TOWN OF CRESTON **Consolidated to February 23, 2016**

BYLAW NO. 1417

A bylaw to regulate standards and specifications for the design and installation of drainage systems.

WHEREAS the Municipal Act allows Council, by bylaw to regulate standards and specifications for the design and installation of drainage systems.

NOW THEREFORE the Council of the Town of Creston, in open meeting assembled, enacts as follows:

1.0 Title

1. This bylaw may be cited as “Drainage Bylaw 1417, 1997".

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2.0 Introduction

2.1 Drainage system design and analysis is to be undertaken in accordance with the Town’s Stormwater Management Policies and Design Manual except as required by this Schedule. Supplemental Drainage Planning and Criteria is provided in the Master Drainage Plan for each basin with the Town of Creston.

2.2 Consulting Engineers retained by the Owner to design the Works and Services must consult with the Town Engineer to determine what existing information may be of assistance to them.

2.3 The presence of an existing municipal drainage system does not mean or imply, that is has adequate capacity to receive the proposed design flows, or does it indicate that the existing system pattern is acceptable to the Town. Existing facilities which are undersized or inadequate to accept additional drainage must be upgraded to accommodate the appropriate flows. Alternative drainage proposals may be considered.

2.4 It must be shown that all downstream drainage facilities are capable of handling the projected increase in drainage created by any Development. Stormwater must be directed to an acceptable discharge point such as a major creek or a ditch or trunk main with adequate capacity.

3.0 Compulsory Connection

3.1 The owner of every parcel of land required to be drained and to which a storm sewer connection can be or has been made shall connect such land to the storm sewer. In the event of any owner failing to make the necessary connections within ninety (90) days of being notified in writing by the Engineer so to do, the Engineer by his workmen or others may have the work done at the expense of any such owner, and The Corporation shall recover the expense thereof with interest with costs in like manner as Municipal taxes.

3.2 The notice in writing required to be given in this section shall be sufficiently given if sent by registered mail to the owner at his address as shown on the last revised Assessment Roll of The Corporation.

4.0 General Design

4.1 No person shall discharge storm water into a sanitary sewer system. **BL#1742**

4.2 Standards That Apply to All Drainage Works **BL#1742**

All new subdivisions and developments shall be provided with drainage works and services that comply with the following standards:

(a) The site shall be graded to ensure positive drainage of water not absorbed by the ground. The site shall drain to the point of water discharge.

(b) The recommended minimum and maximum gradients to ensure positive drainage are set out in Table F-1. If the drainage design is certified by a professional engineer, gradients that do not conform to the recommendations in Table F-1 may be accepted.

TABLE F-1

Driveways	Maximum Gradient Minimum Gradient	1:10 1:100	10% 1%
Parking	Maximum Gradient Minimum Gradient	1:17 1:66	6% 1.5%
Walkways	Maximum Gradient Minimum Gradient	1:10 1:50	10% 2%
Paved Utility Area	Maximum Gradient Minimum Gradient	1:17 1:50	6% 2%
Grass Areas	Maximum Gradient Minimum Gradient	1:3 1:100	33% 1%

4.1 (c) The site shall be graded and planted in a manner that will prevent erosion of the ground.

(d) Site runoff shall not flow onto adjacent properties.

(e) For sites where any foreign material other than natural storm drainage might enter the drainage system, facilities to remove the foreign material shall be designed and sealed by a Professional Engineer and submitted for approval to the Ministry of Environment.

(f) Where disposal is to a natural water course, the drainage system shall be designed and sealed by a Professional Engineer and submitted for approval to the Ministry of Environment.

(g) Disposal of drainage water shall be achieved by one of the following methods:

i. connection to the municipal storm sewer system where the system exists in a roadway adjacent to the parcel, or where the municipality requires the storm sewer system to be extended to the parcel;

ii. discharge to a surface drainage course (ditches) where a storm sewer system is not available and a surface drainage course runs adjacent to the site;

iii. discharge to a dry well where a storm sewer system or ditching is not available and soil conditions and water table level facilitate effective operation of a dry well. Where dry wells are required they must conform to the standards set out in this Bylaw;

iv. discharge to a natural water course, where they run adjacent to or through a site and other disposal methods are not available.

(h) The Applicant shall note that meeting standards set out in this bylaw does not preclude the necessity to apply for permits from other agencies. For example, any discharge to natural water course will require permits from the Ministry of Environment.

5.0 Drainage Plan

5.1 For each new subdivision, a drainage plan shall be prepared and approved by the Town Engineer. The drainage plan shall be presented on a contour map at a scale of not less than 1:2500 with contour intervals of not more than 0.5 metres. The drainage plan will show how storm drainage will be handled within the subdivision, including:

(a) proposed method of handling surface drainage, including discharge points to natural water courses;

(b) provisions of drainage right-of-way where required;

(c) measures to prevent ponding of water on highways and parcels within the subdivision;

(d) measures to prevent erosion and other forms of property damage;

(e) major and minor system routing;

(f) final site grades, fill areas including the depth of fill;

(g) all easements, discharge points and other such details as may be required by the Town Engineer.

(h) alignment, type and size of all pipes, including proposed grades, bedding requirements, manhole, catch basin and drywell locations.

(i) detailed drainage calculations shall be provided at the time of the drawing submission.

6.0 Natural Water Courses

6.1 Natural watercourses shall be protected as directed in the applicable municipal bylaws and the Town of Creston Master Drainage Plan. Where a parcel to be subdivided is traversed by a natural drainage course, there shall be provided either:

(a) a drainage right-of-way conforming to the general alignment of the existing or proposed drainage course of such width as may be designated by the Town Engineer; or
(b) provision made for an alternate drainage system to the satisfaction of the Town Engineer.

6.2 No natural drainage course shall be altered or diverted unless in accordance with a drainage plan approved by the Town Engineer.

6.3 Where approval of the Ministry of Environment is required for such an alteration or diversion, the Town Engineer must be in possession of the Ministry approval prior to the applicant undertaking any work.

7.0 Design Standards

7.1 General

The drainage system in the Town shall consist of two components, the “minor” and the “major” systems and the system design must take these components into account.

7.2 The “minor system” consists of those works necessary to handle a 5 year return flow for low density residential areas and a 10 year return flow for industrial, commercial, institutional and high density residential areas.

7.3 The “major system” consists of those surface flood paths, roadways, drainage courses and water courses to convey the 100 year return flows.

7.4 Where drywells are used to discharge surface water to ground, the Town Engineer may require the Applicant to provide a report prepared by the Developer’s Engineer attesting to the ability of the in situ soils to receive these waters.

7.5 All subdivisions shall be adequately drained throughout the year. Where the whole or part of any prosed subdivision is wet or subject to intermittent or periodic flooding, approval of the subdivision will be withheld until the Town Engineer is satisfied that appropriate steps have been taken to drain the land or otherwise remedy such wet or flooding conditions.

7.6 Where unsatisfactory soil or drainage conditions exist or may develop on part or all of the subdivision area, the Applicant may be required to furnish such information as will allow the determination of the area, shape and dimensions of the parcels which will be adequate in view of the nature of the ground and the anticipated use of the land.

8.0 Design Flow

8.1 The design flow at any point in a storm water collection system shall be calculated by the Rational Formula:

$$Q = C \times I \times A$$

In which,
Q = Design Flow
C = Run-off Coefficient
I = Rainfall Intensity
A = Area drained

8.2 Low density residential systems shall be designed for rainfall intensities which are expected to return on the average once every five years (Return Period – 5 years). Industrial, commercial, institutional and high density residential systems shall be designed for a Return Period of 10 years. The rainfall intensity shall be derived from the intensity curve that uses the projection period that is most closely associated with, but not less than, the typical design life of the infrastructure being impacted, as shown in Table F-2 below. Three different projection period intensity curves, under a changing climate, are included in the Standard Drawing Section. **BL#1837**

Table F-2: Typical Design Life of Infrastructure **BL#1837**

Storm Water Infrastructure Component	**Design Life Range**
CSP Culverts ≤ 450 mm	25 years
CSP Culverts > 450 mm	50 years
Pipes, Manholes, Catch Basins, Inlet & Outlet Structures	75 years
Bridges	100 years
Minor Overland Routes	50 years
Major Overland Routes	75 years
Channels	100 years

9.0 Time of Concentration

9.1 The time of concentration shall be the estimated time required for rain falling on the farthest point in the drainage area to reach a point in the sewer system under design. The inlet time for rain to reach catch basins shall be assumed to be 10 minutes in residential subdivisions and commercial areas.

10.0 Run-Off Coefficient

10.1 Run-off coefficients for storm sewer design shall be calculated for each site but shall not be less than the values given in the following tabulation:

Description of Area	Run-Off Coefficient
Commercial-Downtown	0.80
Residential-single family	0.40
Residential-multi-family	0.60
Apartment Areas	0.70
Parks and Playgrounds	0.25
Unimproved Areas including hillsides	0.30

10.2 The derivation of run-off coefficients to be used for storm sewer design shall include consideration of relative areas of roofs and pavement.

10.3 Ground slope and soil permeability shall also be considered, however, the run-off coefficients shall in no case be less than the values outlines in these standards.

11.0 Overland Flow

11.1 In no case shall the overland flow distance for storm water within the storm sewer design area exceed 150 metres. Storm water contributions from natural drainage features including hillsides shall be collected by inlet structures at the point where the natural drainage features enters the subdivision. The ditching of drainage from hillside drainage features through residential or other proposed lots to storm facilities on roadways will not be permitted.

11.2 Where an open drainage system is required to cross a road, street or driveway, the ditch shall be enclosed by means of a culvert, the size, line and grade of which shall be determined by the Developer's Engineer and approved by the Town Engineer.

12.0 Outfalls

12.1 Outfalls shall be located and constructed such that the outfall storm water will not cause or present the potential of, erosion of Crown, private or municipal property.

13.0 Minimum Pipe Diameters for Storm Sewers

13.1 Minimum pipe diameters shall be:

Mains	200 mm
Catch basin leads	150 mm

13.2 Pipe shall be designed, using the Manning Formula with roughness coefficient n = .013, to flow full (or less than full) at the design flow with a velocity or not less than 0.75 metres per second.

14.0 Main offsets and Depth of Bury

14.1 Storm sewer mains shall be on the centerline of the road between the water line and the sanitary sewer line.

14.2 The minimum depth of bury from finished ground elevation to the top of pipe for mains shall be 1.2 metres. Minimum cover for catch basin leads shall be determined by the sump requirements and pipe diameter but under no circumstances shall be less than 0.9 metres.

15.0 Minimum Velocity and Grade

15.1 Minimum velocity for pipes flowing full or half full shall be 0.75 m/s. Some corresponding minimum grades are as follows assuming n = 0.013. Steeper grades are desirable.

100 mm	2.00%	375 mm	0.23%
150 mm	1.00%	400 mm	0.20%
200 mm	0.60%	450 mm	0.18%
250 mm	0.40%	525 mm	0.15%
300 mm	0.32%	600 mm	0.12%
350 mm	0.28%		

16.0 Drainage Drywells

16.1 Where drainage drywells are used as a means for disposal, drainage drywell wall surface areas shall be sized using Darcy's empirical law:

$Q = A K i$

where

Q = rate of flow
A = cross-sectional area of soil through which flow takes place (consider wall area only in calculations)
K = coefficient of permeability
i = gradient or headloss over a given flow distance

Coefficients of Permeability (K)

Typical Soil	Value of K cm/sec *	Relative Permeability
Coarse gravel	over 1×10^{-1}	very permeable
Sand, fine sand	1×10^{-2} to 1×10^{-3}	Medium permeability
Silty sand, dirty sand	1×10^{-3} to 1×10^{-5}	Low permeability
Silt	1×10^{-5} to 1×10^{-7}	very low permeability
Clay	Less than 1×10^{-7}	practically impervious

* to convert to feet per minute, multiply above valves by 1.97; to convert to feet per day, multiply be 2.88 x 103.

Upon determination of permeability factor, a safety factor of 2 shall be applied.

Hydraulic Gradient (i)

$$i = \frac{h}{1}$$

where: h=average available head
1= flow distance

16.2 Drainage drywells shall, unless otherwise approved by the Town Engineer, be located in the road boulevard or in other lands dedicated to the Town for the purpose of drainage disposal.

16.3 Drainage drywells shall be constructed of precast 1200 mm diameter concrete sections with 75 mm x 150 mm holes spaced 150 mm c/c vertically and 200 mm c/c horizontally in accordance with the standard drawings. One length of solid walled pipe shall form a sump for deposition of silts. See Standard Drawing No. S - 12.

16.4 The depth of the drywell will vary in accordance with the requirements derived from Darcy's law.

17.0 Culverts

17.1 Where an open ditch system is required to cross a road, street or driveway, the ditch shall be enclosed by means of a CMP culvert. All culverts shall be of sufficient size to properly drain all of the area naturally draining into the channel or ditch feeding into the culvert. Allowance shall be made for increasing runoff due to paving and other land development anticipated.

17.2 The minimum diameter for culverts shall be 300 mm (12").

18.0 Manhole Spacing

18.1 The maximum distance between storm sewer manholes shall be 150 m.

18.2 Manholes shall also be provided at the following locations:
- at all changes in grade and/or alignment (for non curvilinear sewers);
- at all changes in pipe size;
- at all pipe junctions;
- at the beginning and end of pipe curvature for curvilinear sewers.

19.0 Catch Basin Spacing

19.1 Catch basin spacing, in general, shall range from 90 to 120 m with closer spacing on flat grades in the drainage path and at all intersections.

19.2 Catch basins shall be located at all low points, or spaced at intervals such that not more than 10% of the gutter flow reaching each inlet will pass on to the next inlet downstream, provided this carry-over is not objectionable to pedestrian or vehicle traffic and the inlet is not in a sump.

19.3 Catch basins at intersections shall be located in such a manner to minimize interference with crosswalks.

19.4 Type II side inlet catch basins are not to be installed without the approval of the Town Engineer.

20.0 Catch Basin Leads

20.1 Catch basin leads shall discharge into a manhole wherever possible or directly into the sewer pipe using a saddle or wye connection.

20.2 Catch basin leads shall have a minimum cover of 0.9 m.

21.0 Pipe Class and Bedding Class

21.1 The quality of pipe and bedding shall be so selected such that the installation will adequately support the loads to be placed on it during construction and in operation. For concrete pipe, the calculations shall follow the method shown in Water Pollution Control Federation Manual of Practice NO. 9, latest edition. A safety factor of 1.5 shall be used for concrete pipe and the bedding classifications shall be as identified in Standard Drawing No. S-8.

21.2 For PVC pipe, the calculations shall follow the methods outlined in the Uni-Bell Plastic Pipe Association publication “Handbook of PVC Pipe - Design and Construction”, latest edition.

21.3 For CSP pipe, the calculations shall follow the methods outlined in the American Iron and Steel Institute publication “Handbook of Steel Drainage & Highway Construction Products”, latest edition.

21.4 Pipe class and bedding class must be identified on all engineering drawings. Pipe shall have at least Class B bedding, as defined by Standard Drawing No. S-8.

22.0 Materials

22.1 Materials shall meet the standards specified in Works and Services Bylaw #1170 Schedule E - Storm Sewers, except as modified herein.

23.0 Pipe

23.1 The following pipe material conforming to the appropriate specifications are acceptable for storm sewers:

(a) reinforced concrete pipe conforming to ASTM C76. Pipe strength (Class III min.) Shall be specified for the trench conditions under which the pipe will be installed and operated. Joints shall conform to ASTM C443;
(b) polyvinyl chloride pipe up to 375 mm diameter conforming to ASTM D3034 and CSA B182.2, stiffness (F/Y) of 320 kPa at 5% deflection conforming to ASTM D2412, complete with approved rubber gasket joints. Polyvinyl Chloride 450-600 mm ASTM F679, SDR 35 equivalent or ASTM F794, minor collection mains and service connections. Maximum pipe length shall be 6 metres and sizes 200 mm diameter and larger shall have a minimum SDR of 35;
(c) CSP (culverts only) galvanized corrugated steel pipe designed to carry H-20 loading in accordance with ASSHO.

24.0 Manholes

24.1 List of Standard Drawings

Title	No.	Title	No.	
Standard Manhole	S-1	Catch Basin Assembly	S-9	
Exterior Drop Manhole	S-2	Manhole Cover Insulation	S-10	
Manhole Benching	S-3	Catch Basin Adjustment	S-11	
Standard Sewer Connections	S-4	Drainage Drywell	S-12	
Encasement Pipe Detail	S-5	Rainfall Intensity Curves 2010-2039	S-13	**BL#1837**
Trench Details Paved Areas	S-6	Rainfall Intensity Curves 2040-2069	S-14	**BL#1837**
Trench Details Gravelled Areas	S-7	Rainfall Intensity Curves 2070-2099	S-15	**BL#1837**
Trench Bedding Details	S-8			

Standard Drawings are attached as Schedule S-1 to S-15 and form a part of this bylaw. **BL#1837**

25.0 Catch Basins

25.1 Catch basins shall be 900 mm diameter precast concrete as shown on Standard Drawing S-9 or an acceptable alternate as approved by the Town Engineer. Frames and grates shall be Dobney Foundary B-24 or B-24 square frame and B-23 grate, or an acceptable alternate as approved by the Town Engineer.

26.0 Workmanship

26.1 Storm sewer systems shall be installed in the manner described in Schedule E of Bylaw 1170 except as modified herein.

26.2 Catch Basins

Catch basins shall be constructed as shown on Standard Drawings S-9. They shall be installed with the longer side against the front of the curb and parallel to it. Catch basin grate to be flush with final surface grade.

26.3 Testing

This storm sewer system shall be tested in accordance with Bylaw 1170 Section E - 4.5

26.4 Head Walls and Aprons

Head walls and aprons to storm sewer and culvert inlets and outlets shall be constructed as designed by the Developer's Engineer in accordance with Bylaw 1170 - Section E-2.5 a & b.

27.0 Penalty and Effective Date

27.1 Any person who is deemed, upon summary conviction, to be in contravention of this bylaw will be liable to a penalty of not more than Two Thousand Dollars ($2,000.00).

27.2 This bylaw shall come into full force and effect upon adoption.

28.0 Service Connection

28.1 Each application for a service connection shall be made to the municipality by the owner or his authorized agent on a form available at the Municipal Office. **BL#1446**

28.2 Such applicant shall, on making application, pay to the municipality the applicable connection fee as set out in Schedule "A" which is attached to and forms part of this Bylaw. **BL#1446**

28.3 If the connection is practicable, the Works Superintendent shall provide and install a service connection to the applicant's property. If such connection is not practicable, the Works Superintendent shall so notify the applicant and the municipality shall refund the fees paid by the applicant. **BL#1446**

28.4 In addition to the fee set out in Schedule "A", where it is necessary to remove and replace asphalt or other hard surface road materials, the applicant shall pay in advance the estimated cost of the removal and replacement of such hard surface. **BL#1446**

READ A FIRST by title and SECOND TIME by content this 6th day of October, 1997.

READ A THIRD TIME by title this 6th day of October, 1997.

RECONSIDERED AND ADOPTED this 27th day of October. 1997.

"Lela Irvine" "Wm F. Hutchinson"
Mayor Clerk

SCHEDULE "A"

DRAINAGE CONNECTION CHARGES

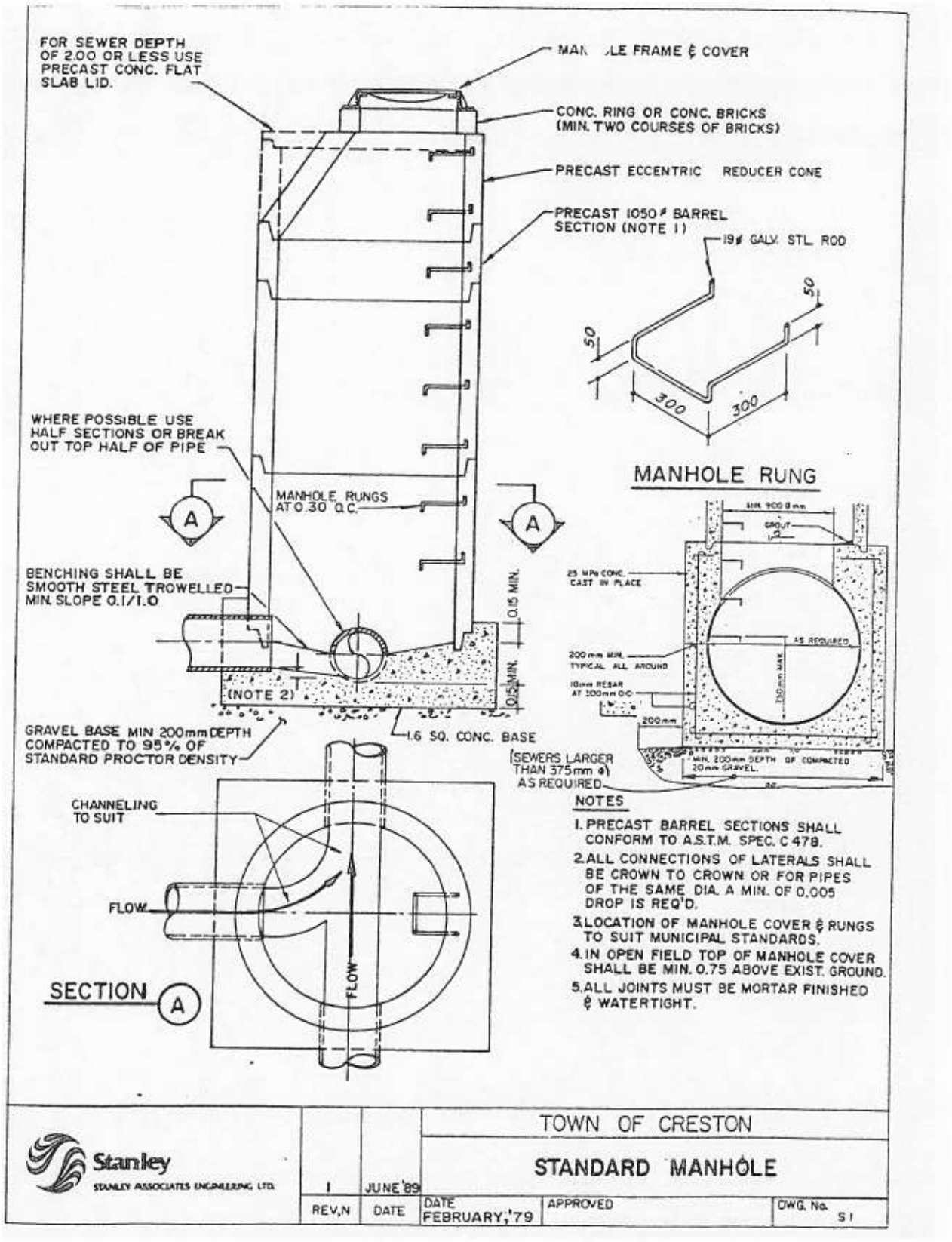
Type of Service	Minimum Rate*
Storm sewer connection	$3,000.00

* The Town of Creston reserves the right to charge actual costs which are in excess of the connection fee charged for any connections done. Asphalt repairs (if required) are an additional charge.

BL#1829

Standard Drawings
Schedule S-1

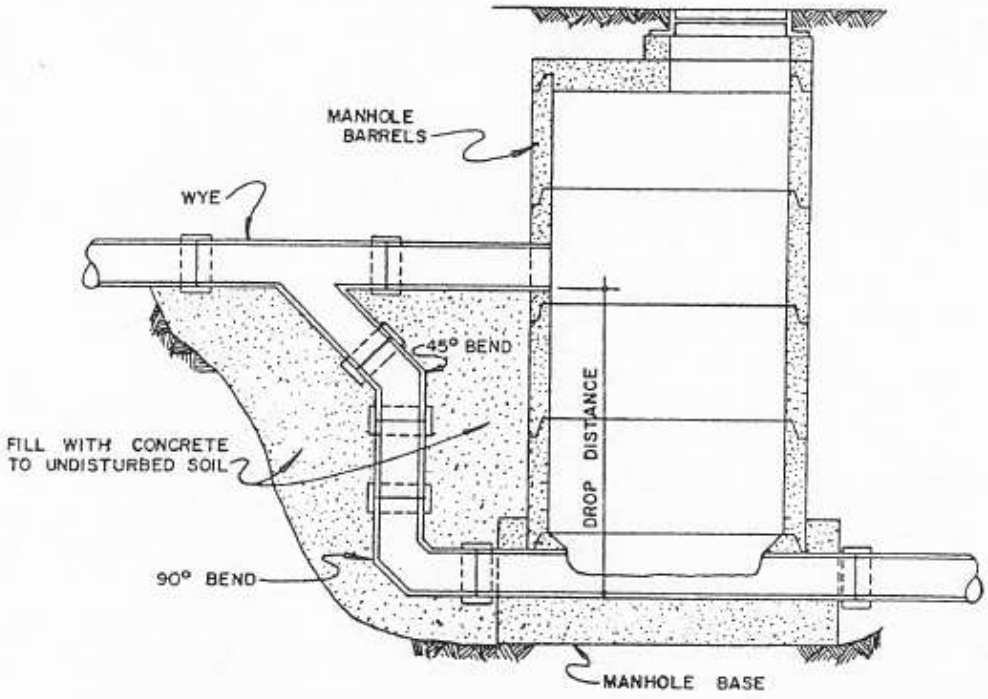
BL#1837



Standard Drawings
Schedule S-2

BL#1837

PIPE	
INFLOW	EXT. DROP
200 TO 450	200
525 TO 750	250
900 TO 1200	450



NOTES:

1. THIS DRAWING ONLY APPLIES TO THE DROP SECTION (SEE STANDARD MANHOLE DETAILS).
2. AN EXTERIOR DROP IS REQUIRED WHERE THE DROP DISTANCE IS MORE THAN 0.6 FOR SANITARY AND 2.5 FOR STORM.

Stanley
STANLEY ASSOCIATES ENGINEERING LTD.

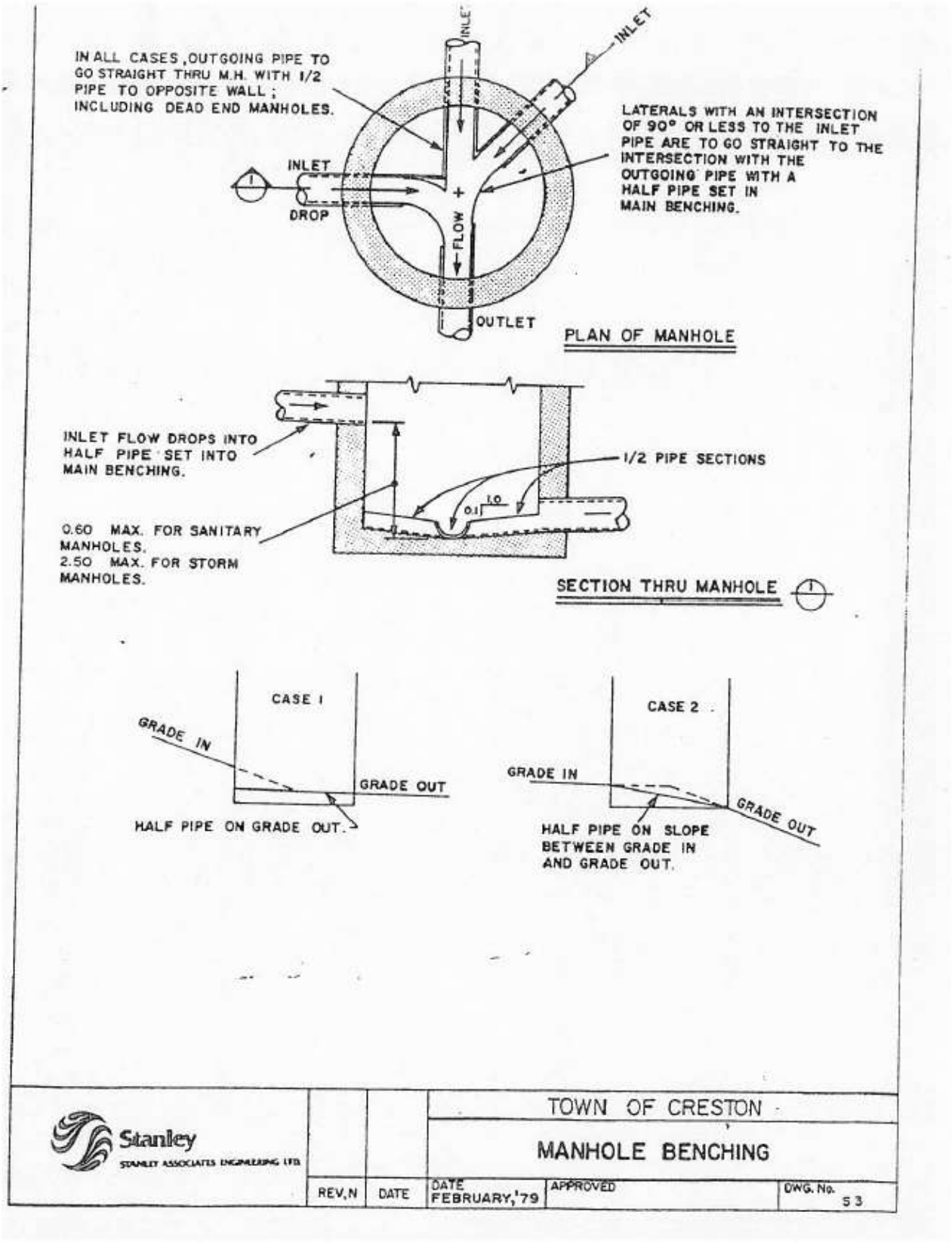
TOWN OF CRESTON

EXTERIOR DROP MANHOLE

REV.N	DATE	DATE	APPROVED	DWG. No.
		FEBRUARY, '79		S2

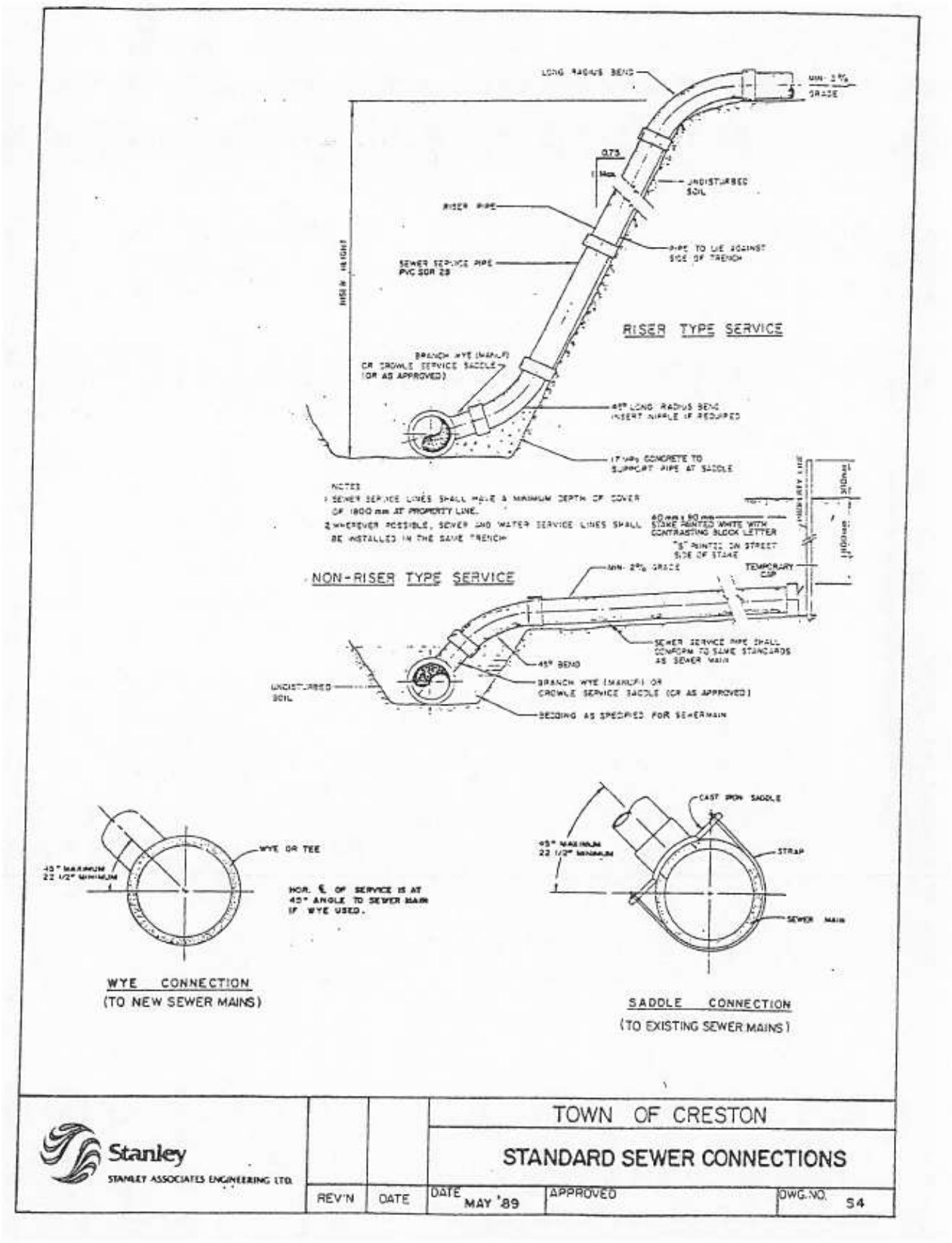
Standard Drawings
Schedule S-3

BL#1837



Standard Drawings
Schedule S-4

BL#1837



Standard Drawings
Schedule S-5

BL#1837

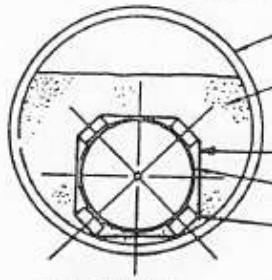
NOTES:
SKIDS MUST BE EVENLY [illegible] ED AROUND PIPES

4 SKIDS ARE REQ'D FOR PIPES 300 & UNDER
5 SKIDS FOR 350 - 400
6 SKIDS FOR 450 - 600
8 SKIDS FOR 750 AND OVER

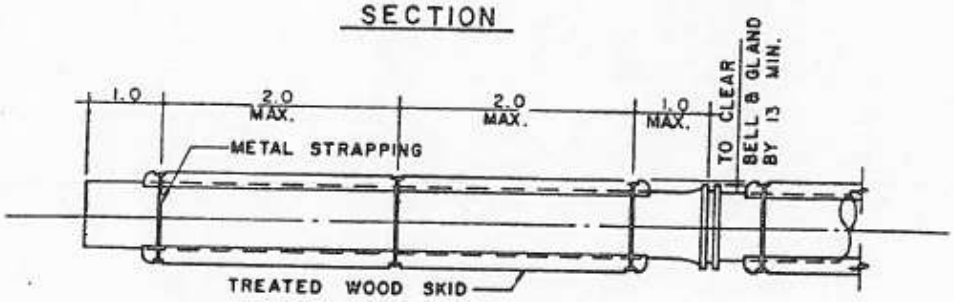
[illegible] E OF CASING SIZES

PIPE SIZE DIA. IN mm	CASING SIZE DIA. IN mm
75	225
100	250
150	300
200	400
250	450
300	500
350	550
400	600
450	650
500	700
600	875
675	975
750	1075
850	1150
900	1225
1000	1375
1075	1450

DUCTILE IRON AND ASBESTOS CEMENT PIPES



SECTION



SKID LOCATION DETAIL

Stanley
STANLEY ASSOCIATES ENGINEERING LTD.

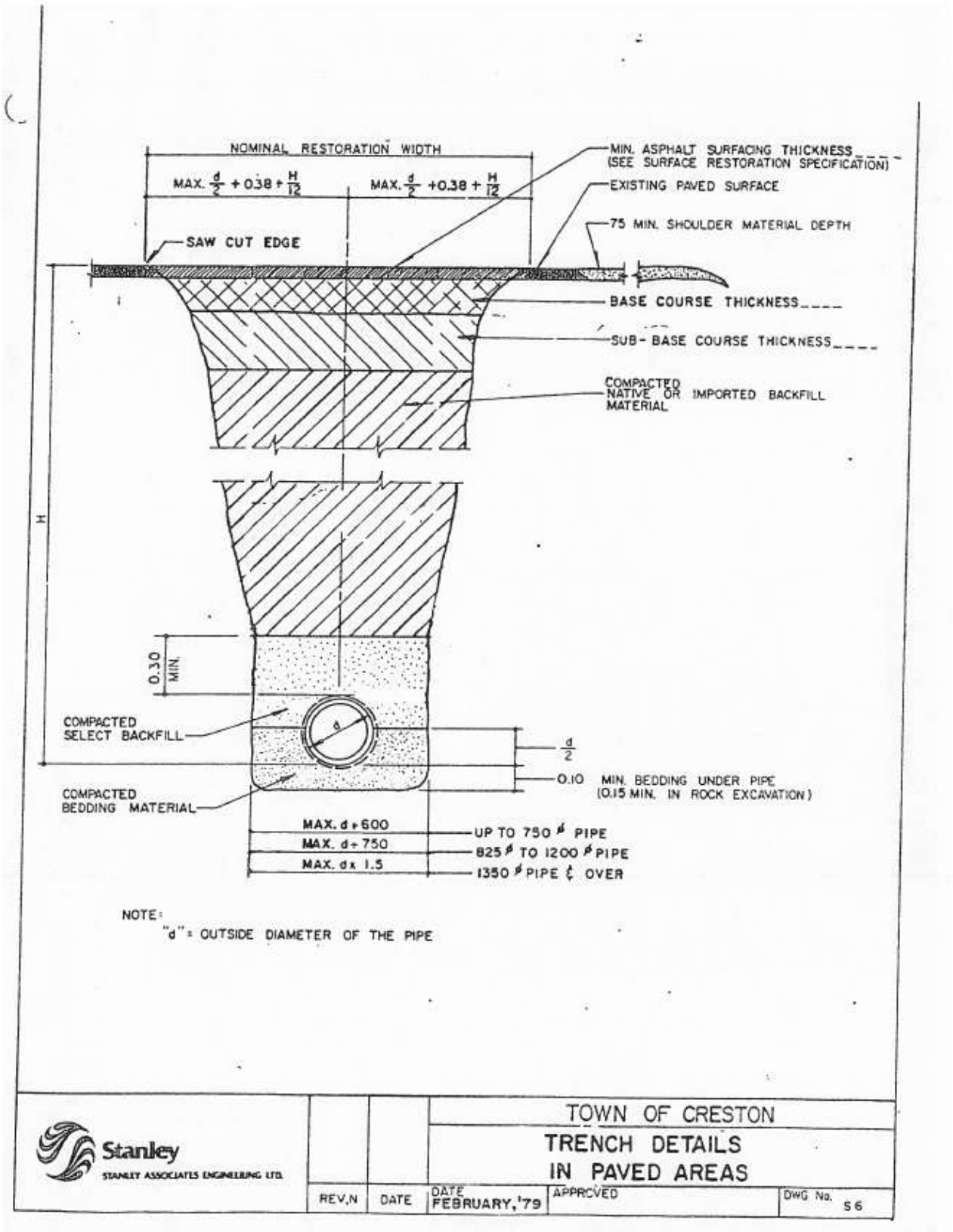
TOWN OF CRESTON

ENCASEMENT PIPE DETAIL

REV.N	DATE	DATE	APPROVED	DWG. No.
		FEBRUARY, '79		S5

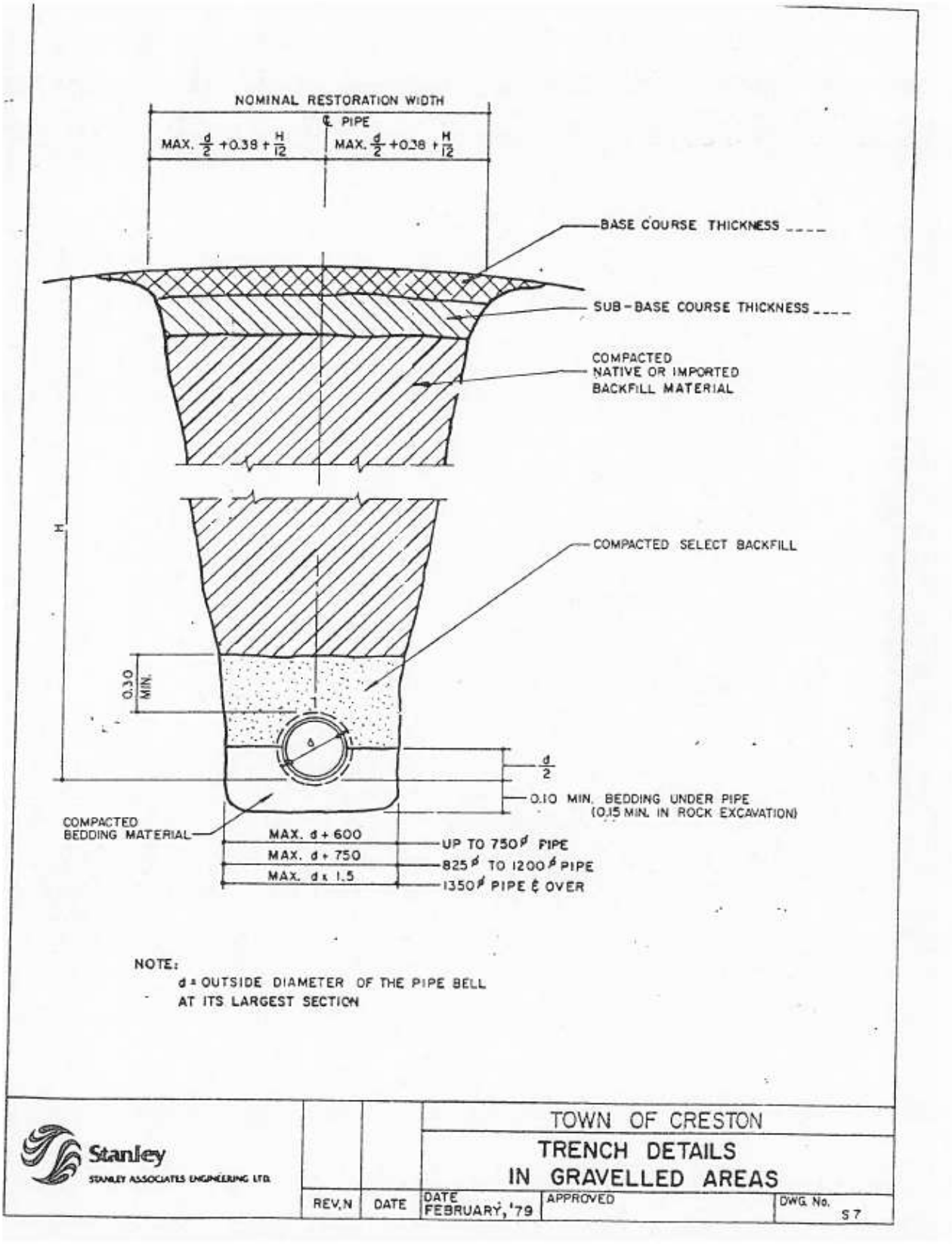
Standard Drawings
Schedule S-6

BL#1837



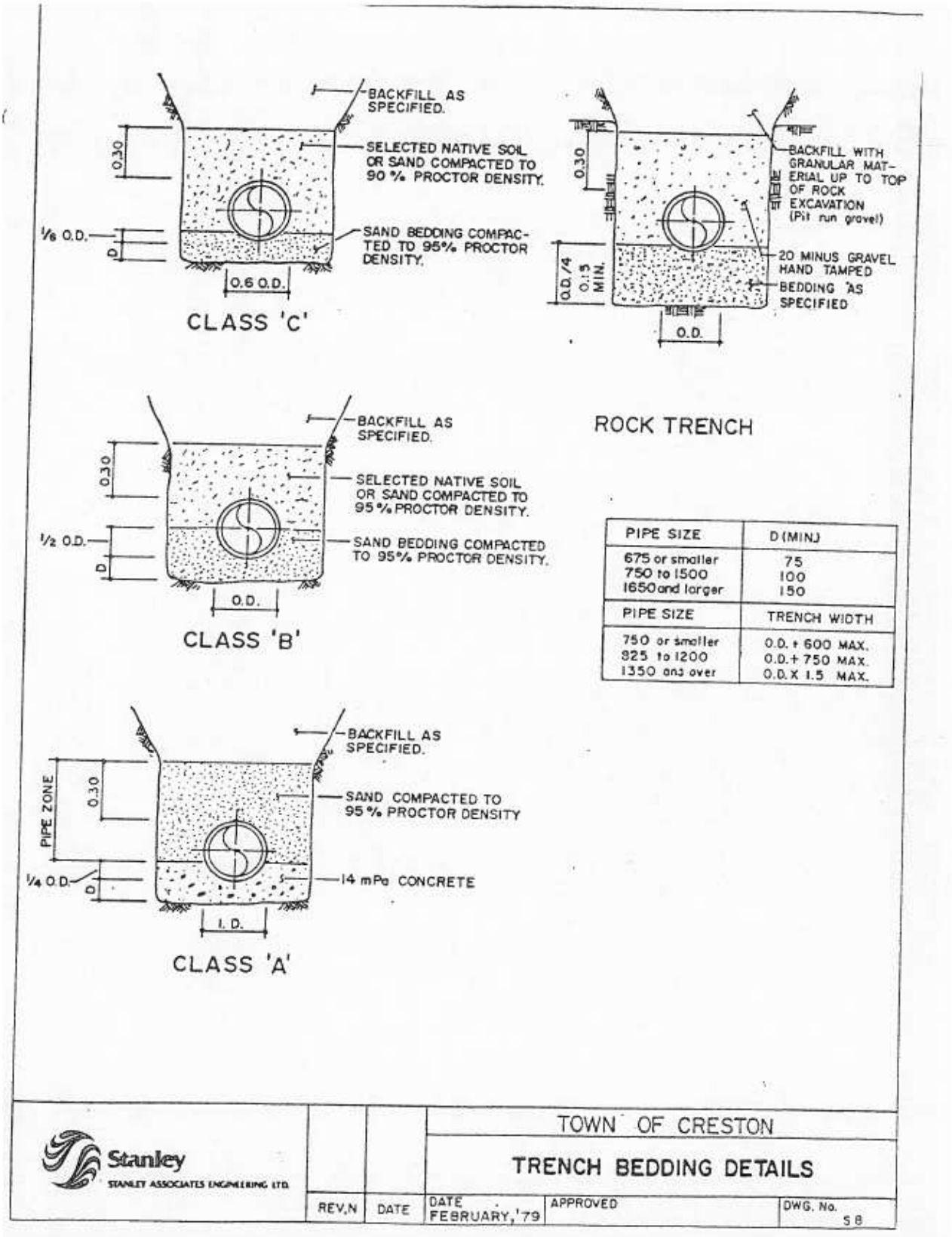
Standard Drawings
Schedule S-7

BL#1837



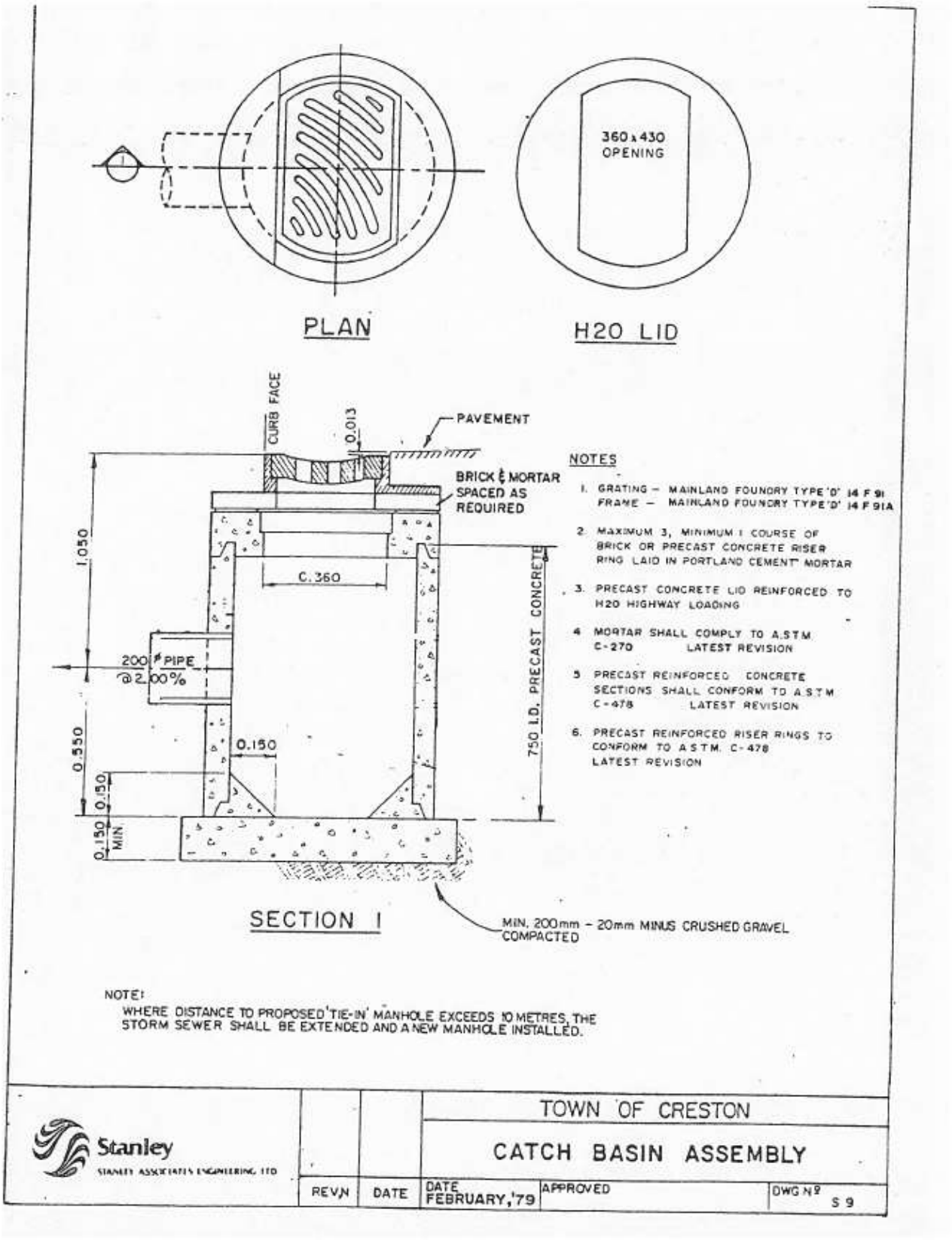
Standard Drawings
Schedule S-8

BL#1837



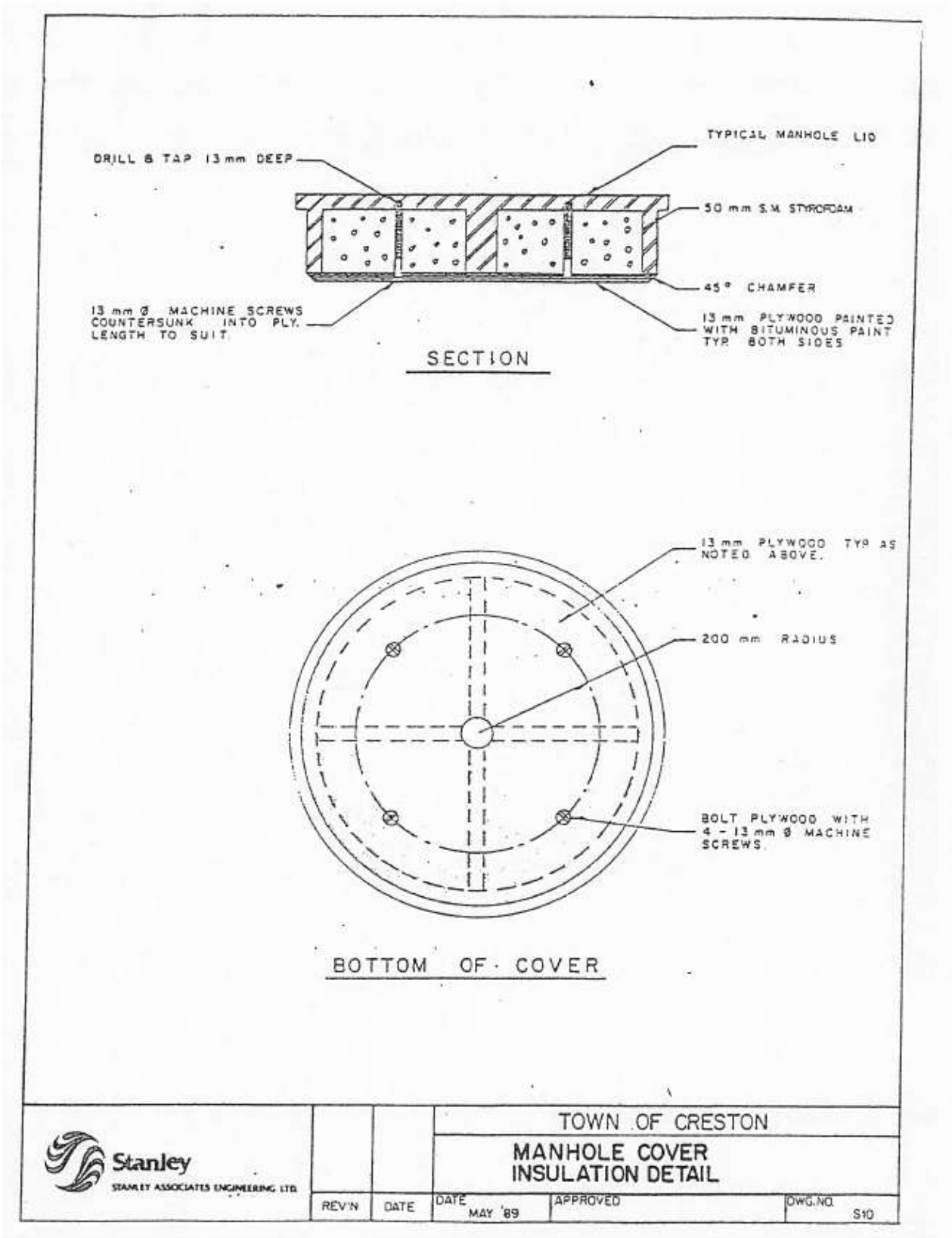
Standard Drawings
Schedule S-9

BL#1837



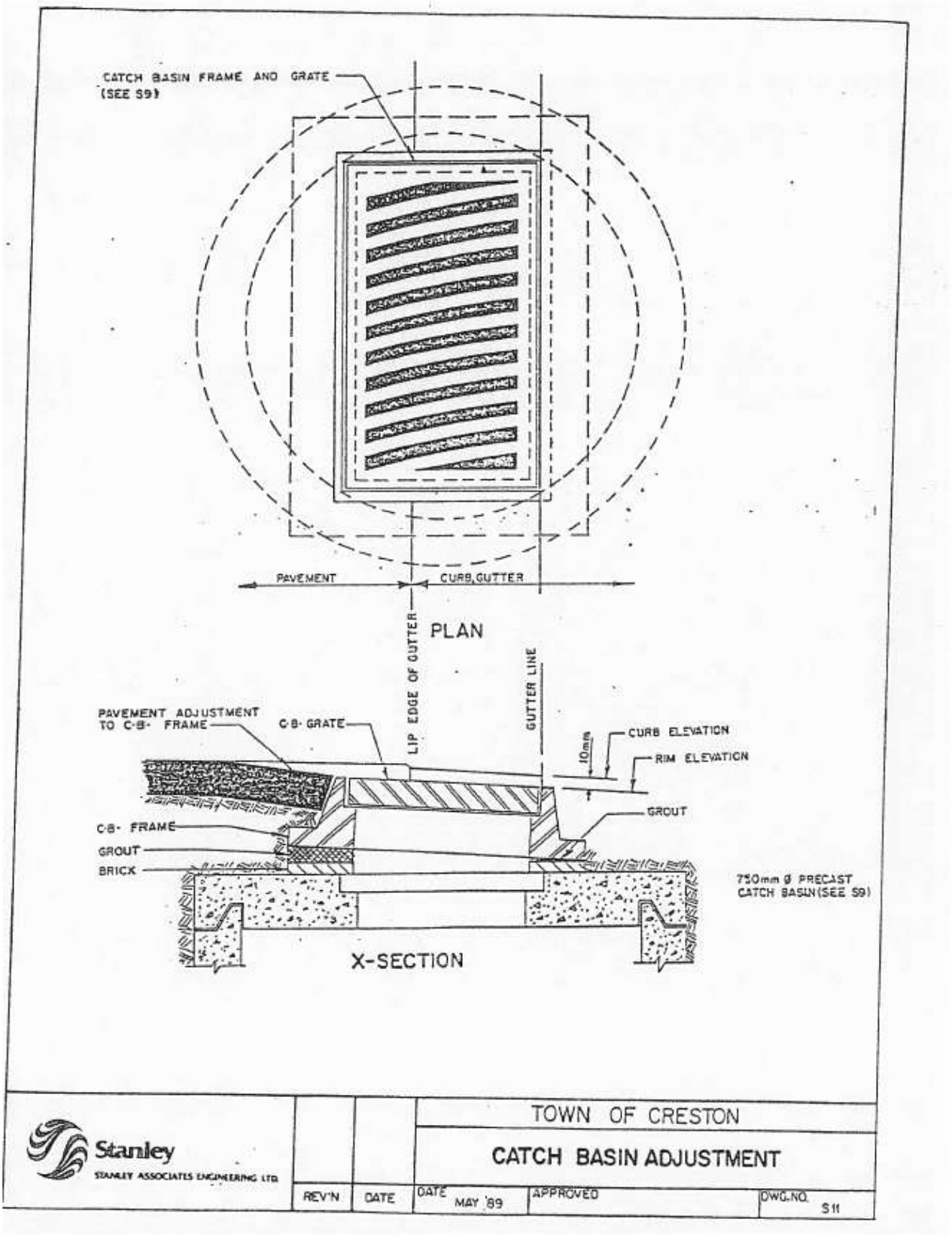
Standard Drawings
Schedule S-10

BL#1837



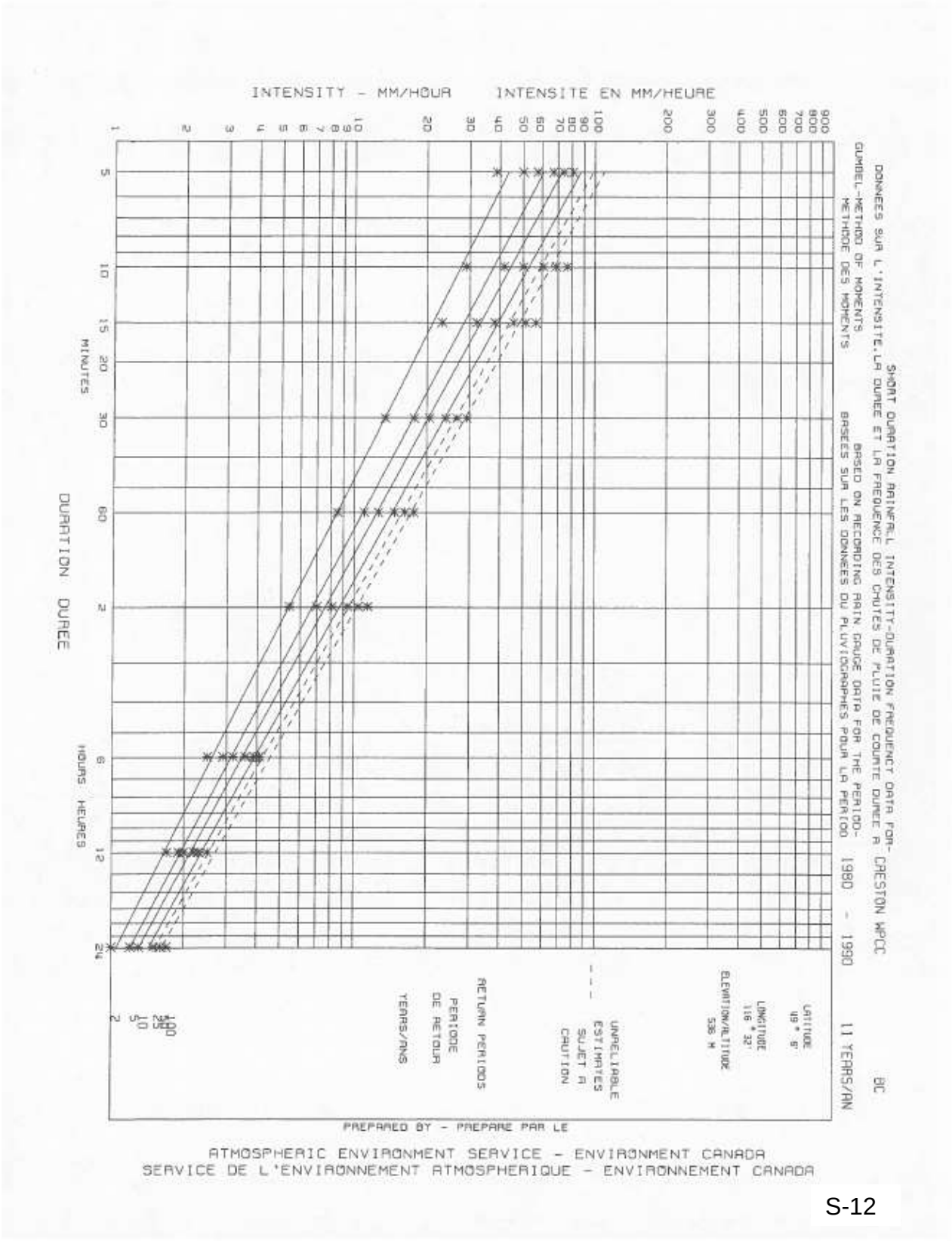
Standard Drawings
Schedule S-11

BL#1837



Standard Drawings
Schedule S-12

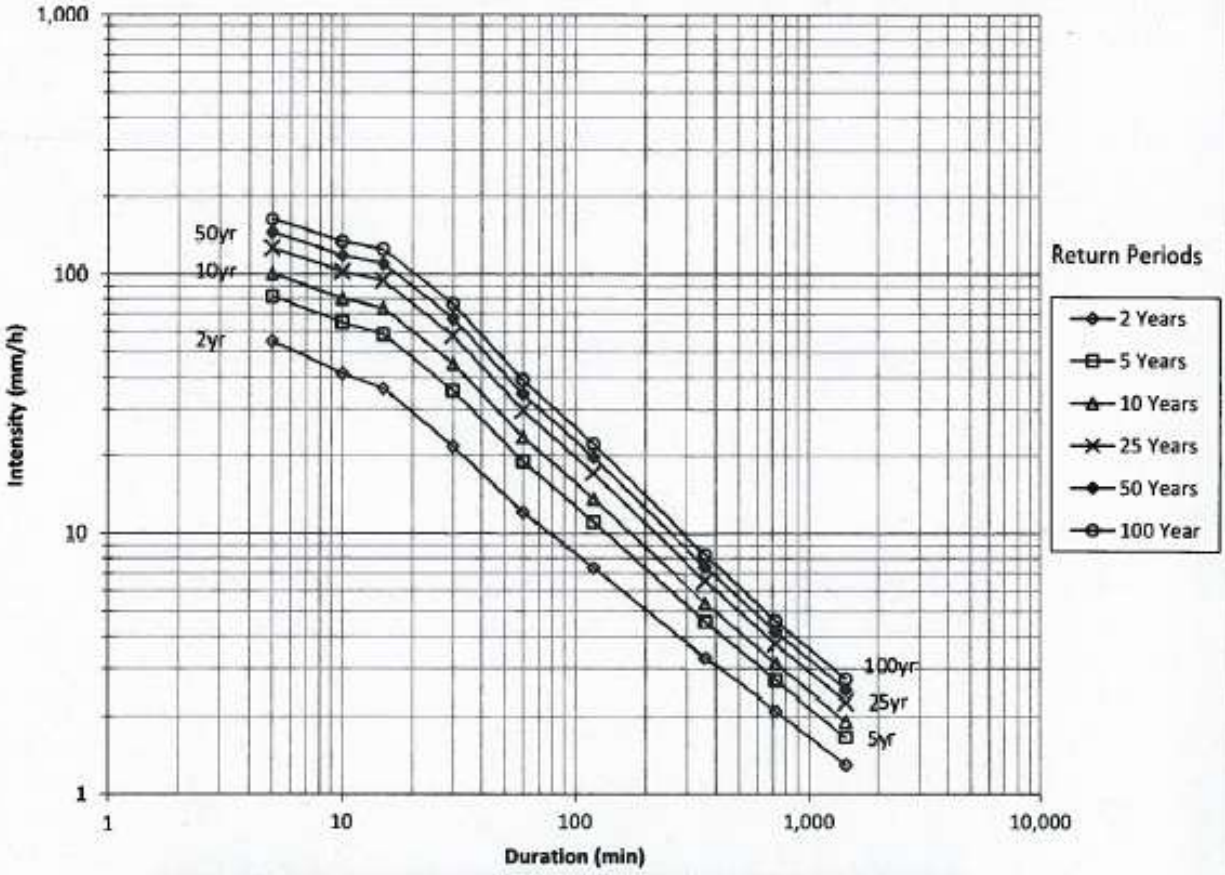
BL#1837



Standard Drawings
S-13

BL#1837

Short Duration Rainfall Intensity-Duration-Frequency Data



Station: Creston WPCC ID 1142164, Projection Period 2010 - 2039							
		Return Period (years)					
		2	5	10	25	50	100
Storm Durations (minutes)	5	*55.07*	*82.05*	*100.35*	*125.76*	*144.68*	*162.56*
	10	*41.43*	*65.08*	*80.48*	*101.91*	*117.88*	*133.35*
	15	*36.25*	*58.63*	*73.75*	*94.20*	*109.60*	*124.49*
	30	*21.63*	*35.58*	*45.07*	*57.78*	*67.35*	*76.60*
	60	*12.06*	*18.99*	*23.51*	*29.80*	*34.49*	*39.02*
	120	*7.36*	*11.07*	*13.60*	*17.07*	*19.65*	*22.14*
	360	*3.31*	*4.55*	*5.39*	*6.55*	*7.42*	*8.24*
	720	*2.09*	*2.72*	*3.15*	*3.74*	*4.18*	*4.59*
	1440	*1.30*	*1.66*	*1.91*	*2.25*	*2.50*	*2.74*

Future Rainfall Intensity (mm/hr) for 5 min - 24hr duration

CRESTON VALLEY
TOWN of CRESTON
WSP

TOWN OF CRESTON

RAINFALL INTENSITY CURVE
2010 - 2039

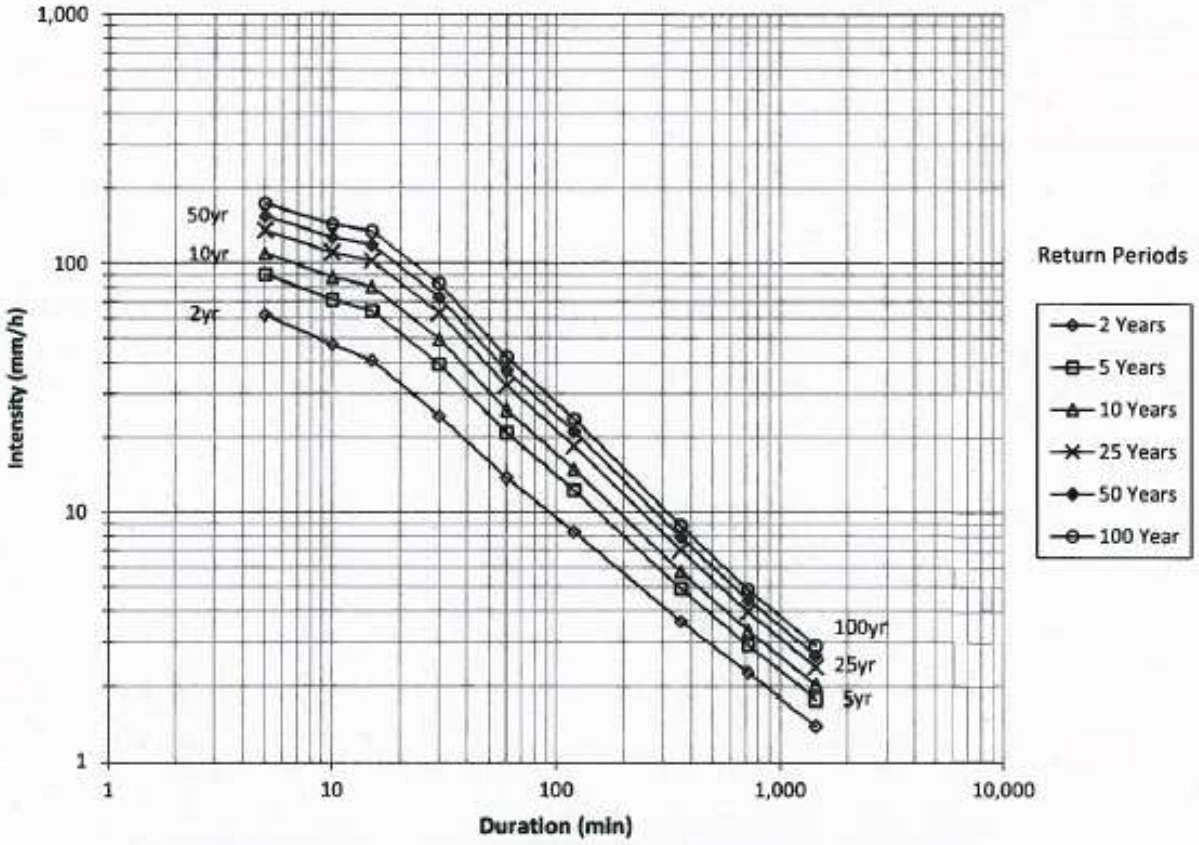
Date: JANUARY 2016

DWG NO: **S-13**

Standard Drawings
S-14

BL#1837

Short Duration Rainfall Intensity-Duration-Frequency Data



Station: Creston WPCC ID 1142164, Projection Period 2040 - 2069							
		Return Period (years)					
		2	5	10	25	50	100
Storm Durations (minutes)	5	*62.15*	*90.37*	*109.67*	*135.63*	*154.90*	*174.02*
	10	*47.20*	*71.46*	*88.05*	*110.38*	*126.94*	*143.38*
	15	*40.77*	*64.42*	*80.60*	*102.37*	*118.51*	*134.54*
	30	*24.34*	*39.33*	*49.55*	*63.06*	*73.09*	*83.04*
	60	*13.75*	*20.87*	*25.73*	*32.28*	*37.14*	*41.96*
	120	*8.33*	*12.21*	*14.86*	*18.43*	*21.08*	*23.71*
	360	*3.63*	*4.93*	*5.77*	*7.02*	*7.94*	*8.81*
	720	*2.26*	*2.92*	*3.34*	*3.97*	*4.44*	*4.88*
	1440	*1.40*	*1.78*	*2.02*	*2.38*	*2.65*	*2.90*

Future Rainfall Intensity (mm/hr) for 5 min - 24hr duration

CRESTON VALLEY
TOWN of CRESTON
WSP

TOWN OF CRESTON

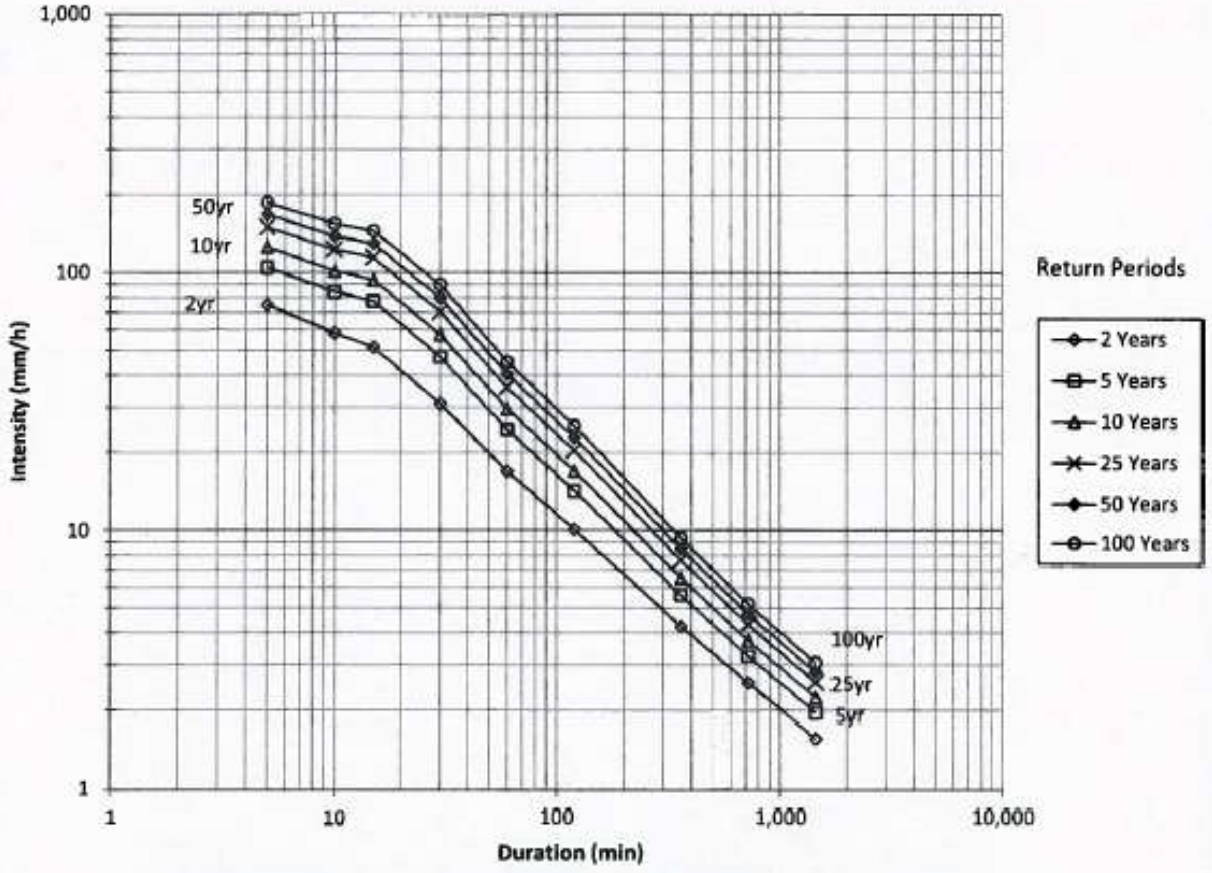
RAINFALL INTENSITY CURVE
2040 - 2069

Date:		DWG NO:
JANUARY 2016		S-14

Standard Drawings
S-15

BL#1837

Short Duration Rainfall Intensity-Duration-Frequency Data



Station: Creston WPCC ID 1142164, Projection Period 2070 - 2099							
		Return Period (years)					
		2	5	10	25	50	100
Storm Durations (minutes)	5	*74.70*	*104.41*	*124.86*	*149.40*	*167.60*	*186.26*
	10	*57.99*	*83.92*	*101.12*	*122.21*	*137.87*	*153.91*
	15	*51.29*	*77.05*	*93.34*	*113.91*	*129.17*	*144.81*
	30	*30.91*	*47.04*	*57.22*	*70.09*	*79.63*	*89.41*
	60	*16.91*	*24.52*	*29.57*	*35.76*	*40.35*	*45.05*
	120	*10.06*	*14.20*	*16.95*	*20.33*	*22.83*	*25.40*
	360	*4.21*	*5.57*	*6.51*	*7.64*	*8.47*	*9.33*
	720	*2.55*	*3.24*	*3.72*	*4.29*	*4.71*	*5.15*
	1440	*1.57*	*1.96*	*2.24*	*2.56*	*2.81*	*3.05*

Future Rainfall Intensity (mm/hr) for 5 min - 24hr duration

CRESTON VALLEY
TOWN of CRESTON
WSP

TOWN OF CRESTON

RAINFALL INTENSITY CURVE
2070 - 2099

Date:		DWG NO:
JANUARY 2016		S-15

INDEX OF AMENDING BYLAWS

Bylaw No. 1446 ..... Adopted April 28, 1998
Bylaw No. 1742 ..... Adopted May 25, 2010
Bylaw No. 1829 ..... Adopted October 13, 2015
Bylaw No. 1837 ..... Adopted February 23, 2016

NOTE TO USERS

“WHEREAS each bylaw consolidation shall be proof, in the absence of evidence to the contrary, of the original bylaw, of all bylaws amending it and of the fact of passage of the original and all amending bylaws”, pursuant to ‘Authority to Consolidate Municipal Bylaws No. 1533', which was adopted on the 11th day of June, 2001.