

## CHAPTER 12: DRAINAGE

### **Inplace Drainage Structures**

On projects where inplace manholes or catch basins are likely to be either adjusted or reconstructed, the following additional information is necessary from survey crews.

Design or type of structure

Cone Type A, B or C.

Height of adjusting rings – if no rings, indicate this

Height of casting

This information is also necessary when the design requires connecting new drainage structures to inplace structures. Please inform you District Surveys Engineer of these requirements.

Also, during review of supplemental agreements, we noticed several agreements had to be processed due to the incorrect size of existing storm sewer pipes in the plan. A more careful check, especially those pipes that require extensions, is in order.

### **Drainage Flow Arrows**

Plans should contain drainage flow arrows on the plan sheets indicating the direction of flow for culverts, bridges, ditches, ditch breaks, etc..

### **Chinook Winds and Winter Snows**

A combination which frequently results in hazardous winter conditions on shaded portions of roadways under bridges. Icing conditions are a danger in themselves, and they present further hazards during corrective maintenance operations. Paradoxically, they melt away maintenance funds. Potentially hazardous conditions and rising maintenance costs often can be prevented by thoughtful design. Hydraulics Engineers, request that designers place catch basins in such a manner so that runoff in gutters can be intercepted before it can flow under bridges to freeze in those shaded areas. This is a relatively simple design concept which, if employed wherever feasible, will not only reduce recurring maintenance cost, but may also prevent bodily harm and property damage. All surface design features should be carefully evaluated to minimize or prevent, where possible, the flow of water across pavement surfaces. This is especially important in the case of water from winter thaws. For example, snow and ice accumulations on raised islands thawing, and then freezing on the road surface, might be prevented by use of a drained, depressed island.

### **Grates**

The type of grate used with a catch basin does affect the amount of runoff intercepted along a curb and gutter. The location of the catch basin, whether on a slope or at a low point, also should be considered when choosing the type of grate to be used. The advantages and disadvantages of some of Mn/DOT grates are as follows:

Grate	Advantages	Disadvantages
Standard Plate 4154 (vane type) (Grate Casting 816)	<ol style="list-style-type: none"> <li>1. Tends not to plug with debris.</li> <li>2. Intercept large flow Depths on steep slopes with No flow across grate.</li> <li>3. Bicycle safe when installed In correct position.</li> </ol>	Has less capacity at low Points than parallel grate Std. Plate 4153.
Standard Plate 4152 (vane type) (Grate Casting 814)	<ol style="list-style-type: none"> <li>1. Bicycle safe</li> <li>2. Accommodates foot traffic debris.</li> <li>3. Accommodates more runoff at low points than other grates.</li> </ol>	<ol style="list-style-type: none"> <li>1. Tends to plug with debris</li> <li>2. Water will tend to skip Across grate with large with large flow depths on Steep slopes.</li> </ol>

The above information indicates that the vane type grate (Standard Plate 4154-Grate Casting 816) should be used on grades. The parallel type grate (Standard Plate 4153 - Grate Casting 815) is recommended at low point except where bicycle traffic is expected. If the low point structures may have bicycle traffic, the vane grate (816) is recommended.

### **Pipe Gauges**

Standard Plate 3041. This plate allows a lighter gauge metal pipe above 36 in. (900 mm) diameter than Standard Plate 3040. Therefore, it is better not to show any gauge within a plan unless a heavier than standard gauge is required (lighter than standard are never used). When a heavier gauge is called for, it should be subnoted as below:

2501.511 48 in. (1200 mm) C.S. Pipe Culvert, 10 gauge (1)

(1) A 10 gauge is required per Standard Plate 3040 or a 12 gauge per Standard Plate 3041.

NOTE: (1) above is assuming that the gauge requirements are based on fill conditions only. If a heavier gauge is desired for velocity - durability reasons, note (1) above should state that regardless of which plate is used, a 10 gauge pipe is required.

### **Standard Plate 3022**

Standard Plate 3022 shows two design options (No. 1 & No. 2). When using this plate the designer should indicate on the drainage tabulation which option was used to determine the length of pipes.

### **Classes for Reinforced Concrete Pipe Arch**

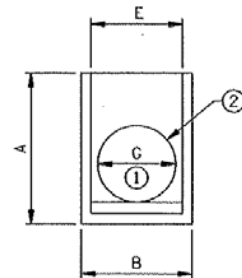
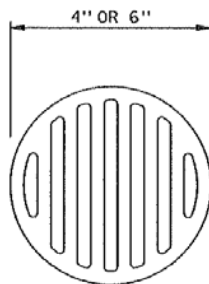
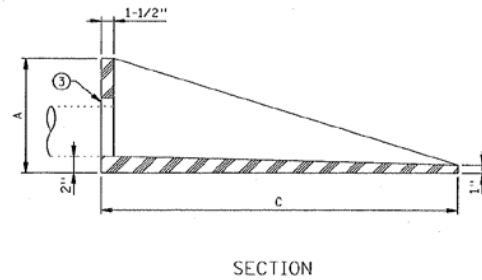
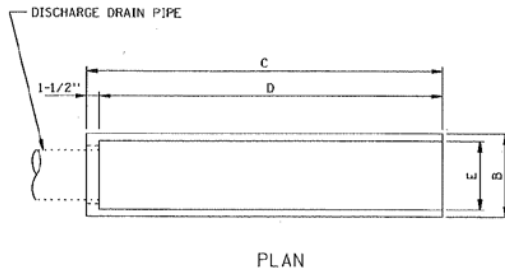
Class IIA is the only class available for pipe arches with a nominal span less than 1855 mm (73 inches). For pipe arch sizes 73 in. (1855 mm) or greater, Class IIA, IIIA and IVA are available. Refer to Standard Plate No. 3014 (M3014) for further information.

**Headwalls (Polyethylene option)**

The headwall detail shown below shall be considered an unapproved standard detail to be used for headwalls for subsurface drains. The intent is to use P.E. as an option to the concrete headwall we currently use. Sub note CONCRETE HEADWALL pay item to read: THE CONTRACTOR HAS THE OPTION OF USING A POLYETHYLENE HEADWALL AS SHOWN ON SHEET

This detail can also be found on ProjectWise at

OTS\DesignStandards\DesignDetails\Development\headwall\_dd.dgn



DIMENSIONS	4" DIA. PIPE	6" DIA. PIPE
A	11-3/4"	13-3/4"
B	7"	10"
C	36"	42-1/2"
D	34-1/2"	41"
E	5-1/2"	8-1/4"
F Δ	1 - 2"	1 - 2"
G	5"	7"
APPROX. WT.	38 LBS.	45 LBS.

① Δ WALL THICKNESS - SIDES, BOTTOM, AND END.

**NOTES:**

SEE PLANS FOR MORE INFORMATION.

HEADWALL TO BE RECYCLED HIGH DENSITY POLYETHYLENE, TENSILE: 3.2 k P.S.I. MINIMUM, FLEXURAL 100 k P.S.I. MINIMUM.

- ① HOLE SIZE TO ACCEPT ALL COMMONLY USED P.V.C. PIPE.
- ② P.V.C. GRATE FOR POLY APRON IS COMMERCIALY AVAILABLE AS A FLOOR STRAINER. SHIELD IS FASTENED TO THE OUT FALL PIPE WITH 2 (TWO) NO. 10 X 1 INCH GALVANIZED SHEET METAL SCREWS. OPTION: SCREENS OF 2 OR 3 MESH, 16 GAUGE OR HEAVIER HOT DIPPED GALVANIZED CARBON STEEL WIRE. FITS SNUGLY TO SIDES AND BOTTOM AND IS BENT TO FIT SECURELY TO THE BACK OF THE ENDWALL. ALLOWS FOR APPROXIMATELY 1-1/2" - 2" EXTENSION OF OUT FLOW PIPE.

- ③ SEAL P.V.C. PIPE WITH SILICONE CAULK OR OTHER APPROVED MATERIAL

### **Plastic Pipe Option for Storm Sewer and Side Culverts**

Mn/DOT has agreed to include acceptable pipe materials within its construction plans. It has been determined that plastic pipe should be used more uniformly statewide for storm sewer and culverts if the plastic pipe design criteria are met. This is being provided in response to industry concern that plastic pipe, although an approved material was not being included as a bid alternate. Designers may continue to specify a particular product to be used when professional engineering judgment determines that circumstances warrant. When this is the case the designer should keep written documentation in the project file on why the option was not used.

Plastic pipe should be used in accordance with Technical memorandum No. 12-01-B-01.

#### **Storm Sewer**

In order to make it clear which pipes shall have options, it is recommended that for each reach of pipe that the options should be noted in the drainage tabulation. On the Statement of Estimated Quantities the listed pay item will be reinforced concrete pipe. A note shall be provided on each appropriate pay item noting that: **Plastic pipe may be used as an option.**

For storm sewer systems where some of the sewer pipe qualifies for the plastic pipe option and the rest of the sewer is concrete, the pay item should have a note on the estimate sheet showing how much pipe may be plastic.

#### **Example:**

2503.511 600 mm (24") RC PIPE SEWER CLASS III (1) LIN FT (m) 500  
(1) Plastic pipe may be used as an option for 200 lin. ft.. See tabulations for locations.

#### **Centerline Culvert**

In order to make it clear which pipes shall have options, it is recommended that for each reach of pipe that the options should be noted in the drainage tabulation. On the Statement of Estimated Quantities the listed pay item will be reinforced concrete pipe. A note shall be provided on each appropriate pay item noting that: Plastic pipe may be used as an option.

#### **Side Culvert**

As with the storm sewer it is recommended that the tabulation for side culverts note those that will have options. As presently done in the Statement of Estimated Quantities the listed pay item will be a generic pipe culvert and generic apron with a note indicating the applicable pipe options as indicated in the **Design Scene (chapter 2) Plastic Pipe Option for Culverts** write up.

The necessary requirements pertaining to the use of plastic pipe for side culvert are available in the Special Provisions under Spec. 2501 Pipe Culverts.

#### **Other**

Plastic pipe is dependent on soil interaction for support. Adequate compaction must be attainable for the pipe to perform satisfactorily. Areas of high groundwater or unusual soil conditions may not be suitable if compaction is not certain. Follow the design criteria in the Technical Memorandum which provide guidance on acceptable pipe sizes, cover requirements, allowable

ADT for centerline culvert, and other considerations. Designers need to apply engineering judgment in such situations and limit the types of pipe materials allowed if site conditions may result in an unsuccessful installation.

### Questions

Any technical questions regarding the usage of plastic pipe should be directed to the State Hydraulics Engineer; any questions about incorporating plastic pipe into the plans should be directed to the Design Liaison Engineer.

### **Culvert Aprons in the Clear Zone**

Several designers have shown a confusion with when to use safety aprons and or grates. They should refer to Chapter 8 of the Road Design Manual for this information.

### **Pipe Lining**

There has been some confusion regarding pipe lining, hopefully this will clear it up...

Lining pipes must state the size of the pipe being lined....

- 2503.603 LINING SEWER PIPE X" by the LIN FT...grout is incidental unless otherwise noted.
- 2507.501 LINING CULVERT PIPE (X") by the LIN FT, when using this pay item they also need to include either...
  - o 2519.607 CLSM LOW DENSITY by the CU YD or
  - o 2519.607 CLSM HIGH DENSITY by the CU YD or
  - o If using cured in place plastic (CIPP) then pay for it as 2507.603 LINING CULVERT PIPE (X") SPECIAL by the LIN FT.