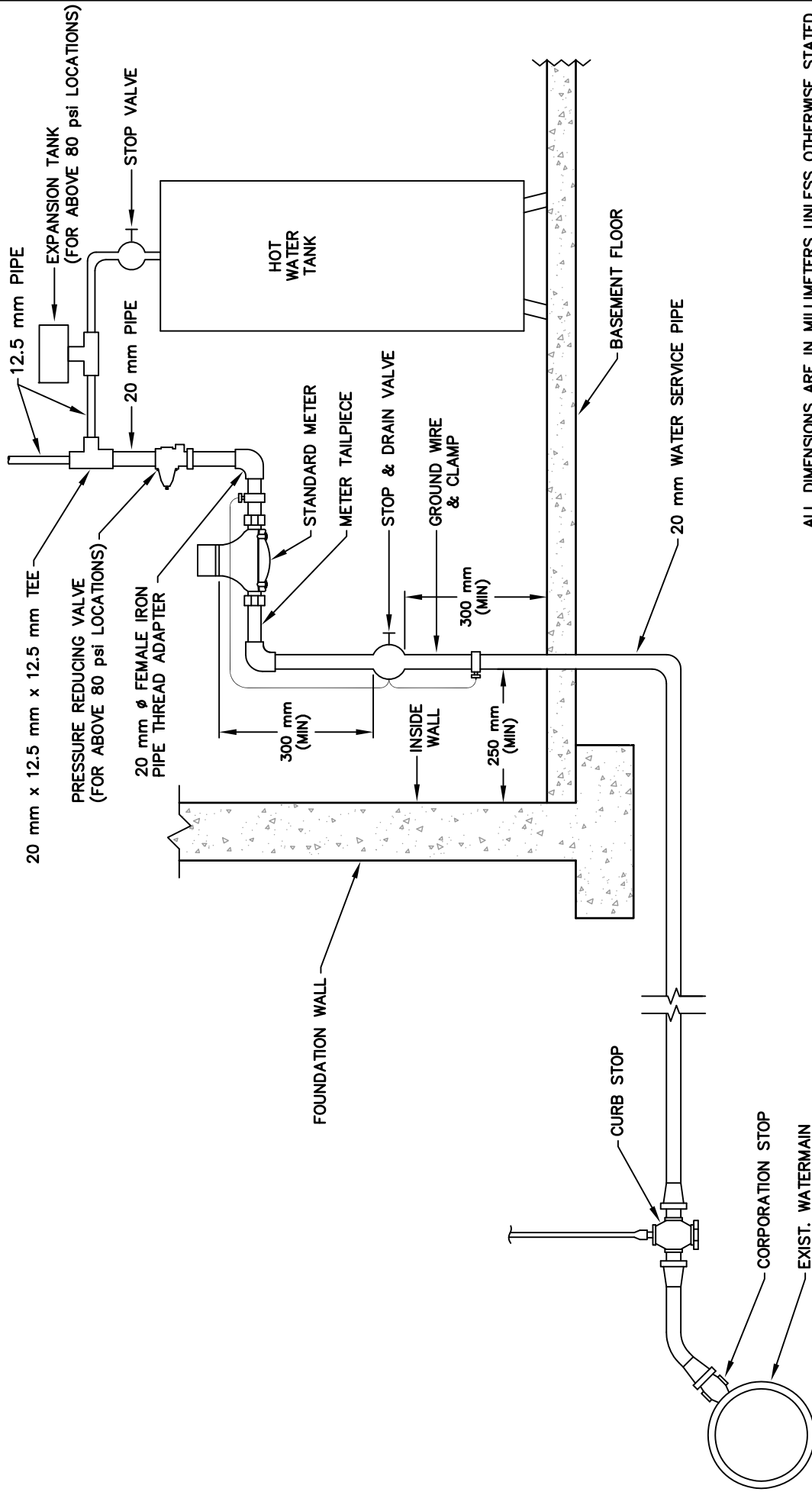
REVISED: JAN. 2010

SCALE: N. T. S.

DWG. NO. **W-104-4**

Z:\ENG\Standard Drawings\Std Dwg\W-104-4.dwg






### NOTES:

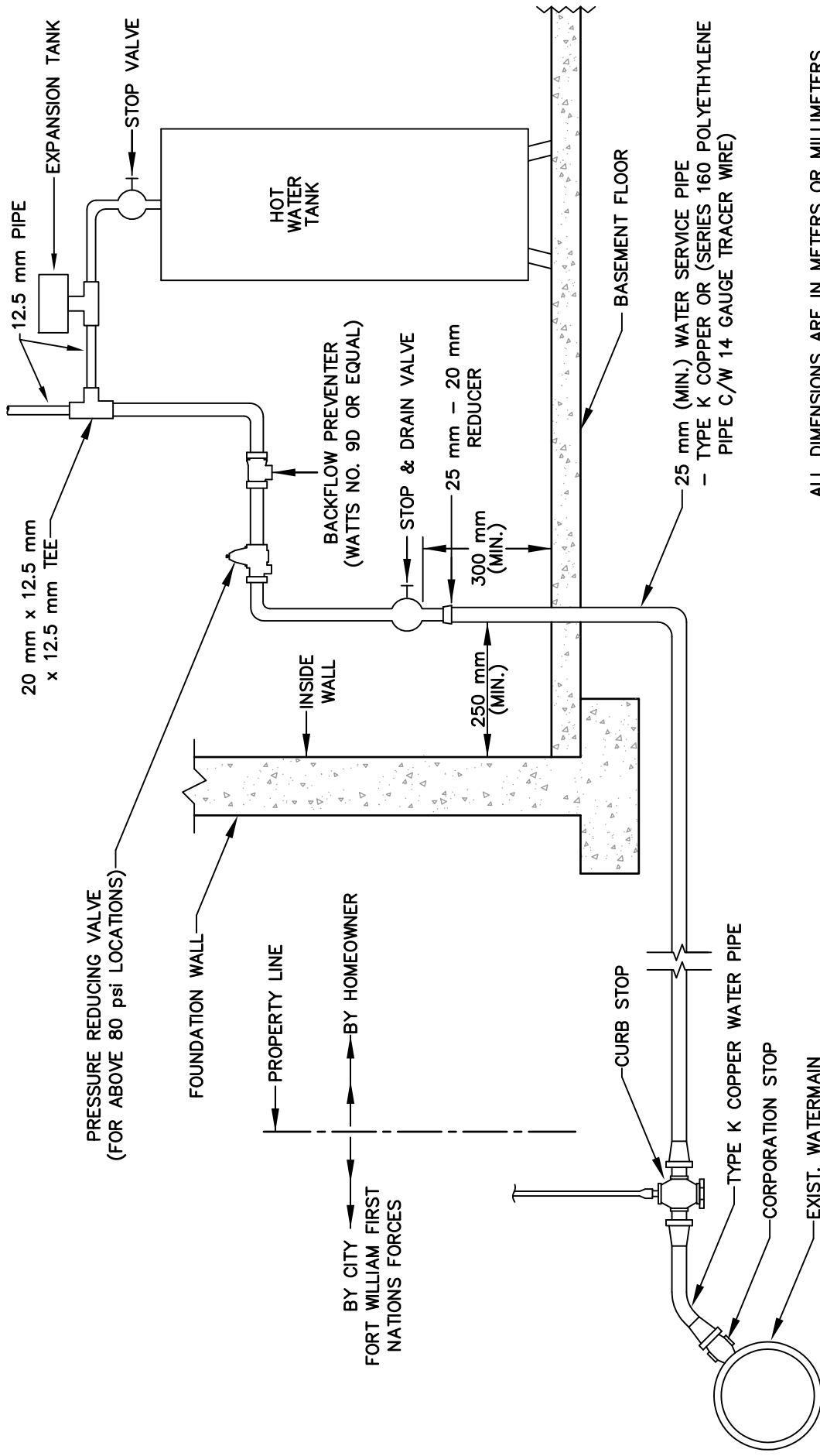
- 1) This drawing is typical for a single family residence with a 20 mm  $\phi$  water connection pipe and a standard sized meter. For other service pipe and/or meter sizes contact the City Engineering Department.
- 2) All water connection piping shall be installed in continuous lengths between the corporation stop, curb stop, and water meter without the use of couplers unless approved by the City Engineer.
- 3) Stop and drain shall be a maximum of 600 mm from and within sight of the water meter.
- 4) Installation shall be compliant with O.B.C. current version.
- 5) Four conductor 22 gauge wire shall be installed from the meter to an outside location for the installation of a remote reading device.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED



CITY OF <i>Thunder Bay</i> <small>Superior by Nature</small>		ENGINEERING STANDARDS	
TITLE TYPICAL RESIDENTIAL METER AND VALVING ARRANGEMENT			
DWN.	M.D.	DATE	 MANAGER, ENGINEERING DIVISION
		NOV./85	
REVISED: JAN. 2015		DWG. NO.	
SCALE		N. T. S.	
Z:\ENG\Standard Drawings\Std Dwg\W-104-5.dwg			

**W-104-5**





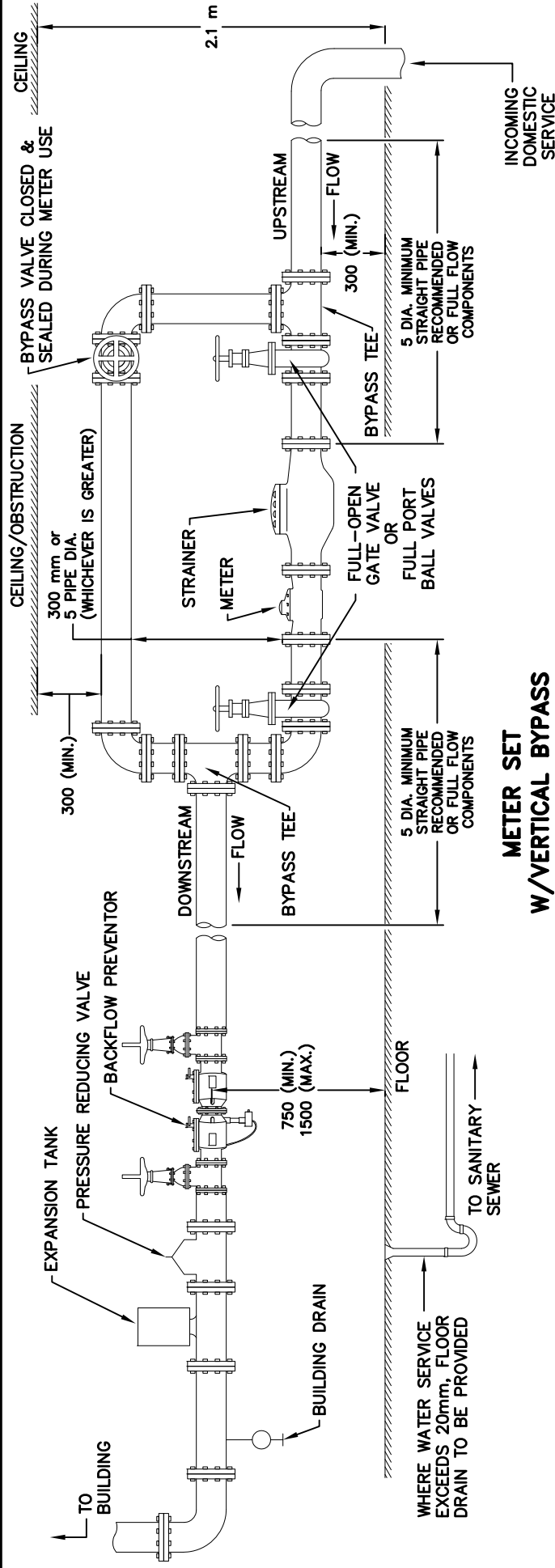
ALL DIMENSIONS ARE IN METERS OR MILLIMETERS

		ENGINEERING STANDARDS	
TITLE			
TYPICAL WATER CONNECTION		FORT WILLIAM FIRST NATION LANDS	
DRAWN	D.R.	DATE	JAN 2002
REVISED: DEC 2009		 MANAGER, ENGINEERING DIVISION	
SCALE		DWG. NO.	
N. T. S.		W-104-6	
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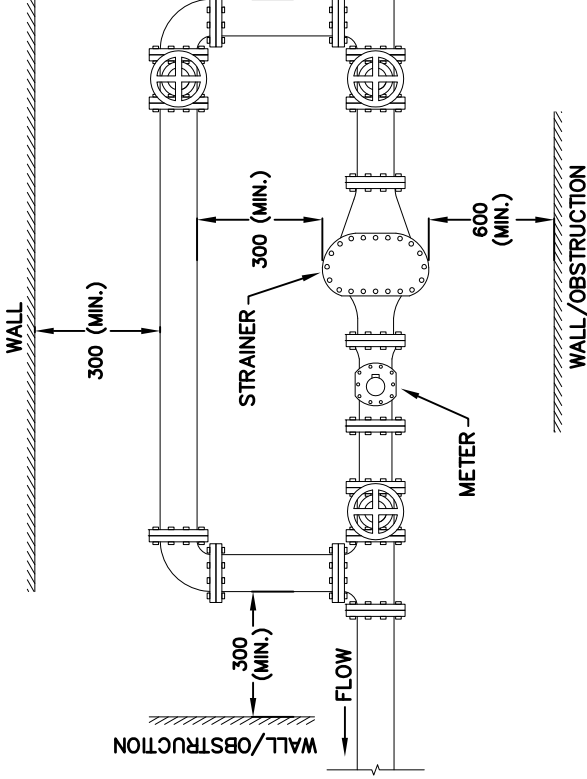
### NOTES:

- 1) This drawing is typical for a single family residence with a 25 mm water connection pipe.
- 2) All water connection piping shall be installed in continuous lengths between the corporation stop, curb stop, and stop and drain valve without the use of couplers.
- 3) For water connections:
  - over 45 m use 40 mm piping
  - over 60 m use 50 mm piping
- 4) Homeowner to make provisions for electrical grounding if required.





**METER SET  
W/VERTICAL BYPASS**  
(shown in elevation view)



**METER SET  
W/HORIZONTAL BYPASS**  
(shown in plan view)

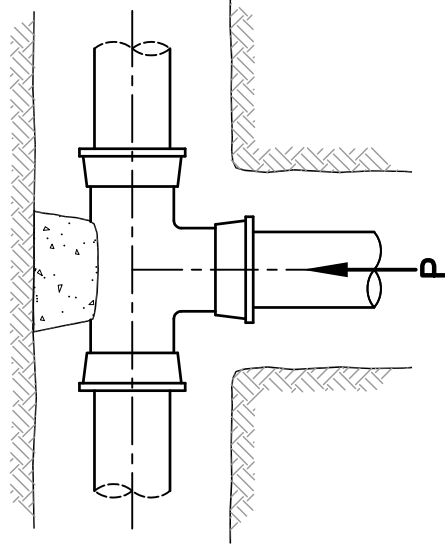
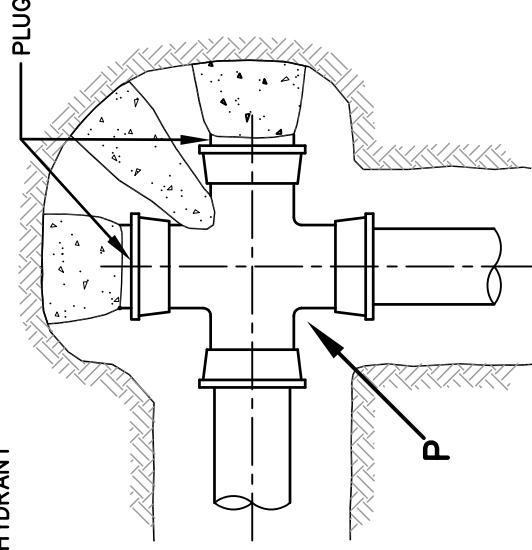
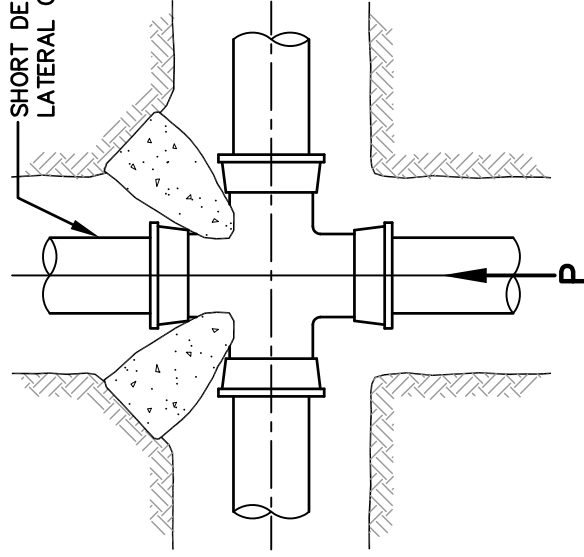
**NOTES:**

1. Bypass to be the same size as the services
2. Meter may be one (1) size smaller than the calculated service size, but not exceeding 75% max. rated flow.
3. Full flow components may consist of straight pipe, full open gate valves, bypass tees, and concentric reducers (one nominal size).

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED	
CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>	
ENGINEERING STANDARDS	
TITLE <b>METER/BYPASS/VALVING ARRANGEMENT (METERS EXCEEDING 25 mm)</b>	
DWN: S.S./S.G.	DATE: JAN. 2010
REVISD: JAN. 2018	MANAGER, ENGINEERING DIVISION
SCALE: N. T. S.	DWG. NO.
Z:\ENG\Standard Drawings\Std Dwg\W-104-7.dwg	
<b>W-104-7</b>	

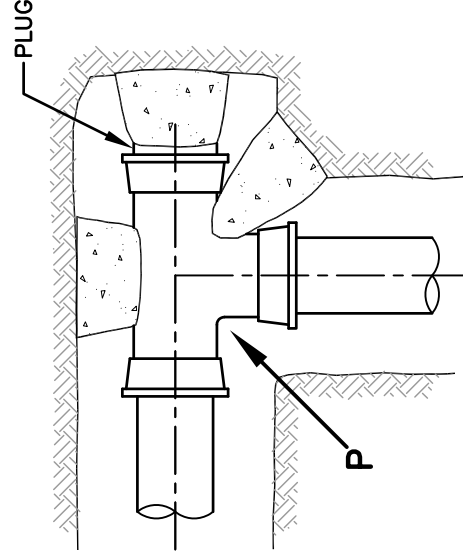


SHORT DEAD END, HYDRANT  
LATERAL OR PLUG



# **NOTES:**

- All watermain bends to be securely braced against unexcavated trench in direction of thrust. For soil conditions other than undisturbed rock also secure watermain using tie rods and clamps. For concrete thrust block sizing see standard drawings W-110, W-112, W-113, and W-116.
- Concrete to be 32 MPa minimum.
- Blocks to contain 0.20 m<sup>3</sup> minimum.
- Bond breaker to be used between concrete and fittings.
- Concrete shall be placed to within 50 mm of the face of the bell.
- "P" denotes direction of thrust.



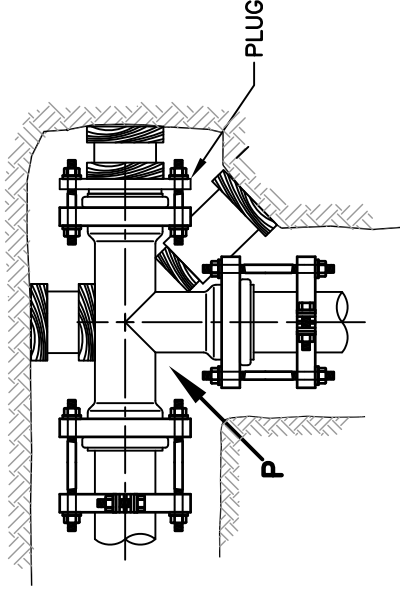
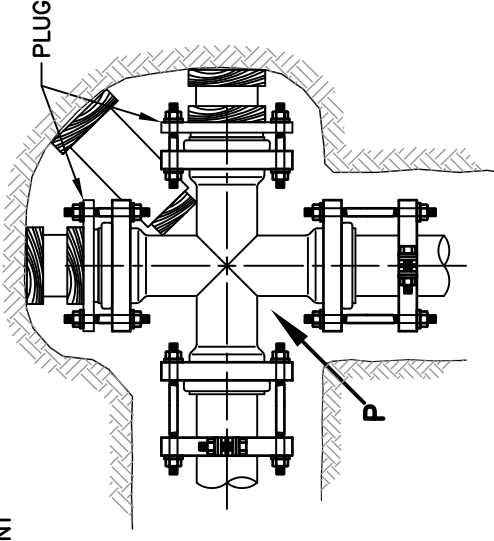
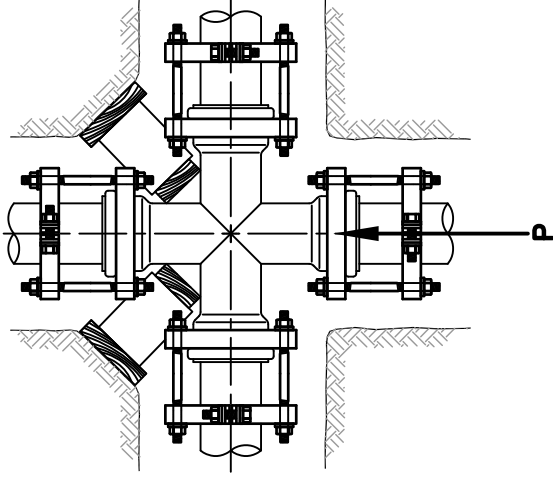
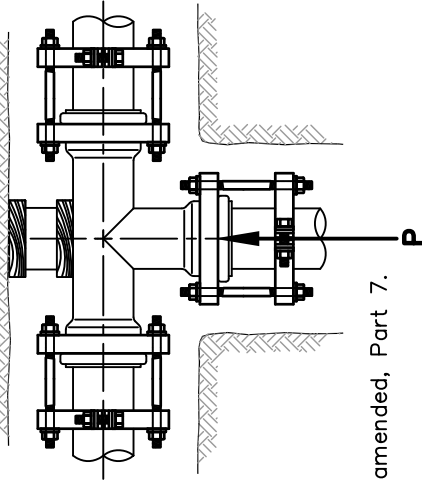
- ALL BENDS, TEES, CROSSES, PLUGS, ETC. SHALL BE PROPERLY ANCHORED WHERE REQUIRED USING POURED IN PLACE CONCRETE OR USING TIE RODS AND CLAMPS

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE ANCHORAGE OF WATERMAIN TEES & CROSSES			
DWN.	D.W.	DATE	MAY/02
REVISD:		JAN. 2018	
SCALE		N. T. S.	
DWG. NO.		W-108-1	
Z:\ENG\Standard Drawings\Std Dwg\W-108-1.dwg			




SHORT DEAD END, HYDRANT  
LATERAL OR PLUG



#### NOTES:

- All watermain tees & crosses at conditions shown to be securely braced against unexcavated trench in direction of trust with treated wood blocking to solid ground and secured using tie rods and clamps. For tie rodding and clamps see standard drawings W-111, W-112, W-113 and W-116.
- Thrust blocking to be CSA treated lumber, cut ends to be treated (TYP.)
- For cathodic protection see standard drawing W-130.
- "P" Denotes direction of thrust.

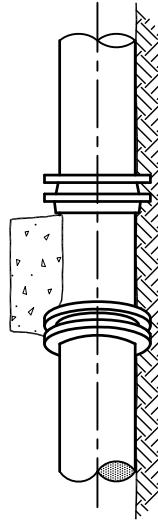
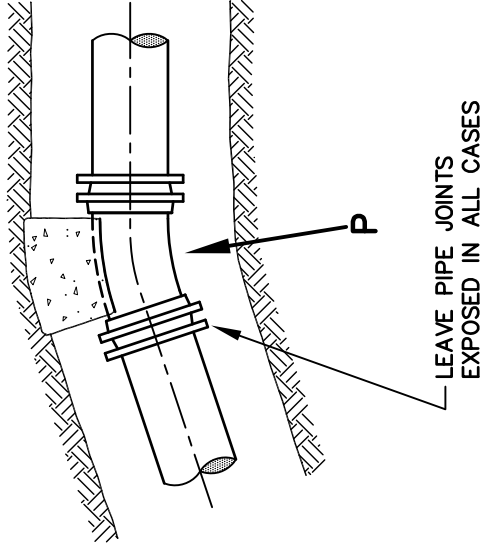
ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

CITY OF <i>Thunder Bay</i> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE ANCHORAGE OF WATERMAIN AT TEES & CROSSES FOR P.V.C. PIPE			
DWN. L.T.G.	DATE MAY/02	 CITY ENGINEER	
REVISED: MAR/03			
SCALE N. T. S.		DWG. NO. W-108-2	
PATH E:\ENG\STD\W-108-2.DWG			

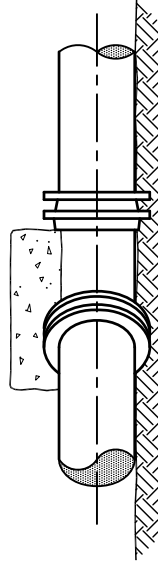
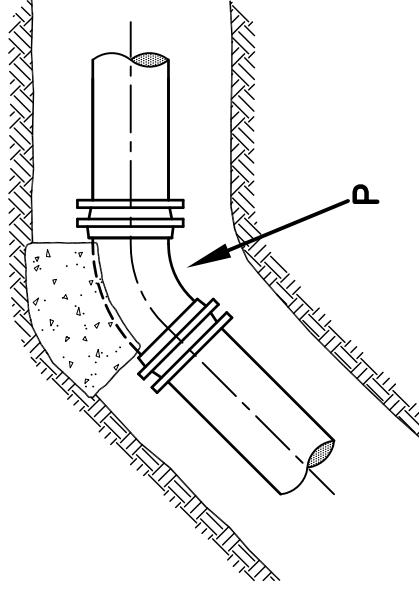
ALL BENDS, TEES, CROSSES, PLUGS, ETC. SHALL BE PROPERLY ANCHORED WHERE  
REQUIRED USING TIE RODS AND CLAMPS AND TREATED WOOD BLOCKING



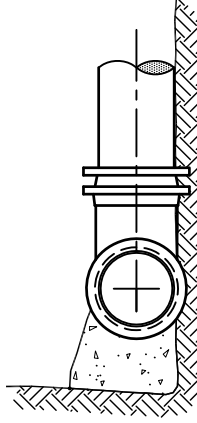
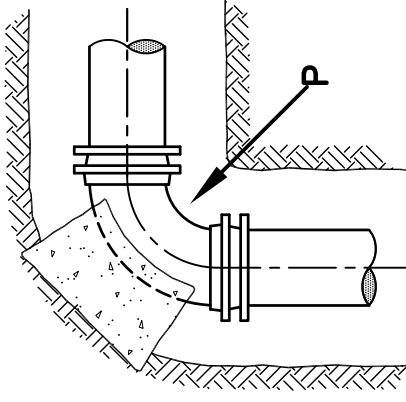
0°-22 1/2° BEND



22 1/2°-45° BEND



45°-90° BEND



## NOTES:

- All watermain bends to be securely braced against unexcavated trench in direction of thrust. For soil conditions other than undisturbed rock also secure watermain using tie rods and clamps. For concrete thrust block sizing see standard drawing W-110, and for tie rods and clamps see standard drawings W-111, W-112, W-113, and W-116.
- Concrete to be 32 MPa.
- Blocks to contain 0.20 m<sup>3</sup> concrete minimum.
- Bond breaker to be used between concrete and fittings.
- Concrete shall be placed to within 50 mm of the face of the bell.
- For horizontal turns only.
- "P" Denotes direction of thrust.

ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

		ENGINEERING STANDARDS	
CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>			
TITLE			
ANCHORAGE OF WATERMAIN BENDS			
DWN.	D. W.	DATE	MAY/02
REVISED: JAN. 2018		MANAGER, ENGINEERING DIVISION	
SCALE		DWG. NO.	
N. T. S.			
Z:\ENG\Standard Drawings\Std Dwg\W-109.dwg			
		<b>W-109</b>	



## CHART 'A'

### (SAFE BEARING PRESSURE OF SOILS)

SOIL (ROCK ONLY)	SAFE BEARING tonnes/m <sup>2</sup>
Rock, hard thick layers	1953.0
Rock, equal good masonry	244.13
Rock, equal best brick	146.48
Rock, equal poor brick	48.83

## CHART 'B'

### (RESULTANT THRUST AT FITTINGS AT 1102 kPa WATER PRESSURE)

Nom. Pipe Dia. (mm)	Branch of Tee or Dead End	90° Bend	45° Bend	22½° Bend	11¼° Bend
150	2.71	3.83	2.08	1.06	0.54
200	4.67	6.60	3.57	1.82	0.92
300	9.93	14.04	7.60	3.87	1.95
400	17.25	24.40	13.21	6.73	3.38
600	37.94	53.66	29.04	14.81	7.44
900	83.62	118.24	64.00	32.62	16.40

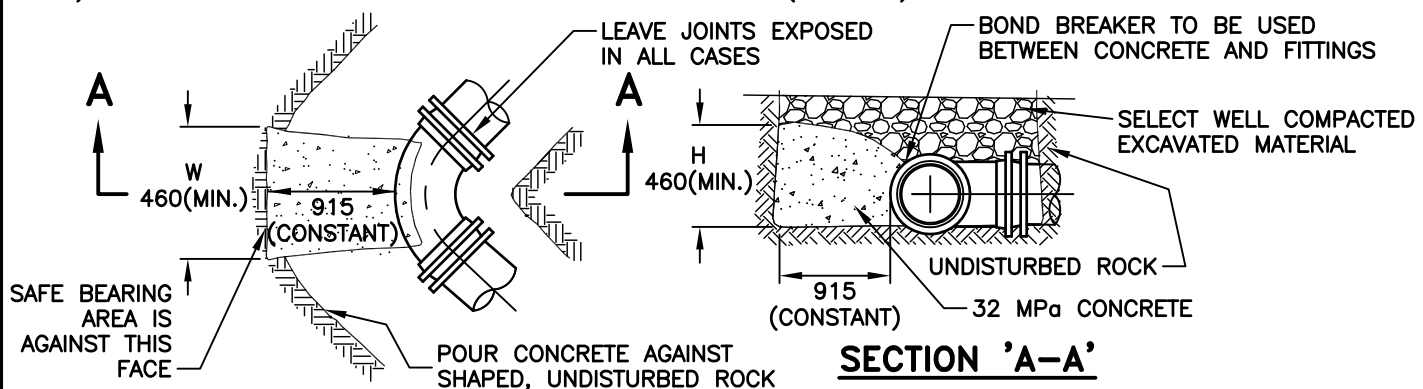
#### EXAMPLE:

To find the size of thrust block required for a 90° bend in a 400 MM diameter watermain laid in Rock, equal to poor brick.

- 1) From Chart 'A' – the safe bearing tonnes/m<sup>2</sup> for Rock, equal best brick is 48.83
- 2) From Chart 'B' – the total tonnes thrust for a 90° bend is 24.40
- 3) Safe bearing area required =  $\frac{24.40}{48.83} = 0.50 \text{ m}^2$
- 4) This thrust block's safe bearing area can be 0.83 m ('W') x 0.60 m ('H') = 0.50 m<sup>2</sup>.  
The actual shape of this area is determined in the field by existing conditions.

#### NOTE:

- 1) Thrust blocks to contain 0.20 cubic metres of concrete (minimum).



ENGINEERING  
STANDARDS

CITY OF  
**Thunder Bay**  
*Superior by Nature*

TITLE

METHOD OF DETERMINING SIZES  
OF THRUST BLOCKS

DWG. NO. K.S. \L.T.G. Aug. 1981

DATE

REVISED: JAN. 2018

SCALE N. T. S.

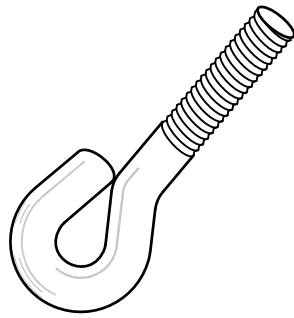
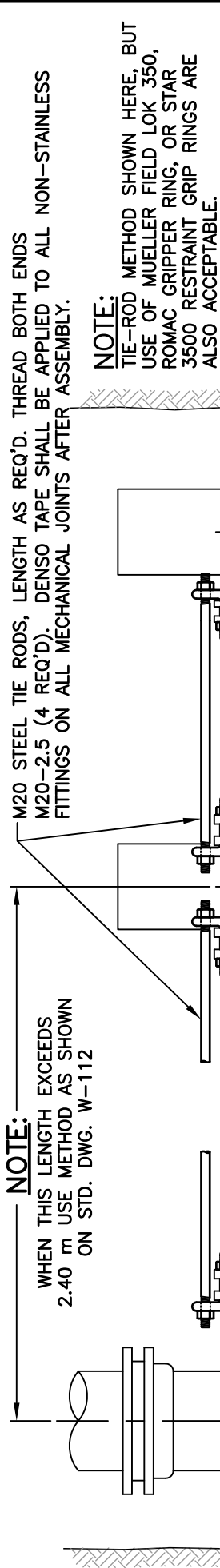
PATHE: \ENG\STD DWGS\W-110.dwg

CITY ENGINEER

DWG. NO. W-110



**NOTE:**  
WHEN THIS LENGTH EXCEEDS  
2.40 m USE METHOD AS SHOWN  
ON STD. DWG. W-112

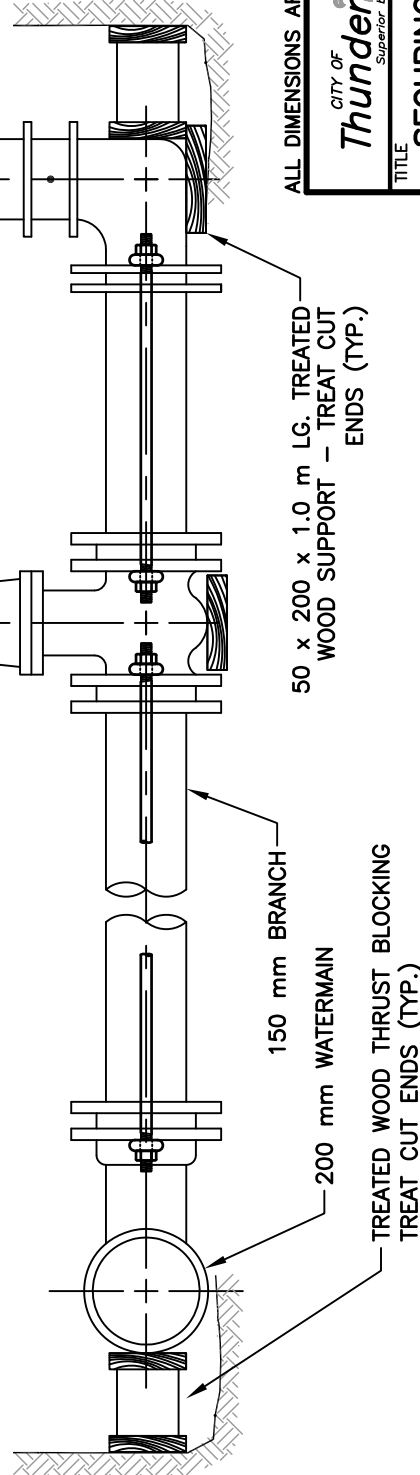


### TIE BOLT DETAIL

THE M20 TIE BOLT TAKES THE PLACE OF THE STANDARD BOLT IN THE MECHANICAL JOINT AND IS USED FOR SECURING THE TIE ROD.

### NOTE:

- FOR FURTHER INFORMATION SEE ST. DWG. W-101  
INSTALLATION OF FIRE HYDRANT WITH GATE VALVE



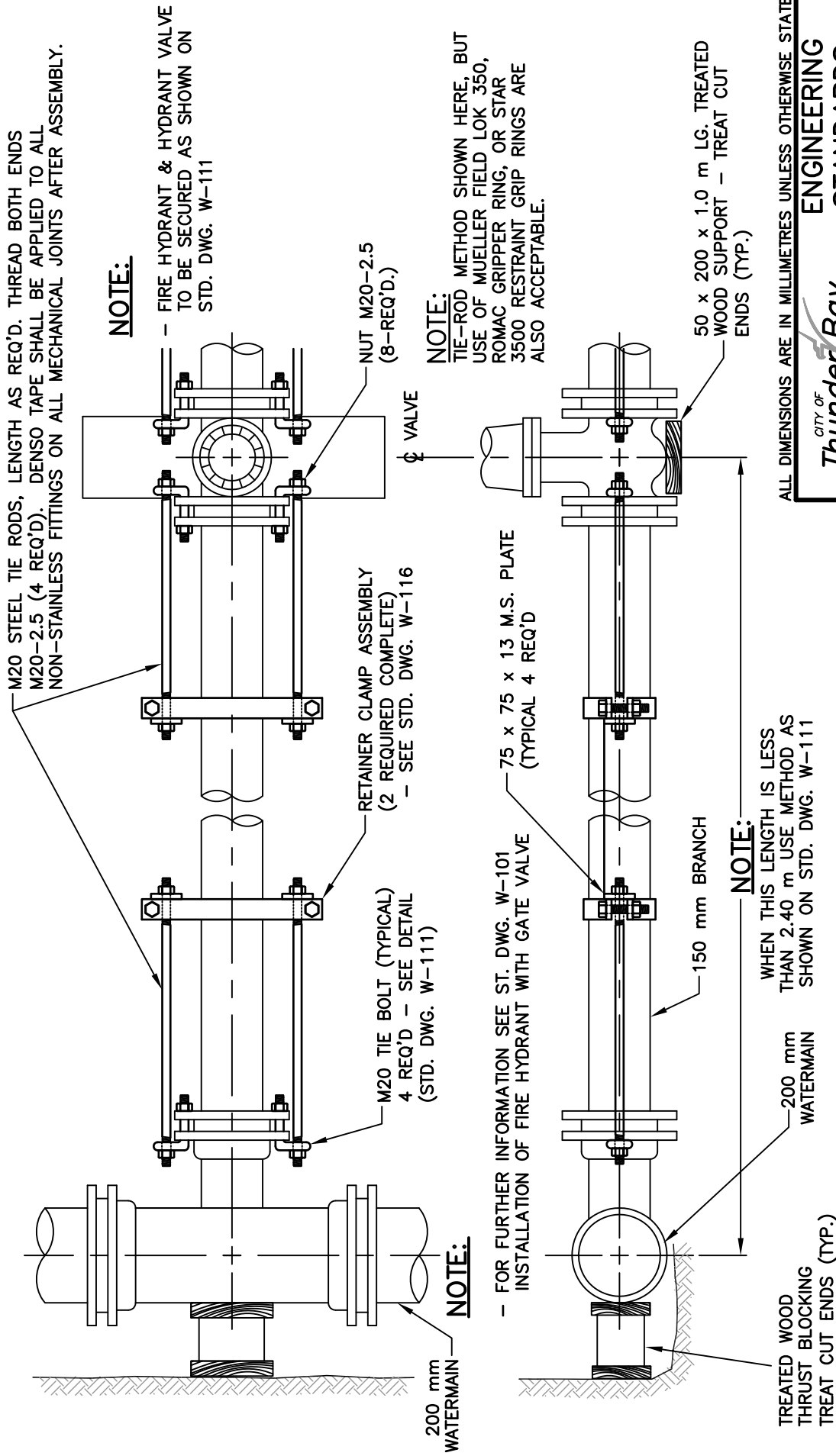
### NOTES:

- 1) This method to be used in all ground conditions except rock.
- 2) See Std. Dwg. W-126 for cathodic protection.

ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED

CITY OF <i>Thunder Bay</i> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE SECURING FIRE HYDRANT AND VALVE TO WATERMAIN (MECHANICAL JOINT PIPE)			
DRAWN L.S./L.T.G.	DATE JUNE/72	<i>J. Mauro</i> MANAGER, ENGINEERING DIVISION	
REVISED: JAN. 2011		DWG. NO.	
SCALE N. T. S.		W-111	
Z:\ENG\Standard Drawings\Std Dwg\W-111.dwg			





ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED

CITY OF  
**Thunder Bay**  
Superior by Nature  
ENGINEERING  
STANDARDS

TITLE  
**SECURING FIRE HYDRANT AND VALVE  
TO WATERMAIN (MECHANICAL JOINT PIPE)**

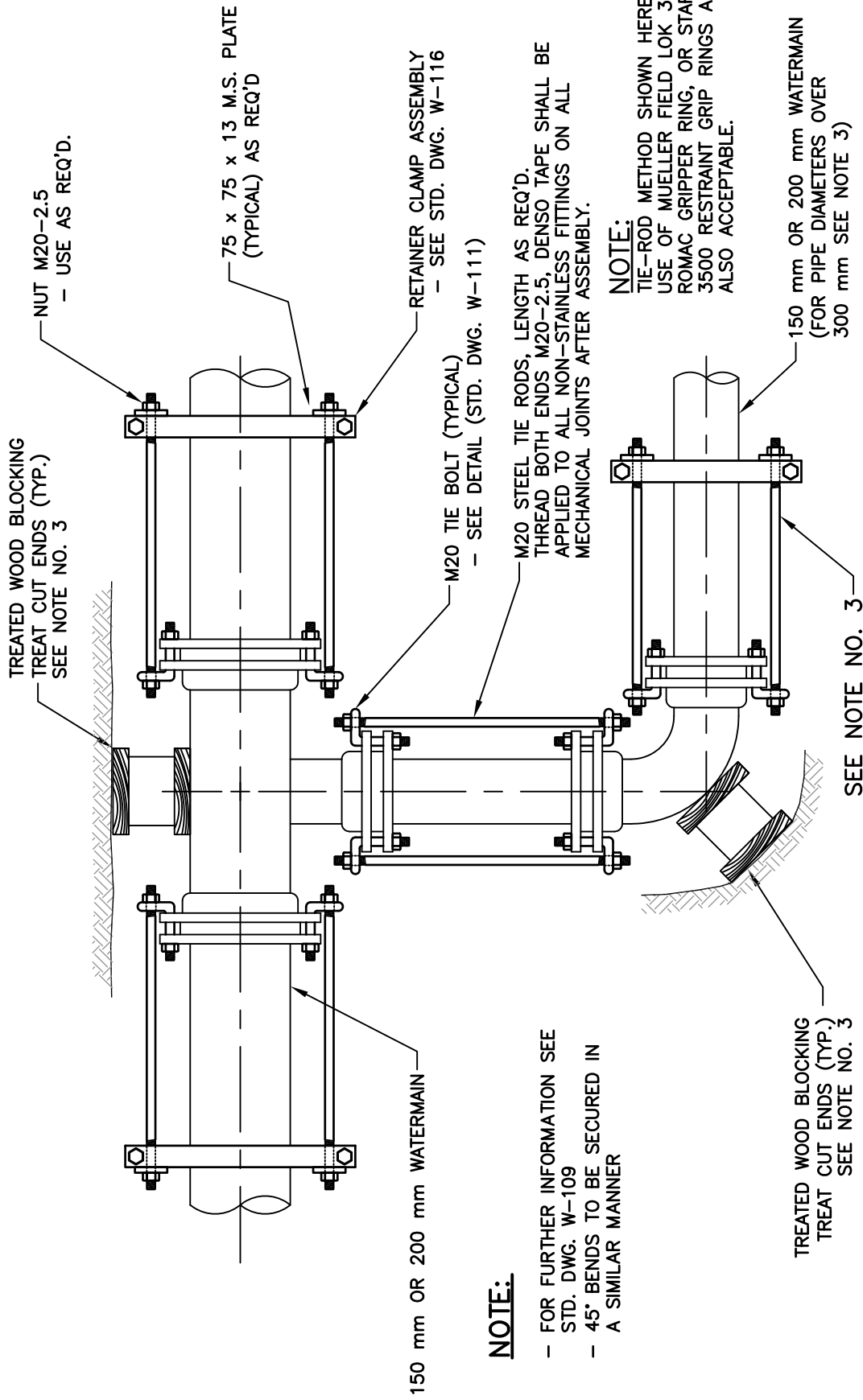
DRAWN L.S./L.T.G.	DATE JUNE 1972	MANAGER, ENGINEERING DIVISION
REVISOR JAN. 2011	DWG. NO.	
SCALE N. T. S.		
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**W-112**

**NOTES:**

- 1) This method to be used in all ground conditions except rock.
- 2) See Std. Dwg. W-126 for cathodic protection.





#### NOTE:

- FOR FURTHER INFORMATION SEE  
STD. DWG. W-109
- 45° BENDS TO BE SECURED IN  
A SIMILAR MANNER

#### NOTES:

- 1) THIS METHOD TO BE USED IN ALL GROUND CONDITIONS.
- 2) ALL DIMENSIONS ARE IN METRES OR MILLIMETRES.
- 3) ALL WATERMAIN BENDS, TEES & CROSSES SHALL BE BRACED AGAINST  
THE UNEXCAVATED TRENCH IN THE DIRECTION OF THRUST (SEE STD.  
DWGS. W-108-2 & W-109-2) WITH TREATED WOOD BLOCKING.
- 4) FOR PIPE DIAMETERS 300 mm AND OVER USE 4 TIE RODS PER JOINT.
- 5) SEE STD. DWG. W-126 FOR CATHODIC PROTECTION.

CITY OF  
**Thunder Bay**  
*Superior by Nature*

ENGINEERING  
STANDARDS

TITLE

SECURING WATERMAIN TEES AND 90°  
BENDS (MECHANICAL JOINT PIPE)

DRAWN  
L.S./L.T.G. DATE  
JUNE 1972

REVISOR  
JAN. 2011

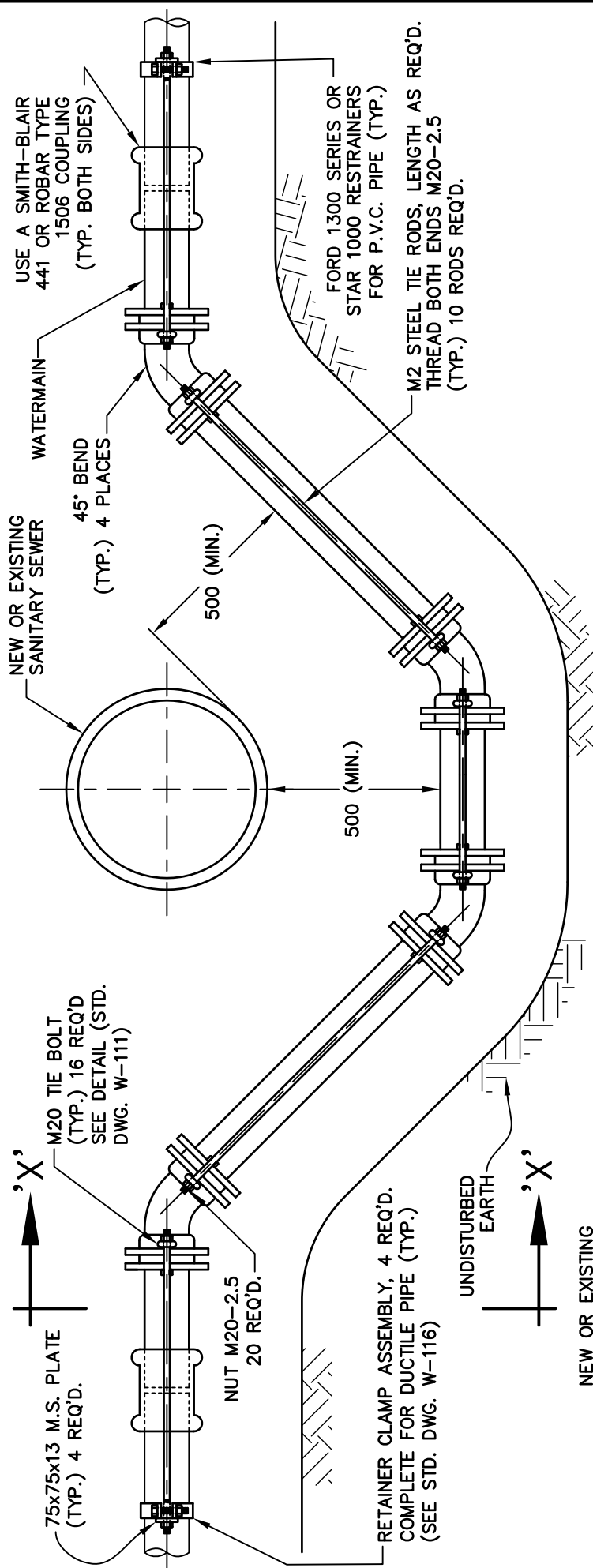
SCALE  
N. T. S.

MANAGER, ENGINEERING DIVISION  
DWG. NO.

**W-113**

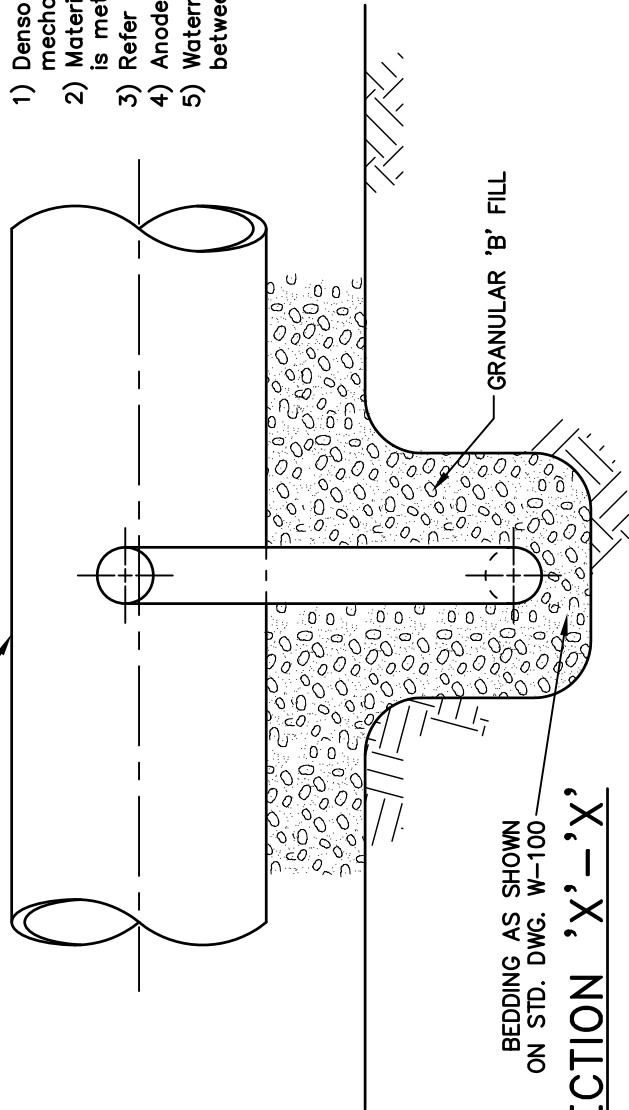
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**NOTES:**

- 1) Denso tape shall be applied to all non-stainless fittings on all mechanical joints after assembly.
- 2) Material for lowering shall be ductile iron if existing material is metallic.
- 3) Refer to std. dwg. W-124 for cathodic protection.
- 4) Anode spacing as per section 8.0.
- 5) Watermain crossing under sewer shall be generally centered between sewer pipe joints.



BEDDING AS SHOWN  
ON STD. DWG. W-100

**SECTION 'X'-'X'**

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED	
CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>	
ENGINEERING STANDARDS	
TITLE LOWERING & SECURING REQUIRED AT NEW OR EXIST. WATERMAIN CROSSING OF NEW OR EXIST. SANITARY SEWER	
DRAWN L.S./L.T.G.	DATE JUNE 1972
REVISOR JAN. 2015	MANAGER, ENGINEERING DIVISION <i>Ed. Howe</i>
SCALE N. T. S.	DWG. NO. W-114
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NEW OR EXISTING CULVERT,  
STORM SEWER, OR DITCH-

- 
- 50 mm THICK DOWEL HI-35  
STYROFOAM PLACED AS  
BEDDING AS SHOWN
- 600
- 1.2 m
- GRANULAR 'B' FILL

50 mm THICK DOW HI-35  
STYROFOAM PLACED AS  
SHOWN

BEDDING AS SHOWN  
ON STD. DWG. W-100-

## SECTION 'X' - 'X'

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

**CITY OF**  
**Thunder Bay**  
Sustaining the Nation

TITLE	Superior by Nature
LOWERING & SECURING OF NEW OR EXISTING WATERMAIN CROSSING NEW OR EXISTING CULVERT, STORM SEWER OR DITCH	

DRAWN J.L./L.T.G.	DATE JAN. 1976
----------------------	-------------------

REVISÉ: JAN. 2015

SCALE

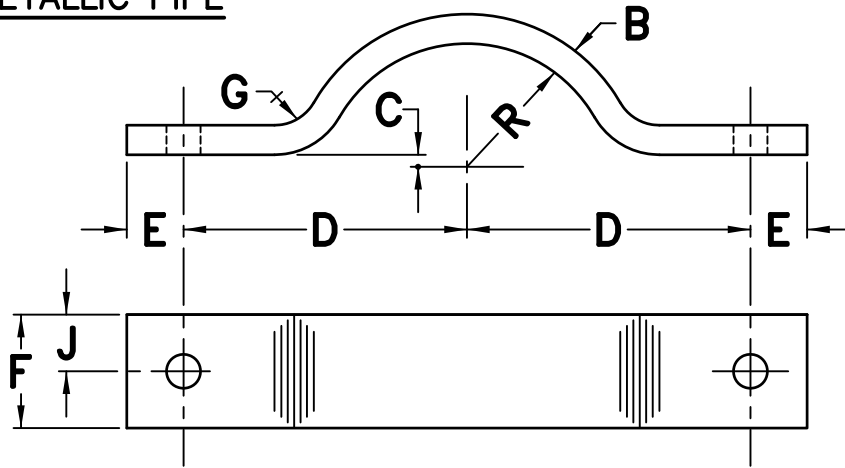
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DWG. NO.                     

W-115



## METALLIC PIPE



### NOTES:

- 1) One shown only, two required for a set.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

CITY OF  
**Thunder Bay**  
Superior by Nature

TITLE

ENGINEERING  
STANDARDS  
WATERMAIN RETAINER  
CHART

DWN. D.R. DATE JAN. 2003

REVISOR: JAN. 2011  
MANAGER, ENGINEERING DIVISION  
DWG. NO.

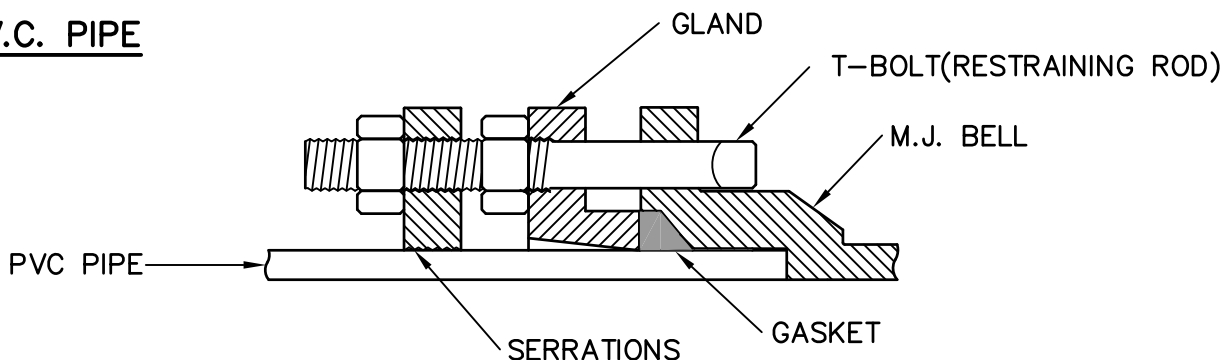
SCALE N. T. S.

Z:\ENG\Standard Drawings\Std Dwg\W-116.dwg

**W-116**

Ductile Iron Water Pipe			All Watermain Pipe and Clamp Sizes are in Millimetres									
Clamp No.	Nom. Dia.	Pipe O.D.	R	B	C	D	E	F	G	H. Dia.	J	Clamping Bolts
1	100	121.92	65	13	16	125	25	50	20	15	25	m 12 x 1.75 x 90 lg.
2	150	175.26	90	13	16	175	25	50	20	18	25	m 16 x 2.0 x 90 lg.
3	200	229.87	120	13	16	210	25	50	20	18	25	m 16 x 2.0 x 90 lg.
4	250	281.94	145	13	16	235	25	50	20	18	25	m 16 x 2.0 x 90 lg.
5	300	335.28	170	13	16	260	25	50	20	18	25	m 16 x 2.0 x 90 lg.
6	350	388.62	200	13	16	295	25	50	20	18	25	m 16 x 2.0 x 90 lg.
7	400	441.96	225	13	16	325	25	50	20	18	25	m 16 x 2.0 x 90 lg.

## P.V.C. PIPE



### NOTE:

**4"-12" SIZES**

- 1) For PVC pipe use Star 1000 Series or Ford 1300 Series Restrainers.
- 2) Denso tape shall be applied to all non-stainless fittings on all mechanical joints after assembly.



# FLUSHING

# CHLORINATION

TABLE 1 REQUIRED FLOW AND OPENINGS TO FLUSH PIPELINES			
DIAMETER OF PIPE (mm)	FLOW REQUIRED TO PRODUCE 0.91 m/s (APPROX.) VELOCITY IN MAIN @ 40 PSI (L/s)	SIZE OF TAP, (mm) 25 (1") 38 (1-1/2") 51 (2") NUMBER OF TAPS ON PIPE	NUMBER OF HYDRANT OUTLETS (mm) 64 (2-1/2") 115 (4-1/2")
100	7.4	1 - - -	1 1
150	16.7	- 1 - -	1 1
200	29.7	- 2 - -	1 1
250	46.3	- 3 2	1 1
300	66.7	- - 3	2 1
400	118.6	- - 5	2 1

## NOTE:

1. H.T.H. IS AN OLIN MATIESON TRADEMARK FOR HIGH TEST HYPOCHLORITE.
2. FLUSHING AND CHLORINATION METHOD TO FOLLOW AWWA C651 STANDARDS AND MECP WATERMAIN DISINFECTION PROCEDURE.
3. FIELD DE-CHLORINATION METHOD TO FOLLOW AWWA C655 STANDARDS.
4. ALL PRIVATE FIRE LINES SHALL HAVE ONE (1) SWAB INSTALLED IN THE SYSTEM FOR FLUSHING PURPOSES.
5. NEW WATERMAIN WORK SHALL BE PHYSICALLY SEPARATED FROM THE EXISTING DISTRIBUTION SYSTEM UNTIL AFTER DISINFECTION IS SUCCESSFULLY COMPLETED. REFER TO STANDARD DRAWING W-117-2.
6. ONCE THE NEW WATERMAIN HAS PASSED BACTERIAL TESTING IT MUST BE CONNECTED TO THE EXISTING DISTRIBUTION SYSTEM WITHIN 15 DAYS. IF NOT CONNECTED WITHIN 15 DAYS THE NEW WATERMAIN SHALL BE FLUSHED AND BACTERIAL TESTING MUST BE PASSED AGAIN PRIOR TO CONNECTION TO THE EXISTING DISTRIBUTION SYSTEM. IF BACTERIAL TESTING DOES NOT PASS THE NEW WATERMAIN WILL REQUIRE CHLORINATION.
7. ALL DISINFECTION AND FLUSHING PROCEDURES SHALL APPLY TO TEMPORARY WATERMAIN AS WELL.
8. REFER ALSO TO CITY OF THUNDER BAY DRINKING WATER WORKS PERMIT NO. 024-201.

\* AT LEVELS OVER 10 MILLIGRAMS PER LITRE, A MEASUREMENT OF COMBINED CHLORINE SHALL BE DEEMED TO BE EQUIVALENT TO A MEASUREMENT OF FREE CHLORINE. REFER TO MECP WATERMAIN DISINFECTION PROCEDURE, SECTION 1.



## POWDER METHOD

SODIUM HYPOCHLORITE SOLUTION (H.T.H.) FED INTO THE MAIN BEING DISINFECTED SHALL BE ANSI/NSF60 CERTIFIED. CONCENTRATION OF DISINFECTANT AND CONTACT TIMES SHALL BE AS PER TABLE 1. ONCE DISINFECTION IS ACHIEVED FLUSH THE LINE AND TAKE BACTERIA SAMPLES.

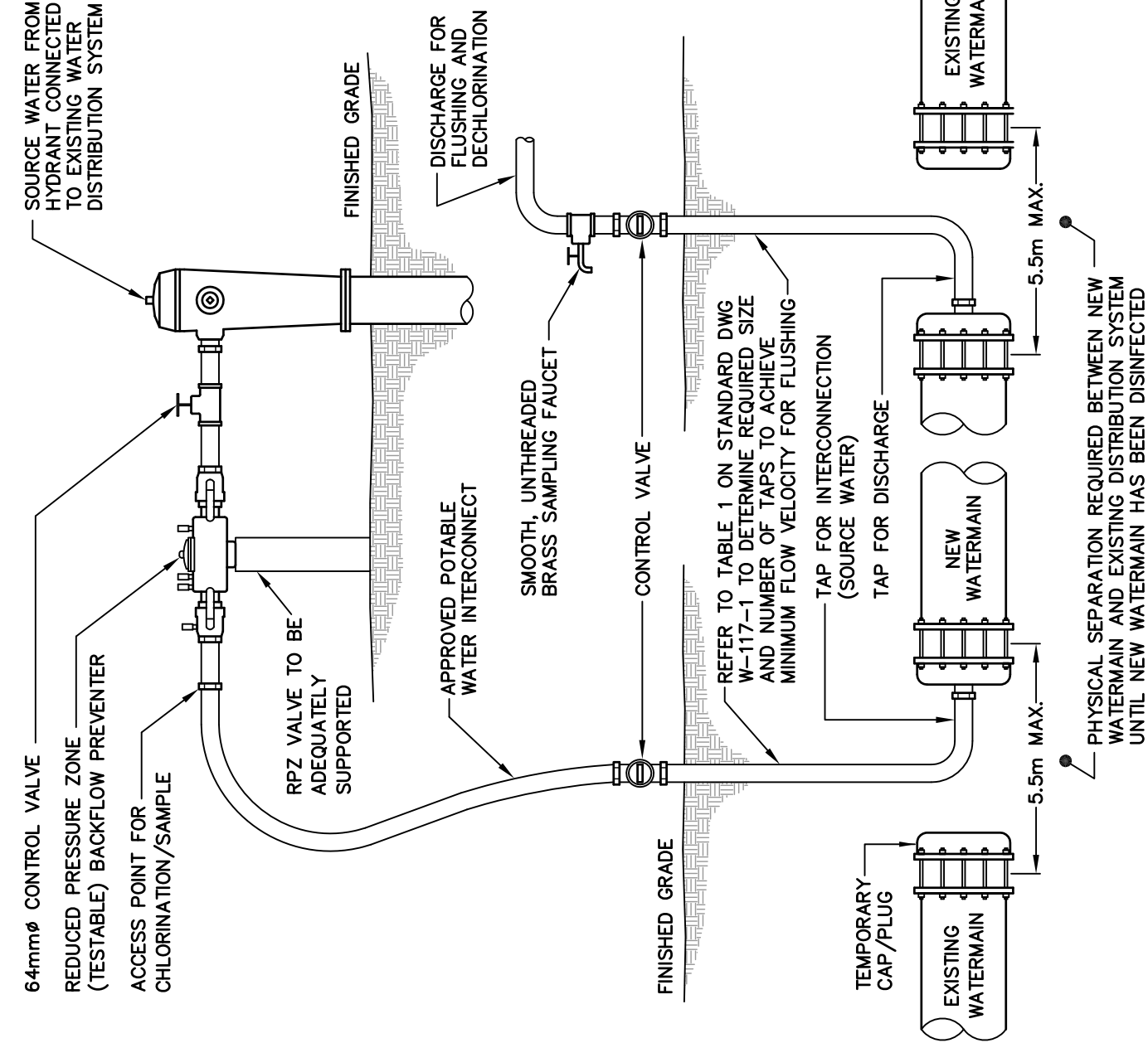
TABLE 2 CHLORINE CONCENTRATIONS AND CONTACT TIMES FOR NEW WATERMAINS*			
DISINFECTION METHOD	MINIMUM CONTACT TIME	INITIAL CHLORINE CONCENTRATION	MAX. ALLOWABLE DECREASE IN CHLORINE CONCENTRATION
TABLET OR CONTINUOUS FEED	24 HOURS	≥ 25 mg/L	40% OF THE INITIAL CHLORINE CONCENTRATION TO A MAXIMUM OF 50 mg/L
SLUG	3 HOURS	≥ 100 mg/L	25 mg/L
SPRAY	30 MINUTES	≥ 200 mg/L	NO MEASUREMENT REQ.

TABLE 3 RECOMMENDED KILOGRAMS OF H.T.H. POWDER (70%) IN SOLUTION, PER 300m OF PIPE TO OBTAIN MIN. CHLORINE DOSAGE OF 25 mg/L	
PIPE DIAMETER (mm)	kg OF H.T.H. POWDER
150	0.20
200	0.35
300	0.78
400	1.39
600	3.13
900	7.04

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

 <b>CITY OF Thunder Bay</b> <i>Superior by Nature</i>		<b>ENGINEERING STANDARDS</b>	
<b>TITLE</b> DISINFECTING AND FLUSHING WATERMAINS			
<b>DWN.</b> S.G.	<b>DATE</b> AUG. 1981		
<b>REVISED:</b> FEB. 2019		<b>DWG. NO.</b> W-117-1	
<b>SCALE</b> N. T. S.		<b>MANAGER, ENGINEERING DIVISION</b>	
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**NOTES:**

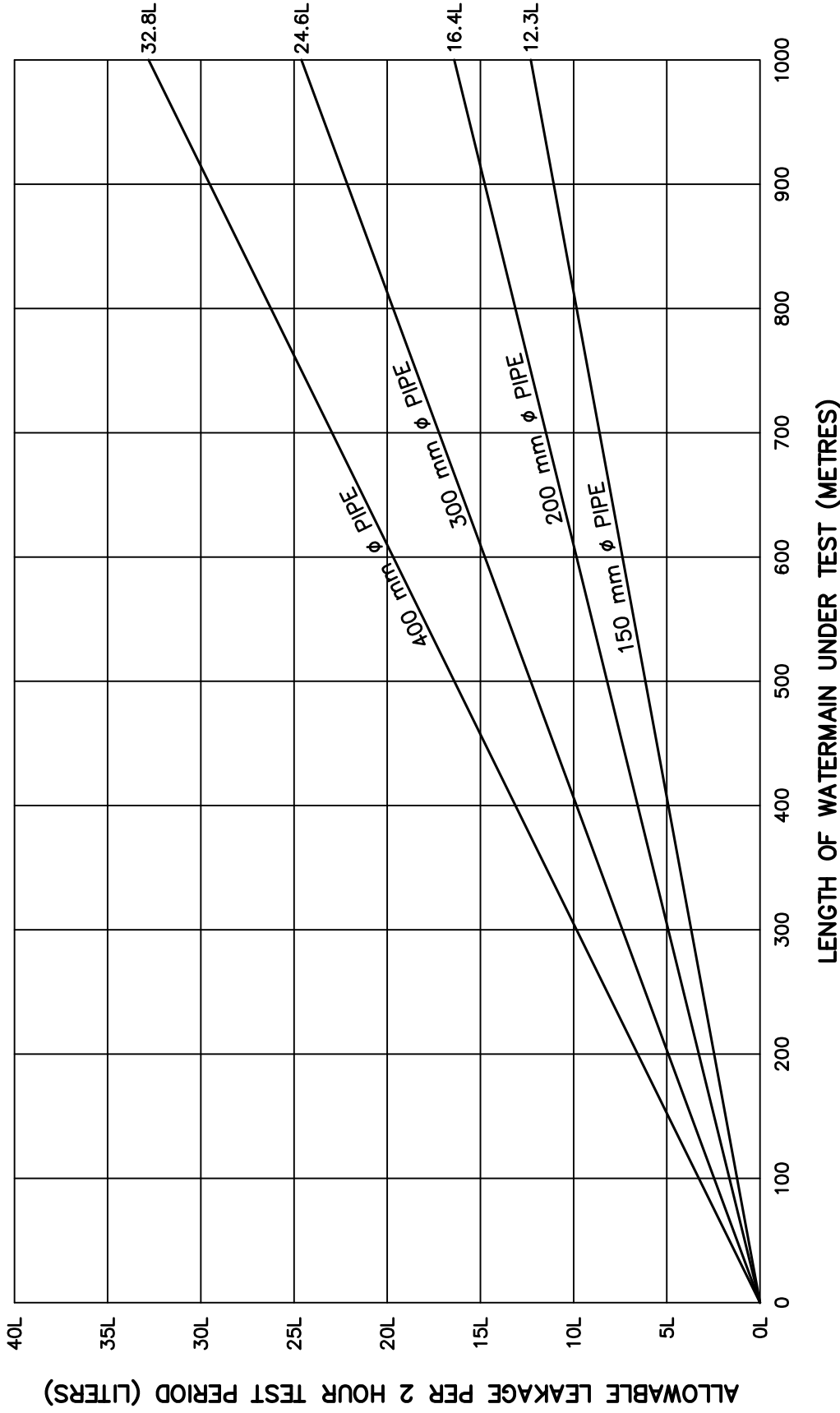
1. THIS DETAIL IS FOR SCHEMATIC INFORMATION ONLY. THE ACTUAL CONFIGURATION USED MUST SATISFY THE INTENT OF THIS DRAWING SUBJECT TO CITY APPROVAL.
2. ONLY CITY STAFF SHALL OPERATE CITY OWNED VALVES.
3. BACK FLOW PREVENTER SHALL BE TESTED AS PER CSA-B64-10. TESTING LOGS MUST BE AVAILABLE ON SITE FOR REVIEW AT ANY TIME.
4. ALL TEMPORARY CAPS TO BE EITHER RESTRAINED OR APPROVED ALTERNATE. ALL RESTRAINED JOINTS AS PER PIPE MANUFACTURER'S SPECIFICATION.
5. FLUSHING/SAMPLING TAP POINTS MUST BE LOCATED WITHIN 3m OF THE END OF EACH BRANCH OR STUB WITHIN THE NEW WATERMAIN SYSTEM. HYDRANT LEADS MAY BE USED AS FLUSHING/SAMPLING POINTS.
6. HYDROSTATIC PRESSURE TESTS SHALL NOT BE COMPLETED AGAINST THE BACK FLOW PREVENTER.
7. CONTRACTOR SHALL OBTAIN AUTHORIZATION FROM THE CITY PRIOR TO COMPLETING THE FINAL CONNECTIONS TO THE EXISTING DISTRIBUTION SYSTEM.
8. ALL NEW PIPING AND APPURTENANCES PLACED IN THE CONNECTION SHALL BE THOROUGHLY DISINFECTED WITH A 1-5% SOLUTION OF SODIUM HYPOCHLORITE JUST PRIOR TO INSTALLATION.
9. THE NEW WATERMAIN SHALL BE CUT BACK TO REMOVE ALL TAPPING POINTS USED AT BRANCH/STUB ENDS.
10. EXISTING SERVICE CONNECTIONS MAY BE RECONNECTED AND REMAIN CLOSED OFF TO THE NEW MAIN AS REQUIRED DURING CONSTRUCTION.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

		<b>ENGINEERING STANDARDS</b>	
<b>PHYSICAL SEPARATION REQUIREMENTS FOR INSTALLATION OF NEW WATERMAINS</b>			
DWN.	S.G.	DATE	JAN./15
REVISED:		 MANAGER ENGINEERING DIVISION	
SCALE	N. T. S.		
DWG. NO. <b>W-117-2</b>			

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#### NOTES:

1. This graph is derived from OPSS 701 watermain specifications and is based on an allowable leakage of 0.082 liters per millimeter of pipe diameter per kilometer of pipe for the 2 hour test period at a static pressure of 1035 kPa.
2. Flushing and air bleeding shall be completed prior to start of test.
3. The minimum duration of test shall be 2 hours.
4. The test pressure shall not fall below 1000 kPa during the test. If the pressure falls, the test pump shall be used to maintain a test pressure of 1035 kPa and the measured leakage recorded.
5. Hydrant leads and barrels shall be included within the test section.

**CITY OF**  
**Thunder Bay**  
Superior by Nature

**ENGINEERING  
STANDARDS**

TITLE

**ALLOWABLE LEAKAGE  
FOR WATERMANS**

DWN.

D.R. DATE

AUG. / 81

REVISED:

DEC. 2009

SCALE

N. T. S.

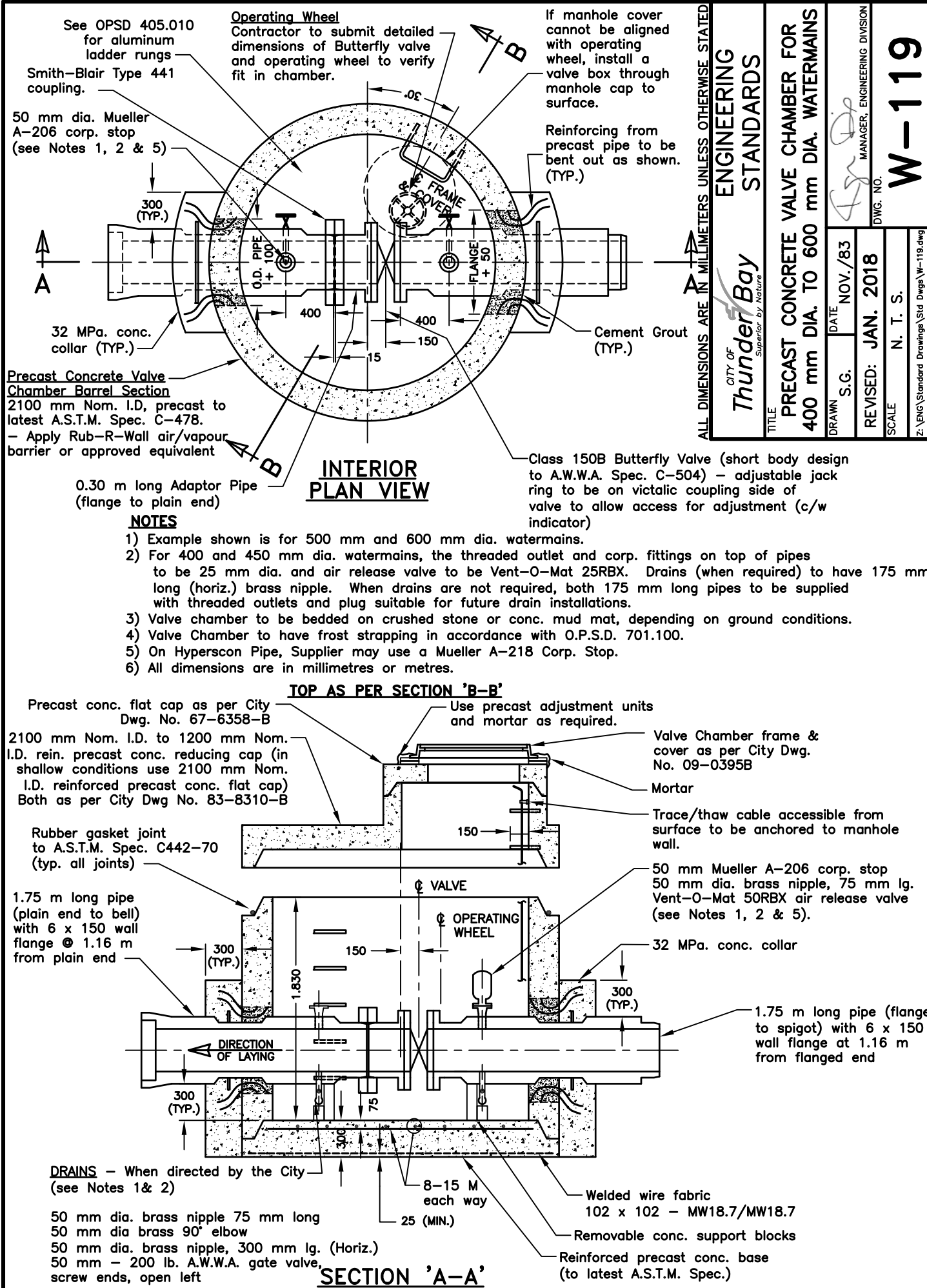
DWG. NO.

MANAGER, ENGINEERING DIVISION

**W-118**

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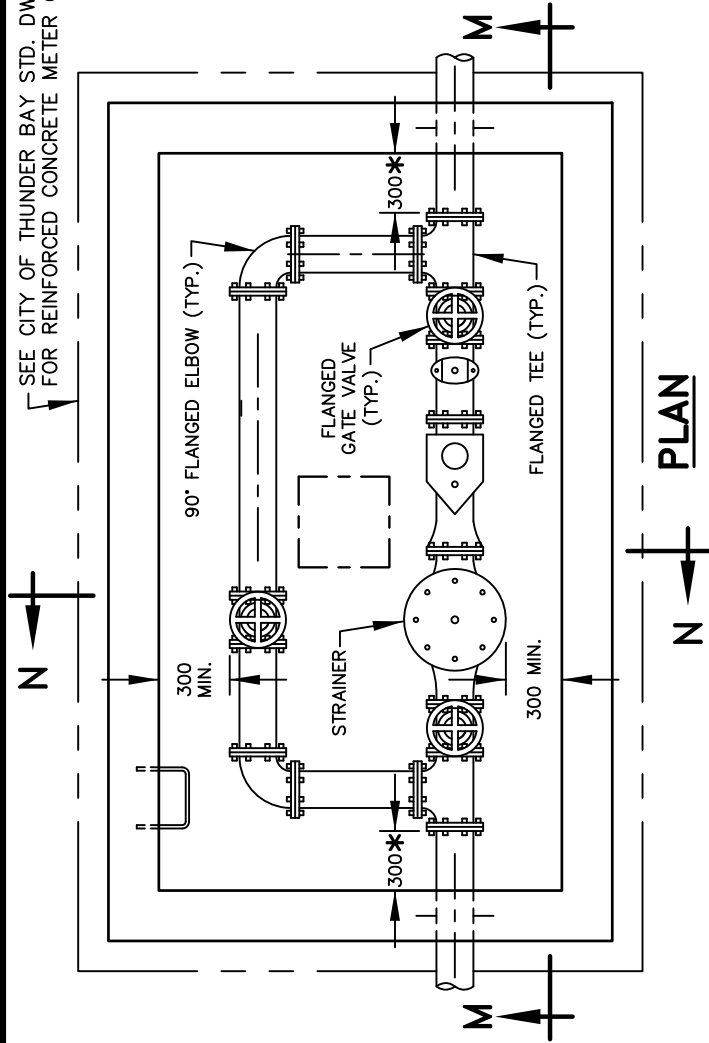




**W-120-1**

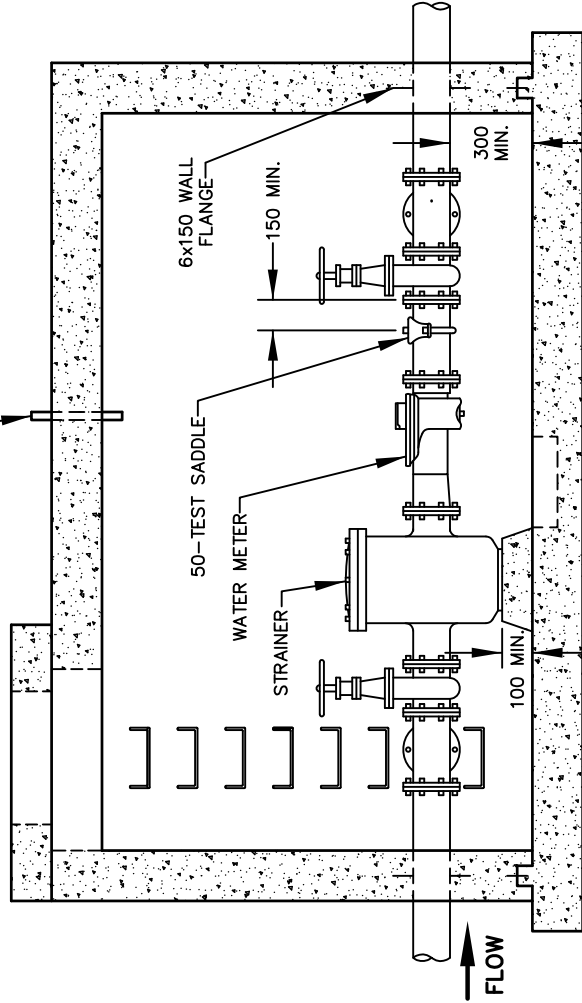


SEE CITY OF THUNDER BAY STD. DWG. W-120-1  
FOR REINFORCED CONCRETE METER CHAMBER

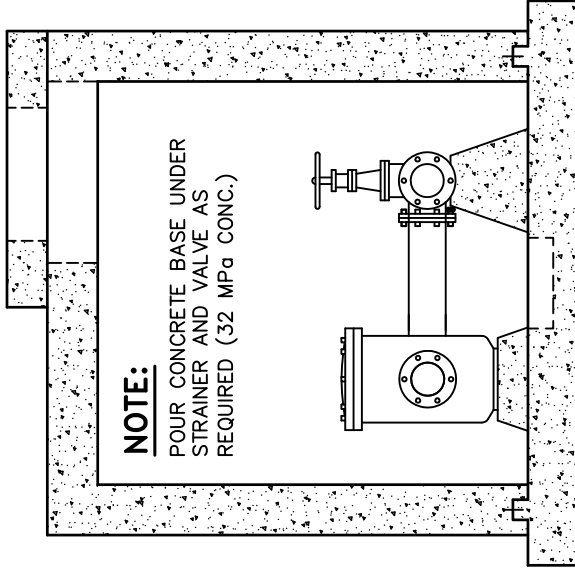


## PLAN

2-20 mm P.V.C. CONDUIT ABOVE METER



## SECTION M-M



## NOTE:

POUR CONCRETE BASE UNDER  
STRAINER AND VALVE AS  
REQUIRED (32 MPa CONC.)

## SECTION N-N

## NOTES:

1. METER AND STRAINER FOR FIRE SERVICE CONNECTIONS.
2. CONFIRM PIPING, METER AND STRAINER DIMENSIONS PRIOR TO ASSEMBLY TO SUIT VAULT SIZE.
3. MINIMUM DIMENSION REDUCED FOR 250mm METER SIZE ONLY.
4. THIS DETAIL IS NOT SUITABLE FOR INSTALLATION OF A BACKFLOW PREVENTOR.

\*

ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

CITY OF  
**Thunder Bay**  
*Superior by Nature*

ENGINEERING  
STANDARDS

TITLE

GENERAL ARRANGEMENT  
-WATER METER CHAMBER

DWN: S.G. DATE: SEPT./81

REVISED: JAN. 2018

SCALE: N. T. S.

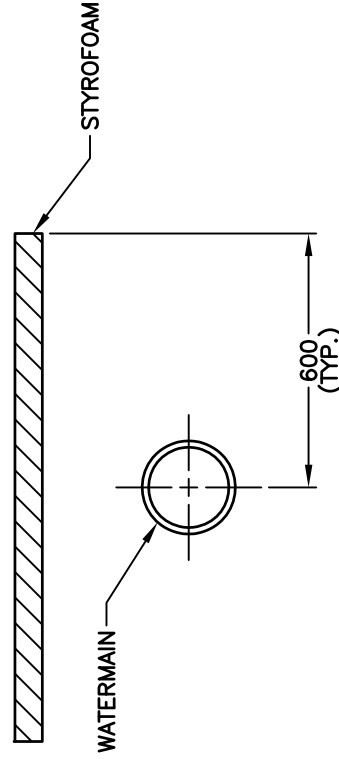
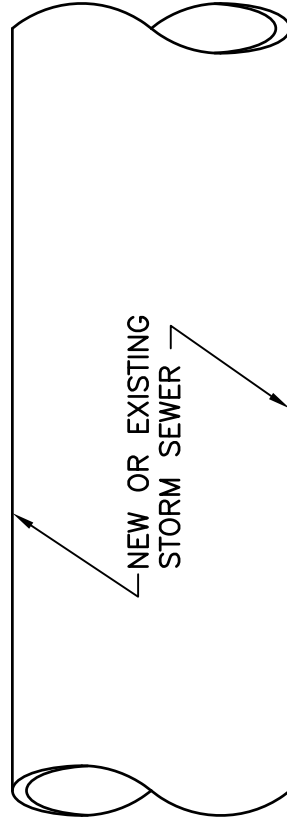
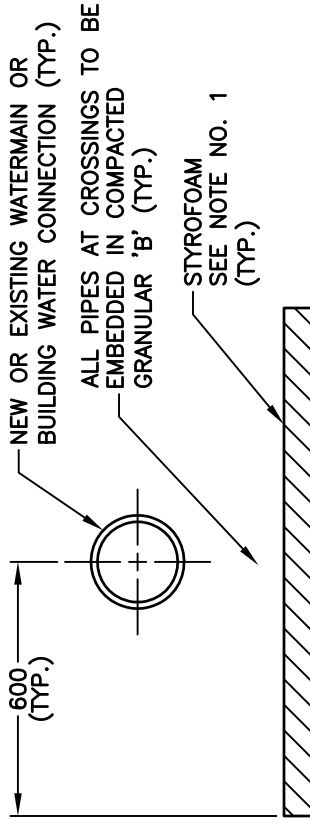
DWG. NO.

**W-120-2**

MANAGER, ENGINEERING DIVISION

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### NOTES:

- 1) STYROFOAM TO BE 50 mm THICK "H.I. BRAND", PLACED TO WIDTH OF SEWER TRENCH (O.D. + 600 mm MIN.).
- 2) WHEN INSTALLING NEW WATERMAINS, JOINTS ARE TO BE 2.45 m (MIN.) FROM  $\phi$  SEWER. JOINTS SHALL BE MADE USING SMITH-BLAIR TYPE 441 OR ROBAR TYPE 1406 COUPLINGS.
- 3) ALL GRANULAR MATERIAL COMPACTION SHALL BE TO 100% PROCTOR DENSITY.

ALL DIMENSIONS ARE IN MILLIMETRES OR METRES.

CITY OF  
**Thunder Bay**  
*Superior by Nature*

ENGINEERING  
STANDARDS

TITLE

**WATERMAIN CROSSING SEWER MAIN  
WITH LESS THAN 500 mm VERTICAL SEPARATION**

DRAWN

L.S./L.T.G.

DATE

OCT. 1993

REVISED: FEB. 2003

SCALE

N. T. S.

PATH

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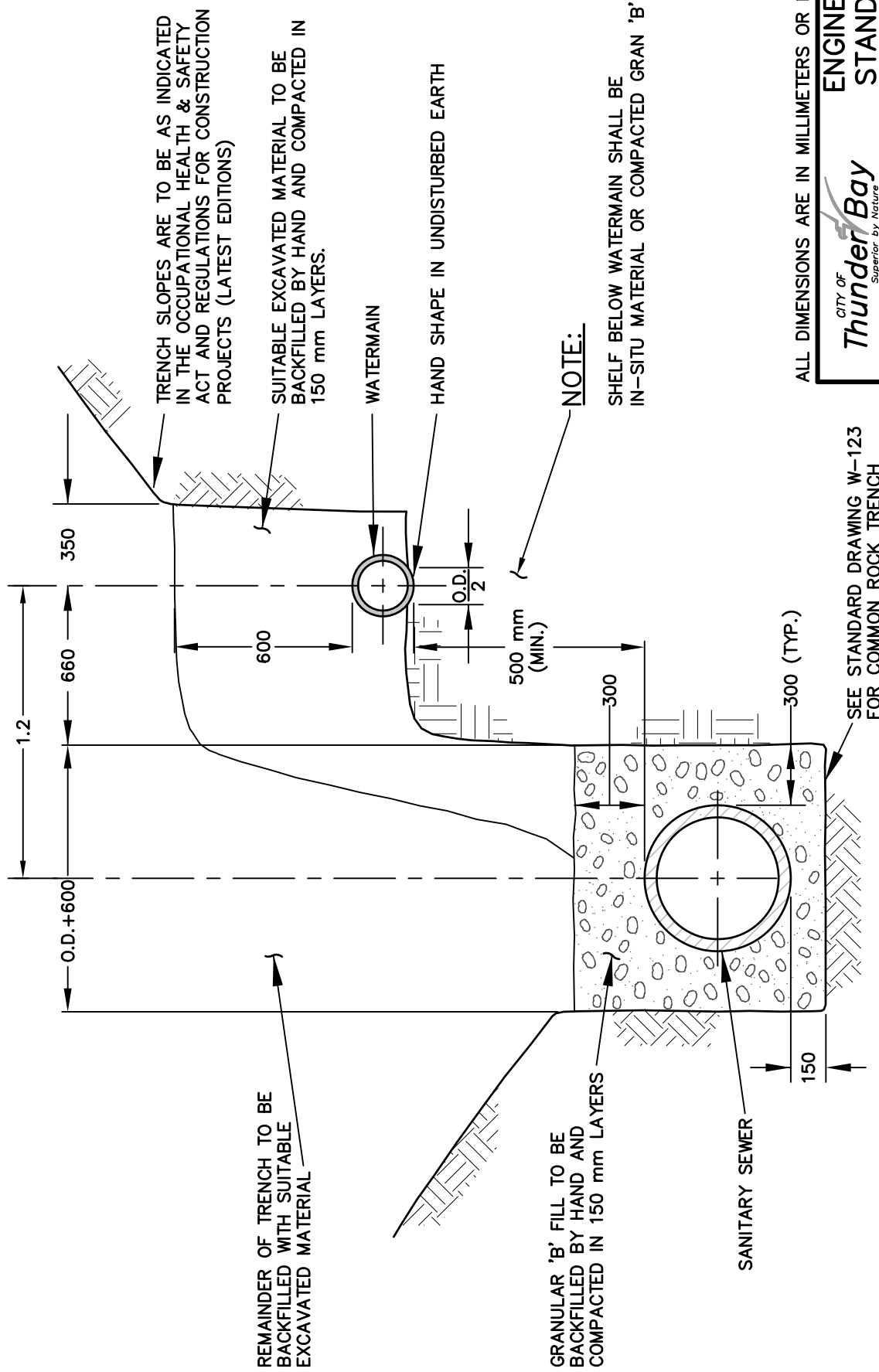
DWG. NO.

**W-121**

CITY ENGINEER

*[Signature]*





## COMMON EARTH TRENCH

### NOTE:

1. This detail shall be used only when "common trench" construction has been approved by the Manager of Engineering Division.

ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

CITY OF  
**Thunder Bay**  
*Superior by Nature*

ENGINEERING  
STANDARDS

TITLE

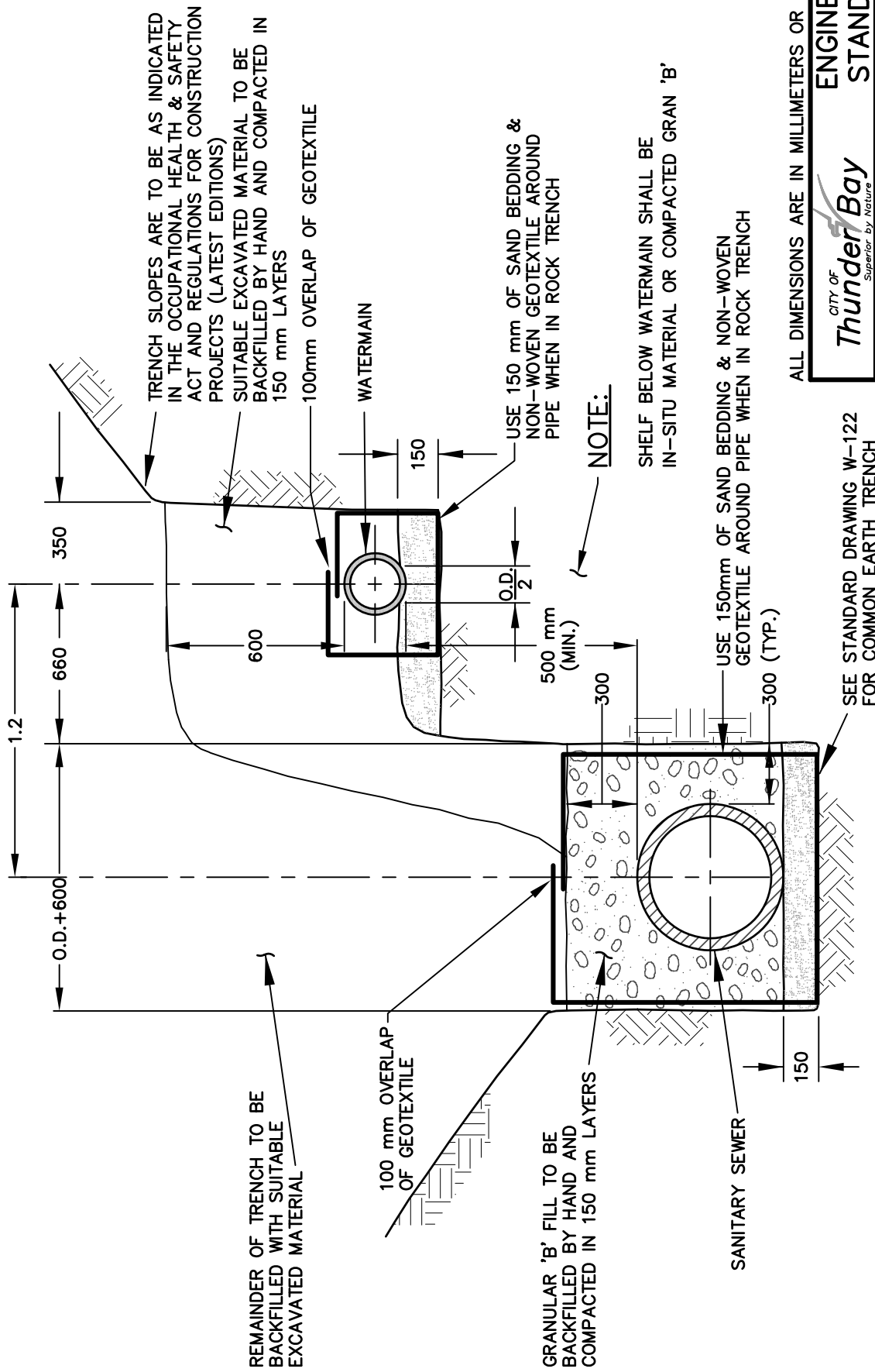
**SANITARY SEWER & WATERMAIN  
INSTALLATION IN COMMON EARTH TRENCH**

DRAWN	DATE	DWG. NO.
L.S./D.R.	JAN. 1985	
REVISED: DEC. 2009		
SCALE	N. T. S.	
Z:\ENG\Standard Drawings\Std Dwg\W-122.dwg		

*[Signature]*  
MANAGER, ENGINEERING DIVISION

**W-122**





# NOTES:

1. This detail shall be used only when "common trench" construction has been approved by the Manager of Engineering Division.

ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

CITY OF  
**Thunder Bay**  
*Superior by Nature*

ENGINEERING  
STANDARDS

SANITARY SEWER & WATERMAIN  
INSTALLATION IN COMMON ROCK TRENCH

DRAWN	DATE	MANAGER
L.S./D.R.	JAN. 1985	<i>J. Moore</i>
REVISED: DEC. 2009	DWG. NO.	
SCALE	N. T. S.	
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**W-123**



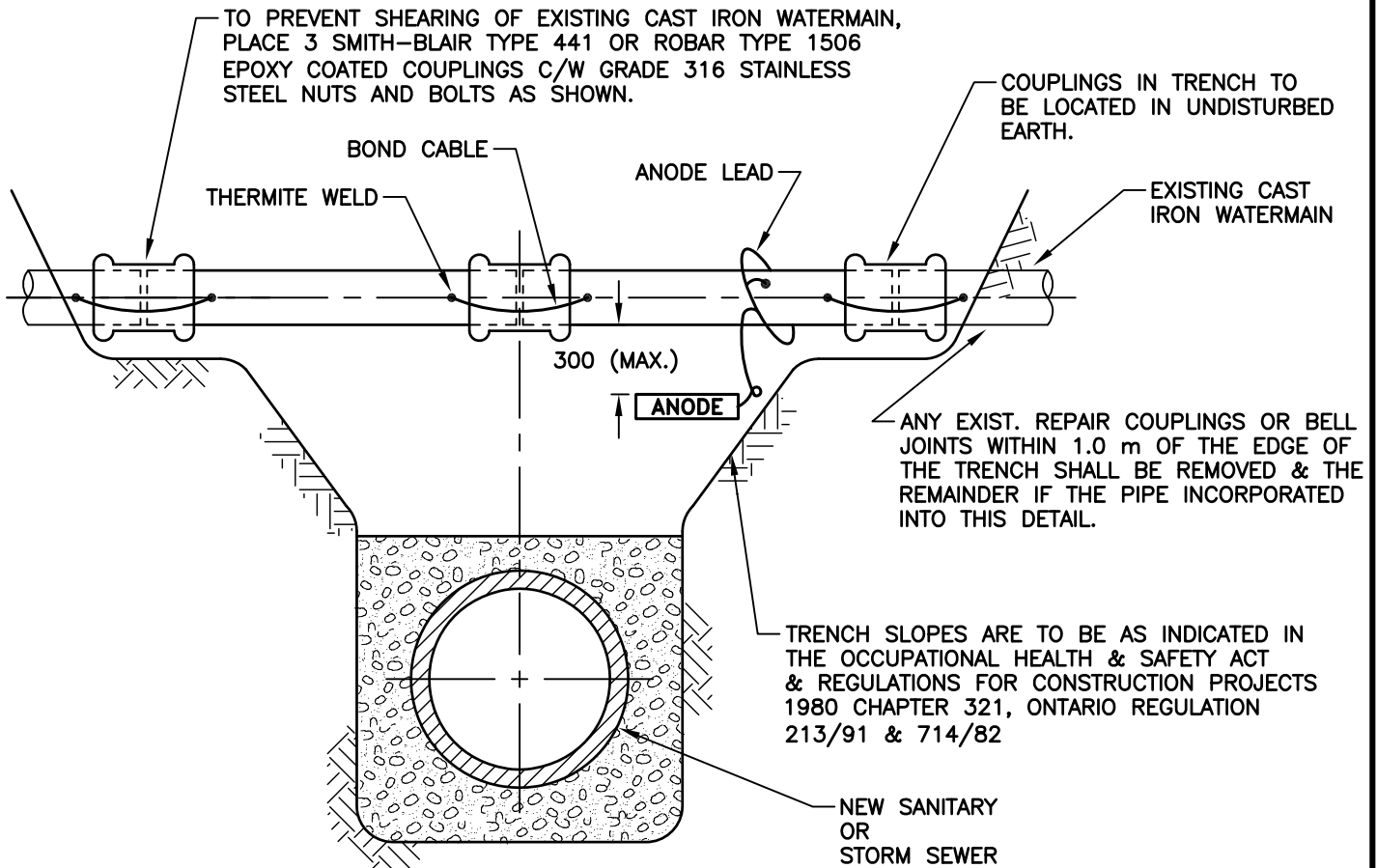
## CATHODIC PROTECTION

- 1) REFER TO STD. DWG. W-125 FOR TYPICAL CATHODIC PROTECTION DETAILS
- 2) ANODE SPACING TO BE MAINTAINED AS PER SECTION 8.0

### NOTE

FOR USE ON CAST WATERMAINS 100 TO 300 mm DIAMETER.

(STANDARD MAY BE APPLIED TO LARGER CAST IRON WATERMAINS UP TO 600 mm DIA. AT THE DISCRETION OF THE CITY ENGINEER.)



ALL DIMENSIONS ARE IN MILLIMETRES OR METRES.

ENGINEERING  
STANDARDS

CITY OF  
**Thunder Bay**  
*Superior by Nature*

TITLE  
PROTECTION OF EXISTING CAST  
IRON WATERMAIN OVER NEW SANITARY  
OR STORM SEWER

DRAWN  
L.S./L.T.G.

DATE  
AUG. 1992

REVISED: FEB. 2003

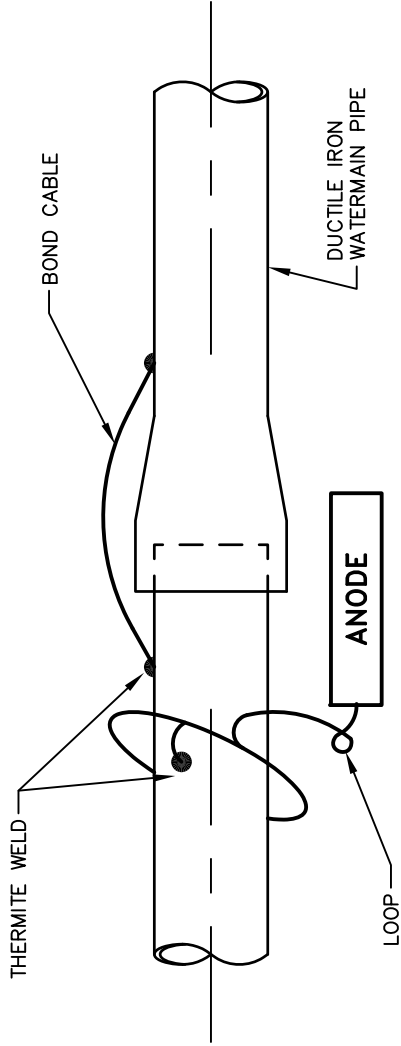
SCALE  
N. T. S.

PATH  
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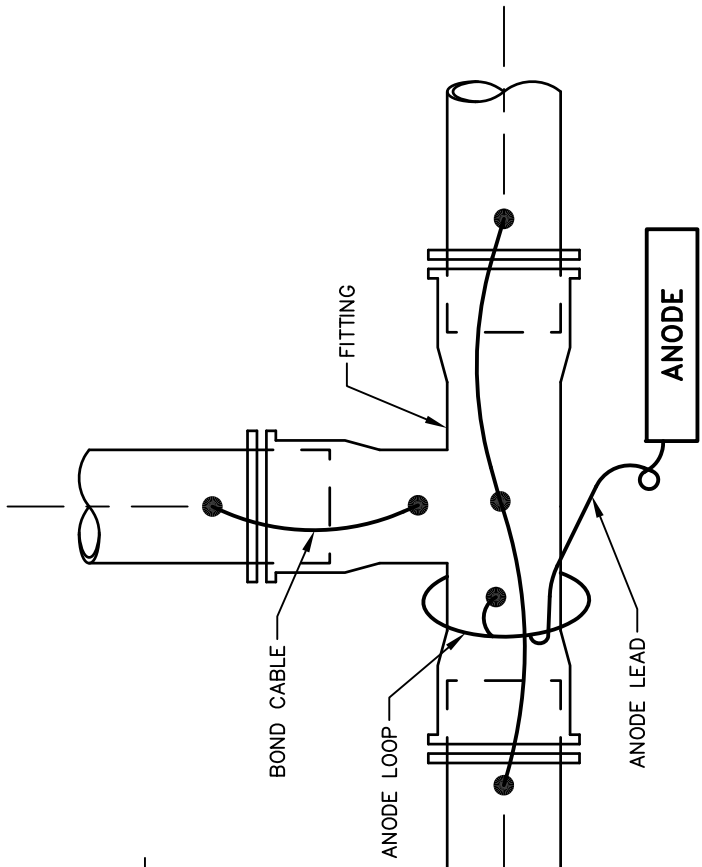
CITY ENGINEER  
DWG. NO.

**W-124**

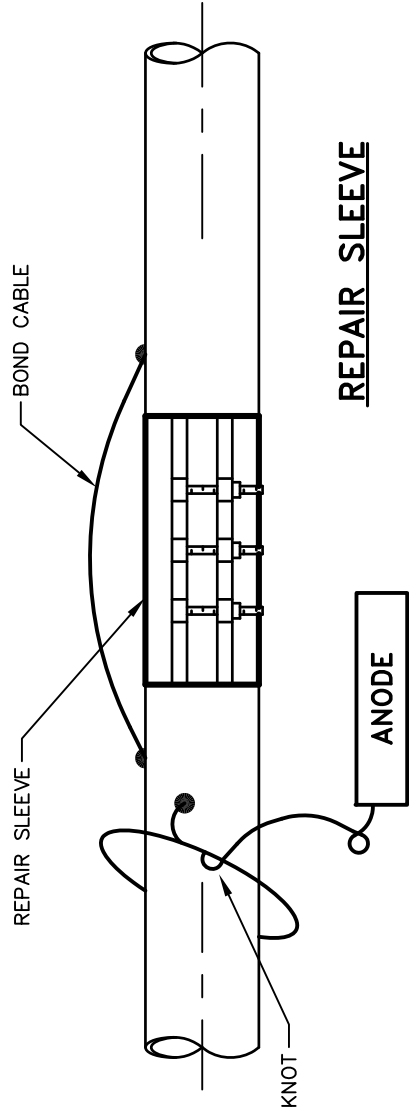




**WATERMAIN JOINT**



**VALVE OR FITTING**



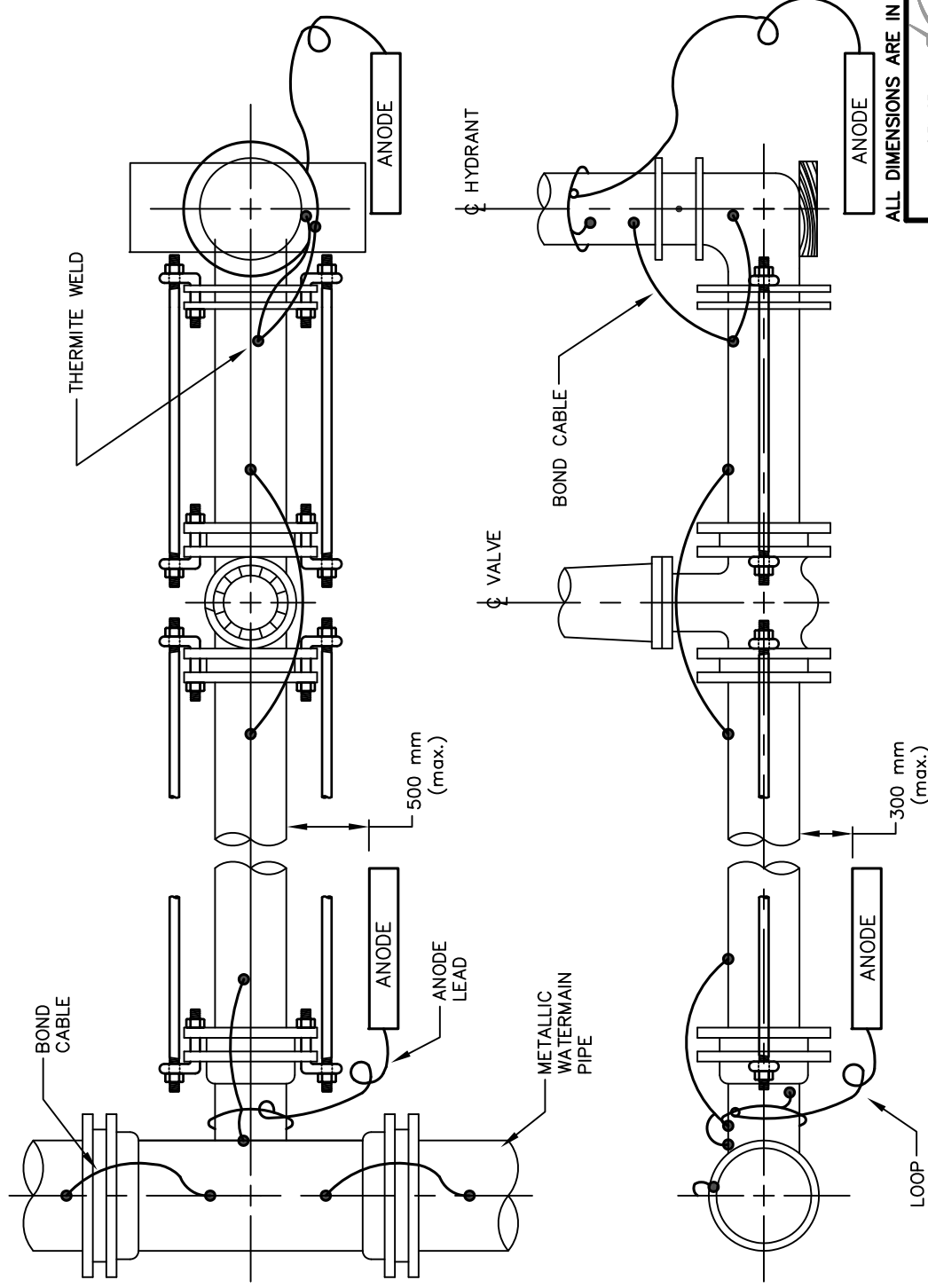
**REPAIR SLEEVE**

**NOTES:**

- 1) REFER TO SECTION 8.0 OF THE CITY OF THUNDER BAY ENGINEERING AND DEVELOPMENT STANDARDS FOR CORROSION PROTECTION REQUIREMENTS
- 2) MULTIPLE FITTINGS (UP TO 4 MAX.) CAN BE PROTECTED BY A SINGLE ANODE IF THEY ARE ALL LOCATED WITHIN 3 m OF EACH OTHER

CITY OF <b>Thunder Bay</b> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE <b>BONDING &amp; CATHODIC PROTECTION OF METALLIC MAINS &amp; FITTINGS</b>			
DWN. M.P.	DATE APR. 1995	MANAGER, ENGINEERING DIVISION <i>[Signature]</i>	
REVISED: JAN. 2012		DWG. NO. <b>W-125</b>	
SCALE N. T. S.			
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# NOTES:

REFER TO SECTION 8.0 OF THE CITY OF THUNDER BAY ENGINEERING AND DEVELOPMENT STANDARDS FOR CORROSION PROTECTION REQUIREMENTS.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

CITY OF  
**Thunder Bay**  
*Superior by Nature*  
ENGINEERING  
STANDARDS

TITLE  
**BONDING & CATHODIC PROTECTION  
OF HYDRANT WITH METALLIC LEADS**

DRAWN K.S./S.K.H.	DATE APRIL 1995
REVISD: JAN 2018	
SCALE N. T. S.	

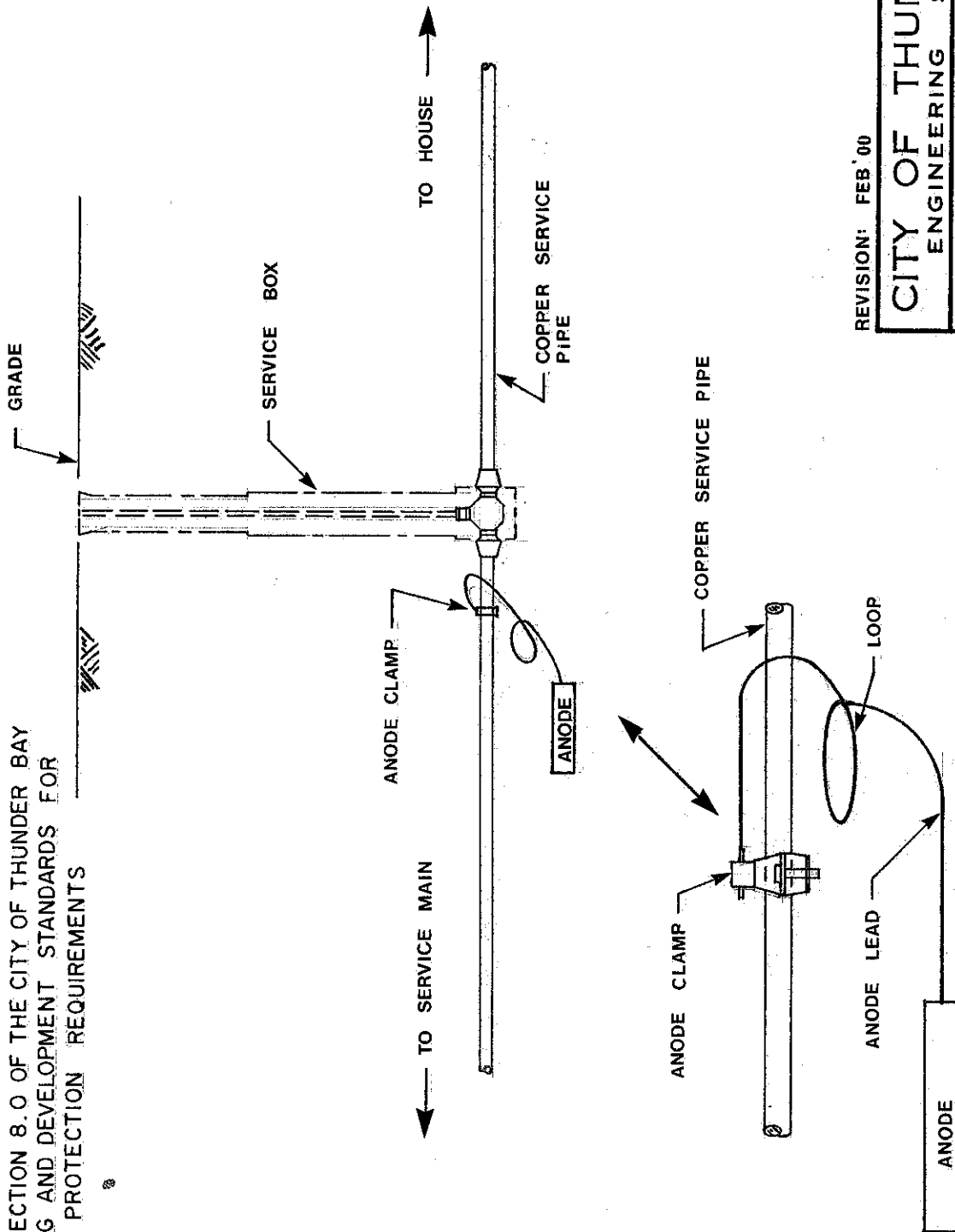
DWG. NO.  
**W-126**

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**NOTE:**

- REFER TO SECTION 8.0 OF THE CITY OF THUNDER BAY  
ENGINEERING AND DEVELOPMENT STANDARDS FOR  
CORROSION PROTECTION REQUIREMENTS



REVISION: FEB'00

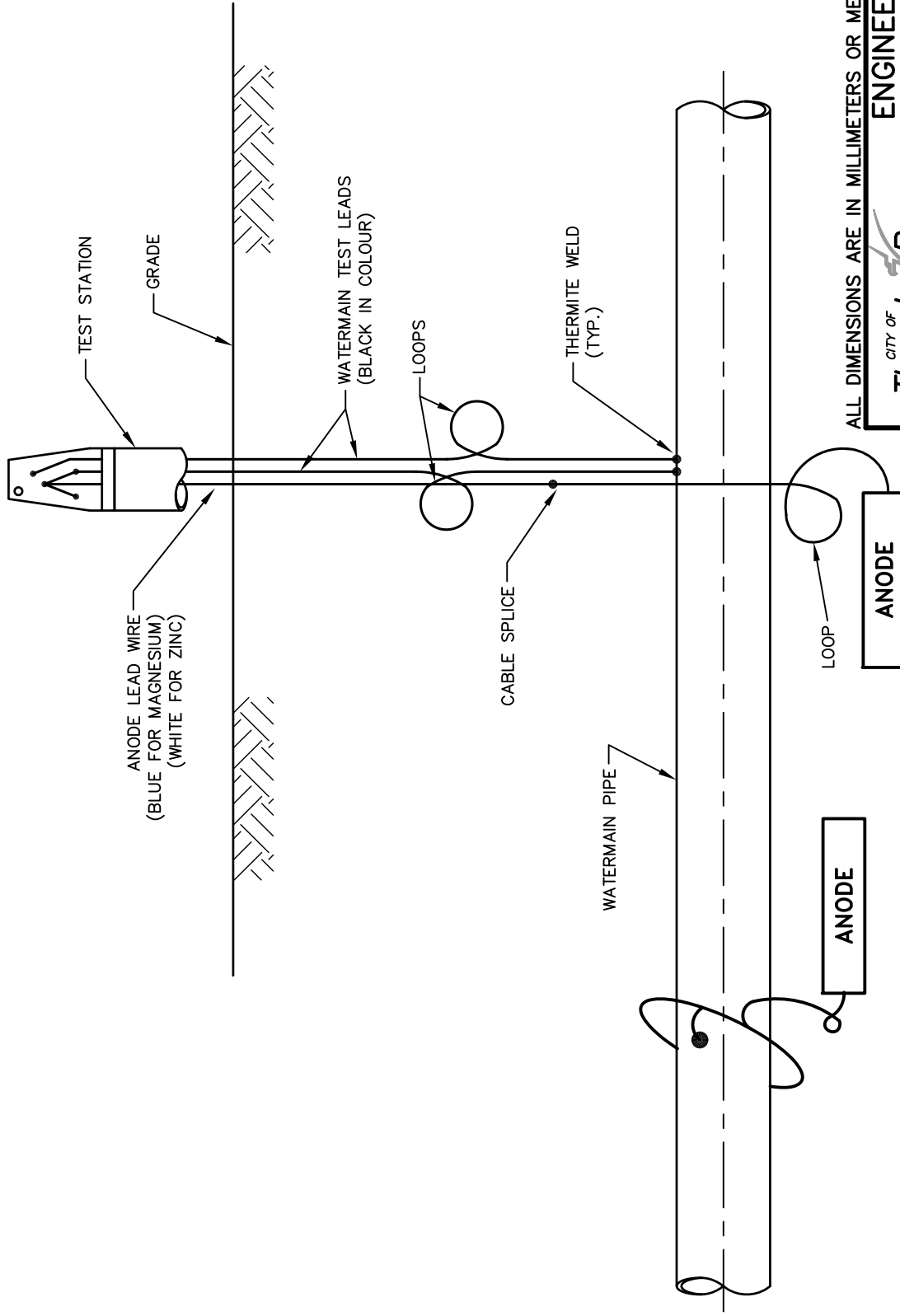
CITY OF THUNDER BAY  
ENGINEERING STANDARDS

TITLE  
CATHODIC PROTECTION FOR  
COPPER SERVICES

DWN. KS	DATE APR '95	CITY ENGINEER
CH'KD.	DATE	DWG. NO.
SCALE		

W-127





# **NOTES:**

- 1) Post mount test stations shall be 2440 mm long carsonite perma post, 100 mm x 100 mm, composite test stations equipped with a 6 terminal board.
- 3) Refer to Section 8.0 of The City of Thunder Bay Engineering and Development Standards for corrosion protection requirements.

ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

CITY OF  
**Thunder Bay**  
*Superior by Nature*  
ENGINEERING  
STANDARDS

TITLE  
**DETAILS OF SACRIFICIAL ANODE  
TEST STATION CONNECTIONS**

DRAWN  
K.S./L.T.G.  
DATE  
APR. 1995

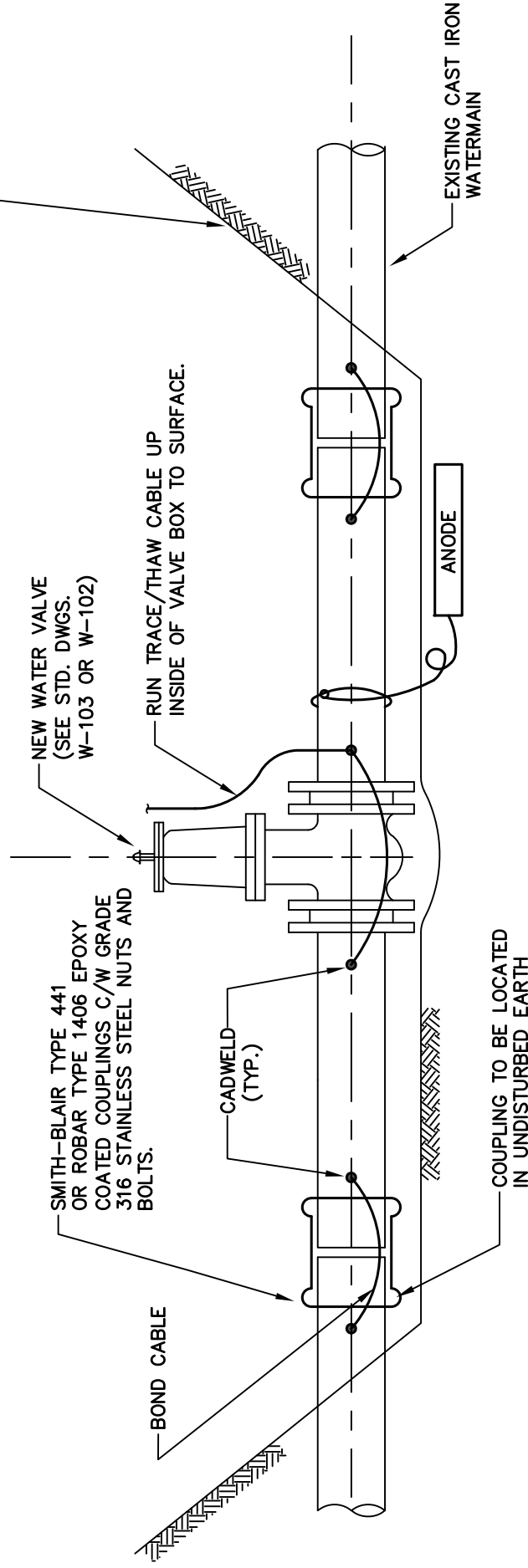
REVISD: MAR. 1/05  
SCALE  
N. T. S.

MANAGER, ENGINEERING DIVISION  
DWG. NO.  
**W-128**

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TRENCH SLOPES TO BE AS INDICATED  
IN THE OCCUPATIONAL HEALTH AND SAFETY  
ACT & REGULATIONS FOR CONSTRUCTION  
PROJECTS 1980 CHAPTER 321, ONTARIO  
REGULATION 213/91 & 714/82.



### NOTES:

1. CATHODIC PROTECTION - REFER TO STANDARD DRAWING W-125 FOR TYPICAL DETAILS.
2. FOR USE ON 100mm TO 300mm DIAMETER WATERMAINS. THIS STANDARD MAY BE APPLIED TO LARGER CAST IRON WATERMAINS UP TO 600mm DIAMETER AT THE DISCRETION OF THE MANAGER OF ENGINEERING DIVISION.
3. EXCAVATION WHICH WILL BE LEFT OPEN FOR MORE THAN 24 HOURS TO ACCOMMODATE ON GOING WORK SUCH AS CEMENT LINING OF WATERMAINS, SHALL BE SHORED TO THE SATISFACTION OF THE MANAGER OF THE ENGINEERING DIVISION.
4. ANODE SPACING TO BE MAINTAINED AS PER SECTION 8.1.1.2.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE STATED

CITY OF  
**Thunder Bay**  
*Superior by Nature*  
ENGINEERING  
STANDARDS

TITLE  
**VALVE REPLACEMENT FOR  
NON-STANDARD PIPE TYPE**

DRAWN S.G. DATE APRIL 1997  
MANAGER, ENGINEERING DIVISION

REVISED: JAN. 2018  
SCALE N. T. S.

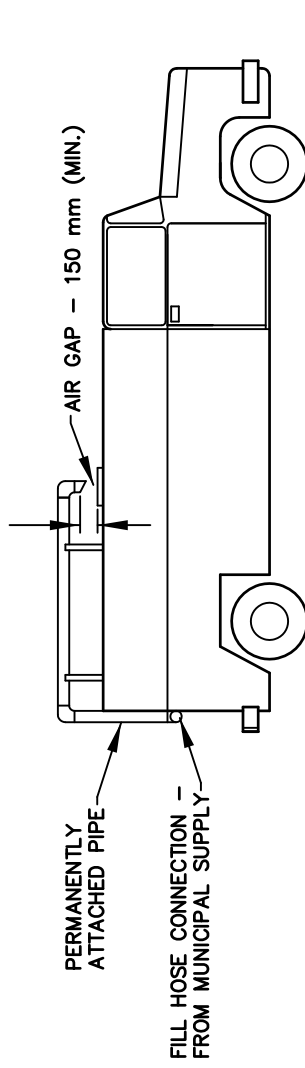
DWG. NO.  
**W-129**

Z: \ENG\Standard Drawings\Std Dwg\W-129.dwg

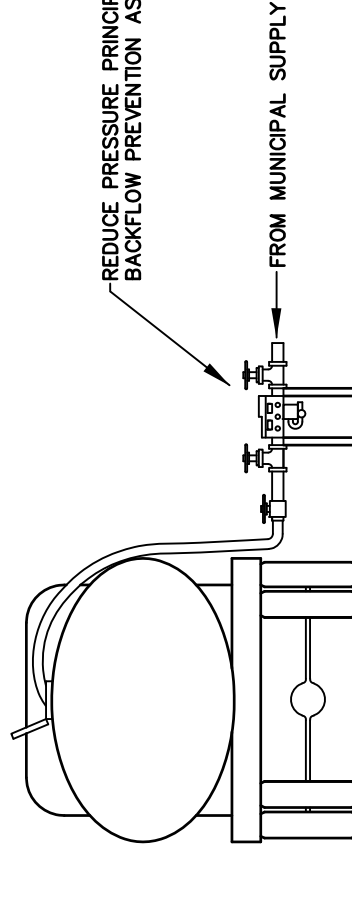






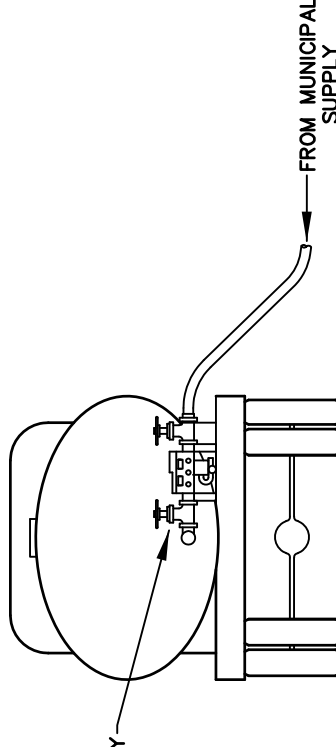


**TYPICAL AIR GAP**



**TYPICAL BACKFLOW PREVENTER**

(REMOTE MOUNT)



**TYPICAL BACKFLOW PREVENTER**

(TRUCK MOUNT)

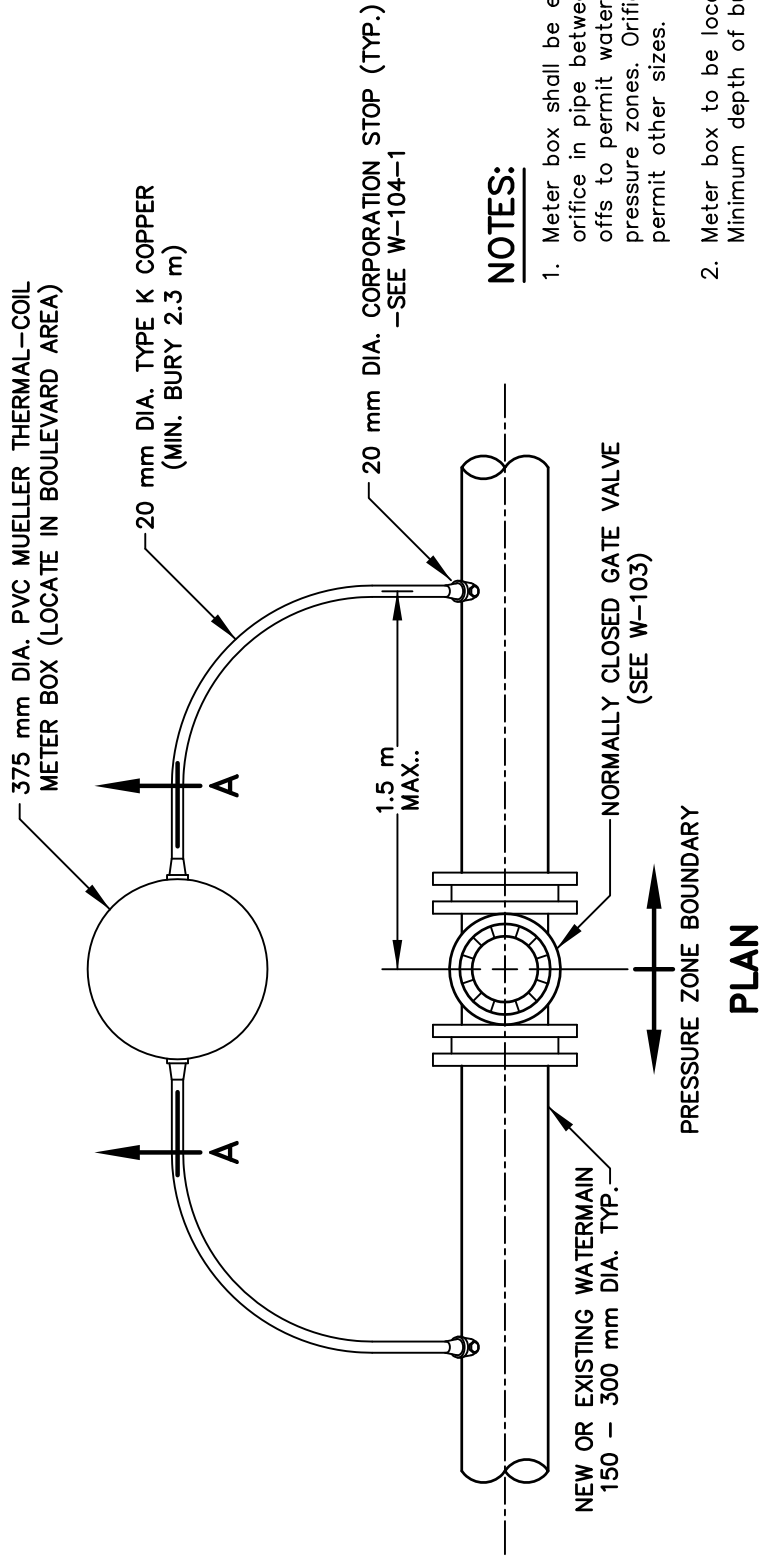
**NOTES:**

1. An approved backflow prevention device or air gap shall be installed on all water-hauling equipment where obtaining water from a municipal supply is required.
2. Reduced pressure principle backflow preventers are the only type acceptable. Single or double check valves are not permitted.

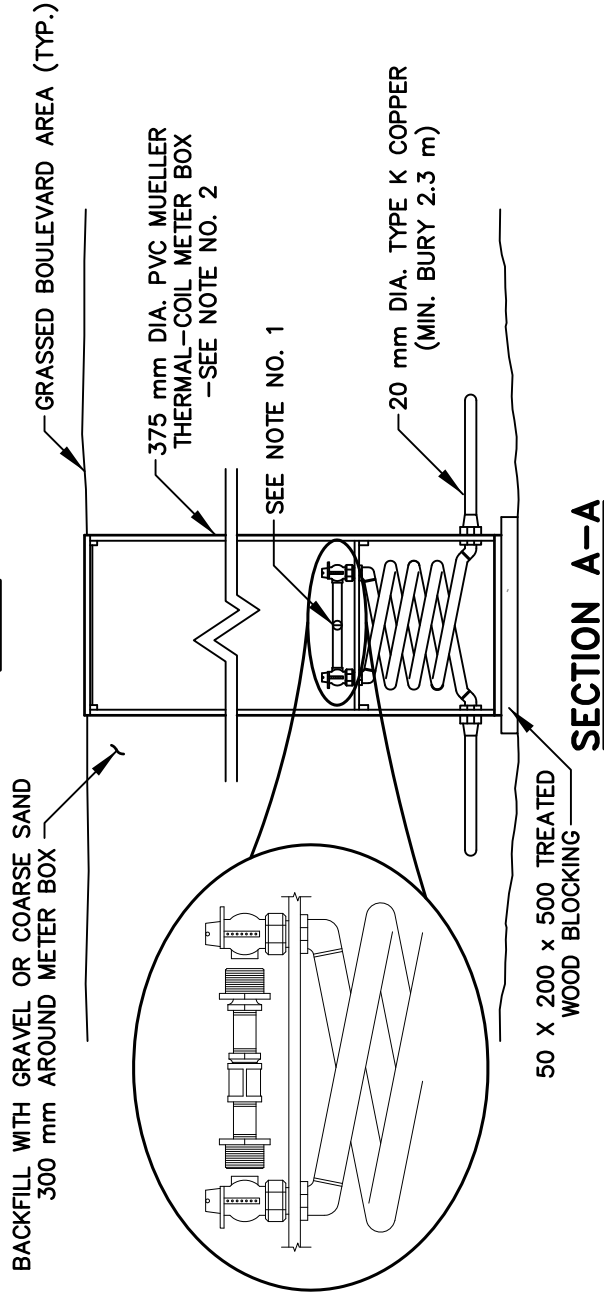
ALL DIMENSIONS ARE IN METER OR MILLIMETRES

CITY OF <i>Thunder Bay</i> <i>Superior by Nature</i>		ENGINEERING STANDARDS	
TITLE WATER-HAULING EQUIPMENT AND BACKFLOW DEVICES			
DWG. NO.	D. R.	DATE	<i>J. Mauro</i> MANAGER, ENGINEERING DIVISION
		DEC./06	
NEW:	DEC./06		DWG. NO.
SCALE	N. T. S.		W-131
Z:\ENG\Standard Drawings\Std Dwg\W-131.dwg			





## PLAN



## NOTES:

1. Meter box shall be equipped with 12 mm orifice in pipe between isolation valve shut offs to permit water circulation between pressure zones. Orifice shall be removable to permit other sizes.
2. Meter box to be located in non vehicle area. Minimum depth of bury 2.3 m.
3. Alternate circulation by-pass configurations may be permitted following approval by the City Engineer.
4. All by-pass fittings shall be brass no lead type and all piping shall be copper.

ALL DIMENSIONS ARE IN MILLIMETERS OR METERS

CITY OF  
**Thunder Bay**  
*Superior by Nature*

**ENGINEERING  
STANDARDS**

TITLE  
**WATER PRESSURE ZONE BOUNDARY  
CIRCULATION BY-PASS**

REDRAWN S.G. DATE JAN./07

NEW: JAN. 2016

SCALE N. T. S.

DWG. NO. *[Signature]* MANAGER ENGINEERING DIVISION

**W-132**

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1. SHALL APPLY TO WATER LINES UP TO AND INCLUDING 50 mm DIA. FOR PIPE SIZES GREATER THAN 50 mm DIA. THE ENCLOSURE DESIGNS MUST BE APPROVED BY THE MANAGER OF ENGINEERING.
2. A BUILDING PERMIT IS REQUIRED.
3. INSTALL PIPE SUPPORTS AS REQUIRED.
4. METER AND BACK FLOW PREVENTER SHALL BE REMOVED FOR SEASONAL OPERATION.
5. SHUT OFF VALVE TO BE LOCATED 1.0 m OUTSIDE OF ENCLOSURE.
6. BACK FLOW PREVENTER SHALL BE REDUCED PRINCIPAL UNLESS APPROVAL FOR LESSER (REQUIRES REDUCED HAZARD ASSESSMENT AND APPROVAL FROM CITY OF THUNDER BAY BACK FLOW PREVENTION OFFICER).
7. IF A PUMP IS REQUIRED TO BLOW OFF THE SYPHON LINE OR ANY OTHER LINES A FILTERED AIR PUMP MUST BE USED TO AVOID CONTAMINATION.
8. CONCRETE SLAB SIZE SHALL BE 1.3 m X 0.635 m X 100 mm THICK WITH 30MPA CONCRETE AND 7% ± 1.5% AIR ENTRAINMENT. REINFORCE WITH 152 mm X 152 mm OPEN WIRE MESH.

2. A BUILDING PERMIT IS REQUIRED.
3. INSTALL PIPE SUPPORTS AS REQUIRED.
4. METER AND BACK FLOW PREVENTER SHALL BE REMOVED FOR SEASONAL OPERATION.
5. SHUT OFF VALVE TO BE LOCATED 1.0 m OUTSIDE OF ENCLOSURE.
6. BACK FLOW PREVENTER SHALL BE REDUCED PRINCIPAL UNLESS APPROVAL FOR LESSER (REQUIRES REDUCED HAZARD ASSESSMENT AND APPROVAL FROM CITY OF THUNDER BAY BACK FLOW PREVENTION OFFICER).
7. IF A PUMP IS REQUIRED TO BLOW OFF THE SYPHON LINE OR ANY OTHER LINES A FILTERED AIR PUMP MUST BE USED TO AVOID CONTAMINATION.
8. CONCRETE SLAB SIZE SHALL BE 1.3 m X 0.635 m X 100 mm THICK WITH 30MPA CONCRETE AND 7%  $\pm$  1.5% AIR ENTRAINMENT. REINFORCE WITH 152 mm X 152 mm OPEN WIRE MESH.
9. ENCLOSURE
  - HOT BOX MODEL DF2TL (ALUMINUM) WITH INTERNAL DIMENSIONS OF 991 MM(L) X 330 MM(W) X 914 MM(H) OR APPROVED EQUIVALENT SHALL BE USED.
  - ENCLOSURE SHALL BE CERTIFIED TO ASSE 1060 AS REQUIRED BY CSA STANDARD B64.10.
  - SHALL BE OF MIN. 1.3 mm THICK REINFORCED STUCCO EMBOSSED ALUMINUM SHEETING, PROVIDING ACCESS THROUGH FLIP BACK ROOF AND FRONT SECTION BEING TOTALLY REMOVABLE FOR MAINTENANCE PURPOSES.
  - SHALL HAVE A HINGED/FOLDING DESIGN WITH A MAX. OF TWO SECTIONS AND FOUR (4) BOLTS REQUIRED WITH NO PANELS REQUIRING JOB SITE ASSEMBLY TO BE ALLOWED. ENCLOSURE MUST OPEN FROM THE TOP AND FRONT.
  - ENCLOSURE DRAIN OPENINGS SHALL BE SIZED FOR FULL PORT BACKFLOW DISCHARGE AND DESIGNED FOR ONE WAY EXIT, INHIBITING INTRUSION OF DEBRIS AND OR VERMIN.
  - ENCLOSURE SHALL BE ANCHORED TO A CONCRETE SLAB FROM WITHIN THE ENCLOSURE WITH STAINLESS STEEL ANCHORS AND BE LOCKABLE FOR SECURITY PURPOSES.



ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED

**ENGINEERING STANDARDS**

**CITY OF Thunder Bay**  
Superior by Nature

**TITLE** SEASONAL BACKFLOW PREVENTION & WATER METER INSTALLATION

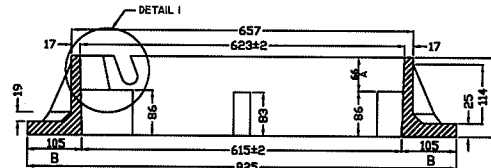
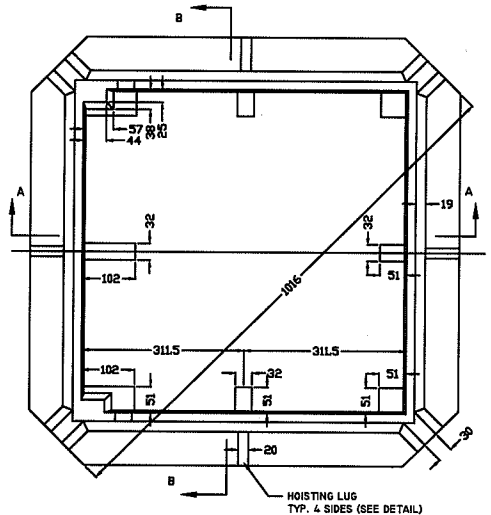
DWN.	C.P.	DATE	JAN. 2011
			
		ENGINEERING DIVISION MANSOUR	

REVISED:  
 SCALE N. T. S.  
**W-133**

Z: \ENG\Standard Drawings\Std Dwgs\W-133.dwg



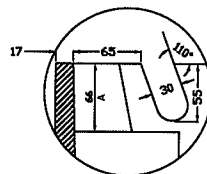
# FRAME PLAN



SECTION A-A

## NOTES:

- (1) CASTINGS SHALL CONFORM TO ALL REQUIREMENTS OF A.S.T.M. DESIGNATION A48 CLASS 20B.
- (2) CASTINGS SHALL BE PRODUCED TO THE DIMENSIONS AND WITHIN THE TOLERANCES NOTED IN TABLE I.
- (3) CASTINGS SHALL BE MARKED WITH THE PROPER IDENTIFICATION MARKINGS WHICH WILL INCLUDE:
  - (A) MARKINGS AS REQUESTED AT TIME OF ORDER.
  - (B) FOUNDRY IDENTIFICATION MARKING, AND YEAR OF CASTING.
  - (C) THESE MARKINGS SHALL BE SO LOCATED IN SUCH A MANNER AND OF SUCH SIZE THAT THEY ARE EASILY IDENTIFIABLE AFTER INSTALLATION.
- (4) ALL CASTING WILL BE FREE OF DEFECTS, BE TRUE TO PATTERN AND BE FREE FROM CRACKS, GAS HOLES, FLAWS AND EXCESSIVE SPRINKLE. SURFACES OF CASTING SHALL BE FREE FROM BURNT ON SAND AND SHALL BE REASONABLY SMOOTH.
- (5) CASTING SHALL NOT ROCK WHEN INSTALLED. THE MANUFACTURER SHALL TRIAL FIT THE CASTINGS AGAINST A STANDARD FRAME.
- (6) CASTING TO BE PAINTED BLACK.

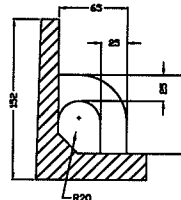
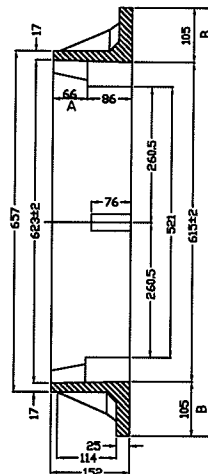


SLOT DETAIL I

TABLE I: MANUFACTURING TOLERANCE

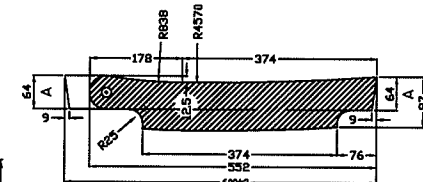
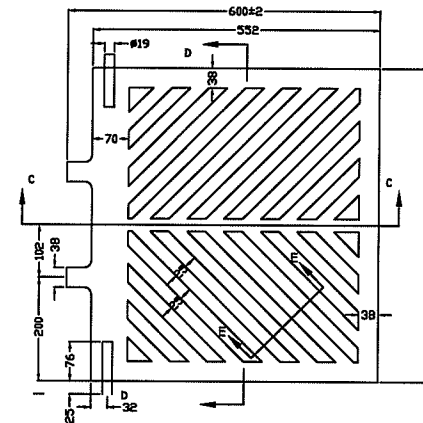
- ALL DIMENSIONS SHALL CONFORM TO ±3MM TOLERANCE EXCEPT:
- (1) AS NOTED.
  - (2) DIMENSIONS MARKED "A" SHALL CONFORM TO A ±1.5MM TOLERANCE.
  - (3) DIMENSIONS MARKED "B" SHALL CONFORM TO A ±8MM TOLERANCE.

SECTION B-B

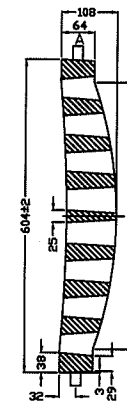


HOISTING LUG DETAIL

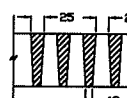
# GRATED COVER PLAN



SECTION C-C



SECTION D-D



SECTION E-E

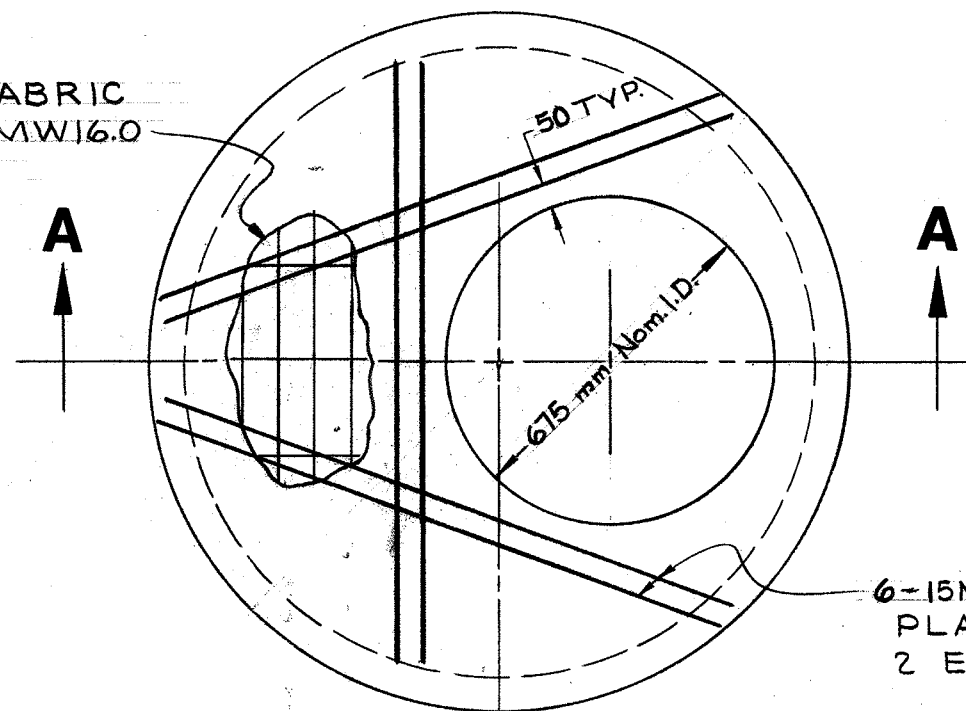
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ALL DIMENSIONS AND ELEVATIONS ARE IN UNITS OF MILLIMETERS UNLESS OTHERWISE NOTED

		<b>ENGINEERING DIVISION</b>	
TITLE <b>STANDARD CATCH BASIN FRAME AND GRATE ASSEMBLY</b>			
DRAWN BY L.B.	NAME L.B.	DATE NOV.2012	FILE NO. <b>13-0569</b>
CHECKED BY R.H.	NAME R.H.	DATE DEC.2012	SIZE <b>B</b>
SCALE N.T.S.		MANAGER, ENGINEERING DIVISION	

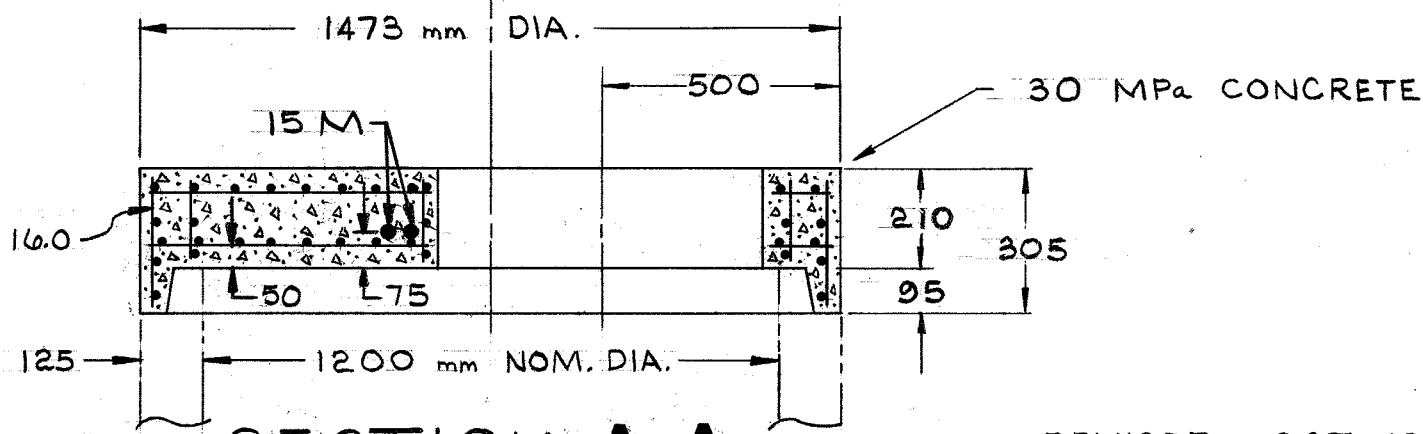


HORIZONTAL  
WELDED WIRE FABRIC  
76x203-MW 34.9/MW 16.0  
(TOP & BOTTOM)



6-15M BARS X 1270 LG.  
PLACED AS SHOWN  
2 EACH SIDE

VERTICAL  
WELDED WIRE FABRIC  
76x203-MW 34.9/MW 16.0



SECTION A-A

REVISED ; OCT., 1983.  
REVISED - METRIC - SEPT. /81  
REVISED APR. 9/73

# NOTE :

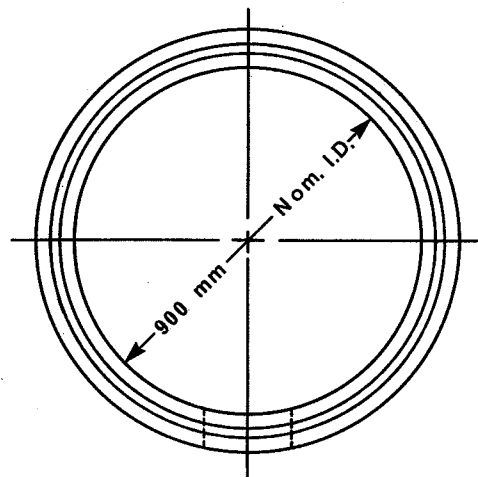
- CAP TO BE MANUFACTURED IN  
ACCORDANCE WITH THE LATEST  
A.S.T.M. SPECIFICATION C-478

ALL DIMENSIONS ARE IN MILLIMETRES.

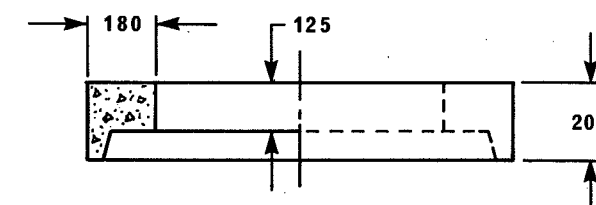
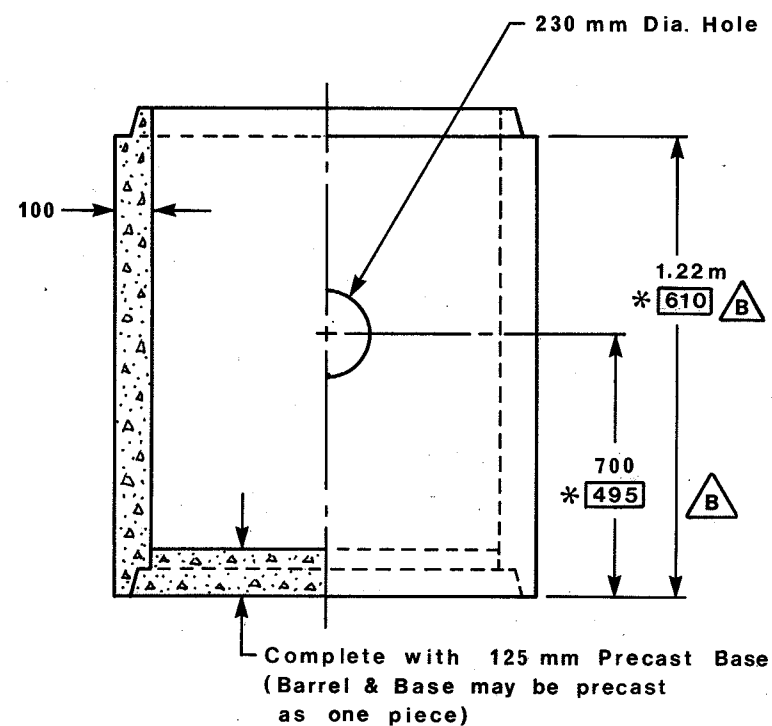
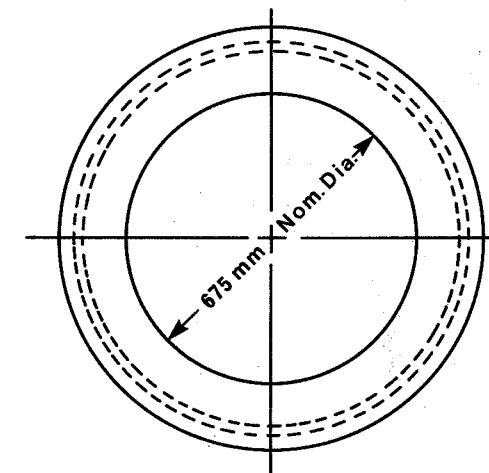
NAME		DATE	CITY OF THUNDER BAY ENGINEERING DEPARTMENT	
DR'WN. BY	B.G.	AUG. 1-67	TITLE	
TRACED BY			1200 mm Nom. I.D. Reinforced Precast Concrete Flat Manhole Cap	
CH'KD. BY			FILE NO.	
APP'RD. BY			67-6358	
APP'RD. BY			SIZE	
SCALE			B	

CITY ENGINEER

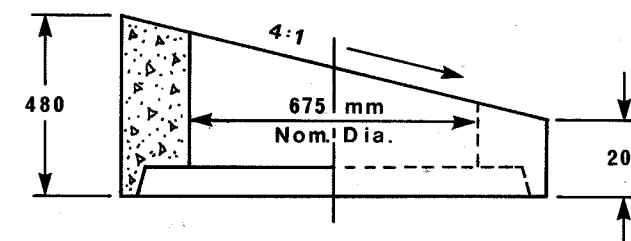




**NOTES:**  
Catch Basin Barrels & Caps to be manufactured in accordance with the latest A.S.T.M. Specification C-76 (Class II, Wall B)



**FLAT CAP**



**SLOPED CAP**

## CATCH BASIN CAP

All dimensions are in metres or millimetres.

## CATCH BASIN BARREL

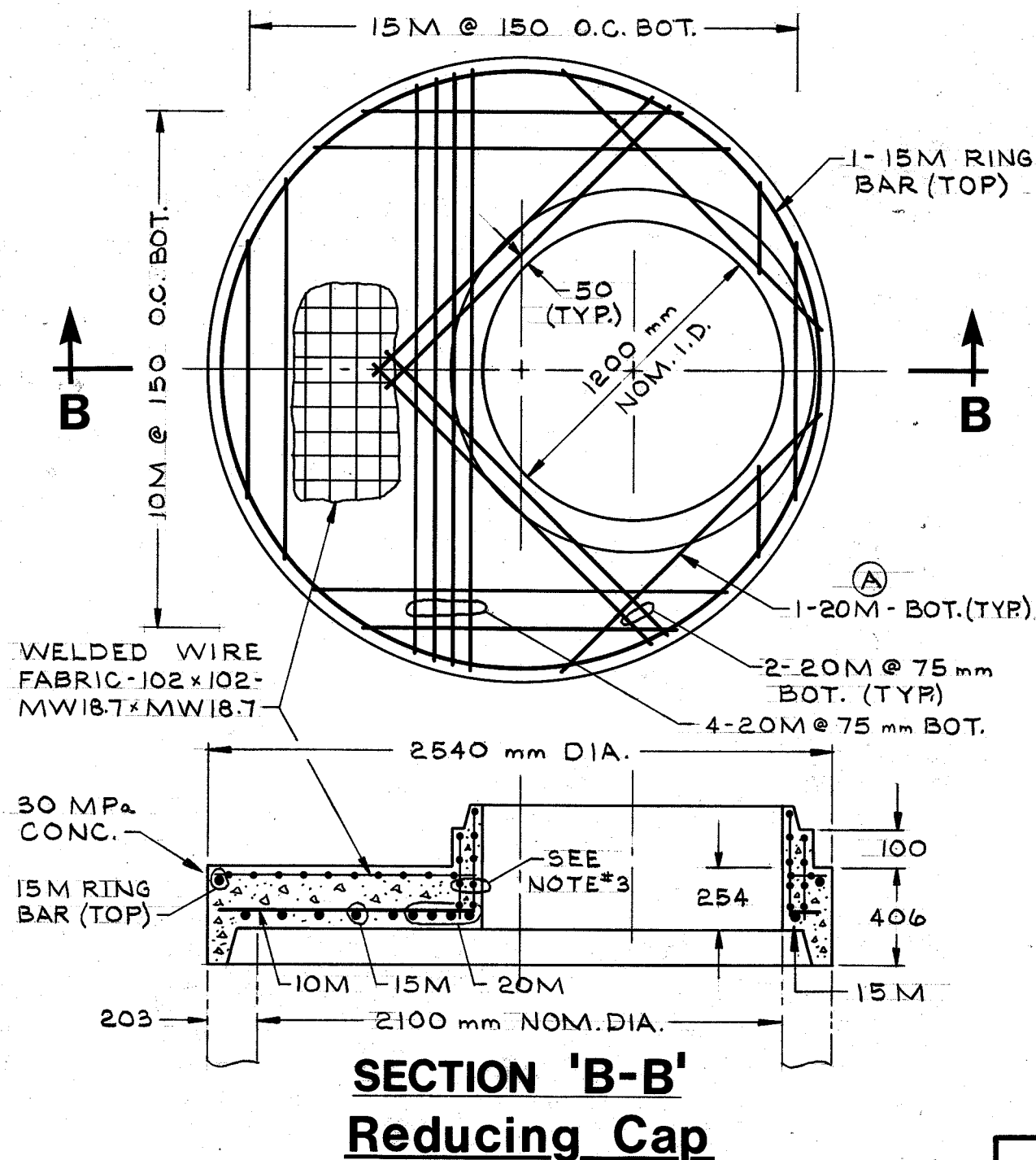
\* SHALLOW TYPE CATCH BASIN

NAME		DATE		CITY OF THUNDER BAY ENGINEERING DEPARTMENT	
DR'WN. BY	<i>W. T. H.</i>	3 Sept 1981		TITLE	
TRACED BY				PRECAST CATCH BASIN COMPONENTS	
CH'KD. BY					
APP'RD. BY					
APP'RD. BY					
SCALE	<i>~</i>			<i>R. Wright</i> CITY ENGINEER	FILE NO. <b>73-6992</b>
				SIZE	<b>B</b>

REVISIONS

<b>C</b> NOMINAL INSIDE DIAMETER CHANGED FROM 750 TO 675 L.S. AUG/92	<b>B</b> SHALLOW TYPE CATCH BASIN INFO. ADDED L.S. APR /90	<b>A</b> Redrawn to Metric, Sloped Cap Added, W.T.H. Sept. /81
---	---	---



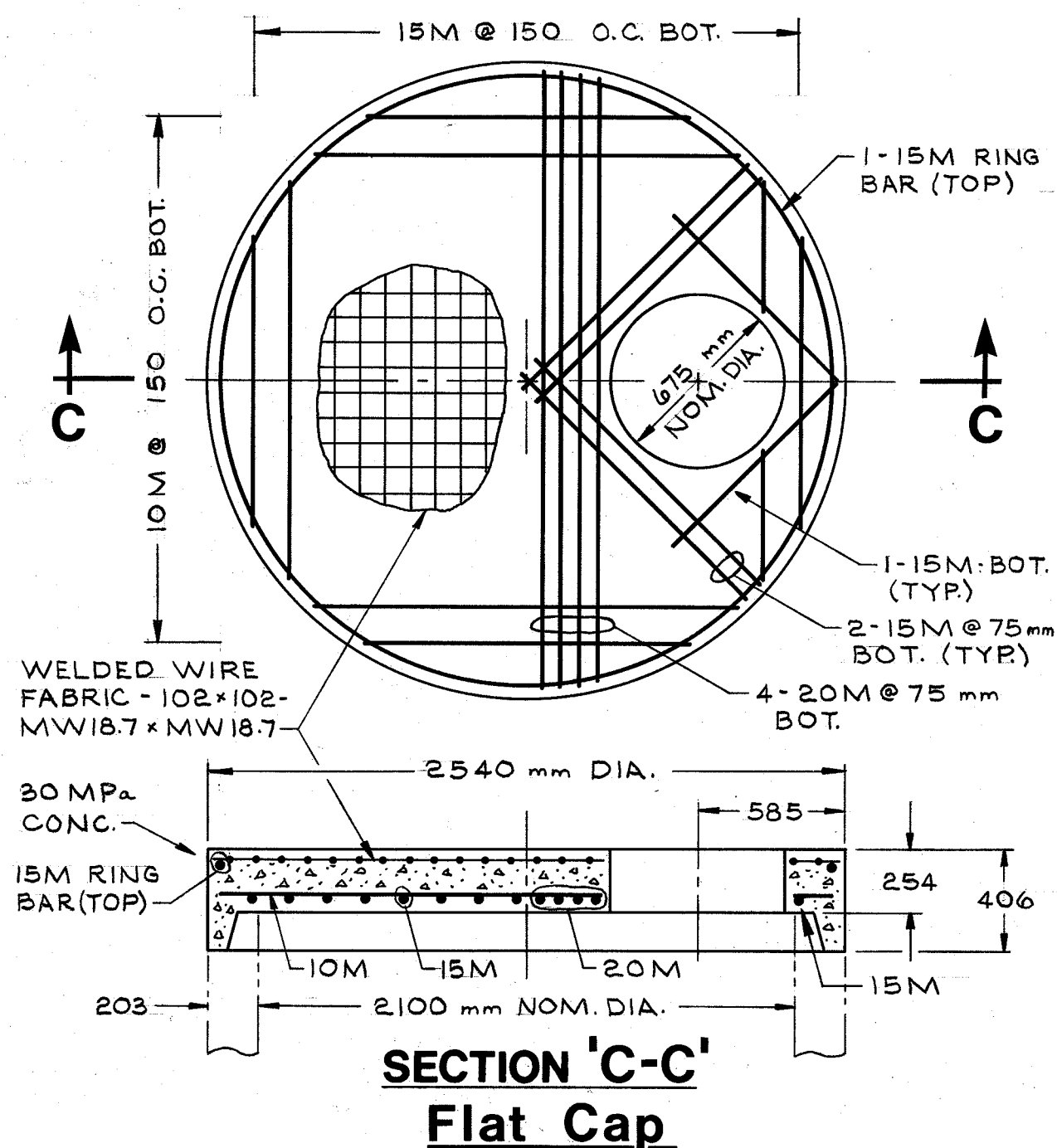



#### NOTES

- 1) Manufacture to latest A.S.T.M. Spec. C-478
- 2) Min. conc. cover - 25 mm over fabric and 50 mm over rein. bars
- 3) Extend pipe rein. into slab 200 mm min.
- 4) All dimensions are in millimetres

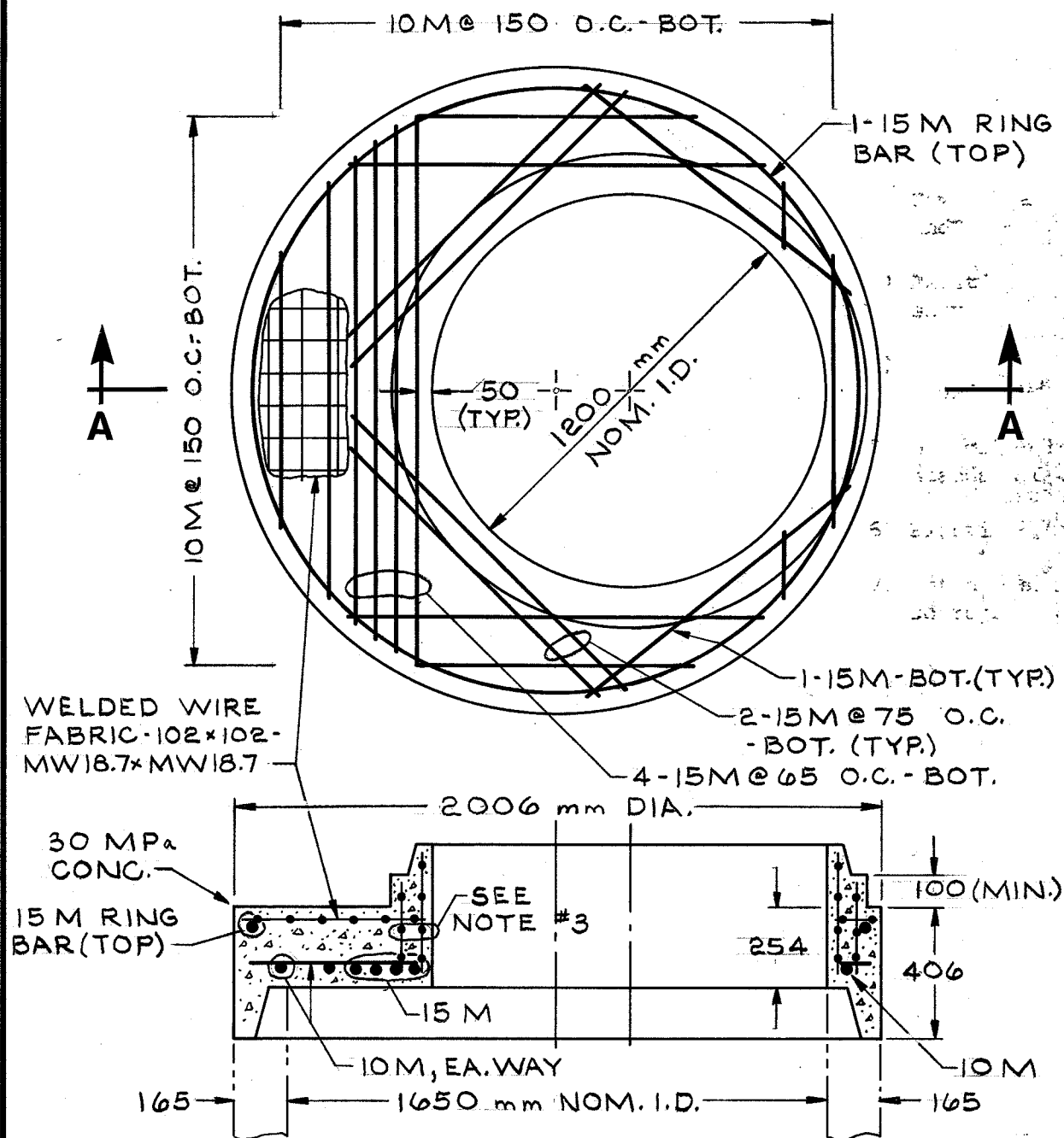
A BAR LENGTHS  
INCREASED WHERE  
SHOWN THUS: (A)  
DEC./86

REVISIONS



	NAME	DATE	CITY OF THUNDER BAY ENGINEERING DEPARTMENT	
DR'WN. BY	W.J.H.	NOV. 1983.		
TRACED BY			2100 mm NOM. I.D. TO 1200 mm NOM. I.D. REINFORCED PRECAST CONCRETE <u>REDUCING CAP</u>	
CH'KD. BY			AND	
APP'RD. BY			2100 mm NOM. I.D REINFORCED PRECAST CONCRETE <u>FLAT CAP</u>	
APP'RD. BY				
SCALE	1:25		 CITY ENGINEER	FILE NO. <b>83-8310</b>
				SIZE <b>B</b>



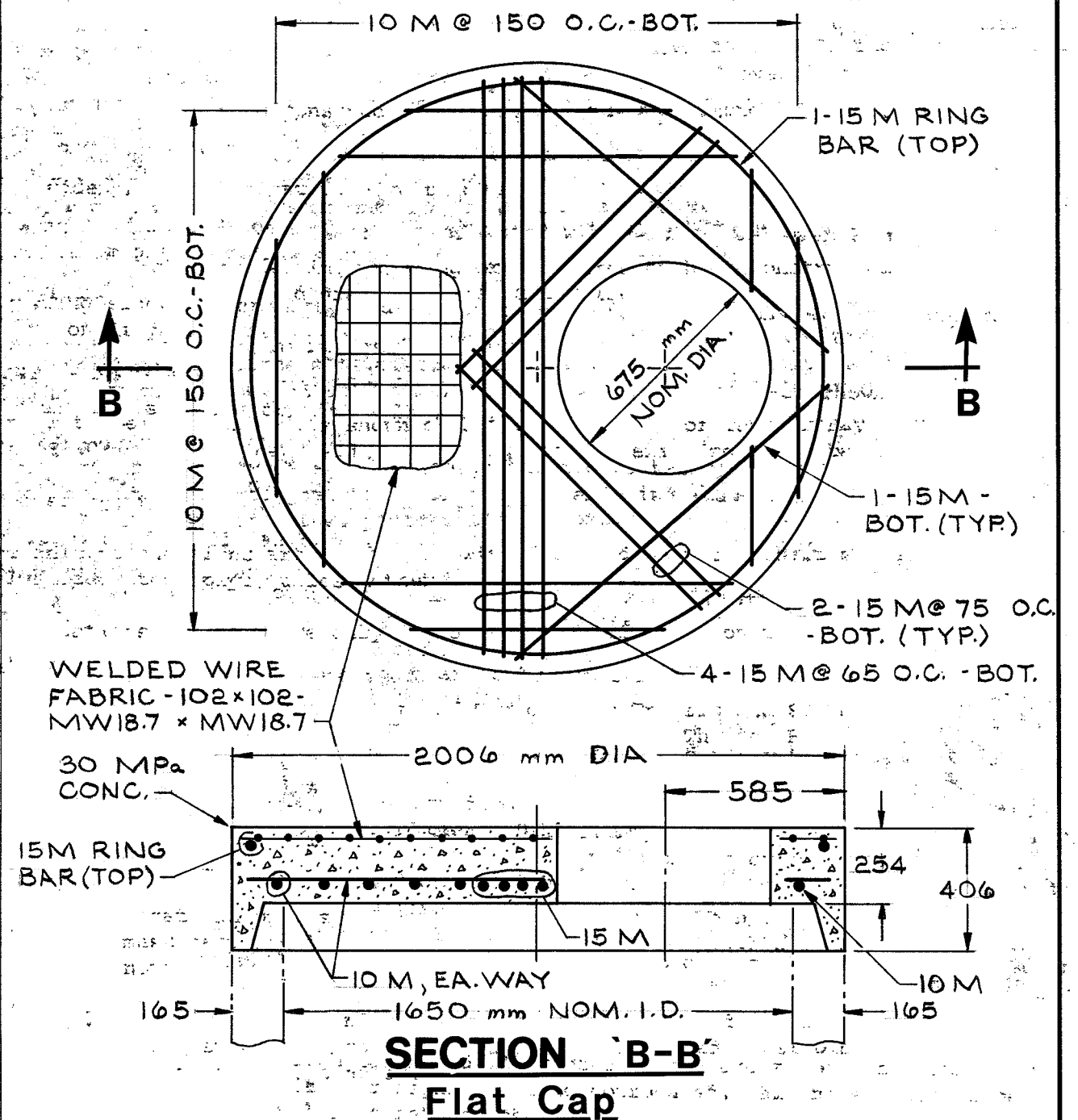


**SECTION 'A-A'**  
**Reducing Cap**

**NOTES:**

- 1) MANUFACTURE TO LATEST A.S.T.M. SPEC. C-478.
- 2) MIN. CONC. COVER - 25 mm OVER FABRIC & 50 mm OVER REIN. BARS.
- 3) EXTEND PIPE REIN. INTO SLAB 200 mm MIN.
- 4) ALL DIMENSIONS ARE IN MILLIMETRES.

REVISIONS	A



**SECTION 'B-B'**  
**Flat Cap**

NAME	DATE	CITY OF THUNDER BAY ENGINEERING DEPARTMENT	
DR'WN. BY W.T.H.	DEC. 1986		
TRACED BY		TITLE 1650 mm NOM. I.D. TO 1200 mm NOM. I.D. REINFORCED PRECAST CONCRETE REDUCING CAP AND 1650 mm NOM. I.D. REINFORCED PRECAST CONCRETE FLAT CAP	
CH'KD. BY			
APP'RD. BY			
APP'RD. BY			
SCALE 1:20		FILE NO. 86-8621	SIZE B

*[Signature]*  
CITY ENGINEER