TOWN OF MOORESVILLE
LAND DEVELOPMENT DESIGN STANDARDS

TOWN OF MOORESVILLE, NC

Engineering Services Division

JUNE 2018

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STANDARDS

DETAILS

Section 1. **Introduction**

This document is intended to establish minimum design and construction requirements for the preparation and submittal of plans for all land development projects within the Town of Mooresville and its Extraterritorial Jurisdiction (ETJ). The Town of Mooresville Engineering Department will use these standards, as well as sound engineering principles, to review the detailed engineering drawings. All Engineers are encouraged to take these guidelines into consideration in the planning phase of any project to minimize required changes. The designing engineer on any project should use judgment and experience to determine any additional information that may be necessary for review. The ultimate responsibility for a given design is that of the engineer of record.

All improvements that are required off-site for a fully functional development project and are to be performed as part of the development project must be included in the Plan submittal.

This manual will be reviewed periodically for updating, and more frequent updates/revisions will be made as significant changes or additions are made to the material covered. Revisions will be available on the website.

1.1. Reference Standards

The latest revision of the "NCDOT Standard Specifications for Roads and Structures" and the "NCDOT Design Manual" shall apply to all roadway and storm drainage construction unless otherwise specified herein this manual. Furthermore, all references to specifications and/or standards by the following institutes, associations, and societies shall be made to the latest revision of each specification:

ANSI - American National Standards Institute
ASTM - American Society for Testing Materials
AWWA - American Water Works Association
AASHTO - American Association of State Highway and Transportation Officials
MUTCD - Manual on Uniformed Traffic Controlled Devices
NCAC – North Carolina Administrative Code

1.2. General Contractors and Subcontractors

In order to perform work in the Town of Mooresville whether for the Town or in the Town zoning limits, ALL General Contractors and Subcontractors must be licensed by the NCLBGC for the specific type of work that will be performed. All limitations and classifications of the NCLBGC apply.

1.3. Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute
APWA	American Public Works Association
ASTM	American Society of Testing and Materials

AWWA	American Water Works Association
BC (BOC)	Back of curb
BCBC	Bituminous Concrete Base Course
cfs	Cubic feet per second
CI	Cast iron
C/L	Centerline
DE	Drainage easement
DENR	NC Department of Environment and Natural Resources.
DIP	Ductile iron pipe
DME	Drainage Maintenance Easement
EP (EOP)	Edge of pavement
EIP	Existing iron pipe or pin
ETJ	Extra Territorial Jurisdiction
FES	Flared end section
FF	Face to face
gpm	Gallons per minute
ID	Internal Diameter
INV	Invert
MH	Manhole
mph	Miles per hour
MSL	Mean Sea Level
MUTCD	Manual on Uniform Traffic Control Devices
NCAC	North Carolina Administrative Code
NCDEQ	North Carolina Department of Environmental Quality
NCDEM	North Carolina Division of Environmental Management
NCDOT	North Carolina Department of Transportation
NCLBGC	North Carolina Licensing Board for General Contractors
NEC	National Electric Code
OD	Outside Diameter
PC	Point of Curvature
PE	Professional Engineer
ppm	parts per million
PSDE	Permanent storm drainage easement
psi	pounds per square inch
PT	Point of Tangency
PVC	Point of Curvature on Vertical Curve (road); Polyvinyl Chloride (pipe)
PVI	Point of Vertical Intersection
PVT	Point of Tangency on Vertical Curve
RCP	Reinforced concrete pipe
RLS	Registered Land Surveyor
R/W	Right-of-way
SCS	Soil Conservation Service (Natural Resources Conservation Service)
VCP	Vitrified clay pipe

Section 2. **Plan Guidelines**

2.1. Erosion Control

Each set of Drawings must include appropriate design of erosion and sedimentation control measures in accordance with the requirements of the Iredell County Erosion Control Division. Erosion control plans must be approved by Iredell County Erosion Control prior to construction.

2.2. Datum and State Plane Coordinates

All horizontal control shall be correlated to the North Carolina State Plane Coordinate System, all vertical control shall be correlated to the North American Datum (NAD) 1983/86 and North American Vertical Datum (NAVD) 88. All digital files must be tied to the State Plane Coordinate System using two Town of Mooresville or NCGS Monuments. No assumed elevations may be used.

2.3. General Notes for All Land Development Drawing Sets

a. Construction notes as listed in the Details shall be included in every project.

b. Construction plans shall be 24" x 36" only. Plans other than that size submitted for Town approval will not be reviewed.

2.4. Domestic Steel and Iron Products Policy

All iron and steel products covered by this Materials Specification shall be purchased from domestic suppliers in conformance with Article 106-1 Paragraph B, "Domestic Steel", of the NCDOT Standard Specifications for Roads and Structures. This specification is in conformance with the "Buy American Act" of Congress. All gray iron castings for heavy duty applications shall be manufactured and tested in according to ASTM A48, Class 35B of AASHTO M306. Foundry certifications and test results, with matching dates and production numbers shall be furnished upon request. Castings shall be of uniform quality, free from sand holes, gas holes, shrinkage cracks, and other surface defects. For traffic surface castings, bearing surfaces between manhole covers and rings or grates and frames shall be cast or machined with such precision to prevent rocking. Manufacturer's published casting weights shall vary +/- 5%.

Section 3. **Water Design Standards**

3.1. General

a. All projects which use these specifications shall be designed in accordance with and shall meet all requirements of NCAC Title 15A, Subchapter 18C. It is the responsibility of the Engineer of Record to ensure that all requirements are met. In cases where a statement herein conflicts with such requirements, the more restrictive shall apply. Variations or exceptions to the following guidelines must be approved by Town of Mooresville Engineering Services Director.

b. Water system design must be consistent with the Town's current Water and Sewer Master Plan and overall needs of the Town.

c. Waterlines must be extended in streets and other easements to the property line or as required by the Engineering Services Director. The waterline design shall ensure future service is available to the remainder of adjacent properties.

d. When building fire protection is to be provided, system design shall be such that fire flows and facilities are in accordance with the requirements of the State Insurance Services Office and the most current Fire Code including all Appendices.

e. The Town of Mooresville has adopted the North Carolina Fire Code including all appendices. Minimum available fire flow for new development shall meet the minimum requirements in the North Carolina Fire Code, as interpreted and approved by the Town of Mooresville Fire Marshall.

f. Design shall be based on a Hazen-William "C" value of 130 for ductile iron pipe (DIP) and 150 for PVC pipe. The acceptable range for pipeline velocity shall be 3-fps to 6-fps for normal working conditions. Sustained high discharge velocities can scour the pipe's interior and increase leakage. Minimum velocity must be maintained to prevent sediment accumulation and bacteriological growth.

g. Water mains shall be designed to provide a minimum residual service flow of 10 gallons per minute (gpm) at a pressure of 20 pounds per square inch (psi) at any point within the system during periods of combined average daily flow and fire flow.

h. The water distribution systems and any extensions shall be designed to supply the demands of all customers while maintaining the following minimum pressures and velocity.

(1) 40 psi for maximum daily flow
(2) 30 psi for peak hourly flow
(3) 20psi for instantaneous flow plus fire flow. If this requirement cannot be met due to system limitations, the minimum pipe diameter shall be 8-inches.
(4) 4 feet per second (fps) for flushing

i. Transmission mains larger than 12-inches shall be designed on the basis of the most recent system wide demand data and hydraulic modeling.

j. Open cut construction on existing paved roads must be approved by Engineering Services Director. Existing paved roads shall be bored or tunneled as appropriate.

k. Water mains will have a minimum of 3 feet of cover, unless reduced cover is required to avoid a conflict. At no time shall cover be less than 24 inches. Designs resulting in less than 3 feet of cover or more than 10 feet of cover must be accompanied with a letter requesting an exception, documentation showing all alternatives, substantiating the depth of the water line. The letter must be approved by the Engineering Services Director.

Water mains shall be located within dedicated street rights-of-way or Town utility easements.

l. Water main depths along road right-of-way shall consider future road widening. Projections of future grades may require increased depths or additional easements for the water main.

m. Permanent Utility Easement (PUE) shall be a minimum width of 25-feet. Larger pipe or deep sewers may require additional permanent easement as required by the Engineering Services Director and as summarized in the following Table:

Minimum Permanent Utility Easement (PUE) Width (feet)

Diameter (inches)	Maximum Pipe Invert Depth (ft)					
	10	12	14	16	18	20
4	25’	25’	30’	35’	40’	45’
6	25’	25’	30’	35’	40’	45’
8	25’	25’	30’	35’	40’	45’
10	25’	25’	30’	35’	40’	45’
12	25’	25’	30’	35’	40’	45’
14	25’	30’	30’	35’	40’	45’
16	25’	30’	30’	35’	40’	45’
18	25’	30’	30’	35’	40’	45’
20	25’	30’	30’	35’	40’	45’
24	25’	30’	30’	35’	40’	45’
30	30’	35’	40’	45’	50’	50’
36	30’	35’	40’	45’	50’	50’
42	30’	35’	40’	45’	50’	50’

n. A Temporary Construction Easement (TCE), of an additional 12.5’ on each side of the PUE, shall be in place for the duration of the construction project.

o. Two-inch-diameter shall be allowed for short cul-de-sacs (400 feet or less) serving less than 5 lots. Longer cul-de-sacs require 8-inch diameter water line and must include a fire hydrant at the end.

p. Automatic air release valves shall be located at all high points along water main transmission lines.

q. Blow-off assemblies or fire hydrants shall be located at water main dead ends. Fire hydrants shall function as the blow-off on the end of 6-inch, or larger, water mains. Two-inch blow-off assemblies are to be used for temporary dead-end water mains, short two-inch water mains, or as directed by the Town.

r. Main line valves shall be located at all pipeline intersections and at changes in pipe diameter. Maximum valve spacing shall be 1000 feet. Two valves shall be provided at tees and three valves at crosses, with valves located either at road intersection radius points or as close to the fittings as possible. Where valves must be located away from intersections, they should be located at hydrant installations. If the line is a one-way feed, the valve should be on the dead-end side of the hydrant branch.

s. Thrust restraint shall be provided via restrained joint pipe unless sufficient pipe length is not available and shall be calculated based on a minimum test pressure of 200 psi and skin friction coefficients supplied by the pipe manufacturer with a safety factor of 1.5.

t. Redevelopment projects may utilize an existing 2" waterline for 5 residential services or less, provided that the existing line is PVC, and no additional fire services are required. Otherwise, the 2" water line must be replaced with an 8" line meeting the Land Development Standards and shall be looped to the extent possible.

3.2. Water Mains In Relation To Sewers

a. Lateral Separation of Sewers and Water Main: Water mains shall be laid at least 10 feet laterally from existing or proposed sewers, unless local conditions or barriers prevent a 10-foot lateral separation--in which case the sewer line shall be constructed of DIP and:

(1) The water main shall be laid in a separate trench, with the elevation of the bottom of the water main at least 18 inches above the top of the sewer; or

(2) The water main shall be laid in the same trench as the sewer with the water main located at one side on a bench of undisturbed earth, and with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.

b. Crossing a Water Main Over a Sewer: Whenever it is necessary for a water main to cross over a sewer, the water main shall be laid at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer. In cases where local conditions or barriers prevent an 18-inch vertical separation, both the water main and the sewer shall be constructed of ferrous materials with joints that are equivalent to water main standards for a distance of 10 feet on each side of the point of crossing.

c. Crossing a Water Main Under a Sewer. Whenever it is necessary for a water main to cross under a sewer, both the water main and the sewer shall be constructed of ferrous materials and with joints equivalent to water main standards for a distance of 10 feet on each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing.

3.3. Service Connections and Meters

a. All water meters shall be sized in accordance with the latest revision of AWWA M22 (Sizing Water Service Lines and Meters). Water meters are provided and installed by the Town of Mooresville Water Department.

b. Minimum service line (from Town main to meter) shall by 1 inch. A reducer shall be used for ¾ inch meter installations.

c. Meters (and cleanouts) must be located behind the sidewalk and at the center of the lots at the right-of-way line. Meters (and cleanouts) shall be located in the grass and shall not be located in streets, parking lots or driveways. Service lines and laterals shall not cross driveways. Water meter shall be located a maximum distance of 30 inches from the sewer clean-out. Corner lots, basement lots, or lots with rear or side sewer connections may be exempted from this pending approval from the Town.

d. Pipes for water meter service connections greater than 2" shall be restrained joint DIP, pressure class 350. Three-inch diameter DIP shall not be used for service connections.

e. When the maximum static pressure in a new system exceeds 80 psi, businesses and/or residences shall be equipped with a pressure-reducing valve (PRV). The PRV shall be located on the outlet side of the meter. It is the property owner's responsibility to install and maintain the PRV.

f. All potable water service connections shall be metered. Dedicated fire lines are not metered but shall have backflow prevention RPZ with a Detector Check (per detail).

g. Approved tapping saddle with stainless steel straps (Model 202S by Romac Industries or approved equals) shall be used for 2 inch and smaller taps. Direct taps shall not be used.

h. Stainless steel tapping sleeves shall be used for taps over 2 inches. Stainless steel sleeves shall be two-piece sleeves with removable bolts and a flanged outlet (Model 665 Smith-Blair or approved equal). Size on taps, such as 8x8, shall be Mechanical Joint Sleeves. Twelve-inch and smaller sleeves shall be rated for 200 psi working pressure. Sixteen-inch and larger shall be rated for 150 psi working pressure.

i. All connections to the Town's water system with the exception of a single-family residence's main service connection shall have a RP backflow preventer installed.

All residential connections shall have a double check valve backflow preventer installed.

j. Meter boxes shall be Model MB16 for ¾" meters and Model MB17 for 1" services, manufactured by Southeastern Distributors, Inc. The product numbers are:

(1) ¾" – MB16: Part No. 176 (Box), and Part No. 170WE36 (Lid)
(2) 1" – MB17: Part No. 178 (Box), and Part No. 174 WE37

k. All meters 1 ½" and larger shall be installed in precast concrete vaults as detailed. Vaults shall be approved for use in NCDOT rights-of-way and shall be used for H-20 loading.

3.4. Waterline Materials

a. The following materials are acceptable for waterline extensions:

Size (inches)	**Allowable Materials**
Service Connection (2 inch and smaller)	Copper Only
Service Connection (3 inch)	NOT ALLOWED
Service Connection (4 inch and larger)	RJ DIP
Waterline (2 inch) *	PVC SDR 13.5
Waterline (4 inch through 12 inch)	PVC C900 DR 14, DIP
Waterline (16 inch and larger)	DIP

* 3-inch pipe is not allowed for public waterline extensions

b. Ductile Iron Pipe and Fittings

Ductile iron pipe for all water applications shall be designed in accordance with ANSI/AWWA C150/A21.50 and manufactured in accordance with ANSI/AWWA C151/A21.51. Pipe shall have a cement mortar lining in accordance with ANSI/AWWA C104/A21.4. Ductile iron pipe shall be push-on type or mechanical type joint manufactured in accordance with ANSI/AWWA C111/A21.11, for rubber gasket joints. The exterior of ductile iron pipe shall be coated with a bituminous coating.

Ductile iron pipe up to 12-inch diameter must be thickness pressure Class 350. Pipe diameters 16 inch and lager must have a minimum thickness pressure Class 250. Any deviations in pressure class must be approved by the Engineering Services Director.

Ductile iron fittings shall be compact fittings conforming to ANSI/AWWA C153/A21.53 and will be of the mechanical joint type in accordance to ANSI/AWWA C111/A21.11. All glands shall be ductile iron, not gray iron. The interior of fittings will be cement-mortar lining of standard thickness in accordance with ANSI/AWWA C104/A21.4. The exterior of all fittings shall be coated with

bituminous coating. Fittings coated on the interior and exterior with 8 mils of fusion-bonded epoxy in accordance with ANSI/AWWA C116/A21.16 are acceptable.

c. Flanged Ductile Iron Pipe

Flange joint pipe is approved for use only in non-buried applications, such as meter vaults. All flange fittings shall be ductile iron and have minimum working pressures of 250 psi. Flange joints shall be manufactured and tested in accordance with AWWA C110/A21.10. Flanges, flange bolts and nuts, and gaskets shall conform to the dimensional requirements of ANSI B16.1 for Class 125 flanges. Flange pipe accessories shall be in accordance to ANSI/AWWA C115/A21.15. Bolts shall have standard hexagonal heads and shall be provided with standard hexagonal cold pressed nuts unless otherwise specified. Bolts and nuts shall be made of the best quality refined iron or mill steel and shall have sound, well-fitting threads.

d. Restrained Joint Ductile Iron Pipe

All restrained joint pipe shall have flexible push-on joints designed to deflect a minimum of 3^{o} per joint. Field welding will not be allowed. Factory supplied field cut kits shall be used as directed by the pipe manufacturer. Approved restrained retainer glands shall be used to connect pipe to mechanical joint fittings. Restrained joint pipe is subject to approval by the Engineering Services Director, whose acceptance or rejection shall be final.

Restrained joint development length calculations shall be performed using the Ductile Iron Pipe Research Association (DIPRA) *Thrust Restraint Design for Ductile Iron Pipe* computer program which can be downloaded from http://www.dipra.org/. The output shall be submitted to the Town for review and approval. The Engineering Services Director reserves the right to specify the type of restrained pipe to be used on specific projects and specific field applications. All restrained joint pipe material must meet Domestic Steel Policy. Field Lok Gaskets must be made in the USA. Approved restrained joint pipe are:

(1) Field Lok 350® Gaskets (16 inch and smaller pipe only)
(2) TR Flex by U.S. Pipe
(3) Snap-Lok by Griffin
(4) Super-Lock by Clow.
(5) Flex-Ring by American

Threaded rods, tie bolts and washers used for thrust restraint shall be ¾" stainless steel.

Retainer glands shall be wedge action glands with torque limiting twist off nuts or glands with wedge type gripping gaskets. Approved glands shall be the following:

(1) Megalug E1100 by EBBA Iron Sales, Inc.,
(2) MJ Field Lok® Gaskets by U. S. Pipe
(3) Ford Meter Box, Series 1400
(4) Approved Equal

e. Polyethylene Encasement for Ductile Iron Pipe

Materials and installation shall conform to ANSI/AWWA C105/A21.5. The polyethylene shall have a minimum thickness of 8 mil, shall be tubing type, and shall be manufactured of virgin material. Installation of the polyethylene tubing shall conform to Method "B" outlined in Section 4.3.2.2 of ANSI/AWWA C105/A21.5. The tape used for installation of polyethylene tubing shall be plastic-backed adhesive with a thickness of 12 mils and a minimum width of 1 ½". The tape shall be capable of bonding to metal, bituminous coating and polyethylene at a temperature range of 32 to 120 degrees F.

f. PVC Pipe 4 inches through 12 inches

All PVC pipe 4" and larger shall be manufactured in conformance with AWWA Standard C 900, ASTM 2241 and shall conform to the requirements of DR 14 class 200 psi. The exterior of all PVC shall bear a continuous stamp indicating the AWWA certification, DR ratio, size and manufacturer. Two strands of 12-gauge copper tracer wire shall be installed with all PVC pipe (see tracer wire paragraph).

All PVC shall have a bell with integral rubber gasket and be slip joint manufactured in accordance with AWWA C 151.

Bells of pipe shall be contoured to receive a bulb shaped circular rubber gasket and spigot end shall have sufficient taper to facilitate installation. Jointing shall be achieved by lubricating joint with approved lubricant, guiding spigot end of pipe into bell end of adjacent pipe until contact is made with gasket and exerting enough compressive force to drive the spigot forward into the bell until they achieve full contact. No joint shall exceed the maximum deflection allowed by the manufacturer, normally 11" in a 20' joint.

Fittings for PVC pipe 4 inches through 16 inches shall be mechanical joint ductile iron with a minimum pressure rating of 250 psi as conforming to ANSI/AWWA Standard C110/A21.10 and A21.4.

PVC pipe shall be blue for potable water and green for sewer force main applications.

g. Restrained Joint PVC Pipe

Restrained joints for PVC pipe shall be Uni-Flange Series 1350 for PVC-PVC joints and Uni-Flange Series 1300 or EBBA PV2000 fittings for PVC-DIP joints, or equal.

Restrained joint development length calculations shall be performed using the EBBA Iron *Restrained Length Calculator* computer program which can be found at http://rcp.ebaa.com/. The output shall be submitted to the Town for review and approval.

h. 2-inch PVC Pipe

2-inch PVC pipe shall be SDR 13.5 and manufactured in accordance with ASTM D2241. Pipe shall be slip joint with integral bell and gasket meeting ASTM F477. 12-gauge copper tracer wire shall be installed with all PVC pipe (see tracer wire paragraph).

i. Tracer Wire

All underground pipe shall have two strands of 12-gauge solid insulated copper tracer wire securely installed on top of the pipe at the 12 o'clock position. The wire shall be held in place with nylon cable ties (or equal means of attachment) at each end and on 48-inch centers along the pipe sections. The wire shall be of sufficient length to be extendable to the surface at each valve box every 500 feet, allowing a current to be induced through the wire to detect the location of the pipeline. The wire shall be brought to the surface inside valve boxes and terminated with a tinned wire connector. Tracer wire must be tested after installation before the line is accepted for service.

j. Copper Pipe and Fittings

All copper pipes shall conform to ASTM B88, and shall by Type K, soft copper. All joints shall be compression fittings.

3.5. Valves

a. Air Release

All air release valves shall conform to ANSI/AWWA C512. The air release valve shall be designed for potable water applications and be a pressure air valve (operating pressure 0-200 psi) manufactured by GA Industries, Crispin or an approved equal. Valves shall be used as described by the manufacture for clean water air release valves and for potable water lines. All interior iron surfaces of the air valve shall be coated with a minimum of 8 mils of fusion bonded epoxy or liquid epoxy in accordance with ANSI/AWWA C550. All internal working parts shall be stainless steel. All valves shall be furnished with back flushing attachments. The bronze ball valve curb stops shall have a minimum working pressure of 300 psi.

b. Valves (Gate)

All gate valves shall be resilient-seated gate valves which meet the specifications of ANSI/AWWA C509 or ANSI/AWWA C515. The valve body, bonnet and seal plate shall be coated on all exterior and interior surfaces with a minimum of 8-10 mils of fusion bonded epoxy in accordance with ANSI/AWWA C550. The valve shall incorporate a guide system with guide lugs on the wedge or on the body. The wedge shall be gray or ductile iron, fully encapsulated with rubber (including guide lugs and stem nut holder). Non-rising stem valves shall have two O-ring seals above the stem thrust collar that can be replaced with the valve under pressure. Non-rising stem valves shall also have a thrust washer on the stem thrust collar. Valves used for buried service will have a non-rising stem, mechanical joint end connections, and a 2" square operating nut. The word "OPEN" and an arrow to indicate the direction of opening the valve shall be cast on the flanged base of the operating nut. Above ground valves, unless otherwise specified, will have an outside screw and yoke rising stem or a non-rising stem, flanged end connections, and a hand wheel to operate the valve. The word "OPEN" and an arrow to indicate the direction of opening the valve shall be cast on the rim of the hand wheel. All valves will open by turning the nut or hand wheel counterclockwise. Valves installed in manholes will normally be considered to be buried service valves and valves installed in vaults will normally be considered to be above ground valves.

Resilient-seated gate valves shall be designed for a minimum working pressure of 200 psi. Each valve shall be seat tested at the rated working pressure and shell tested at twice the rated working pressure in accordance with ANSI/AWWA C509 - Section 5 or ANSI/AWWA C515 - Section 5. All valves shall be warranted for l0 years from date of purchase against defective materials and workmanship. Gate valves furnished under these specifications must be manufactured by one of the following:

(1) Clow Valve Company
(2) M & H Valve Company
(3) American Flow Control
(4) U.S. Pipe and Foundry Company
(5) Mueller Company
(6) Kennedy Valve Company

c. Tapping Sleeves & Valves

Tapping sleeves and valves shall be used for “wet” taps into existing water mains. The tapping valve shall meet all specifications for “gate valves”. Flange by Mechanical Joint tapping valve shall have an inlet flange (with centering ring) for connection to the flanged sleeve outlet of the flanged tapping sleeve, conforming to AWWA C207, Class D, ANSI 150 lb. drilling. Tapping valves shall be supplied with stainless steel bolts, and heavy hexagon nuts conforming to ANSI/AWWA C111/A21.11. Tapping valve seal plates and bonnets shall have 316 stainless steel bolts and nuts.

All tapping sleeves and valves shall be water tested before the tap is made. Test pressure shall be 200 psi. All tapping sleeves and valves shall be installed level. Valve shall be supported so sleeve does not shift during tap. Setup shall be inspected by the Town prior to beginning tap.

Approved tapping valves are as follows:

(1) Clow Valve Company
(2) M & H Valve Company
(3) U.S. Pipe and Foundry Company
(4) Mueller Company
(5) Kennedy Valve Company

d. Stainless Steel Tapping Sleeve

Stainless steel tapping sleeves shall be manufactured from type 304 stainless steel. The outlet shall be mechanical joint outlet to be used with a standard mechanical joint valve. The mechanical joint outlet shall be stainless steel. The sleeve shall include a test plug for pressure testing the installed sleeve prior to making the tap. All welds shall be passivated for corrosion resistance. Stainless steel tapping sleeves shall be Smith-Blair 665 or JCM 439, 459 or approved equal.

e. Valve Boxes (Round Top)

Cast iron valve boxes will conform to ASTM A48, Class 30B. Valve boxes shall be free from holes, cracks or any other defects. Lid shall be clearly labeled "WATER" or "SEWER" as appropriate. Locking lids shall be used in areas where private utilities are also located. Lids must have a minimum 1-1/2" skirt and weigh at least 13 lbs. Lids in areas subject to vehicle traffic may require extended 4 inch skirts and weigh at least 24 lbs. Valve box extensions are to be of ductile iron in and along roadways or areas that may be widened. Unless directed plastic valve box extensions such as C-900 are acceptable in other areas. Valve boxes are to be manually adjusted to grade in roadways. Valve box riser rings cannot be used to adjust final grade.

All castings will be thoroughly coated with an asphaltic varnish. Valve boxes that do not meet specifications shall be rejected. Cast iron valve boxes furnished under these specifications shall be supplied by one of the following East Jordan Iron Works – Made in USA or an approved equal.

3.6. Trenchless Utility Installation (Jack & Bore)

Water and sewer lines which cross NCDOT or Town roads shall be installed via jack and bore. Steel casing pipe shall extend a minimum of 10-feet beyond the edge of pavement on both sides of the roadway unless specific existing constraints preclude it.

a. Casing Pipe

Steel encasement pipe shall be smooth wall pipe with welded joints. All section joints of steel casing pipe shall be full penetration welded with a continuous circumferential weld. The pipe shall have minimum yield strength of 35,000 psi in accordance with ASTM A139 and A283. The encasement pipe must be capable of withstanding highway loadings and must have an inside diameter which will allow the carrier pipe to be removed subsequently without disturbing the encasement pipe. Encasement pipe and joints shall be of leak proof construction. The inside diameter of the encasement pipe shall be at least 2 inches greater than the largest outside diameter of the carrier pipe, joints or couplings, for carrier pipe less than 6 inches in diameter; and at least 4 inches greater for carrier pipe 6 inches and larger in diameter. In general, to determine the casing size you should double the size of the carrier pipe, i.e., a 8" carrier pipe requires a 16" casing pipe. The Engineer shall verify the clearance is sufficient to allow the carrier pipe to be removed without disturbing the casing pipe.

Minimum steel casing pipe size and wall thickness shall be as indicated as follows:

Carrier Pipe (inches)	Casing Pipe (inches)	Thickness (inches) NCDOT	Railroad
6	16	.250	.281
8	20	.250	.344
12	24	.250	.375
16	30	.312	.469
18	30	.312	.469
24	36	.375	.562
30	48	.500	.750

b. Carrier Pipe

The carrier pipe shall be restrained joint ductile iron in all cases.

c. Casing Spiders

Casing spiders shall be made of Type 304 stainless steel (including risers and hardware). Each shell shall be PVC lined and shall have bolted flanges. Casing spacer runners shall be constructed of ultra-high molecular weight polymer (minimum 1 ½" wide) with a friction coefficient of not more than 0.12. Risers shall be 10 gauge. Risers and runners for top and bottom shells shall be of equal height. With approval of the Town, unequal height risers and runners may be used to obtain proper grade for sanitary sewer mains. Casing spacers must be designed to ensure that only the runners of the spacer are in contact with the steel encasement pipe. The bell of the carrier pipe will not be allowed to be in contact with the encasement. Casing spacers shall be manufactured by one of the following:

(1) Cascade Waterworks Manufacturing Company
(2) Advance Products and Systems, Inc.
(3) BWM Company

3.7. Fire Hydrants

a. All fire hydrants private and public connected to the Town's water supply shall be Storz dry-barrel fire hydrants, which comply with ANSI/AWWA C502.

b. Fire hydrants shall be placed on lot lines no closer than one foot from the back of the curb. Spacing shall be subject to approval by the Town of Mooresville Fire Marshall and Engineering Department, but at a minimum must meet North Carolina Fire Code.

c. All hydrants shall be opened by turning counter clockwise, and the direction of opening shall be indicated by means of an arrow and appropriate wording on the top of the hydrant. A weather cap around the operating nut on top of the hydrant is required. All hydrants will have a 6" mechanical joint base connection.

d. Hydrants shall be designed for a minimum working pressure of 200 psi. Each hydrant shall be assembled at the factory with one 5" steamer nozzle with the 5" Storz connection and cap. Each hydrant shall have two 2 1/2" nozzles.

e. All hydrants will be furnished with the breakable traffic feature that will break upon impact. The feature shall consist of a breakaway safety flange on the barrel and a breakable safety coupling in the main valve stem. The bottom of the breakaway flange shall be 1 to 4 inches above finished grade.

f. All exterior surfaces of hydrants placed in the public right-of-way shall be painted two coats of "Safety Yellow" or to the town's satisfaction with Rust-Oleum Industrial Enamel Paint 944402 or approved equal. Private fire hydrants shall be painted silver. Plastic "Out of Use" disks or bags must be placed on hydrants immediately upon fire hydrant installation.

g. Hydrant will normally be three and one-half feet from the ground to the bottom of the hydrant (42" bury depth). However, when plans indicate deeper bury is required, such hydrants will be furnished conforming to the depth of bury as shown on the plans. Hydrant extensions will be installed only if necessary.

h. Hydrants accepted by the Town of Mooresville are as follows:

(1) Super Centurion 250, A-423 5-1/4" manufactured by Mueller Company
(2) 5-1/4" American Darling B-84-B, manufactured by American Flow Control
(3) K-81A 5-1/4" Guardian, manufactured by Kennedy Valve Company
(4) Medallion Hydrant 5-1/4", manufactured by Clow Valve Company

3.8. Concrete and Reinforcing Steel

a. Concrete

All concrete will be made of Portland cement, water and aggregate and shall have a minimum 28-day compressive strength of 3,600 psi unless stated otherwise. Aggregate shall conform to ASTM C33. Ready-mix concrete shall conform to ASTM C94. Any concrete poured that has a slump over 4 inches as per ASTM C143, or has a batched time of more than 90 minutes, will be considered unacceptable. Concrete shall be air entrained with 4.5-7.5% air. Retarders and accelerators shall be used only as directed by the Engineering Services Director.

A design of the mix made by an independent laboratory for each class of concrete will be submitted to the Town for approval before concreting is started. No waterproofing material or admixture will be used in the concrete without the Town's approval.

During the progress of work, standard compressive strength test specimens will be made, cured in accordance with ASTM C31 and tested by an independent testing laboratory in accordance with ASTM C39. At least four cylinders will be made for each test (one 7-day, two 28-day, and one reserve). Tests will be submitted for each 50 cubic yards or fraction thereof for each class of concrete used for the first 200 cubic yards of each class placed. For the next 300 cubic yards used, one test will be furnished for each 100 cubic yards and for all over 500 cubic yards, one test for each 500 cubic yards. The Engineering Services Director determines testing rates and testing dates as necessary. Sampling concrete for test cylinders may be required at any time.

The Engineering Services Director may request that high early strength concrete be used in certain situations. High Early Strength Concrete shall conform to Article 1000-7, "High Early Strength Portland Cement Concrete", of the NCDOT Standard Specifications for Roads and Structures.

b. Sand

All sand used in mortar or as fine aggregate in concrete will be clean, sharp, practically free from loam, clay or vegetable matter, and so graded as to insure workability and water-tightness when mixed with other ingredients. Sand will conform to ASTM C33, and when made into mortar will have a compressive strength at 7 and 28 days of not less than 100 percent of mortar made with standard sand.

Independent laboratory tests will be submitted for approval of the Town. Mortar sand shall meet the requirements of article 1040-6, "Mortar Sand," of the NCDOT Standard Specifications for Road and Structures. Sand used for concrete shall meet the requirements of Section 1014, "Aggregate for Portland Cement Concrete," of the NCDOT Standard Specifications for Road and Structures.

c. Reinforcing Steel

All reinforcement steel bars will conform to ASTM A615 (Grade 60) and all reinforcement welded steel wire fabric will conform to ASTM A185. All steel will be free from rust or other coatings which would destroy the bond between the steel and the concrete. Bars shall be tied together and supported to prevent damage by construction loads or pouring of concrete.

3.9. Pressure Test

Piping and other equipment designed to carry fluids under pressure shall be tested as a whole, or in sections valved or bulkheaded at the ends. Testing shall be under a hydrostatic pressure equal to the design pressure, but not less than 200 psi. All pressure testing shall be performed in accordance with AWWA C600 or AWWA C605, current editions, as applicable.

Test pressure shall be applied by means of a pump and a tap in the pipe. The rate of leakage shall be determined by means of volumetric measurement of the water added during the test, for a minimum of 2 hours after the rate of leakage has stabilized.

Any defective pieces discovered in any pipeline as a result of the test shall be removed, replaced with sound pieces and retested until tight.

Tests of insulated and concealed piping shall be made before the piping is covered or concealed.
For pressure pipelines installed in the ground, the rate of leakage shall not exceed the following:

$$L = \frac{SD\sqrt{P}}{148{,}000}$$

Where:

L = testing allowance (makeup water), in gallons per hour
S = length of pipe tested, in feet
D = nominal pipe diameter, in inches
P = average test pressure during hydrostatic test, in psi

3.10. Chlorination

Water distribution systems, including storage tanks and water mains, after flushing to remove sediment and other foreign matter, and after testing for leaks, shall be disinfected by the addition and thorough dispersion of a chlorine solution in concentrations sufficient

to produce a chlorine residual of at least 50 milligrams per liter (or ppm) in the water throughout the distribution system, including all water mains and storage tanks.

The chlorine solution shall remain in contact with interior surfaces of the water system for a period of 24 hours. Then the water system shall be flushed with fresh water from an approved water source until the chlorine solution is dispelled to a maximum of 2.0 milligrams per liter (or ppm) free chlorine.

Representative samples of the water shall then be collected. If bacteriological tests of the samples indicate that the water quality is satisfactory, the water mains and storage tanks may be placed in service. Contractor is responsible for taking the sample and having it tested at an AWWA approved laboratory.

Section 4. **Sanitary Sewer Design Standards**

4.1. General

a. All projects which use these guidelines shall be designed in accordance with and shall meet all requirements of North Carolina Administrative Code (NCAC), the Division of Water Quality's (Division) Gravity Sewer Minimum Design Criteria (latest revision), and the Division's Minimum Design Criteria for the Permitting of Pump Stations and Force Mains (latest revision). It is the responsibility of the Engineer of Record to ensure that all requirements are met. In cases where a statement herein conflicts with such requirements, the more restrictive shall apply. Variations or exceptions to the following guidelines must be approved by Town of Mooresville Engineering Services Director and the Division, as applicable.

b. Sewer design must be consistent with the Town's current Water and Sewer Master Plan and overall needs of the sewer basin, following the natural drainage pattern of the basin. All sub basins and any other basins or sub basins that may or will be pumping into the sewer being designed must be identified. The Engineer of Record shall furnish topographic maps, zoning maps, and design data to substantiate sizing of all major basin outfalls. Installation depths shall be minimized during the design process.

c. Sewer mains must be extended on outfalls, in streets, or other easements to the property line or as required by the Engineering Services Director. The sewer design shall ensure future service is available to the remainder of the drainage basin and or adjacent properties.

d. Open cut installation of sewer mains in roads must be approved by the Engineering Services Director.

e. Design average daily flow for residential units shall be provided by the Engineering Services Director for use. Design flows for all other uses shall be as published in the NCAC.

f. Gravity sewer sizes shall remain constant between manholes. In manholes with smaller upstream sewer line and larger downstream line, the crowns of the two sewer lines shall match. All sewers shall have a straight alignment between manholes. Sewers shall be designed with uniform slope between manholes.

g. Minimum diameter pipe for gravity sanitary sewer applications shall be 8 inches, with a minimum of 4 inches for sanitary service laterals. Velocity calculations for determining pipe diameter shall be based on Manning's formula, minimum velocity of 2 ft/sec with an "n" value of 0.014.

h. Sewer depths greater than 12' for all sewer lines must be approved by the Engineering Services Director. Sewer depths for all sewer lines along road right-of-

ways must consider future road widening. Projections of future road grades may require increased depths or additional easements.

i. Tapping saddle connections are not allowed in new sewer design/construction.

j. Laterals 6" or larger must connect to manholes.

k. Rubber couplings or "No-hub bands" are not allowed on sewer laterals or sewer lines. Mechanical joint sleeves or approved equal must be used on pipe material transitions. However, transitions from Vitrified Clay Pipe must use a rubber coupling (repair clamp). Approved couplings must have a wide solid stainless-steel center band .012" thick, with 4 stainless steel screw clamps, Mission Flex-seal ARC coupling or approved equal.

l. Pipes designed at minimum slopes shall be avoided. Minimum slopes are difficult to maintain during installation and limits the ability to make necessary field changes. Pipe designed to be constructed at minimum slopes must have a letter submitted with necessary documentation showing all alternatives, substantiating the design, and must be approved by the Engineering Services Director. Minimum slope is 1 percent, for dead-end lines. Otherwise, minimum slopes must conform to the following Table:

PIPE DIA. (in)	MIN. DESIGN SLOPE	MAX. DESIGN SLOPE
8	0.6%	18%
10	0.3%	16%
12	0.3%	13%
15	0.2%	9%
18	0.2%	7%
24	0.1%	5%
30+	0.1%	4%

Maximum design slope may be exceeded in certain situations where topography warrants it unavoidable. This must be approved by the Engineering Services Director.

m. Bores, encasement pipes, creek crossings or other grade limiting situations are not to be designed with minimum slopes. Manholes shall be placed adjacent to these situations and adjacent sewer lines shall be designed to allow for field changes in grade.

n. Permanent Utility Easement (PUE) shall be a minimum width of 25-feet. Larger pipe or deeper sewers may require additional permanent easement as required by the Engineering Services Director and as summarized in the following:

PIPE SIZE	MIN. PERMANENT UTILITY EASEMENT WIDTH
8”	25’
12”	25’
15”	25’
18”	25’
24”	30’
30”	35’
36”	35’
42”	40’

A Temporary Construction Easement (TCE), of an additional 12.5’ on each side of the PUE, shall be in place for only the duration of the construction project.

o. Buoyancy of sewers and manholes shall be considered and flotation of the pipe and manholes shall be prevented with appropriate construction where shallow cover and high groundwater or flooding conditions are anticipated. For design purposes, assume water to top of pipe or manhole and pipe or manhole is empty.

p. Where design velocities are projected to be greater than 15 feet per second, the sewers and manholes shall be protected against displacement by erosion and impact. Design velocities greater than 15 feet per second must have a letter submitted with necessary documentation showing all alternatives, substantiating the design, and must be approved by the Engineering Services Director. Ductile iron pipe (DIP) material is required when design velocities are 15 feet per second or greater.

4.2. Sewers In Relation To Streams, Other Water Bodies or sources and Storm Sewers

a. Permanent stream crossings for maintenance access shall be provided. As a result, additional easements may be necessary to construct creek crossings for maintenance adjacent to aerial stream crossings.

b. The top of all sewers entering or crossing streams shall be at a sufficient depth below the natural bottom of the stream bed to protect the sewer line. The following cover requirements shall be met:

(1) One foot of cover where the sewer is located in rock
(2) Three feet of cover in other material unless ferrous pipe is specified. In major streams, more than three feet of cover may be required; and
(3) In paved stream channels, the top of the sewer line should be placed below the bottom of the channel pavement.

c. Sewers located along streams, lakes or impoundments, shall be located at least 20 feet outside of the stream bank or sufficiently removed there from to provide for future possible stream widening and to prevent siltation of the stream during construction. A distance of 50 feet shall be maintained between sewers and water classified as WS-II, WS-III, B, SA, ORW, HQW, or SB (from normal high water [or tide elevation]) and

wetlands. Sewer lines less than 100 feet from a water supply well shall be DIP with water-tight joints. Sanitary sewer lines shall not be located less than 25 feet from a private well.

d. The sewer outfalls, headwalls, manholes, gate boxes, or other structures shall be located so they do not interfere with the free discharge of flood flows of the stream.

e. Sewers crossing streams shall be designed to cross the stream as nearly perpendicular to the stream flow as possible and shall be free from changes in grade. Protection against freezing, such as increased slope or insulation, shall be provided. Sewer systems shall be designed to minimize the number of stream crossings.

f. Sewers entering or crossing streams shall be constructed of ductile iron pipe with mechanical joints. Material used to backfill the trench shall be stone, coarse aggregate, washed gravel, or other materials which will not readily erode, cause siltation, damage pipe during placement, or corrode the pipe.

g. Aerial stream crossings are to be avoided and must be substantiated and approved by the Engineering Services Director. Restrained joints and adequate supports to prevent excessive flexion shall be provided for all aerial pipe crossings. DIP is required, and pipe spans must be installed to manufacturer's specifications. Suspended joints and adjacent joints shall be Mech-Lok® Rigid Restrained joint by Griffin Pipe (or approved equal). Supports shall be designed to prevent frost heave, overturning, and settlement.

h. Expansion jointing shall be provided between above ground and below ground sewers. Where buried sewers change to aerial sewers, special construction techniques shall be used to minimize heaving.

i. For aerial stream crossings, the impact of flood waters and debris shall be considered. The bottom of the pipe should be placed no lower than the elevation of the 25-year flood.

j. Steel H-piles are required for all creek crossings and areas subject to erosion.

k. In areas where the sewer trench has the potential to drain wetlands, anti-seepage collars shall be installed. Please be advised, in these areas, a 401/404 permit may be necessary.

l. Potable water supplies and storm sewers shall be protected in accordance with the Minimum Design Criteria and NCAC 2T .0305, g.

4.3. Piping Materials

a. Sewer laterals and gravity lines less than 3 feet or over 12 feet deep must be ductile iron pipe. Sewer laterals located in the right-of-way of major roads, or as directed by

the Engineering Services Director, will also be ductile iron pipe. Otherwise Schedule 40 PVC pipe can be used for sewer laterals.

b. Pipe material requirements are based on specific use, installation conditions, and the Engineering Services Director. The following types of pipe are allowable for gravity sewer applications:

(1) Polyvinyl Chloride (PVC) Pipe
(2) Extra Strength Vitrified Clay Pipe (VCP) (in certain industrial areas only, subject to Town approval)
(3) Ductile Iron Pipe (DIP) (401 Lined)

c. Gravity Sewer Ductile Iron Pipe and Fittings

Ductile iron pipe shall be designed in accordance with ANSI/AWWA C150/A21.50 and manufactured in accordance with ANSI/AWWA C151/A21.51. Ductile iron pipe shall be push-on type or mechanical type joint manufactured in accordance with ANSI/AWWA C111/A21.11, for rubber gasket joints. The exterior of ductile iron pipe shall be coated with a bituminous coating. Ductile iron pipe up to 12-inch diameter must be thickness pressure Class 350. Pipe diameters 16 inch and larger must have a minimum thickness pressure Class 250. Any deviations in pressure class must be approved by the Engineering Services Director.

All ductile iron pipe and fittings used for all gravity and pressure applications shall be lined with 40 mils of Protecto 401™ Ceramic Epoxy or approved equal. All bells and spigots for pipes which require Protecto 401™ must be coated with a minimum of 8 mils of Protecto 401™ Joint Compound. Ductile iron sewer pipe must be easily recognized by the brownish red bells and spigots, as well as stenciling of the words showing “For Sewer Only”.

d. Restrained Joints

All restrained joint pipe shall have flexible push-on joints designed to deflect a minimum of 3^{o} per joint. Field welding will not be allowed. Factory supplied field cut kits shall be used as directed by the pipe manufacture. Approved restrained retainer glands shall be used to connect pipe to mechanical joint fittings. Restrained joint pipe is subject to approval by the Engineering Services Director, whose acceptance or rejection shall be final. The Engineering Services Director reserves the right to specify the type of restrained pipe to be used on specific projects and specific field applications. Restrained pipe shall be lined per the requirements for push-on joint DIP for sewer. Approved restrained joint pipe are:

(1) Field Lok 350® Gaskets (16 inch and smaller pipe only)
(2) TR Flex by U.S. Pipe
(3) Snap-Lok by Griffin
(4) Super-Lock by Clow.
(5) Flex-Ring by American

e. Rigid Restrained Joints

Rigid restrained joint pipe, when required, shall be Mech-Lok™ by Griffin Pipe. All rigid restrained joint pipe shall be lined with 40 mils of Protecto 401™. Details of pipe joints and structural support of aerial crossings shall be submitted to the Engineering Services Director for review and approval prior to construction.

f. Flanged Joints and Accessories (Sewer)

Flange joint pipe is approved for use only in above ground applications, such as pump stations and valve vaults. All flange fittings shall be ductile iron and have minimum working pressures of 250 psi. Flange joints shall be manufactured and tested in accordance with AWWA C110/A21.10. Flanges, flange bolts and nuts, and gaskets shall conform to the dimensional requirements of ANSI B16.1 for Class 125 flanges. Flange pipe accessories shall be in accordance to ANSI/AWWA C115/A21.15. Bolts shall have standard hexagonal heads and shall be provided with standard hexagonal cold pressed nuts unless otherwise specified. Bolts and nuts shall be made of the best quality refined iron or mill steel and shall have sound, well-fitting threads. Flanged joint pipe and fittings shall be lined with 40 mils of Protecto 401™.

g. Ductile Iron Pipe Fittings (Sewer)

Ductile iron pipe fittings for all sewer applications shall be lined with 40 mils of Protecto 401™ Ceramic Epoxy, or approved equal, and be compact fittings conforming to ANSI/AWWA C153/A21.53. Fittings will be of the mechanical joint type in accordance to ANSI/AWWA C111/A21.11. All glands shall be ductile iron, not gray iron. The exterior of all fittings shall be coated with bituminous coating. The interior shall be lined to match the DIP on either side of the fitting. All fittings are subject to approval by the Engineering Services Director, whose acceptance or rejection shall be final.

h. Gravity Sewer PVC Pipe and Fittings

Sewer pipe 8-inches through 15-inches in diameter may be Poly Vinyl Chloride (PVC) sewer pipe and fittings with a minimum Standard Dimension Ratio (SDR) of 26 and shall meet all requirements of ASTM Specification D3034. Sewer pipe 18-inches through 27-inches in diameter may be Polyvinyl Chloride Pipe (PVC) large diameter sewer pipe with a minimum pipe stiffness of 46 PSI in accordance with ASTM Specification F679. Pipe joining shall be push-on elastomeric joints only, and joints with integral bells and with gaskets that are permanently installed at the factory,

in accordance with ASTM Specification D3212. The pipe shall be furnished in nominal lengths of 13 feet. At the discretion of the town, PVC pipe shall be covered with an opaque material while permitting adequate air circulation around the pipe.

PVC pipe shall contain the markings required by ASTM D-3034, ASTM F-679, or AWWA C900 as applicable. The manufacture shall submit certifications that the pipe has been found to meet all requirements. Test samples shall be as selected by the manufacture or testing laboratory unless otherwise stipulated.

Fittings shall be in accordance with ASTM D_3034, F-679, AWWA C900 and /or D-3212 as applicable, with stiffness and wall thickness equal to or greater than the pipe. Adapters shall be provided to join different materials.

i. PVC for Sewer Service Lateral Applications

PVC pipe for gravity sewer service lateral applications, including the cleanout stack shall be PVC Schedule 40, manufactured in accordance with ASTM D1785, "Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe" solvent cement joints (type SC).

j. PVC Pipe and Fittings (Forcemain)

Tracer wire shall be stubbed up every 500 feet in a valve box. Refer to Water Design Standards, Section 3.4 for material specifications for pipe and tracer wire. PVC pressure sewer pipe shall be C900 – DR14 – Green Pipe.

k. Vitrified Clay Pipe (VCP)

Vitrified clay pipe (VCP) shall be manufactured in accordance with ANSI/ASTM C700, tested in accordance with ANSI/ASTM C301 and shall be classified as extra strength pipe. The specific type of joint shall be the O-ring compression type joint. This joint shall conform to ANSI/ASTM C425. All VCP will be unglazed. All VCP shall be subject to inspection by the Town and its acceptance or rejection will be final. Use of VCP must be approved by the Engineering Services Director. Pipe shall be manufactured by Logan Clay Products Company or approved equal.

l. Service Saddles

Service saddles for 4" sewer connections to existing sewer mains shall be style CB Sewer Saddle by Romac Industries, Inc. or approved equal.

4.4. Manholes

a. Manholes shall be installed on all gravity sewer mains at: the end of each line, changes in grade, changes in main size, changes in alignment, and all intersections. Spacing shall not exceed 400 feet for all sewers.

b. Vented covers shall be used on manholes in the center (crown) of the roadway when the surface slope is 3% or less. Unvented covers shall be used in off-road applications where the manhole is flush with grade, and also in the center (crown) of the roadway when the surface slope is greater than 3%.

c. Manholes will be furnished with the following clear inside diameters according to depth and the sewer main diameter:

(1) 8" to 18" pipe 4' Manhole (< 12’ deep)
(2) 8" to 18" pipe 5' Manhole (≥ 18’ deep)
(3) 2l" to 36" pipe 5' Manhole
(4) 39" to 54" pipe 6' Manhole
(5) 54" and larger 8' Manhole

d. Manholes shall be constructed of precast reinforced concrete designed for H-20 loads per ASTM C478. Manhole shelves and channels must be of the precast type, by the manufacturer. Steps are required in all structures greater than 36-inches deep. All manhole steps shall conform to current OSHA standards and ASTM C478. Channels shall be built to a depth and width and slope to conform to the outside diameter of the influent and effluent pipes. The channel shall be constructed with a minimum 0.2 foot drop from the invert of the influent pipe to the invert of the effluent pipe through the manhole.

e. Drop manholes are required for sewers entering a manhole at an elevation greater than 2.5 feet above the manhole invert. Outside drop manholes shall be used unless existing underground facilities require inside drops. Inside drops must be approved by the Engineering Services Director and will require a minimum 5-foot diameter manhole.

f. Manhole shelves shall slope from the manhole wall to the channel at a minimum slope of 0.5” per foot. A maximum of two inches (2”) shall be allowed for the protrusion of the influent and effluent pipes beyond the inside wall of the manhole. Manhole shall have precast inverts for all lateral connections directing flow to the manhole outlet. All inlet and outlet pipes shall be joined to the manhole, with flexible watertight connections (rubber boots). Mortar shall be placed around all pipe connections.

g. All manhole joints shall be sealed on the outside of the manhole with butyl adhesive tape (minimum 6” wide). Manhole joints shall be assembled using Type B-Butyl Rubber conforming to AASHTO M-198. The tape shall be EZ-Wrap by Press-Seal Gasket Corp., or approved equal. Manholes on outfalls or in un-maintained areas shall be flat-top manholes 24” to 36” above existing ground. The types of manholes

are subject to approval by the Engineering Services Director, whose acceptance or rejection shall be final.

h. Manholes shall be inspected by the Town inspector or a Town-assigned designee for acceptable installation and water tightness prior to placing into service. The Contractor shall conduct testing to confirm water tightness.

i. Manhole Linings

The manhole and the next down line manhole on the receiving end of a force main shall be coated with an epoxy lining system to prevent corrosion. The lining system shall be a two component, spray applied system, Cor-Cote SC Sewer-Cote as manufactured by Sherwin-Williams, Inc.

Existing manholes that are connected to by a new force main shall be sand blasted and cleaned in accordance with SSPC-SP13/NACE 6 prior to application of the lining. Any repairs to the concrete including reinforcing steel shall be made as part of the surface preparation. Corobond 100 Epoxy Primer/Sealer as manufactured by Sherwin-Williams, Inc. shall be used to repair holes in the concrete as recommended by the manufacturer.

All work shall be performed in accordance with the manufacturer's recommendations and by an experienced applicator.

j. Manhole Rings and Covers

Standard manhole rings and covers will be made of cast iron and will conform to ASTM A48, Class 35B. Metal riser rings shall not be used. In addition, all manhole rings and covers shall be designed to support an H-20 wheel load. All castings will conform to the shape and dimensions shown on the Town of Mooresville detail drawing (Detail S-2) and will be free from holes, cracks or any other defects. Rings and covers will have machined seats so that the cover will not rattle. Rings will weigh a minimum of 190 pounds and covers a minimum of 120 pounds. The name of the foundry and the part number shall be cast permanently on the ring and the cover. Castings that do not meet specifications shall be rejected. Rings and covers furnished under these specifications shall be manufactured by one of the following:

(1) East Jordan Iron Works, Inc. (Ring - Part No. V-1384-1; Cover - Part No. V-1384)
(2) U.S. Foundry & Manufacturing Corp. (Ring - Part No. 669; Cover - Part No. KL)

k. Sealed Ring and Cover

Sealed (watertight) rings and covers shall be installed wherever the manhole will be flush with grade, or where the top of the manhole is not above the 100-year flood

elevation. Vented covers may be used at high points in the line to allow for safe escape of sewer gas. Locations shall be as coordinated with the Town but not less than every 1,000 feet.

Secured rings and covers shall meet all specifications for Secured Rings and Covers and shall conform to the Town of Mooresville detail drawing for Sealed Rings and Covers (Detail S-4). Sealed covers shall have no vent holes. Rings and covers shall be manufactured by one of the following:

(1) East Jordan Iron Works, Inc. (Ring - Part No. V-2384; Cover - Part No. V-l385)
(2) U.S. Foundry& Manufacturing Corp. (Part No. 669-KL-BWTL)

l. Flat Top Manhole Sealed Ring and Cover

Flat top manhole sealed covers shall meet all specifications for Standard rings and covers, except that rings will weigh a minimum of 136 pounds and covers a minimum of 120 pounds. All rings and covers shall conform to the Town of Mooresville detail drawing for Type 3. Covers shall not have vent holes. Flat-top manholes shall have flat top sealed covers cast into the top. Rings and covers shall be manufactured by one of the following:

(1) East Jordan Iron Works, Inc. (Ring - Part No. V-2484; Cover - Part No. V-2384)
(2) U.S. Foundry & Manufacturing Corp. (Ring - Part No. 571; Cover - Part No. KK)

m. Install a manhole vent scrubber (Wager 3000 or equal) at first manhole on the receiving end of a force main.

4.5. Sewer Valves

a. Combination Air Vacuum Valves

All air release valves shall be of the combination air vacuum type and shall conform to ANSI/AWWA C512. The air release valve shall be a pressure air valve (operating pressure 0-150 psi) manufactured by GA Industries, Crispin or an approved equal designed for sewer applications. The valves shall be capable of exhausting air as the pipeline fills, and allowing air to enter as the pipeline empties. All interior iron surfaces of the air valve shall be coated with a minimum of 8 mils of fusion bonded epoxy or liquid epoxy in accordance with ANSI/AWWA C550.

All internal working parts shall be stainless steel. Nipples shall be stainless steel or brass. Valve shall be furnished with back flushing attachments. The bronze ball valve curb stops shall have a minimum working pressure of 300 psi.

All combination air vacuum valves shall be installed with Wager 3100 VWS odor control valves.

b. Swing Check Valves

All swing check valves shall meet the specifications of AWWA C508. The valves shall have an iron body, be of the clear waterway type and have bronze to bronze or rubber to bronze seat construction. End connections can be flanged or mechanical joint, depending on the application. Check valves shall be designed for a working pressure of 175 psi for 2-12 inch valves. Assembled check valves shall be subjected to the following hydrostatic tests in accordance with AWWA C508-Section 5:

(1)	Shell Test:	350 psi for 2-12 inch valves 300 psi for 16-24 inch valves
(2)	Seat Test:	175 psi for 2-12 inch valves 150 psi for 16-24 inch valves

Check valves will be lever and weight operated only. All valves shall have two coats of asphalt varnish applied to the outside ferrous metal surfaces. All interior iron surfaces (including the disc, clapper and clapper arm) shall be coated with a minimum of 8 mils of fusion bonded epoxy or liquid epoxy in accordance with ANSI/AWWA C550. Check valves furnished under these specifications must be Golden Anderson, Cushioned Swing Check or approved equivalent. Approved manufacturers:

(1) Golden Anderson
(3) Mueller Company
(4) American Flow Control
(5) M & H Valve Company

4.6. Testing Requirements

a. Exfiltration Test

Gravity sewer pipe shall be tested for leaks using a low pressure air test method. Pressure loss shall not exceed 0.5 psi when pressurized to 3 psi for the required testing time. Testing time in minutes shall conform to ASTM F1417 , latest revision, for PVC and DIP. Testing time for VCP shall conform to C828, latest revision. The contractor shall furnish supplies for exfiltration testing. Maximum allowable air loss is 0.5 psi when the section is pressurized to 3 psi for 5 minutes.

b. Deflection Test

Not less than 30 days following completion of backfill, gravity sewer pipe shall be tested for deflection with a 5% mandrel sized as defined in ASTM D-3034. Mandrels shall be furnished by the Contractor. The mandrel shall be pulled through each section of pipe from manhole to manhole. The mandrel must slide freely through the pipe with only a nominal hand force applied. No mechanical device shall be used in pulling the mandrel. Any pipe which refuses the mandrel shall be removed and

replaced or re-rounded and the bedding shall be properly constructed as specified to prevent excessive deflection. Such sections shall be re-tested for deflection after completion of backfill.

c. Manhole Testing

Vacuum testing shall be in accordance with ASTM C1244, except as specified otherwise. Other forms of testing of some manholes may be required, as deemed necessary by the OWNER. A minimum of two (2) or twenty-five percent (25%) of the total sanitary sewer manholes on each project shall be vacuum tested as specified. Manholes to be tested shall be selected by the ENGINEER at the time of testing. No advance notice will be provided to the CONTRACTOR as to which manholes will be tested. If more than ten percent (10%) of the manholes tested fail the initial test, an additional twenty-five percent (25%) of the total manholes shall be tested. This process shall continue until a series of manholes (25% of the total) successfully tests with no more than 10% initial failures or until all manholes have been tested.

A vacuum of at least ten inches of mercury (10" Hg) shall be drawn on the manhole. The manhole shall be considered to pass the vacuum test if the vacuum reading does not drop more than 1" Hg (i.e. from 10" Hg to 9" Hg) during the following minimum test times according to ASTM C1244-11.

MINIMUM MANHOLE VACUUM TEST TIMES FOR VARIOUS MANHOLE DIAMETERS PER DEPTH OF MANHOLE			
Manhole Depth (Feet)	**48 inch Diam. MH (Seconds)**	**60 inch Diam. MH (Seconds)**	**72 inch Diam. MH (Seconds)**
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30	74	98	121
>30	as per plans		

4.7. Pumping Stations

a. Whenever possible, sanitary sewerage facilities shall be designed so as to avoid the necessity of providing pumping stations.

b. Sanitary sewer pump station design information including control panel must be submitted for approval along with all other civil design drawings and specifications.

c. These standards refer to design of the wet well (submersible) variety only. Regional pump stations of the wet pit/dry pit variety as determined necessary by the Town's Master Plan will be designed on a case by case basis.

d. Pumps with motors larger than 20 HP must have a soft start or VFD w/bypass (Allen Bradley or equal).

e. Pump station shall be fully accessible by the Town's maintenance staff and equipment prior to any flow being allowed to discharge to the station. This includes any active construction areas within the development to access the station. "Fully accessible" shall mean that, at a minimum, the road subgrade and stone are installed from the pre-existing road network to the station itself, and that the station driveway and yard are paved.

f. Pumps shall be equipped with 3-phase/480 volt motors and shall be manufactured by one of the following:

<u>Grinder/Shredder Stations</u>
(1) ABS Piranha
(2) Tsurumi
(3) BJM

<u>Stations smaller than 20HP</u>
(1) ABS
(2) Flygt
(3) Homa
(4) Tsurumi (cutters)
(5) BJM (cutters)

<u>Stations bigger than 20HP</u>
(1) ABS
(2) Wilo-EMU
(3) Fairbanks Morris
(4) Flygt

g. Pumps shall be selected such that the design point is at or near the maximum efficiency for that model.

h. A stand-by internal combustion power source shall be provided for pumping stations. All stand-by power sources must be installed in a weatherproof building structure suitable to accommodate the power source, controls, alarm system, and all required appurtenances. The structure must be large enough to allow for servicing of all equipment and must meet all building codes. A junction box with breaker shall be located on the generator.

i. For pump stations to be turned over to the Town for ownership and maintenance, the developer will be billed a cost to install the necessary communication system compatible with the Town's SCADA system. Cost is determined on a case by case basis depending on the size, location and intended use of each pump station and will be invoiced to the engineer at the beginning of pump station construction. Depending upon the panel provided, an additional seven to twelve contacts are required for SCADA installation. It is the developer's responsibility to provide the correct amount.

j. Wiring shall be installed in sch. 80 or PVC coated rigid conduit. All conduit other than those running from the junction box to panel shall be minimum 3" diameter.

k. No pipe, fittings or appurtenances shall be galvanized or PVC within or between the wetwell, valve vault or bypass piping.

l. The following items are required for with any pump station to be turned over to the Town for ownership and maintenance:

(1) Six foot high vinyl coated chain link fence with sixteen foot clear gate
(2) Site security lighting with manual all-weather switch
(3) All weather shelter. The shelter shall extend 2 feet past the ends and back of the panel and 4 feet in front and shall provide 7 feet vertical clearance.
(4) Alarm light on top of shelter tied into the pump alarm system
(5) Emergency bypass connection (See Detail PS-5.0)
(6) 110V 20 amp GFI outlet
(7) Yard hydrant with RPZ (see appropriate backflow detail)
(8) Full depth commercial asphalt up to and within fencing to accommodate pump maintenance vehicles
(9) LED Utility light under shelter
(10) UPS to panel for control power failure alarm contact
(11) 3 phase power must be provided to the site. Phase converters are not allowed.
(12) Control panel switches and pilot lights must be oil tight type "AB" (Alan Bradley) or equal
(13) Control panel with soft start or VFD must have a bypass across the line and soft start bypass
(14) Pump disconnects shall be accessible through the dead front.

Section 5. **Drainage Design Standards**

5.1. General Storm Water Management Requirements

a. The Town of Mooresville requires that development and re-development activities properly manage and control stormwater runoff rate, volume, pollutants, and erosion/sedimentation as necessary to protect and safeguard the environment, property, health, safety and welfare of citizens within the Town's jurisdiction.

b. The following are required stormwater management performance criteria for all land disturbing activity in the Town of Mooresville:

(1) Stormwater treatment shall be designed to achieve either runoff treatment or runoff volume match as defined by 15A NCAC 02H.1002 and must apply to the volume of post-development runoff resulting from the first one-inch of rainfall.

(2) The stormwater volume leaving the site post-development for the two-year, 24-hour storm shall be controlled. Runoff volume drawdown time shall be a minimum of 48 hours but not more than 120 hours. Volume reduction may be achieved by detention, hydrologic abstraction, recycling and/or reuse, or any other accepted scientific method.

(3) The runoff rate leaving the site post-development shall not exceed the stormwater runoff rate leaving the site pre-development (existing conditions) for the local 1-year, 2-year, and 10-year, 24-hour duration storm events.

c. Residential development that cumulatively disturbs one acre or more and nonresidential development that disturbs one-half acre or more is required to maintain the pre-development hydrologic response in their post-development state as nearly as practicable for the applicable design storm.

d. Land disturbance within the stream channel of any perennial and intermittent stream shall be prohibited.

e. Considerations in selecting and using stormwater management means and measures for a specific development will include, but are not limited to: site applicability, public safety, spatial requirements, soil characteristics, hydrologic benefits, slope, existing land use conditions, maintenance requirements, location within the watershed, overlay districts, buffer requirements, tree protection, easements, etc.

f. Stormwater runoff from the development shall be transported from the development by vegetated conveyances to the maximum extent practicable.

g. All built-upon area shall be at a minimum of 35 feet landward of all perennial and intermittent surface waters (i.e., the buffer zone). This zone shall begin at the most landward limit of the top of bank or the rooted herbaceous vegetation and extend landward a distance of 35 feet on all sides of the surface water, measured horizontally

on a line perpendicular to the surface water. For ponds, lakes and reservoirs located within a natural drainage way, this zone shall begin at the most landward limit of the normal water level or the rooted herbaceous vegetation and extend landward a distance of 35 feet, measured horizontally on a line perpendicular to the surface water. A perennial or intermittent surface water shall be present if the feature is approximately shown on the most recent version of the soil survey map prepared by the Natural Resources Conservation Service of the United States Department of Agriculture or is identified in a field survey.

h. All stormwater management structures shall be located in recorded drainage easements for the purposes of operation and maintenance and shall have recorded access easements to the nearest public right-of-way. These easements shall be granted in favor of the party responsible for operating and maintaining the stormwater management structures.

i. If the land disturbing activity encroaches the 100-year floodplain, consult with the Town of Mooresville Floodplain Administrator as a Floodplain Development Permit may be required.

5.2. Design Basis

a. The design standards addressed in this Section shall apply to all drainage facilities designed and constructed in the Town of Mooresville. Where these standards conflict with those of the NCDOT, Iredell County, or NCDEQ that applies to a given facility, the more stringent shall apply.

b. Hydrologic Method: Catch basins and collection piping shall be sized using the Rational Method for drainage areas under two hundred (200) acres. For drainage areas over two hundred (200) acres, the SCS method shall be used. The time of concentration shall not be less than 5 minutes. Calculations used for drainage design shall be submitted along with the Plans for review and with the final approved Plans. Drainage areas are to be shown on the Plans.

c. The following Table summarizes recommend runoff coefficients for use in the Rational Method:

Recommended Runoff Coefficient Values

Description of Area	Runoff Coefficient (C)
Lawns	0.30
Wooded	0.25
Streets	0.95
Gravel Areas	0.55
Drives, Walks, Roofs	0.95
Parks and Cemeteries	0.30
Residential (including streets):	
Single-Family (lot <20,000 sf)	0.60
Single-Family (lot >20,000 sf)	0.50
Multi-Family, Attached	0.70
Industrial:	
Light	0.70
Heavy	0.80
Commercial:	
Office Parks	0.75
Shopping Centers	0.80

d. The Sample Storm Drainage Chart (Figure 1, on page 38) shall be shown on all plans that rely on the Rational Method to size drainage facilities.

e. Design Frequency Policy: Minimum design frequency shall be 25 years for storm sewers carrying off-site drainage and 10 years for incidental drainage. Rainfall Intensity-Duration-Frequency data for hydrologic analysis shall be based on that published for the Charlotte, NC area.

f. Channel Design: Channel side slopes shall be stable throughout the entire length and side slope shall be a maximum of 3:1 (H:V) for ease of maintenance. Open channel drainage systems shall be designed to handle the 10-year design storm. The channel protection required to prevent erosion is determined by computing the velocity in the channel at the design discharge and comparing that velocity with the permissible value for the type of channel lining used.

g. All streams that drain more than one square-mile in Iredell County are regulated by FEMA, therefore development in those flood plains is restricted. Please refer to Iredell County's Floodplain Management Policy (see http://www.co.iredell.nc.us/Departments/Planning).

h. Hydraulics: Pipe inlets and culvert situations are to be checked for inlet and outlet headwater control so as to insure that headwater will not encroach on uphill adjacent property or create a hazard to existing and future development. Twelve-inches of freeboard is required for all culverts up to 3 feet in diameter. 18-inches of freeboard is required for larger culverts.

i. Water Supply Watersheds: If the proposed development is located in a water supply watershed then it is subject to land development restrictions as detailed in Chapter 4.2 of the Town of Mooresville's Zoning Ordinance.

5.3. Drainage Lines

a. Storm drainage lines that are located on private property and that do not receive runoff from public rights-of-way are not under the jurisdiction of the Town and are not subject to the requirements herein. However they will be inspected by the Town.

b. All storm drainage lines located in the right-of-way are under the jurisdiction of the Town and must consist of reinforced concrete pipe (RCP), minimum Class III or HDPE. Corrugated metal pipe shall not be used.

c. HDPE shall be governed under the following criteria:
   1. The product used shall be corrugated exterior/smooth interior pipe. (Type S), conforming to the requirements of AASHTO Specification M294 (latest edition) for Corrugated Polyethylene Pipe and ASTM F-2306.
   2. 15" minimum to 48" maximum HDPE pipe can be used.
   3. Bell and spigot joints shall be required on all pipes. Bells shall cover at least two full corrugations on each section of pipe. The bell and spigot shall have an "O" ring rubber gasket meeting ASTM F477 with the gasket factory installed, placed in the spigot end of the pipe. Pipe joints shall meet all requirements of AASHTO M294.
   4. All cross draining HDPE within the Town's R/W is to be installed per Detail 28.0
   5. All other HDPE applications shall have to be installed per the Plastic Pipe Institutes installation standards using good quality native backfill materials.
   6. All HPDE pipe installed must be inspected and approved by the Town inspector prior to any backfill being placed.
   7. All HDPE shall bear the Plastic Pipe Institute's (PPI) certificate sticker.
   8. No HDPE flared end sections shall be allowed.
   9. All HDPE shall maintain at least 18" of cover below sub-base.
   10. Transition of HDPE to RCP to require Dissimilar Materials Adapter incorporating a geo-textile coupler with mastic coating and stainless steel straps, and full concrete encasement around the connection.
   11. Minimum trench widths can be found on Detail R- 28.0

d. Permanent Utility Easement (PUE) for storm drainage lines shall be a minimum width of 25-feet. Larger pipe, deeper drainage lines or close proximity to existing or planned buildings may require additional PUE as required by the Engineering Services Director and as summarized in the following:

PIPE SIZE	MIN. PERMANENT UTILITY EASEMENT (PUE) WIDTH
15”	25’
18”	25’
24”	25’
30”	30’
36”	30’
42”	35’
48”	35’
54”+	40’+

e. The minimum pipe diameter for storm drainage lines shall be 15 inches.

f. The minimum slope on all storm drainage lines shall be 0.5% or the slope that will produce a velocity of 2 feet per second (fps) when the pipe is flowing full, whichever is greater. The maximum velocity shall not exceed 10 fps at pipe outlets.

g. Storm drainage lines shall cross under streets at right angles. Storm drainage lines greater than 18” are not to cross diagonally under the radii at intersections as illustrated below in Figure 2. Engineer must show that lines less than 18” crossing radii diagonally can be fully maintained within the right-of-way or dedicated easement and the easement shall not encroach on a building envelope.

Pipes Greater than 18”

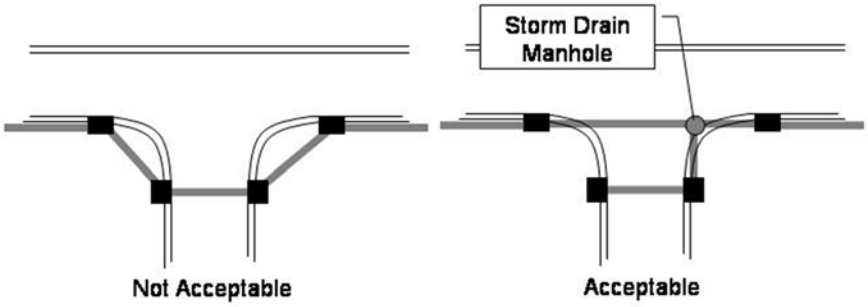

Figure 2

h. When RCP is used at a stream, then an 8-foot joint must be used at the lower end (nearest the stream) to prevent undermining.

i. Storm drainage lines shall generally be located below the curb and gutter of streets or along lot lines.

j. Storm drainage lines shall have a minimum 18 inches of cover. Pipe diameters 30" and larger shall be deep enough to accommodate drainage structures.

k. Concrete storm drainage lines with less than 24 inches of cover shall be Class IV pipe.

l. Engineer of Record must ensure that proposed storm drains will not conflict with existing sanitary sewer service laterals.

m. Storm drainage lines shall have at least a one-foot vertical separation from all water and sanitary lines.

n. Storm drain outfalls shall be piped to the rear of any possible building envelopes.

o. Flared-End-Sections or end walls plus an appropriate energy dissipater shall be used on the inlet/outlet end of any pipe receiving or discharging surface water (i.e., to or from a ditch, channel or creek). Flared end sections may be used with pipes 36-inches or less in diameter.

p. The Town may, at its discretion, require that the contractor camera all or portions of installed drainage systems at no cost to the Town.

5.4. Collection System Drainage Structures

a. Street catch basins shall be NCDOT 840.01 or 840.02 with type E grate as appropriate (NCDOT 840.03). Solid wall, square precast concrete structures conforming to NCDOT 840.45 or precast manholes conforming to NCDOT 840.52 are acceptable. Manholes shall be situated such that the barrel is under the curb line. No waffle wall boxes shall be allowed. All pipe openings in precast structures must be cast or cored. Unless the structure is stamped by the manufacturer as NCDOT approved, shop drawings must be submitted for approval prior to their installation.

b. Junction boxes shall be NCDOT 840.31, 840.32 or 840.34. No waffle boxes shall be allowed.

c. Frames, Grates and Hoods shall conform to NCDOT 840.03. No catch basins will be allowed in driveways. Hoods shall be stamped with "Drains to Creek" or equivalent notation.

d. Yard inlets shall be NCDOT 840.05.

e. All drainage structures shall be designed with 0.2 feet vertical difference between invert in and invert out.

f. Curb and gutter is required in all cases.

g. Inlets should be placed at (upstream of) intersections and all low points in the gutter grade to prevent gutter flow from crossing traffic and pedestrian lanes of the intersecting road. There shall be no boxes in curb radii. Inlets are normally placed upstream of pedestrian crossings to intercept the gutter flow before it reaches the crosswalk. Where pavement surfaces are warped, as at cross streets, ramps, or transitions between super elevated and normal sections, gutter flow should be diverted into the storm drainage system to prevent water flow across the roadway. Where a curbed roadway crosses a bridge, gutter flow should be intercepted before it reaches the bridge. Runoff from areas adjacent to streets should be intercepted before reaching the pavement. This applies to water that would normally run onto the street from side streets or from cut slopes and areas along the edge of pavement.

h. Inlets on a continuous grade should be spaced to limit the spread of stormwater onto the pavement. The spacing of inlets is based on the allowable spread, grade of the street, flow and the inlet capacity. Maximum spread shall be 8 feet from the face of the curb based on a rainfall intensity of 4 inches/hour. Manning's n-value for concrete curb and gutter calculations shall be 0.016. The flow bypassing an inlet must be included in the flow arriving at the next inlet.

i. The maximum length of pipe without installation of a catch basin, curb inlet or junction box is 400 feet.

j. Spot grades or profiles shall be provided in cul-de-sacs to ensure positive drainage.

k. Storm drainage pipe and structure information shall be listed on each sheet of plan and profile drawings. This information shall include pipe diameter, material, grade, inverts, structure type, grate type, and the drainage area and flow into the pipe structure. A 0.2 ft drop between inlet and outlet pipes shall be provided in all structures. This information should be written in a table format with corresponding pipe or structure numbers shown in plan view. Drainage structures shall be numbered in increasing order as one moves from downstream to upstream.

l. All manholes shall be clearly marked with the words "storm sewer."

m. If a proposed structure exceeds 12'-0" vertical height, a structural design will be required for approval.

5.5. Stormwater Control Measures (treatment facilities)

All Stormwater Control Measures (SCM's) shall be designed in accordance with the "Stormwater Design Manual", latest edition, prepared by the NCDEQ (https://deq.nc.gov/sw-bmp-manual). Any SCM noted as acceptable for use in the manual shall be considered acceptable by the Town, pursuant to appropriate basis of design per the manual.

a. All calculations for determination of sizing of SCM's shall be based on one of the calculation methods detailed in the "Stormwater Design Manual", latest edition, prepared by the NCDEQ.
b. All Bioretention/ Rain Gardens must provide a certified soil sample for the media material or a receipt for the material purchased from a supplier with certified media stock. The media mix must meet the requirements of 15A NCAC 02H.1052(6) and (7).

c. All SCM riser type structures shall be precast concrete and be fitted with a trash rack sufficient to withstand the temperature and submersion fluctuations inherent in pond design. Corrugated metal trash racks are not allowed. All emergency overflow weirs shall be stabilized with cast-in-place concrete, 4-inch minimum thickness. All SCM's that permanently impound water shall be fitted with drain piping with a valve located in the riser structure. The valve shall have a riser stem such that it can be accessed from above without entering the structure. Spillways may be of concrete design. Rip-rap spillways may be utilized in cut only situations. Grass-only spillways are not acceptable.

d. A separation structure shall be provided between the forebay and main pond. The separation structure can be an earthen or rip-rap berm, or a wall made of concrete or a gabion system. Rip rap shall be Class B, minimum 15" depth. The berm shall be set no lower than an elevation 6" below the temporary pool elevation.

e. Rules in the North Carolina Administrative Code (NCAC), specifically 15A NCAC 2H.1050-.1062 provides information on the appropriate minimum engineering design criteria for SCM's (see http://ncrules.state.nc.us/ncac.asp). Earthen BMP's shall be designed with the following minimum requirements:

    (1) Exposed side slopes shall be 3:1 or flatter
    (2) A minimum width of 10 feet at the top of dam shall be provided for maintenance access
    (3) Design shall include a spoil area for dredged material
    (4) Outlet pipes must be concrete or HDPE.
    (5) Detention pond worksheets are available on the Engineering Department website for use during the review process

f. Calculations submitted for wet detention ponds and other SCM's shall include a printout of the Supplement EZ Forms found on the NCDEQ Stormwater website, as available. The Supplement EZ Forms can be found at https://deq.nc.gov/sw-bmp-manual.

g. Any SCM designed to permanently contain water shall have fencing installed around the entirety of the facility, with an appropriately sized gate for maintenance access. 4-foot split rail fencing is acceptable; however, it must be covered in wire fencing in locations where final grade slopes towards the pond.

h. SCMs must be made accessible for maintenance and repair. The access path shall have a minimum width of 10 feet and may be grassed, paved or gravel. The maximum allowed slope shall be less than 10% with a maximum 5% cross slope.

i. Liners
   1. Clay liners shall comply with the following parameters:
      a. Liner thickness shall be 12"
      b. Clay shall be compacted to 95% minimum dry density, modified proctor method ASTM D-1557).
      c. The slope of clay lines shall be limited to 3H:1V for all areas requiring soil cover.

   2. Geomembrane Liners (GLs) shall comply with the following parameters:
      a. GLs shall be ultraviolet (UV) light resistant and have a minimum thickness of 30 mils. A thickness of 40 mils shall be used in areas of maintenance access or where heavy machinery must be operated over the membrane.
      b. GLs shall be added according to the manufacture's recommendations
      c. Liners shall be installed so that they can be covered by 12" of top dressing.

Section 6. **Roadway Design Standards**

6.1. Roadway Classifications

a. All streets within the Town's jurisdiction shall comply with the requirements of one of the following street classifications:

(1) Local Streets – A Street intended solely for access to adjacent properties. Consists of all roads not defined as arterials or collectors; primarily provides access to land with little or no through movement. Local streets are further classified as (1) Residential, (2) Commercial or (3) Industrial.

(2) Collector Streets – A Street that provides direct service to and from local areas, routing traffic to the arterial street system. A Collector Street provides the primary means of circulation between adjacent neighborhoods and can serve as a local bus route. The Street provides the dual purpose of land access and local traffic movement. Generally, these roadways are not used for through trips. Provides a less highly developed level of service at a lower speed for shorter distances by collecting traffic from local roads and connecting them with arterials. Collector streets are further classified as either (1) Major, or (2) Neighborhood. If a street meets at least two of the criteria, the street will be designated as a collector street and must be built to the appropriate standard.

(1) the street intersects directly with a thoroughfare and provides access to an area with an overall density of one dwelling per acre, or provides access to more than 125 dwelling units.

(2) The street by its general configuration, in relationship to the existing development of the area, in effect serves a collector function.

(3) The street serves as a primary access to a significant nonresidential, institutional or recreational land use, as well as access to a residential area.

(3) Arterial Streets – A thoroughfare, used primarily for through traffic rather than for access to abutting land, that is characterized by high vehicular capacity and continuity of movement. Provides the highest level of service at the greatest speed for the longest uninterrupted distance, with some degree of access control. Arterial streets are further classified as either two-lane, or four-lane (with median).

(4) Private Streets – Privately maintained streets may be used within commercial and multi-family developments. Private streets within subdivided single family developments are generally prohibited. Private streets must be built to the same standards as Town streets.

(5) Alleys – Privately maintained streets that provide rear access to properties, reduce curb cuts and access points along frontage streets, permit unencumbered pedestrian access along frontage streets, and provides less visible access for service functions. Alley streets exhibit a narrower pavement width to accommodate single direction

movement of vehicles, adequate right-of-way width to accommodate passing, and an inverted section for drainage. Parking shall not be allowed along an Alley.

b. All proposed public streets shall be designed to become part of the overall street system and be identified as such on all adopted plans. All streets and roads shall align with other designated roadways for continuity in the Town's street system.

c. All new street names shall be approved by the Iredell County Planning Department. Proposed streets, which are obviously in alignment with other streets, may be required by the Iredell County Planning Department to bear the assigned name of the existing street.

d. Any area with on-street parking other than parallel (ie diagonal or head in) shall be considered private driveways or parking lots for purposes of Town review and approval and shall not be considered for inclusion into the Town's street system. These areas would not be platted as right-of-way. The Iredell County Planning Department, at its discretion, may elect to assign street names and addressing to these areas to maintain appropriate 911 servicing.

6.2. Design Basis

a. The design standards described herein are the minimum requirements for roadways to be accepted and maintained by the Town of Mooresville and for private streets. Design criteria not established in this Manual shall be as set forth by the North Carolina Department of Transportation (NCDOT), Division of Highways, as taken or modified from the American Association of State Highway Officials' (AASHTO) various guidelines and requirements. Where these minimum requirements conflict with those of the NCDOT or AASHTO, the more restrictive requirements shall apply.

b. A North Carolina Professional Engineer must sign and seal all construction plans and revisions submitted for review. A Professional Land Surveyor may certify As-Built drawings verifying that the construction was completed according to plans.

c. Pavement markings, etc. shall be in accordance with the Manual on Uniform Traffic Control Devices for Street and Highways (MUTCD) and NCDOT Standard Specifications for Roads and Structures, current editions. The location and design of street name signs shall be approved by the Engineering Services Director as in accordance with the standards set forth in the MUTCD.

d. All signs shall be purchased from and fabricated by the Town Public Works Department before vertical construction may begin.

e. If the property is located on or adjacent to a thoroughfare then all rights-of-way must be dedicated and lanes must be added in accordance with future widening plans.

f. Curb and gutter and sidewalks are required on both sides for all new street construction. Curb and gutter shall be NCDOT Standard 846.01. Sidewalk is also required across the frontage of the property along any existing street.

g. Sidewalks shall be installed at the time of roadway construction or installed in phases as approved by the Department. Sidewalks shall be a minimum of six (6) feet behind the back of curb with a minimum width of five (5) feet. The Town may require a wider sidewalk and/or planter strip in developments were a substantial amount of pedestrian or vehicular traffic is anticipated.

h. Where sidewalks and/or greenways intersect any section of curb and gutter, curb or accessible ramps are required. The current NCDOT wheelchair ramp standards shall apply. Approved colors for truncated domes are red and yellow.

i. Planting strips, located between the curb and sidewalk parallel with the street, shall be 6 feet or more in width. To maintain sight lines, trees and other objects are prohibited in the sight distance areas. If trees or plantings are placed in the right-of-way, the property owners' association covenants shall include language which outlines how and when the trees or plantings will be maintained. The covenants must be submitted to Town Public Works Street Superintendent for review and approval. Tree types placed within the right-of-way must be approved by the Engineering Services Director (See the Landscape Section). The developer and/or property owners' association must keep the trees trimmed on the road side to maintain a clear distance from the pavement to a height of 10-feet above the pavement. Approval shall be based on the assurance that the property owners' association covenants clearly state how the trees and plantings within the right-of-way will be adequately and routinely maintained and replaced if needed.

j. When using NCDOT Standard 1264.02 End of Road Markers, a sign denoting "Future Roadway Extension" must be installed on the center marker.

k. Design speed shall be a minimum of 5 mph greater than the posted speed limit. The posted speed limit shall not be less than 25 mph. Therefore, the design speed shall be a minimum of 30 mph.

l. Minimum travel lane width shall be 11 feet measured from lip to road centerline. Street widths are measured from lip of curb to lip of curb and spanning a median, if present.

m. Minimum design speed, right-of-way and road widths shall be as summarized in the following Table:

DESIGN SPEED ROW AND STREET WIDTH			
Street Classification	Standard Detail Number	Min. Design Speed (mph)	Minimum Right-of-Way Width (feet)
Local Residential	R-1.0	30	50
Local Commercial	R-2.0	30	55
Local Industrial	R-3.0	30	55
Major Collector	R-4.0	40	100
Neighborhood Collector	R-5.0	30	55
2-Lane Arterial	R-6.0	40	55
3-Lane Arterial	R-6.0	40	65
4-Lane Arterial	R-7.0	40	100
Alley	R-24.0	N/A	20
Limited Access Streets	R-24.0A	N/A	25

n. Roadways shall have a minimum grade of 0.5 percent. The minimum centerline radius shall be as given below. No super-elevation will be permitted without approval of the Engineering Services Director. Sight distance and maximum grade parameters used for the design of vertical curves shall be as follows:

ROADWAY DESIGN PARAMETERS		
	Design Speed (mph)	
Sight Distance Parameter	**30**	**40**
Posted Speed (mph)	25	35
Maximum Grade	8%	8%
Min. Horizontal Radius (feet)	200	415
Min. “K” Value	30	44

o. Pavement design for all streets shall be in accordance with the Standard Details. For streets in industrial zoned areas, the Engineering Services Director may require a special pavement design be submitted for review and approval.

p. Maximum cut and fill slope is three-to-one (3:1) in residential areas and two-to-one (2:1) in other areas.

q. Retaining Walls: No retaining walls shall be allowed in the right-of-way. Retaining walls shall not be used to elevate (hold up) the right-of-way without the approval of the Engineering Services Director. If so approved, only “Concrete Retaining Walls”

shall be used to hold up a roadway. All retaining wall systems must be designed by a Professional Engineer.

r. Streets that are multi-lane and/or divided will require special design reviews.

s. Grades shall not exceed 3% for the first 300 feet from the centerline of any publicly maintained road for a residential collector/nonresidential street. Grades should not exceed 5% for the first l00 feet from the centerline of any publicly maintained road for a residential street.

t. Turn lanes shall have a minimum width of 12 feet and be incorporated when required by traffic considerations. Tapers shall be used as necessary in street design. Approach tapers are used to shift lanes laterally. The following equations shall be used as applicable:

(1) L = WS for posted speeds of 45 mph and greater;
(2) $L = WS^2 / 60$ for posted speeds of 40 mph or less;
(3) L = Taper and approach length in feet
(4) S = Speed in miles per hour
(5) W = Lateral offsets in feet

u. Turn lane tapers shall be at least 15:1 (L:W) for posted speeds of 45 miles per hour and more. The minimum turn lane taper allowed for streets posted less than 45 miles per hour is 8:1. Symmetrical reverse curve tapers are recommended for non-thoroughfare streets. Storage lengths for the turn lanes shall be calculated using an acceptable method and approved by the Engineering Services Director. The minimum storage lane length shall be 150 feet for left turn lanes and 100 feet for right turn lanes, unless otherwise specified by a TIA.

v. Plans for all widening's shall show that the contractor will saw and remove the top 1-1/2" of existing pavement a minimum of 12" from the edge, or as directed by the Town, and place new pavement over the existing base. All thoroughfares and industrial or commercial roads shall receive a full overlay rather than patch.

w. Guardrail shall be installed in any area where there is a risk of a vehicle going off the roadway in accordance with appropriate AASHTO requirements or when required by the Engineering Services Director.

x. Minimum striped on-street parking width shall be 8 feet as measured from the face of the curb or 7 feet from the lip of the gutter whichever is greater. On-street parking requires a minimum travel lane width of 12 feet. When on-street parking is allowed, a minimum travel way width of 20 feet shall be maintained at all times.

y. Concrete traffic islands designed to direct turning movements are acceptable and shall be constructed and placed as per NCDOT standard specifications. Concrete traffic islands shall be a minimum of 4 feet wide.

z. Medians designed to direct turning movements are acceptable and shall be constructed and placed as per NCDOT standard specifications. Medians shall be a minimum of 4 feet wide as measured from the back of curb to back of curb.

6.3. Intersections

a. Intersections shall intersect at 90 degrees when possible, with minimum of 75 degrees.

b. A minimum radius of 30 feet to the back of the curb is required at all intersections except in residential street to residential street intersections. A minimum radius of twenty-five (25) feet to the back of curb shall be required where residential streets intersect.

c. Offset intersections shall be avoided; however, when necessary a minimum distance of 200 feet between centerlines shall be provided. A minimum of 800 feet shall be provided between intersections on thoroughfare and collector streets.

d. Sight distance requirements presented in this section are minimum requirements and should be increased where considerations allow. Sight distance calculations apply to existing and new infrastructure.
   i. Intersection Approach Triangles – Sight triangles of 35’ x 35’ shall be preserved for all intersections. Additional sight triangles of 10’ x 70’ shall be provided along NCDOT intersecting rights-of-way, with the 70-foot dimension along the cross street. This sight triangle must be shown at all connections to a state-maintained roadway and is located on each side of the approaching street or driveway. Intersection approach sight triangles shall be measured from the right-of-way line.
   ii. Stopping Sight Distance - The minimum stopping sight distance shall be determined using *A Policy on Geometric Design of Highways and Streets*, AASHTO, latest edition (AASHTO Green Book). The minimum stopping sight distance shall be available to the driver at all locations on publicly-traveled ways and applies to both horizontal and vertical alignments. New streets or driveways that fail to provide adequate stopping sight distance will not be approved. Proposed subdivisions must provide full stopping sight distance on all internal streets.
   iii. Intersection Sight Distance - The minimum intersection sight distances shall be determined using *A Policy on Geometric Design of Highways and Streets*, AASHTO, latest edition (AASHTO Green Book). Intersection Sight Distance refers to the available lines of sight approaching and departing an intersection. It takes into consideration multiple factors, such as the type of traffic control at the intersection, the speeds of vehicles, intersecting-street cross-section,

intersecting-street approach grade, design vehicle, and number of crossing lanes.

iv. Driveway Location and Spacing - The desired spacing between driveways on collector streets is 100’ and arterials is 200’, with a minimum of 50’ for collector streets or higher classification. Driveways located near unsignalized intersections should have a minimum corner clearance of 100’, measured from each point of tangency of the radius of curvature. Driveways located near a signalized intersection will have a minimum of 200’ corner clearance. In addition, driveways within the functional area of a signalized intersection will be restricted to right-in-right-out. Where possible, the Town encourages the use of consolidated driveway accesses between individual properties in order to minimize the number of potential conflicting turning movements on the adjacent roadway and with pedestrians.

e. If a traffic signal is required as part of a given land development project, the traffic signal will be fitted with 3M’s Opticom Priority Control System. This system allows the emergency vehicle-initiated preemption of traffic signals and must be provided at the Developer’s expense. All preemption equipment must be approved by the Engineering Services Director.

6.4. Culverts

a. All culverts under NCDOT or Town roads shall be designed for the 50 year storm event.

b. Culvert crossings shall be designed with the following clear zone distances:

Design ADT	Clear Zone from Edge of Pavement	
	Tangent Section	Curve (within 125’ of culvert)
Under 750	10’	15’
750 – 1000	12’	18’
1501 - 6000	14’	21’
Over 6000	16’	24’

c. Handrails shall be installed behind the sidewalk unless a 10-foot pedestrian clear zone is provided behind the sidewalk. A pedestrian clear zone shall be defined as any slope at 6:1 or flatter.

d. Handrails must extend a minimum of 20’-0” past the end of the wingwall.

e. Slope from handrail or edge of pedestrian clear zone shall be at a slope of 2:1 or flatter

6.5. Cul-de-Sacs

a. Permanent cul-de-sacs are permitted on local residential and commercial streets only.

b. Cul-de-sacs shall not exceed 400 feet in length unless approved by the Town and a hydrant is provided at the end of the cul-de-sac.

c. Cul-de-sacs shall not be used to avoid connection with existing streets. To encourage future development in an orderly manner street rights-of-way shall be extended to adjacent property and a temporary cul-de-sac or T-shaped turnaround provided as appropriate. In such instances, the width of the right-of-way of the approaching street shall be extended to the adjacent property. Curb and gutter is not required on temporary cul-de-sacs.

6.6. Driveways

a. A driveway permit is required for all non-residential driveways, streets, or turnouts accessing public streets. Once a site plan has been approved, a driveway permit must be submitted to the Town for driveways accessing both Town and State roads.

b. A driveway inspection is required prior to pouring concrete or placing asphalt. Once the driveway location has been approved and concrete forms set, the Town's Inspector must be notified for an inspection. Failure to request a driveway inspection and failure to comply with the specifications may necessitate removal and replacement of the driveway apron by the property owner and/or responsible party.

c. The arrangement of driveways should be related to adjacent driveways and nearby street intersections to avoid conflicting turning movements.

d. Driveways shall be free from all obstructions such as water meters, cleanouts, curb or accessible ramps and storm drainage structures.

6.7. Speed Humps

a. Speed humps shall only be allowed on residential streets and in accordance with the speed hump policy must be approved by the Engineering Services Director.

b. To gain maximum effect, speed humps must be the full 3". Speed humps shall be 3" high with an allowable maximum tolerance of +/- 0.25". Developers must not exceed this height based on consideration for emergency and fire department vehicles. Because of this concern, any speed humps constructed over 3.25" must be corrected immediately.

6.8. Bicycle Lanes

a. Bicycle lanes are the portion of the street specifically designated for the use of bicyclists by pavement markings or other means of delineation on the street. Bicycle lanes are required on all streets designated as bicycle routes on the Town of Mooresville Bicycle Master Plan.

b. Bicycle lanes provide a clearly marked area of the street for bicycle travel and separates cyclists from motor vehicles, help reduce conflicts between motor vehicles and bicycles, provide an additional buffer between pedestrians and motor vehicles, and give motorists more confidence about passing cyclists.

c. Placement and width of bicycle lanes is dependent on right-of-way width, traffic speed and volume, signalization, turn lanes and parking. A marked bicycle lane should be a minimum of four feet wide (not including gutter), with 5' generally preferred. Wider lanes are preferred next to on-street parking (to avoid opening car doors) and on steep hills (to allow room for weaving caused by pedaling uphill).

d. If there is a right turn lane at an intersection, the bicycle lane should be placed to the left of the right turn lane, to clearly separate the bicycles' through movement from the motor vehicles' turning movements.

e. Bicycle lanes, signage and pavement markings shall be in accordance with the current edition of the MUTCD.

Signage

f. A signage plan must be submitted under Professional Engineer seal and signature to the Engineering Department for approval and all signage must be paid for in accordance to the Town's signage price list prior to any signage being installed.

g. All signage in the right of way must be installed by the Town of Mooresville including but not limited to street name signs, regulatory signs, warning signs, etc. All signs must be in accordance with MUTCD standards.

h. Developers or Homeowners Associations may not remove, replace or add to the Town-installed signage.

i. Stop bars shall be placed at all stop sign locations.

6.9. Street Lighting

a. All street lighting shall be the responsibility of the Developer. Developers should consult with the appropriate utility provider in the development of proposed street lighting plans.

b. Street lighting plans must be reviewed and approved by Public Works. Such plans shall show the location of each light, size of the luminaires in watts or lumens, , and number of street lights. All lights must be LED.

c. In order to minimize glare and up-lighting, no acorn style street lights are allowed, only those street light fixtures considered full cutoff (180º) will be allowed.

d. The electrical distribution system shall be underground. Distribution cable may be direct buried except under streets, driveways, sidewalks, and parking areas where it shall be in a conduit. The cable shall be sized so that the voltage drop does not exceed five percent at any point in the system.

e. Required minimum levels of illumination (expressed in average maintained horizontal foot-candles) are presented in the following Table:

Street Classification	Illumination Levels (foot-candles)		Uniformity Ratio[1]
	Commercial	Residential	
Major Arterial	1.3	0.8	3:1
Minor Arterial	1.6	0.8	3:1
Collector	1.1	0.6	4:1
Local	0.9	0.4	6:1
Alley	0.6	0.3	6:1
Sidewalk	0.9	0.3	6:1

The uniformity ratio is defined as the ratio of the average luminous flux incident on a surface to the minimum luminous flux incident to the surface.

f. The following standards should be used to determine the placement of street lights on residential streets:

(1) Street light spacing shall be determined based on the illumination level of the street. At no time shall lights be more than 220 to 250 feet apart depending on the lot lines.
(2) Street lights should be located at all public street intersections and at the end of all cul-de-sacs and T-turnarounds.
(3) Where possible, all street lights that are not located at an intersection should be located on or adjacent to a property corner.
(4) Street lights should alternate on both sides of the street.

g. In other areas within the Town, street lighting design is based on street classification and on the uses of adjacent properties. Because these factors vary from site to site, developers should contact the Engineering Department when proposing street lighting in non-residential areas.

h. All street lighting shall be LED.

6.10. Roundabout Design

A roundabout may be proposed for any street intersection. The proposed design will be evaluated using guidance from National Cooperative Highway Research Program (NCHRP) Report 672 – Roundabouts: An Informational Guide (Second Edition). Additionally, North Carolina Department of Transportation (NCDOT) policy and guidance will apply to any State facilities impacted by the proposed roundabout location.

Single-lane roundabout guidance is provided in this section as a starting point for design. The combination of site-specific features and geometric decisions should guide the development of the roundabout design beyond these guidelines. Mini and multi-lane roundabouts shall be specifically designed for the location and use. Engineering Services staff reserves the right to require additional design components as appropriate.

For the purposes of this guidance, the roundabout footprint includes the legs through the limits of the splitter island.

a. Design Parameters – Traffic Flow

(1) All approaches shall yield at entry point
(2) There shall be no driveways within 50’ of the roundabout footprint
(3) Maximum queue lengths of downstream intersections cannot extend into roundabout footprint
(4) Approach design speed must be 35 mph or less

b. Geometrics
(1) Inscribed Diameter shall be no less than 105’
(2) All legs should be tangent and coincident with center of roundabout and 90° from one another
(3) Approach Lane should flare to a radius equal to or less than the circulating radius, widen from the standard lane width to 14’-16’ at yield line and have a 45-60° vehicle deflection angle
(4) Circulating Lane width shall be between 16’-20’
(5) Departure Lane alignment must be tangential to circulating path
(6) Circulating roadway shall slope away from center of roundabout at standard crossfall ¼” per foot

c. Islands
(1) Splitter islands should be raised and should extend a minimum of 50’ from yield line
(2) Center island diameter shall be no more than 50’ and should be raised and landscaped or hardscaped to prevent traverse by vehicle and pedestrian
(3) Apron should be a 3” raised, mountable area for trailer tracing. Buses must traverse the roundabout without crossing into the apron

d. Pedestrian and Bicycle Accommodations
(1) On collector roads or higher, crosswalks should be provided across each leg approximately 25’ from yield line with a minimum 3’ long by 6’ wide pedestrian refuge in each splitter island
(2) Raised crosswalks and/or notification of pedestrians to drivers (e.g. sign or flashing signal) should be considered
(3) Bicycles are expected to take the approach and circulation lane. Bike lanes, if present, should begin and end at splitter island

e. Bus, Fire Engine, and SU truck turning paths shall be submitted with the proposed design. WB-50 truck turning paths will also be required on any facility classified as a

minor thoroughfare or higher. The outer turning radius shall be a minimum of 45'-4" and the inner radius shall be a minimum of 26'-8".

f. Minimum sight distances should be provided for
   (1) Approaching – driver must have enough sight distance to stop at the yield line
   (2) Entering – driver must have enough sight distance to see circulating and entering vehicles and determine if there is a sufficient gap to enter the roundabout
   (3) Circulating – driver must have enough sight distance to stop for obstruction within roundabout
   (4) Exiting – entering and circulating drivers must have enough sight distance to stop for a pedestrian in roundabout crosswalk

g. Signing and Pavement Markings
   (1) Single-lane roundabouts internal to a residential subdivision must include the following:
      - 2 – Yield/street name combination signs at opposite corners of roundabout
      - Yield signs at all remaining entrances
      - One-way signs placed in island opposite each approach
      - Advance warning signs are not required for internal residential roundabouts.
   (2) Roundabouts located on collector roads or higher should follow the requirements in the current Manual on Uniform Traffic Control Devices (MUTCD).

h. Additional Considerations
   (1) Height of landscaping within sight distance lines shall be less than 24".
   (2) Safety lighting shall be considered at each location especially if pedestrian activity is present or anticipated.
   (3) Facility shall comply with Americans with Disabilities Act (ADA) standards.

6.11. United States Postal Service

a. The United States Postal Service requires the use of cluster boxes for all residential development, including single family residential developments. Mail delivery systems must be approved by the USPS, and must be shown on concept and construction plans. Any conflicts between these requirements and those of the USPS shall be resolved in favor of the more stringent requirement.

b. The HOA is responsible for maintenance of the box and the surrounding concrete.

c. In addition to meeting USPS requirements, cluster boxes for single family residential must meet the following additional conditions if they are located along the road within the right-of-way:
    (1) Boxes must be located at least 10 feet from a driveway, as measured along the curbline from the edge of the driveway flare to the concrete pad for the box.
    (2) Boxes must be oriented such that they are facing perpendicular to the street.
    (3) A concrete pad must be provided that extends a minimum of 5 feet from the face of the box, and the entire width of the planting strip (standard of 6 feet). The concrete pad shall integrate the support and foundation for the box itself as one continuous pad.
    (4) A street light shall be located the box such that it does not impede access to the box but provides sufficient light to access mail drawers and also provides a sense of security to users.
    (5) Each box shall be located central to the properties that it serves.

d. Boxes that serve more than 8 residences must be located in common open space, behind the right-of-way. An overhead, full cut-off LED light must be provided at the box.

e. Boxes (or groups of boxes) that serve more than 50 residences at one location shall have a vehicle turn-off area or parallel parking location outside of the standard road cross-section.

6.12. Plantings In Street Right-Of-Way

a. Chapter 7 of the Town of Mooresville Zoning Ordinance entitled “Landscaping and Open Space” governs the preservation and protection of trees in the Town and its extra-territorial jurisdiction. Where these standards conflict with those of the Zoning Ordinance, or the NCDOT, the more stringent shall apply.

b. There will be no irrigation sprinklers or associated piping allowed in the rights-of-way, including medians. System layout should Follow NCAC 23.0504.

c. There shall be no fences, electric pet fences, lighting, boulders or trees other than approved street trees allowed in the right-of-way. Street trees are required to be planted on the lot(s) to be developed (not in the plantings strip). No vegetation other than grass is allowed around regulatory signs or street lights.

d. Tree grates and associated irrigation systems are only allowed in the Neighborhood Center Zoning areas. Any grates in public right-of-ways must be approved by the Engineering Services Director.

e. Landscaped islands in parking lots, and medians separating lanes of traffic on public streets and on internal drives, should be a minimum of 4' in width measured from the

back of curb. If large trees are to be planted in landscape islands or medians, these islands or medians should be a minimum of 10' in width measured from the back of curb, and include a minimum of 200 sf of soil surface area per large tree. Note that if landscaped islands or medians are located within the right-of-way, irrigation sprinklers or associated piping is still not allowed.

f. All landscaped islands and medians shall receive a minimum of 6" of topsoil over finished subgrade, and shall be graded to provide adequate drainage. Subsurface drainage is recommended for all landscaped islands and medians per the Standard Detail L-7.0.

g. In all areas it is important to be certain that the placement of plantings does not interfere with site visibility at intersections. Adjust tree placement to avoid obstruction of sight triangle at intersection by AASHTO standards.

h. In general the following tree placement standards apply:

(1) Large Trees - All trees reaching a mature height of thirty five (35) feet or more should be planted a minimum of:

- 8-10 feet from back of curb, edge of street pavement and driveways (allow for any proposed future widening);
- 8-10 feet from sidewalks and other paved pedestrian surfaces except where urban conditions would prohibit any planting;
- 10 feet from all buildings;
- 15 feet from street lights, utility poles and above-ground utility wires;
- 10 feet from all underground utilities; and
- 10 feet from utility vaults and ground level utility structures.

(2) Small Trees - All trees reaching a mature height of less than 35 feet should be planted a minimum of:

- 8-10 feet from back of curb, edge of street pavement and driveways (allow for any proposed future widening);
- 8-10 feet from sidewalks and other paved pedestrian surfaces except where urban conditions would prohibit any planting;
- 8-10 feet from all buildings;
- 10 feet from street lights and utility poles;
- 5 feet from all underground utilities; and
- 5 feet from utility vaults and ground level utility structures (10 feet from door side).

(3) Staking Trees: Support should be provided only for trees greater than 8 feet in height planted in exposed locations. Trees should be secured using vertical stakes driven into the ground outside the planting pit with constraining lines made of webbing, hose-protected wire or other material that will not abrade or become embedded in trunk. Slack

should be provided in each constraining line to allow for some trunk movement and all supports should be removed after one year unless tree is excessively weak. Where required, wrap or cover straps with fluorescent flagging.

i. General Pruning Requirements: Pruning should consist of the removal of dead, dying, diseased, interfering, obstructing and weak branches and selective thinning to lessen wind resistance and improve the appearance of trees and shrubs. All cuts should be made close to the trunk or parent limb without leaving a protruding stub and without cutting into the branch collar or the branch bark ridge. Clean cuts should be made at all times.

j. Trees limbs too heavy to handle by hand should be precut above the final cut to prevent splitting or peeling of the bark. Where necessary to prevent tree or property damage, branches should be lowered to the ground with ropes or equipment. Treatment of cuts and wounds with tree wound dressing is discouraged except for cosmetic purposes in highly visible areas. If such treatment is made, materials non-toxic to the cambium layer must be used and care should be taken to treat only the exposed wood with a thin coat of dressing.

k. Climbing spurs should not be used unless the tree is dead or is to be removed.

l. All shrubs located in the right-of-way in median shall be trimmed to a height of less than 3 feet.

m. Topsoil for Plantings: Topsoil shall be fertile, natural soil typical of the locality, free from large stones, roots, sticks, clay, peat, weeds, and sod and obtained from naturally well-drained areas. It shall not be excessively acid or alkaline, nor contain toxic material harmful to plant growth. Topsoil stockpiled on-site may be used subject to approval of the Town Inspector.

The following is a list of large maturing drought tolerant trees approved for planting in the right-of-way:

Latin Name	Common Name	Maturing Height (ft)	Maturing Width (ft)	Group
Acer campestre	Maple, Hedge	35	30	Deciduous
Acer rubrum	Maple, Red	60	50	Deciduous
Acer x fremanii	Maple, Freeman	65	50	Deciduous
Carpinus betulus	Hornbeam, European	60	40	Deciduous
Carpinus caroliniana	Hornbeam, American	35	25	Evergreen
Cedrus deodara	Cedar, Deodar	50	30	Evergreen
Celtis laevigata	Hackberry, Sugar	50	40	Deciduous
Celtis occidentalis	Hackberry, Common	60	50	Deciduous
Cryptomeria japonica	Cryptomeria, Japanese	45	20	Evergreen
Gymnocladus dioicus	Kentucky Coffeetree	75	65	Deciduous
Pistacia chinensis	Chinese Pistache	40	35	Deciduous
Quercus acutissima	Oak, Sawtooth	45	45	Deciduous
Quercus falcata	Oak, Southern Red	70	60	Deciduous
Quercus lyrata	Oak, Overcup	50	40	Deciduous
Quercus phellos	Oak, Willow	60	40	Deciduous
Quercus shumardii	Oak , Shumard	60	50	Deciduous
Quercus virginiana	Oak, Live	50	60	Evergreen
Taxodium distichum	Baldcypress	70	30	Deciduous
Tilia Cordata	Linden, Little leaf	70	40	Deciduous
Ulmus parvifolia	Elm, Lacebark	50	50	Deciduous
Zelkova serrata	Zelkova, Japanese	70	55	Deciduous

The following is a list of small maturing (largely) drought tolerant trees approved for planting in the right-of-way:

Latin Name	Common Name	Maturing Height (ft)	Group
Acer buergeranum	Maple, Trident	30	Deciduous
Cercis canadensis	Redbud, Eastern	25	Deciduous
Cercis chinensis	Redbud, Chinese	15	Deciduous
Chionanthus retusus	Fringetree, Chinese	30	Deciduous
Crataegus phaenopyrum	Hawthorne, Washington	25	Deciduous
Crataegus viridis 'Winter King'	Hawthorne, Green	30	Deciduous
Ilex X attenuata 'Fosteri'	Holly, Foster	25	Evergreen
Koelreuteria bipinnata	Chinese Flame Tree	30	Deciduous
Lagerstroemia indica	Crape Myrtle	20	Deciduous
Magnolia grandiflora	Magnolia, 'Little Gem'	25	Evergreen

The following is a list of drought tolerant shrubs approved for planting in the right-of-way:

Botanical Name	Common Name	Normal Height	Group
Abelia x grandiflora	Abelia	3-4 ft	Evergreen
Aucubajaponica	Dwarf Aucuba	3-4 ft	Evergreen
Berberis julianae	Wintergreen Barberry	5-6 ft	Evergreen
Berberis thunbergii	Japanese Barberry	3-5 ft	Evergreen
Buxus microphylla	Japanese Boxwood	3-4 ft	Evergreen
Cytissus scoparius	Scotch Broom	5-6 ft	Evergreen
Deutzia gracilis	Slender deutsia	2-4 ft	Semi-Evergreen
Hydrangea quercifolia	Oakleaf Hydrangea	6-8 ft	Deciduous
Ilex cornuta	'Carissa' Carissa Holly	3-4 ft	Evergreen
Ilex cornuta	'Rotunda' Dwarf Chinese Holly	3-4 ft	Evergreen
Ilex cornuta,	'Burfodii Nana' Dwarf Buford Holly	5-6 ft	Evergreen
Ilex crenata	'Green Lustre'	3-5 ft	Evergreen
Ilex glabra	Inkerry Holly	6-8 ft	Evergreen
Ilex vomitoria	'Nana' Dwarf Yaupon Holly	3-4 ft	Evergreen
Itea virginica	Virginia Sweetspire	3-5 ft	Deciduous
Jaminum floridum	Showy Jasmine	3-5 ft	Evergreen
Jasminum nudiflorum	Winter Jasmine	3-4 ft	Evergreen
Juniperus davurica	'Expansa' Parsons Juniper	2 ft	Conifer
Juniperus hoirizontalis	'Plumosa,' Andorra Juniper	2 ft	Conifer
Kerria japonica	Japanese Kerria	3-5 ft	Evergreen
Lespedeza thunbergii	Thunberg Lespedeza	5-6 ft	Deciduous
Lonicera pileata	Privet Honeysuckle	2-3 ft	Evergreen
Mahonia bealei	Leatherleaf Mohonia	6-7 ft	Evergreen
Pyracantha koidzumii	'Santa Cruz'	2-3 ft	Evergreen
Rhaphiolepis indica	Indian Hawthorne	2-4 ft	Evergreen
Spiraea prunifolia,	'Plena' Bridalwreath Spirea	5-7 ft	Deciduous
Spiraea vanhouttei	Vanhoutte Spirea	5-7 ft	Deciduous
Spirea nipponica	'Snowmound'	3-5 ft	Deciduous
Spirea thunbergii	Thunberg Spirea	3-4 ft	Deciduous
Spirea x burmalda	Bumald Spirea	2-3 ft	Deciduous
Yucca filamentosa	Adam's Needle Yucca	5-6 ft	Evergreen

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NOTE:
DETAIL SHEETS G–1.0 – G–3.0 ARE INTENDED FOR PUBLIC AND PRIVATE INFRASTRUCTURE REQUIRED TO BE BUILT TO TOWN STANDARDS. THESE NOTES DO NOT NECESSARILY APPLY TO DRIVEWAYS, PARKING LOTS, OR PRIVATE WATER AND SEWER.

ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE MOST RECENT TOWN OF MOORESVILLE STANDARDS AND SPECIFICATIONS.

General Notes:

1. Contractor is responsible for locating all existing utilities prior to start of construction.

2. All erosion control devices shall be constructed and maintained in accordance with the most current standards of the Land Quality Section of NCDENR.

3. Stabilization stone is required under piping when conditions warrant or as required by the Town Inspector.

4. As a minimum requirement, all graded areas not under pavement and within the right-of-way and/or easements shall be prepared, fertilized and limed, seeded, and mulched immediately upon completion of construction as follows (Application rate PER 1,000 SQUARE FEET):

   Type I Seeding (Lawns, shoulder, or other maintained areas):

   100 lbs. of lime
   15 lbs. of 19-23-12
   4 lbs. of tall fescue, containing a blend of 2 or more tall fescues
   1 lb. of sericea lespedeza (use unscarified seed August 15 to February 1)
   ¼ lb. of German millet (May 1 to August 15)
   1 lb. of rye grain (prior to May 1 or after August 15)

   Seeding mixtures other than those listed above shall be approved by the Town Inspector prior to seeding.

5. Prior to final acceptance by the Town, the Developer or his agent shall ultimately be responsible for administering the correction of all problems associated with the project.

6. The Contractor must have a copy of the approved NCDOT three-party encroachment agreement on the job site prior to beginning any work within NCDOT right-of-way.

7. All backfill shall be non-plastic in nature, free from roots, vegetative matter, waste, construction material or other objectionable material. Said material shall be capable of being compacted by mechanical means and shall have no tendency to flow or behave in a plastic manner under the tamping blows or proof rolling.

8. Materials unsuitable for backfill purposes or as required by the Town Inspector shall be removed and replaced with select backfill material.

- The most current editions of The North Carolina Department of Transportation Standard Specifications for Roads and Structures and The North Carolina Department of Transportation Roadway Standard Drawings will govern all roadway construction unless otherwise specified herein.

- Street catch basins shall be NCDOT 840.01 with type E grate as appropriate (NCDOT 840.03). Solid wall, precast concrete structures conforming to NCDOT 840.45 are acceptable. No waffle walls shall be allowed. All pipe openings in precast structures must be cast or cored. Unless the structure is stamped by the manufacturer as NCDOT approved, shop drawings must be submitted for approval prior to their installation.

- Catch basins for curb and gutter must conform to NCDOT 840.01 or 840.02. Frames, Grates and Hoods shall conform to NCDOT 840.03.

- Frames, grates and hoods shall be of cast iron and shall be of a design and weight which is recommended by the manufacturer as being adequate for HS-20 loadings. The number 840.03 and the name of the manufacturer must be permanently cast on the frame and on the grate.

- No catch basins will be allowed in driveways.

- All subgrade under paved areas, curb and gutter, sidewalk, and roadway shoulders shall be compacted to at least 95% of the maximum dry density as determined by AASHTO T99 and Section 500, "Fine Grading Subgrade, Shoulders, and Ditches," of the NCDOT Standard Specifications for Roads and Structures. The final 12" of subgrade shall be compacted to 100%. Density tests by an independent testing lab are to be made as directed by the Town Inspector at no expense to the Town. The subgrade shall be proof rolled by an overloaded tandem dump truck provided by the developer/owner and witnessed by the Town Inspector prior to placement of stone or asphalt base. The developer/owner shall notify the Department at least 48-hours before the proof roll to schedule an appointment with the Town Inspector. If rain occurs between the proof roll and prior to base placement, another proof roll may be required by the Town Inspector. It is the responsibility of the Developer to make corrections to the subgrade when sections of the roadway fail the proof roll test. The proof roll shall provide a non-yielding surface (pumping, rutting, saturated soil, etc. are unacceptable).

- All stone base shall be compacted to 100% of the dry unit weight as determined by AASHTO T180 and Section 520, "Aggregate Base Course," of the NCDOT Standard Specifications for Roads and Structures. The unit weight and optimum moisture content will be determined by proctor tests performed by an independent laboratory at the developer/owner's expense. Density tests are to be performed and made available to the Inspector for review. Moisture content must be no more than 50% of the optimum moisture content prior to paving. The stone base shall also be proof rolled and witnessed by the Inspector prior to paving. The proof roll shall provide a non-yielding surface (pumping, rutting, saturated stone, etc. are unacceptable). Stone from different quarries shall not be mixed.

- Paving contractors and subcontractors shall be certified by NCDOT on all projects.

- Asphalt must be tested by core sampling or nuclear gauge method in accordance with Article 609-5 D, "Field Compaction Quality Control," of the NCDOT Standard Specifications for Roads and Structures, latest edition.

- All testing records shall be submitted to the Town Inspector within 72 hours.
- Underdrains to stabilize subgrade shall be required as directed by the Town Inspector.
- Existing curb and gutter and pavement shall be replaced or repaired as required to tie on to sound material as defined by the town.
- Wheelchair ramps are required at intersections. See Town Standard Drawings for "Accessible Ramp" for ramp construction. Ramps may not be placed in driveway entrances.
- Minimum diameter of pipe for storm drainage shall be 15 inches. The minimum earthen cover for all pipes is 18 inches.
- Only reinforced concrete pipe (RCP) is allowed in the right-of-way or in drainage networks that receive runoff from the right-of-way. No other type of pipe shall be used without prior approval by the Town. RCP within the right-of-way shall be minimum Class III and joints must have O-rings or flexible joint material, which conforms to AASHTO specification M-198 for Type B flexible plastic gaskets.
- All concrete shall be minimum 3,600 psi compressive strength in 28 days.
- The interior surfaces of all masonry storm drainage structures shall be pointed up, jointed and smoothed to an acceptable standard using mortar, which shall conform to the requirements of Section 1040, "Masonry," of the NCDOT Standard Specifications for Roads and Structures. The invert shall be formed of concrete such that no standing water is possible.
- All pipe terminations in storm drain structures shall be flush with the inside wall.
- Any storm drain structures over three (3) feet and six (6) inches (3'6") in height must have steps in accordance with NCDOT Standard Drawing No. 840.66, "Drainage Structure Steps."
- All graded creek banks and slopes shall be at a maximum of two (2) feet horizontal to one (1) foot vertical (2:1) and not to exceed 10' in height without terracing.
- Backfilling of pipe trenches shall be accomplished immediately after the pipe is laid. The fill around the pipe shall be placed in layers not to exceed eight (8) inches, each layer shall be thoroughly compacted to 95% of the maximum density obtainable with ASTM D698, the Standard Proctor Test (a density of 100% Standard Proctor is required for the top eight (8) inches).
- Compaction requirements shall be attained by the use of mechanical compaction methods. Each layer of backfill shall be placed loose and thoroughly compacted in place.
- Water shall not be permitted to rise in unbackfilled trenches after the pipe has been placed.

Water and/or Sanitary Sewer Notes:

1. The most current edition of the Town of Mooresville Land Development Design Standards will govern all water and sanitary sewer construction.

2. Water meters, and sewer cleanouts shall be located at the right-of-way line.

3. Water and sewer connections shall be beside each other at the center of each lot. Connections are to be spaced not more than 30" center to center and have 2" x 2" stakes placed on each side. Stakes shall be flagged or painted for visibility.

4. Water and sewer connections (including meter boxes, cleanouts and service lines) may not be located in driveways.

5. Hydrants shall be placed preferably at lot lines a minimum of one foot behind the curb, within the planting strip.

6. Field construction materials tests by an independent testing lab are to be made as directed by the Town Inspector at no expense to the Town.

TOWN OF MOORESVILLE

STANDARD DETAIL

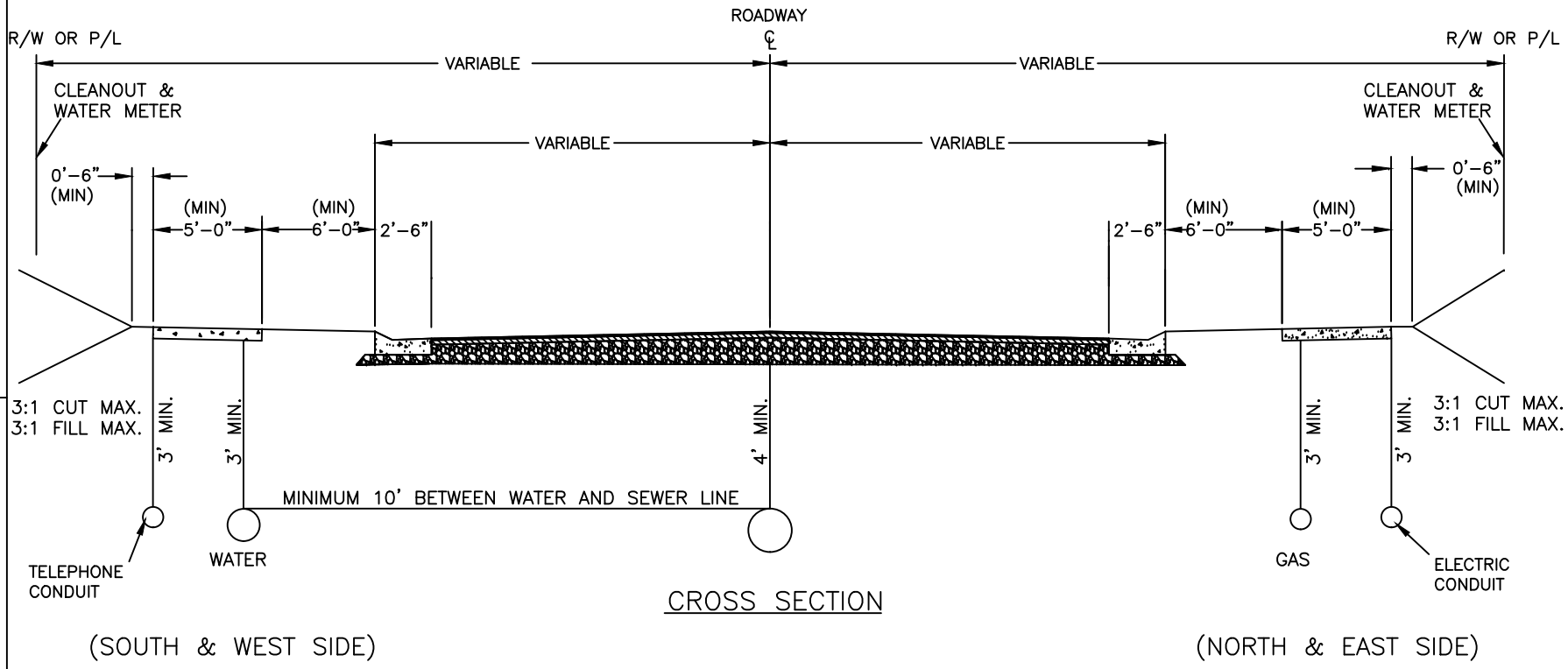
GENERAL

TYPICAL UTILITY PLACEMENT

NTS

June 2018
Revision 2

G - 5.0



CROSS SECTION

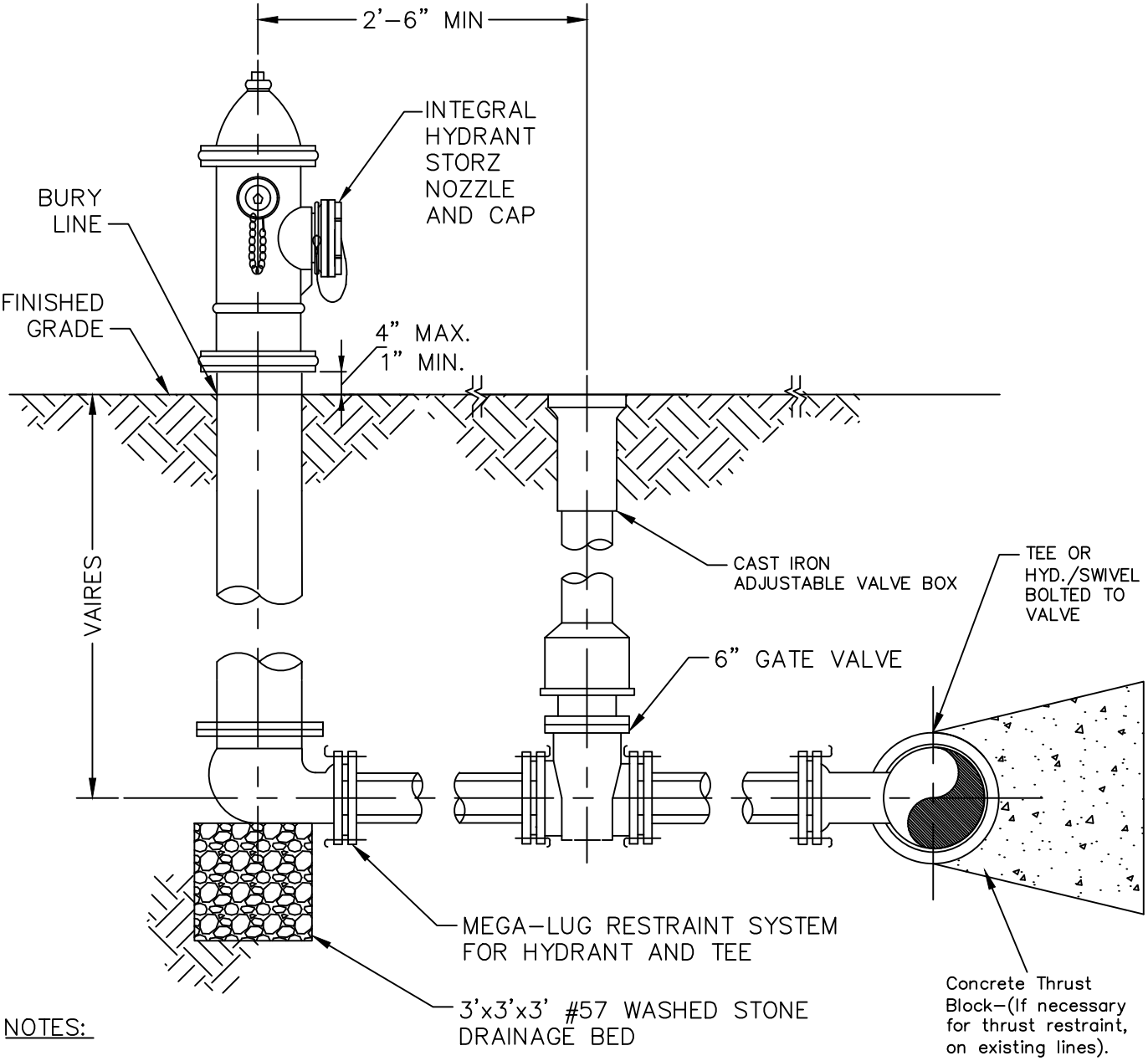
(SOUTH & WEST SIDE)

(NORTH & EAST SIDE)

NOTES:

1. THERE SHALL BE AN 18" VERTICAL SEPARATION BETWEEN WATER AND SEWER LINES.
2. WATER AND/OR SANITARY SEWER LINES SHALL BE A MINIMUM OF TWO (2) FEET FROM THE EDGE OF THE CURB AND GUTTER.
3. WATERLINES SHALL BE LOCATED SUCH THAT VALVE BOX LIDS ARE EITHER COMPLETELY IN OR COMPLETELY OUT OF THE SIDEWALK AND/OR DRIVEWAY.

STANDARD WATER SYSTEM DETAILS:



NOTES:

1. HYDRANTS SHALL CONFORM TO AWWA SPEC. C-502.

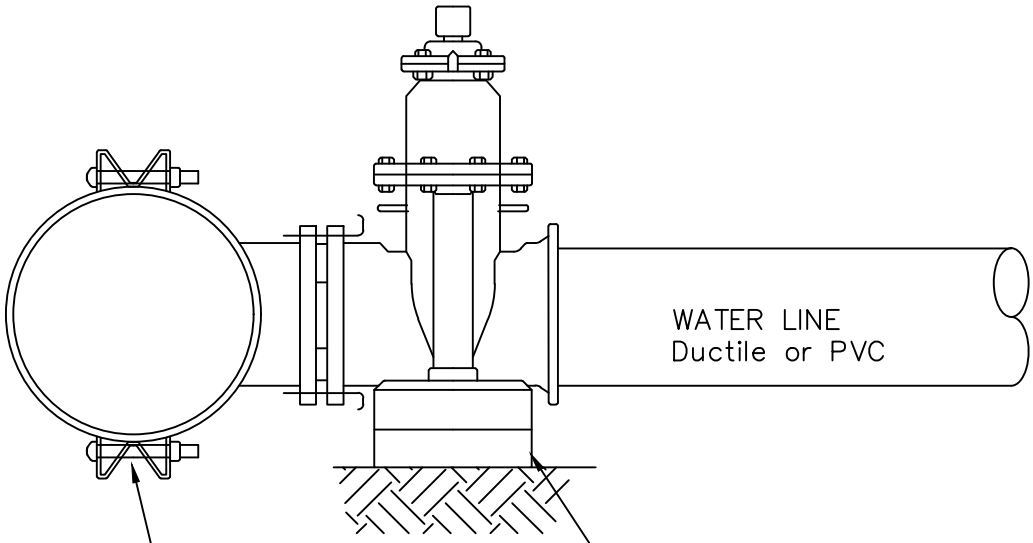
2. HYDRANTS SHALL HAVE MAIN VALVE OPENINGS OF 5 1/4" WITH (1) 5" STORZ PUMPER CONNECTION FACING THE STREET AND TWO 2.5 INCH HOSE OUTLETS.

3. ALL HYDRANTS SHALL OPEN COUNTERCLOCKWISE

4. PUBLIC HYDRANTS SHALL BE PAINTED WITH SAFETY YELLOW ENAMEL. PRIVATE HYDRANTS SHALL BE PAINTED SILVER.

5. PUMP NOZZLE SHALL BE ONE-PIECE DESIGN COMPATIBLE WITH STORZ HOSE COUPLING. NOZZLE SHALL BE INTEGRAL TO THE FIRE HYDRANT ASSEMBLED AT THE FACTORY. STORZ ADAPTERS WILL NOT BE ACCEPTED.

TOWN OF MOORESVILLE STANDARD DETAIL	WATER SYSTEMS FIRE HYDRANT	June 2018 Revision 2 NTS | W - 1.0



NOTES:

1. CONCRETE SHALL NOT CONTACT BOLTS OR ENDS OF FLANGE OUTLET FITTNGS.

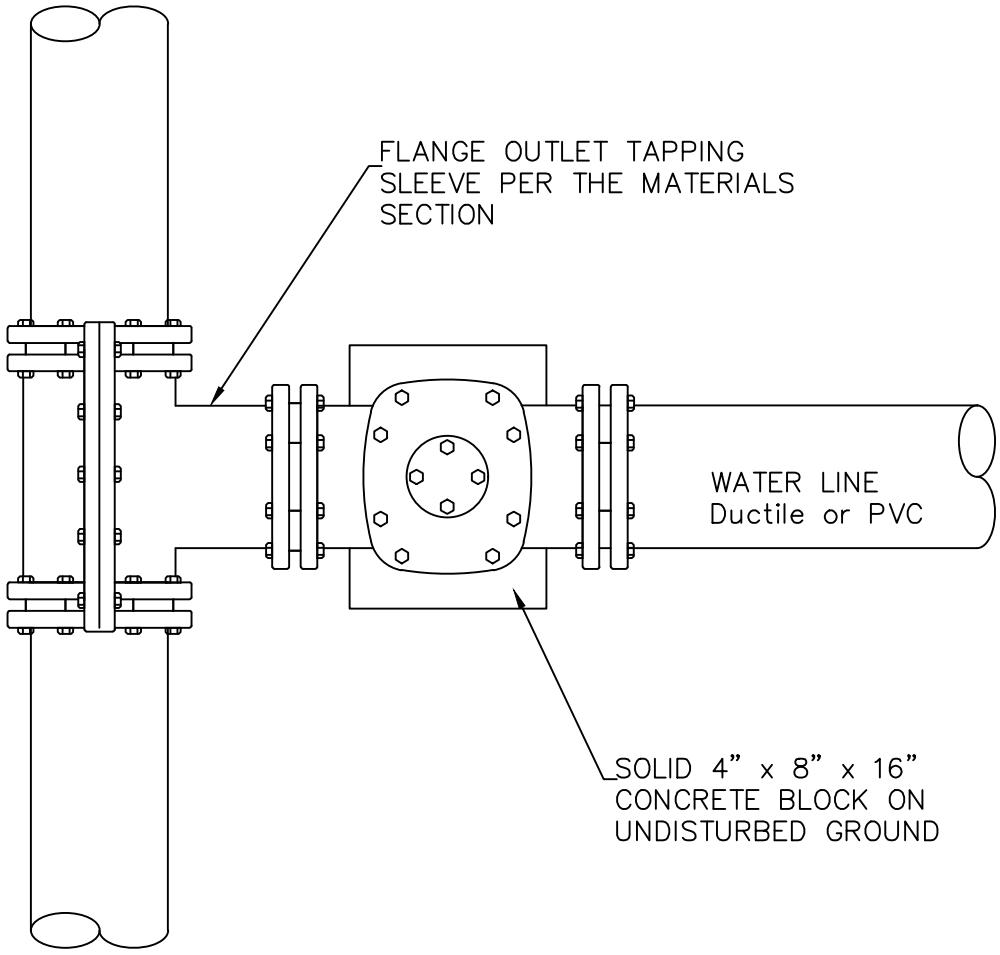
2. SEE APPROPRIATE STANDARD DETAIL FOR THRUST BLOCK DIMENSIONS.

3. WHEN NEW WATER LINE AND WATER LINE BEING TAPPED ARE OF THE SAME SIZE, A DUCTILE IRON TAPPING SLEEVE WITH FLANGE OUTLET MUST BE USED. SEE W–2.0B.

4. CONCRETE THRUST BLOCKING MAY BE REQUIRED AT THE DISCRETION OF THE TOWN.

5. STAINLESS STEEL TAPPING SLEEVES SHALL BE SMITH–BLAIR 665, JCM 439, 539 OR APPROVED EQUAL.

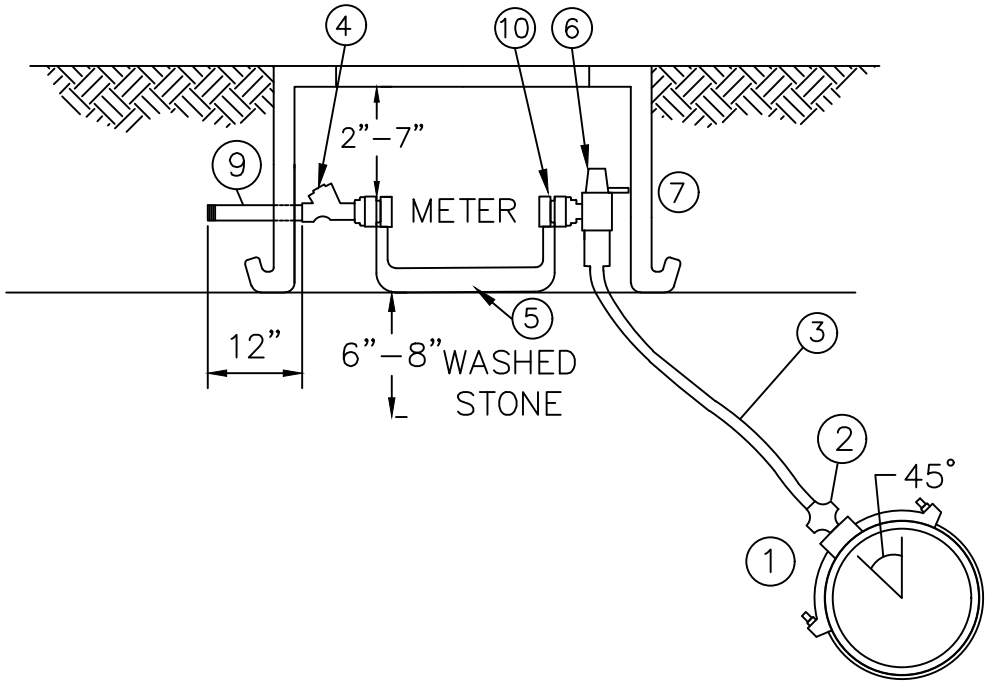
TOWN OF MOORESVILLE STANDARD DETAIL	WATER SYSTEMS TAPPING SLEEVE & VALVE ASSEMBLY	June 2018 Revision 3	
		NTS	W - 2.0A



NOTES:

1. CONCRETE SHALL NOT CONTACT BOLTS OR ENDS OF FLANGE OUTLET FITTINGS.
2. SEE APPROPRIATE STANDARD DETAIL FOR THRUST BLOCK DIMENSIONS.
3. WHEN NEW WATER LINE AND WATER LINE BEING TAPPED ARE OF THE SAME SIZE, A DUCTILE IRON TAPPING SLEEVE WITH FLANGE OUTLET MUST BE USED.
4. CONCRETE THRUST BLOCKING MAY BE REQUIRED AT THE DISCRETION OF THE TOWN.

TOWN OF MOORESVILLE STANDARD DETAIL	WATER SYSTEMS TAPPING SLEEVE & VALVE ASSEMBLY (SIZE ON SIZE)	March 2013 Revision 3	
		NTS	W - 2.0B



NOTES:

1. METER TO BE FURNISHED AND INSTALLED BY TOWN OF MOORESVILLE. ALL COMPONENTS PROVIDED SHALL BE COMPATIBLE WITH A FORD METER.

2. LEGEND:

(1) ROMAC INDUSTIRES STYLE 202S TAPPING SADDLE OR APPROVED EQUAL, NO DIRECT TAPS

(2) MUELLER B–25008 CORPORATION STOP BALL VALVE WITH COMPRESSION FITTING OR APPROVED EQUAL

(3) 1" COPPER TUBING, TYPE K.

(4) RESIDENTIAL USE: STRAIGHT DUAL CHECK VALVE (MUELLER) H–14247N OR EQUIVALENT. COMMERCIAL USE WITH SEPARATE BACKFLOW DEVICE: CHECK VALVE

(5) FORD METER YOKE Y502

(6) 90° ANGLE BALL VALVE OR ANGLE KEY VALVE

(7) BLACK POLYETHYLENE METER BOX MANUFACTURED BY SOUTHEASTERN DISTRIBUTION.
¾" SERVICE – MB16–176 & SOLID LID 170 WE–36
1" SERVICE – MB17–178 & SOLID LID 174 WE–37

(8) 6"–8" WASHED STONE BELOW METER BOX

(9) ¾"x12" or 1"x12" THREADED BRASS NIPPLE

(10) STAR NUT (MUELLER) PART NO. 509316 OR EQUIVALENT

TOWN OF MOORESVILLE STANDARD DETAIL	WATER SYSTEMS 3/4" & 1" SERVICE CONNECTION	June 2018 Revision 3 NTS | W - 3.0

TOWN OF MOORESVILLE

STANDARD DETAIL

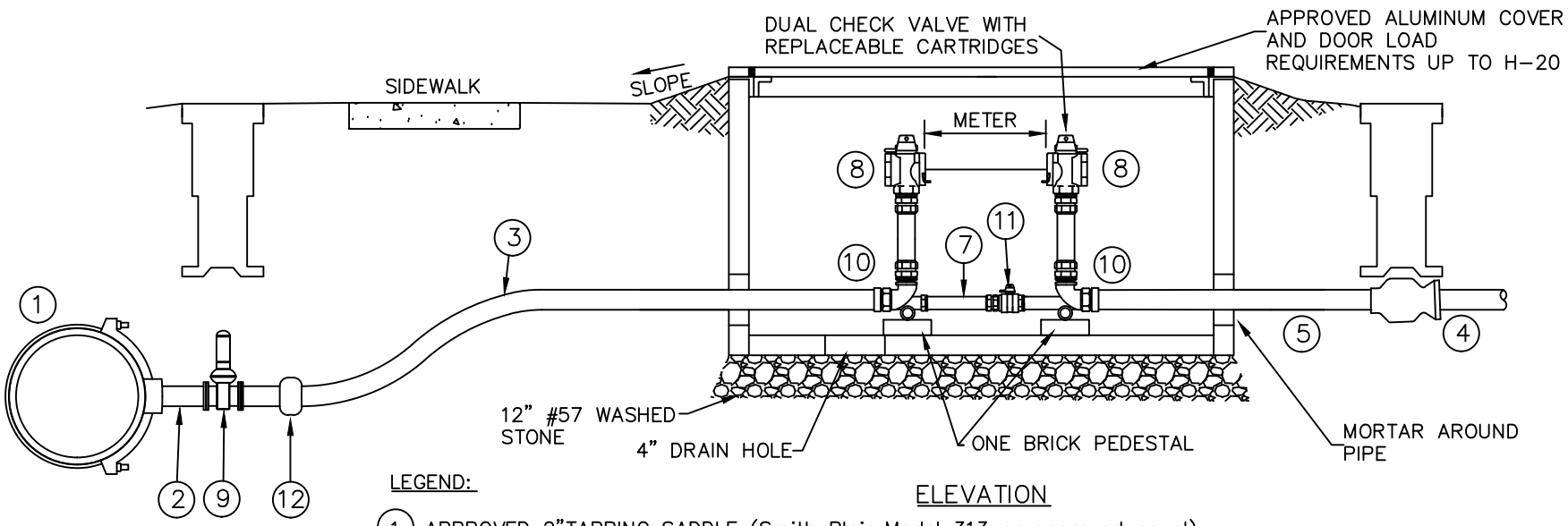
WATER SYSTEMS

1 1/2" TO 2" SERVICE CONNECTION

NTS

June 2018
Revision 2

W - 4.0



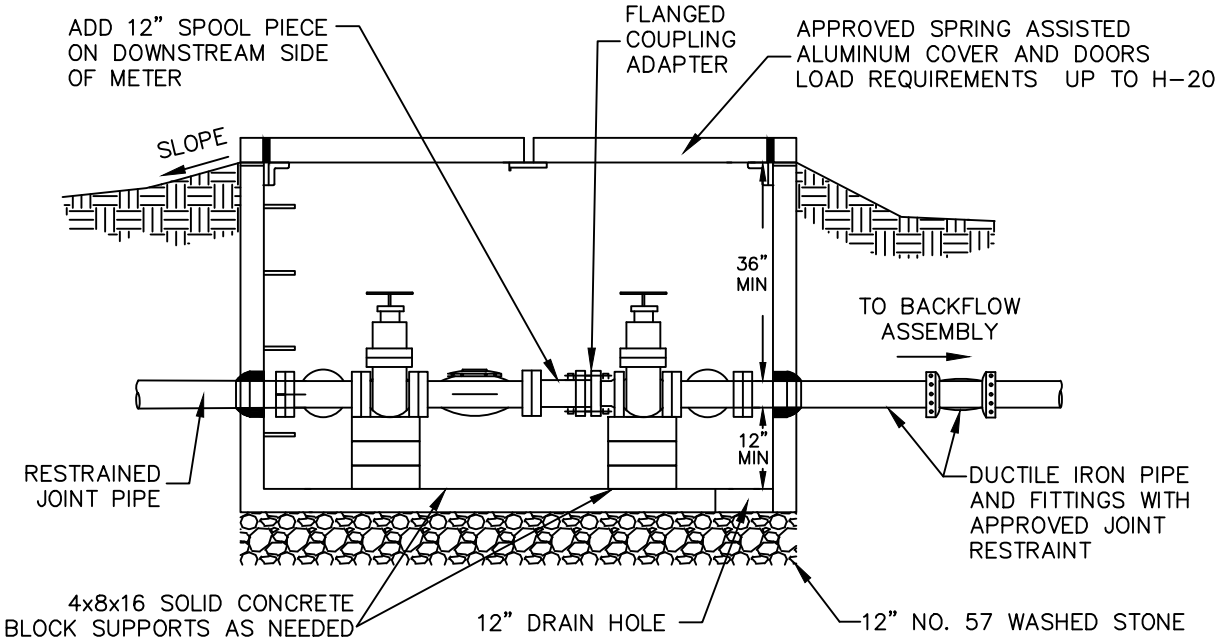
ELEVATION

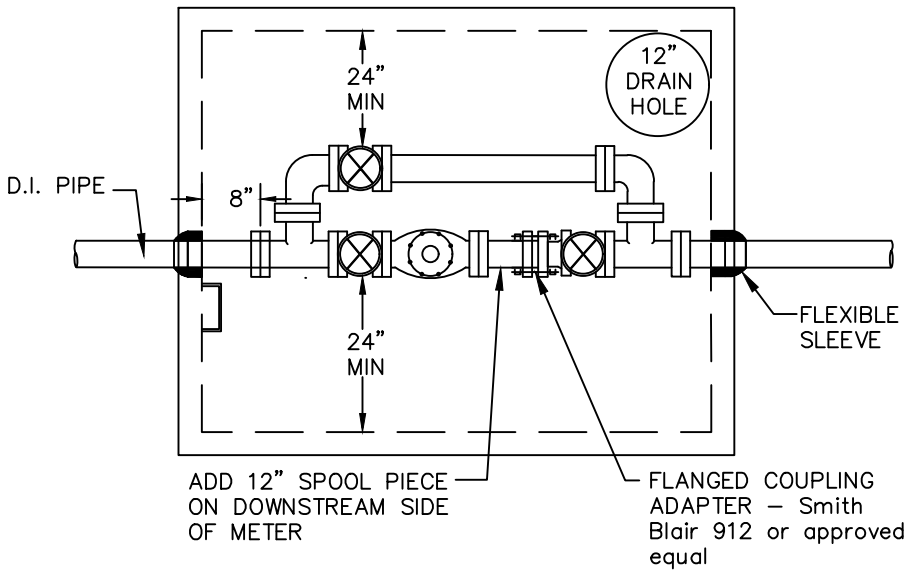
LEGEND:

1. APPROVED 2"TAPPING SADDLE (Smith Blair Model 313 or approved equal)
2. 2" THREADED BRASS NIPPLE
3. COPPER TUBING TYPE K OR SDR 13.5 PVC PIPE
4. CURB STOP BALL VALVE COMPRESSION X THREAD & VALVE BOX
5. 3' SECTION THREADED BRASS PIPE
6. PRE-CAST CONCRETE VAULT 24"W x 36"L x 31"D, H-20 LOAD RATED
7. 1"-1.5" BYPASS
8. BALL ANGLE METER VALVE
9. 2" RESILIENT WEDGE THREAD X THREAD GATE VALVE & VALVE BOX
10. 2" x 1-1/2" REDUCERS FOR 1-1/2" SERVICE LINES
11. 1" BALL VALVE
12. THREAD X COMPRESSION CONNECTION

NOTES:

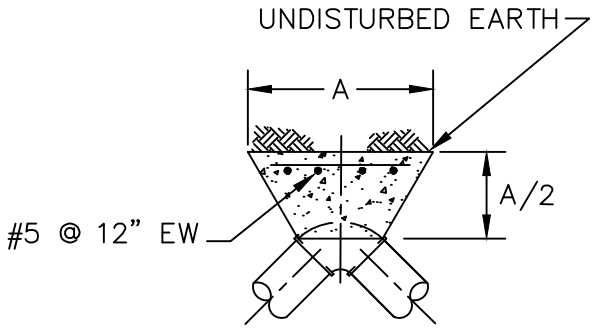
1. THE DISTANCE BETWEEN METER FLANGES VARIES. 1 1/2" METER IS 13 1/4" AND 2" METER IS 17 1/4".
2. METER SETTER IS STABILIZED USING (2) 1" DIA., 18" LONG PIPES RESTING ON (4) BRICKS.
3. WATER MUST DRAIN AWAY FROM CONCRETE VAULT. VAULT MUST BE LOCATED IN A GRASS OR LANDSCAPE AREA, AND NOT IN SIDEWALKS OR DRIVES.



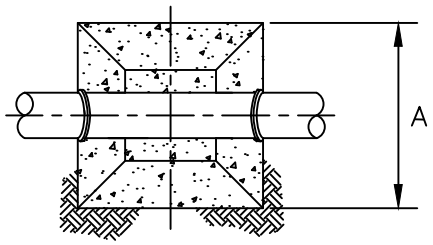


1. NOTES:
2. MINIMUM PIPE DIAMETER OF 4 INCHES.
3. ALL PIPE MUST BE DUCTILE IRON PIPE WITH APPROVED RESTRAINED JOINTS AND FITTINGS.
4. METER VAULT MUST BE BEHIND CURB AND/OR WALK AND OUT OF VEHICULAR TRAFFIC. PRE-CAST CONCRETE VAULT REQUIRED (H-20 LOAD RATING).
5. MAIN LINE AND BYPASS VALVES WILL BE PER THE MATERIAL SECTION OF THE LAND DEVELOPMENT STANDARDS MANUAL. PROPERTY OWNER'S VALVE MUST BE LOCATED OUTSIDE OF TOWN OF MOORESVILLE'S METER VAULT.
6. NOTCHES WHERE PIPING GOES THROUGH VAULT SHALL BE FILLED WITH MORTAR.
7. THE TOP OF THE METER VAULT SHALL BE AT AN ELEVATION SUCH THAT THE SURROUNDING GROUND SLOPES AWAY FROM THE VAULT.

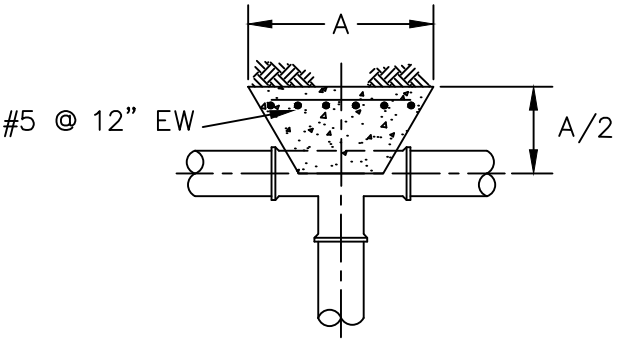
TOWN OF MOORESVILLE STANDARD DETAIL	WATER SYSTEMS 4" AND LARGER SERVICE CONNECTION	June 2018 Revision 4	
		NTS	W - 5.0



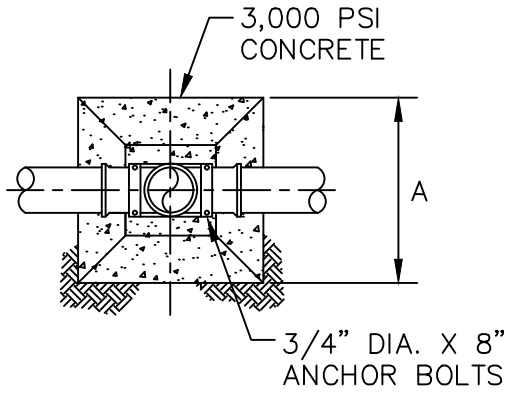
PLAN



ELEVATION



PLAN



ELEVATION

NOTES:

1. ALL FACES OF THE BLOCK SHALL REST AGAINST UNDISTURBED SOIL.
2. PIPE JOINTS, BOLTS, NUTS, RETAINER GLANDS ARE NOT TO BE ENCASED IN CONCRETE.
3. DIMENSIONS BASED ON 150 PSI TEST PRESSURE 1,000 PSF BEARING CAPACITY.
4. THRUST BLOCKS ARE ALLOWED ONLY WHEN THERE IS NOT ENOUGH PIPE LENGTH TO PROVIDE SUFFICIENT THRUST RESTRAINT VIA RESTRAINED JOINT PIPE, OR WHEN CONNECTING TO AN EXISTING PIPE THAT IS NOT RESTRAINED JOINT.

DIMENSION "A"				
FITTING	PIPE SIZE			
	4"	6"	8"	12"
11 1/4 BEND	1'–6"	1'–6"	1'–6"	2'–0"
22 1/2 BEND	1'–6"	1'–6"	2'–0"	2'–8"
45 BEND	1'–6"	2'–0"	2'–6"	3'–8"
90 BEND	1'–8"	2'–6"	3'–4"	5'–0"
TEE	1'–8"	2'–6"	3'–4"	5'–0"

TOWN OF MOORESVILLE

STANDARD DETAIL

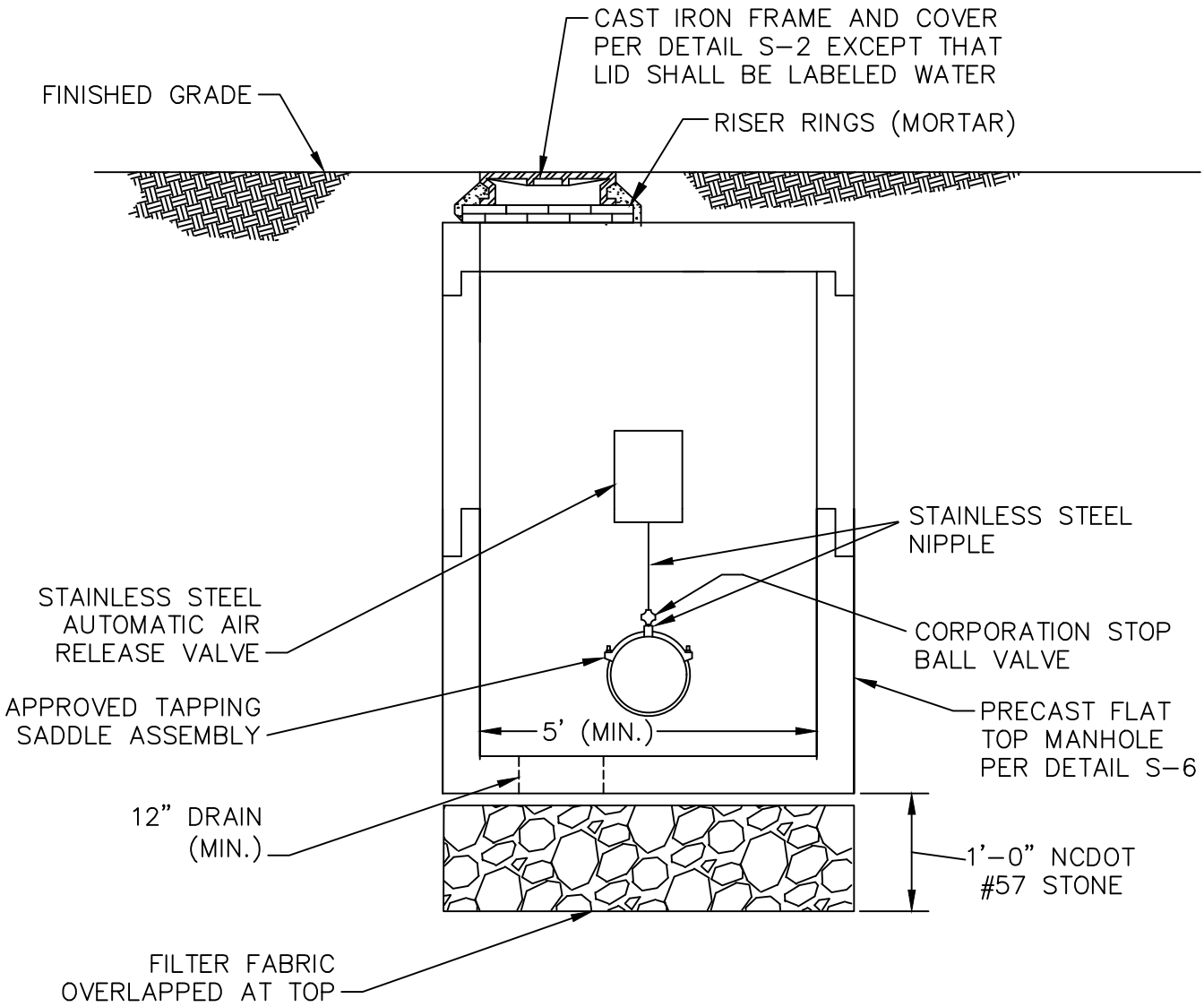
WATER SYSTEMS

THRUST BLOCK

January 2009
Revision 1

NTS

W - 6.0

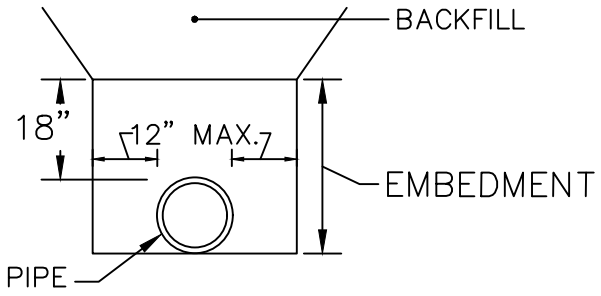


NOTES:

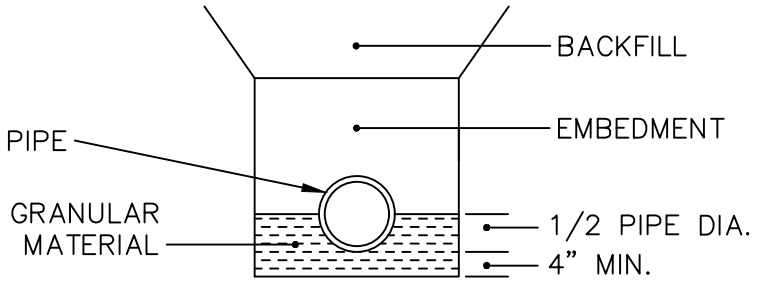
1. 1" AIR RELEASE VALVE AND 1" FITTINGS FOR WATER MAINS UP TO 12" IN DIAMETER.

2. 2" AIR RELEASE VALVE AND 2" FITTINGS FOR WATER MAINS GREATER THAN 12" IN DIAMETER.

TOWN OF MOORESVILLE STANDARD DETAIL	WATER SYSTEMS AIR RELIEF MANHOLE	January 2009 Revision 1 NTS | W - 7.0



ORDINARY PIPE BEDDING



TYPE "A" BEDDING

BEDDING	LIMITING INVERT DEPTHS				
	PIPE DIAMETER				
	6"	8"	10"	12"	16"
ORDINARY	4'–20'	4'–15'	4'–10'	4'–10'	4'–10'
TYPE "A"	–	15'–20'	10'–20'	10'–20'	10'–20'

NOTES

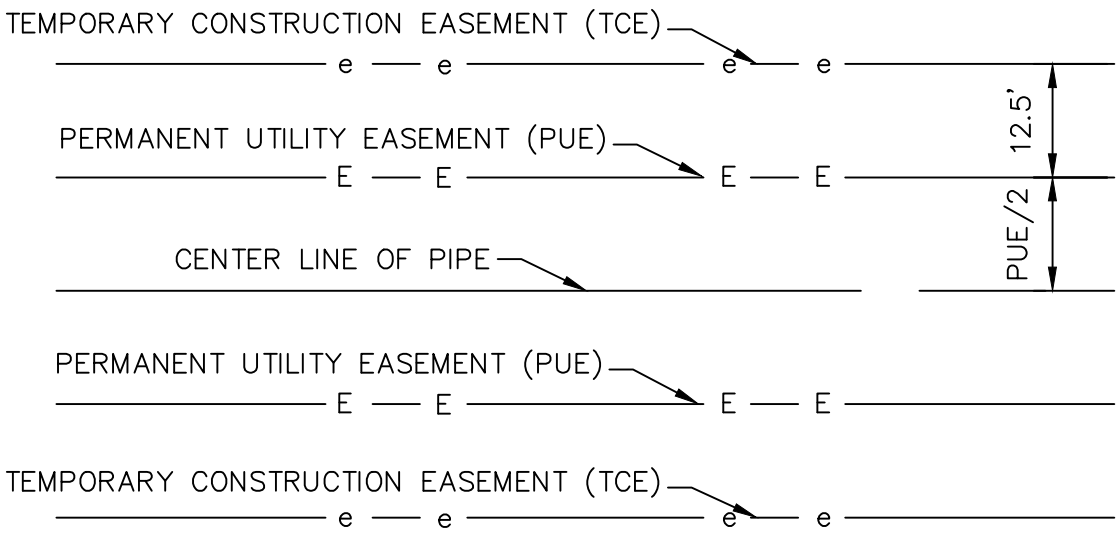
1. PIPES AT DEPTHS GREATER THAN 12' MUST BE APPROVED BY THE DIRECTOR OF ENGINEERING.

2. PIPE BEDDING SHALL BE DESIGNED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.

3. PIPE EMBEDMENT SHALL BE PLACED IN A MAXIMUM OF 6" LAYERS & COMPACTED TO 95% OF THE MAXIMUM LABORATORY DRY DENSITY AS DETERMINED BY THE STANDARD PROCTOR METHOD.

4. PIPE EMBEDMENT SHALL EXTEND TO FINISHED GRADE FOR PIPELINES WITHIN ROAD RIGHT–OF–WAY.

TOWN OF MOORESVILLE STANDARD DETAIL	WATER SYSTEMS WATERLINE PIPING TRENCHING & BACKFILLING (UP TO 20' DEEP)	January 2009 Revision 1	
		NTS	W - 8.0



MINIMUM PERMANENT UTILITY EASEMENT WIDTH (PUE)

	MAXIMUM PIPE INVERT DEPTH (FT)					
DIAMETER (IN.)	10'	12'	14'	16'	18'	20'
4"	25'	25'	30'	35'	40'	45'
6"	25'	25'	30'	35'	40'	45'
8"	25'	25'	30'	35'	40'	45'
10"	25'	25'	30'	35'	40'	45'
12"	25'	25'	30'	35'	40'	45'
14"	25'	30'	30'	35'	40'	45'
16"	25'	30'	30'	35'	40'	45'
18"	25'	30'	30'	35'	40'	45'
20"	25'	30'	30'	35'	40'	45'
24"	25'	30'	30'	35'	40'	45'
30"	30'	35'	40'	45'	50'	50'
36"	30'	35'	40'	45'	50'	50'
42"	30'	35'	40'	45'	50'	50'

NOTES:

1. MINIMUM PUE WIDTH SHALL BE 25'.

2. EASEMENTS SHOWN ARE MINIMUM FOR TOWN OWNED UTILITIES. ADDITIONAL EASEMENTS MAY BE REQUIRED FOR DEEPER THAN AVERAGE OR LARGE LINES.

3. FOR PARALLEL LINES, EASEMENT SHALL BE MINIMUM PUE/2 FEET FROM CENTER OF EACH LINE.

4. TCE OF 12.5' IS REQUIRED ON EACH SIDE OF PUE.

TOWN OF MOORESVILLE STANDARD DETAIL	WATER SYSTEMS MINIMUM EASEMENT	January 2009 Revision 1	
		NTS	W - 9.0

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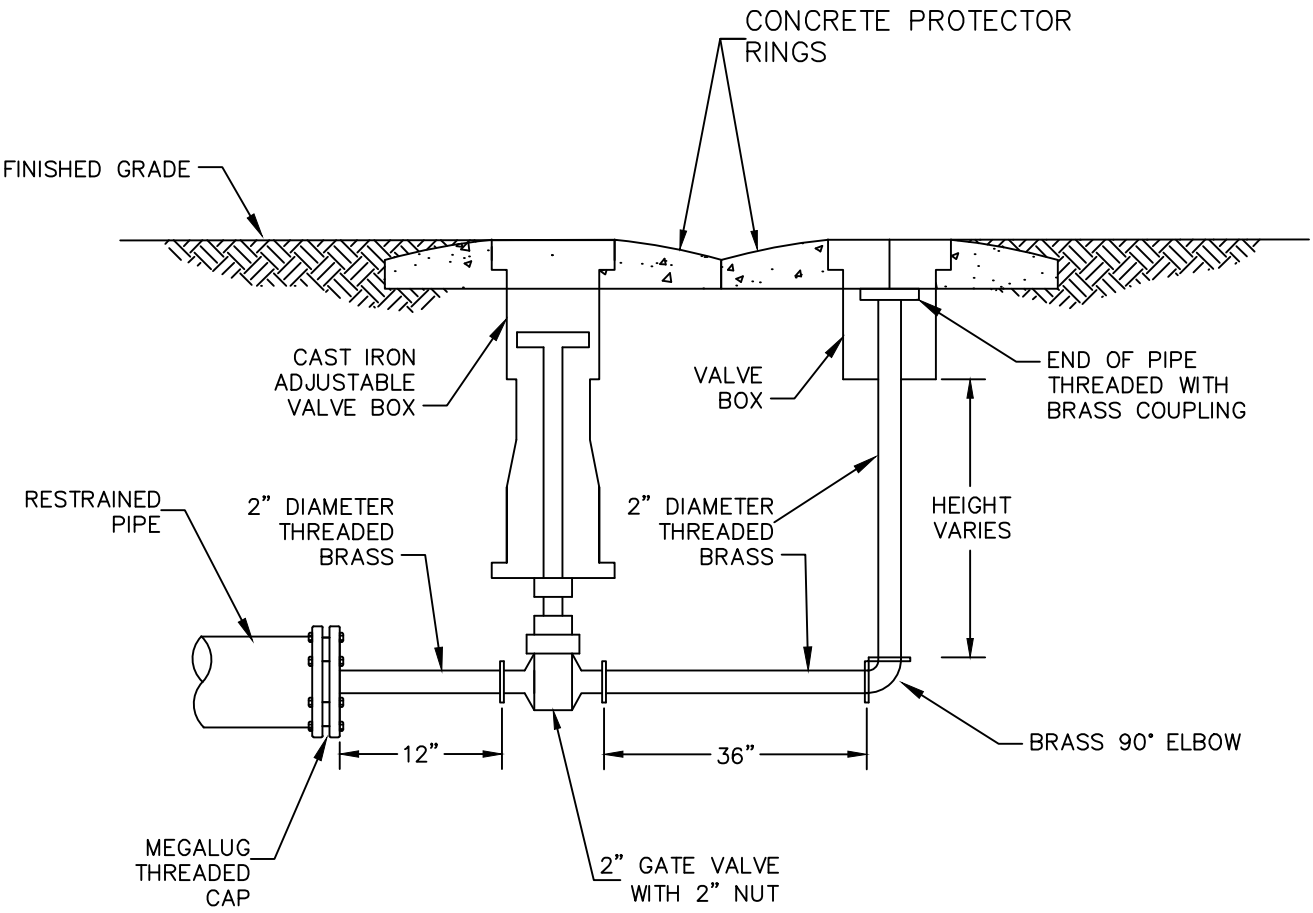
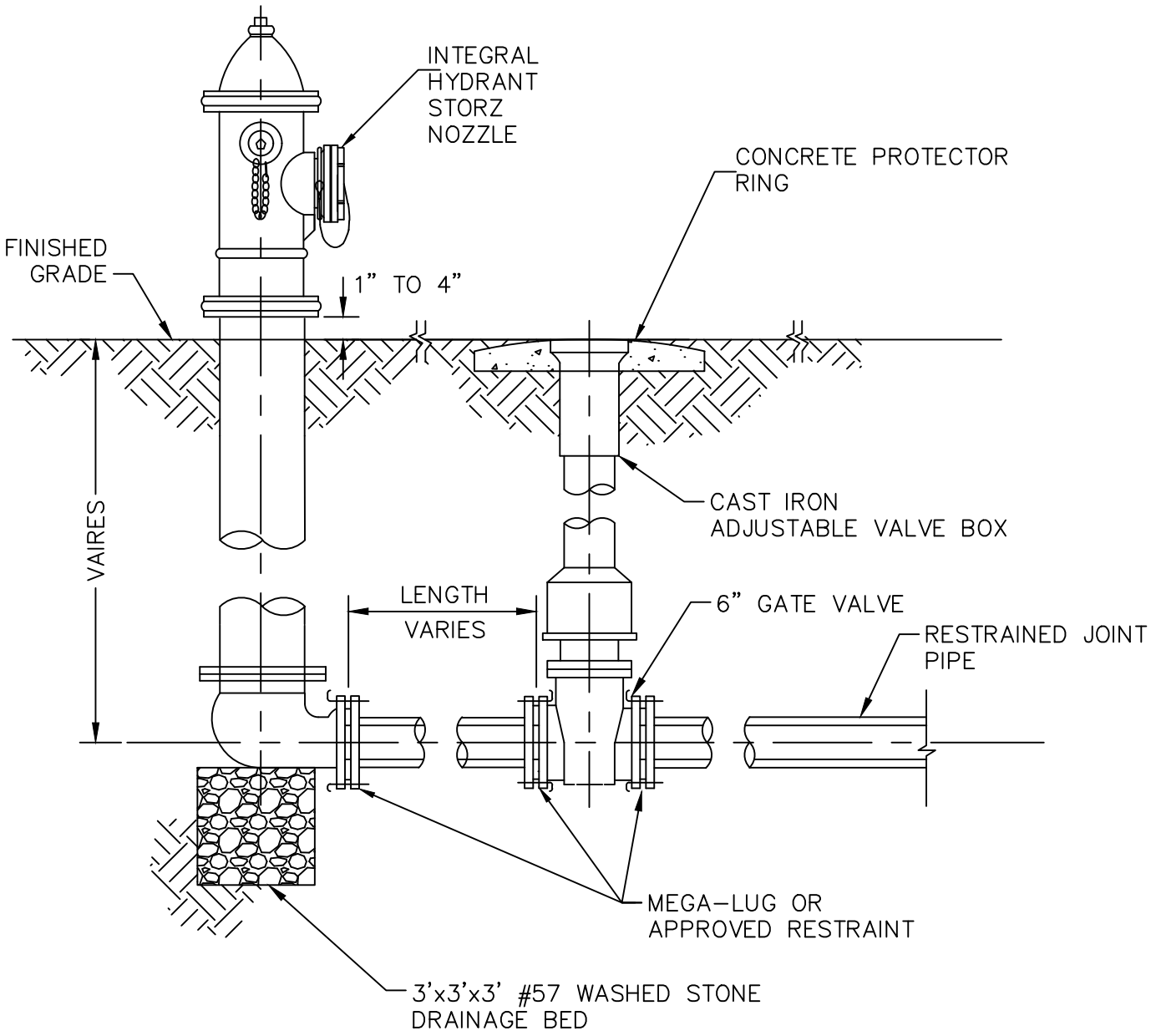


NOTES:

1. FIRE HYDRANTS ARE TO BE USED AS PERMANENT BLOW OFFS ON DEAD END WATER LINES 6 INCHES OR GREATER, UNLESS APPROVED BY THE DIRECTOR OF ENGINEERING.

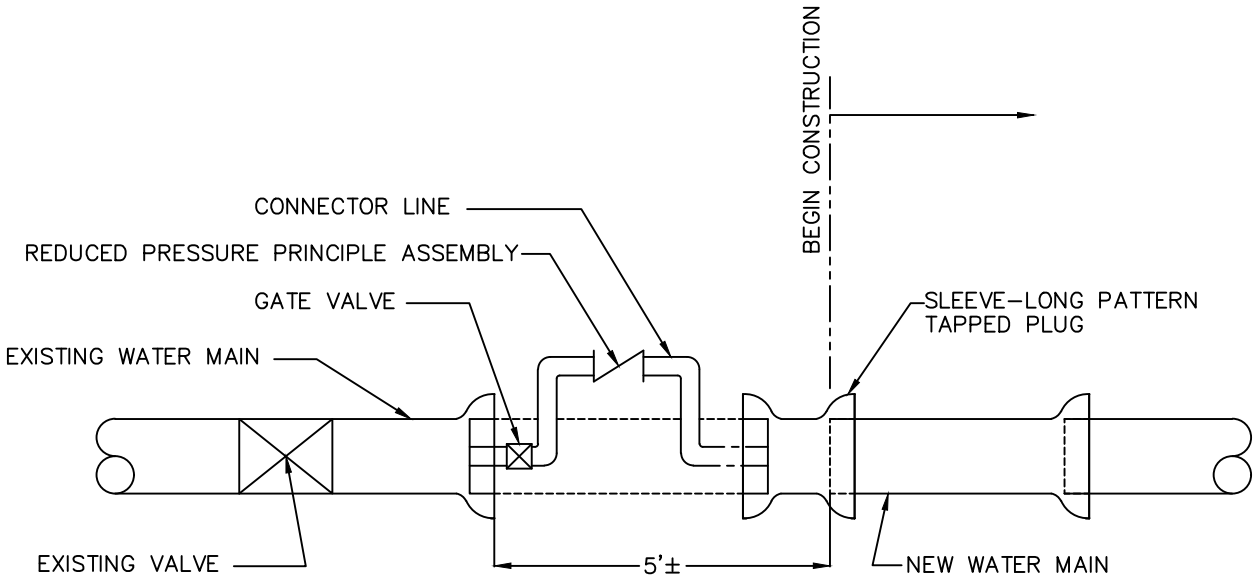
TOWN OF MOORESVILLE STANDARD DETAIL	WATER SYSTEMS 2" BLOWOFF ASSEMBLY	June 2018 Revision 2 NTS | W - 11.0



NOTE:

1. WATER LINES 6" OR LARGER SHALL HAVE FIRE HYDRANT AS PERMANENT BLOW OFF.

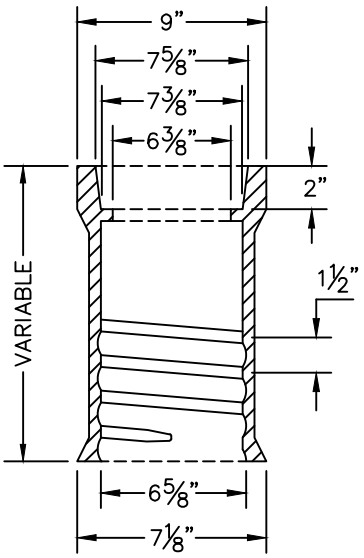
TOWN OF MOORESVILLE STANDARD DETAIL	WATER SYSTEMS FIRE HYDRANT BLOW OFF	June 2018 Revision 2 NTS | W - 12.0



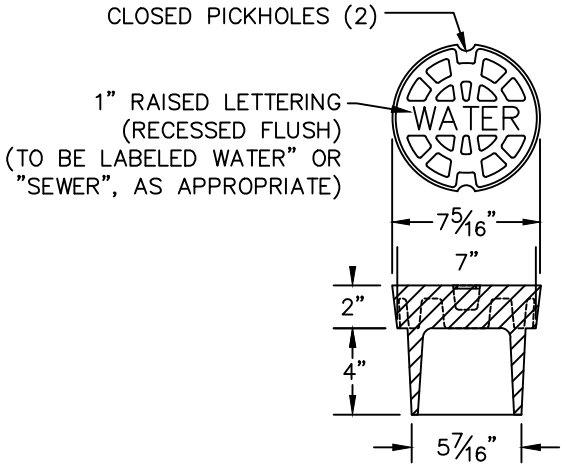
NOTES:

1. INSTALL CONNECTOR LINE FROM EXISTING BLOW OFF ASSEMBLY TO NEW MAIN FOR FILLING, TESTING AND STERILIZING NEW MAIN.
2. CONNECTOR LINE TO BE ASSEMBLED WITH CHECK VALVE AND TO BE OPERATED INDEPENDENT OF EXISTING MAIN.
3. BLOCKING ON EXISTING LINE IS NOT TO BE DISTURBED.
4. FINAL CONNECTION TO EXISTING MAIN TO BE MADE ONLY AFTER TOTAL PROJECT IS ACCEPTED BY THE OWNER.
5. VALVES ON EXISTING SYSTEM TO BE OPERATED BY OWNER FORCES ONLY.
6. ONLY ONE CONNECTION WILL BE ALLOWED BETWEEN THE EXISTING SYSTEM AND THE NEW CONSTRUCTION UNTIL TESTING AND DISINFECTION ARE COMPLETE.

TOWN OF MOORESVILLE STANDARD DETAIL	WATER SYSTEMS JUMPER CONNECTION	January 2009 Revision 1	
		NTS	W - 13.0



TOP SECTION



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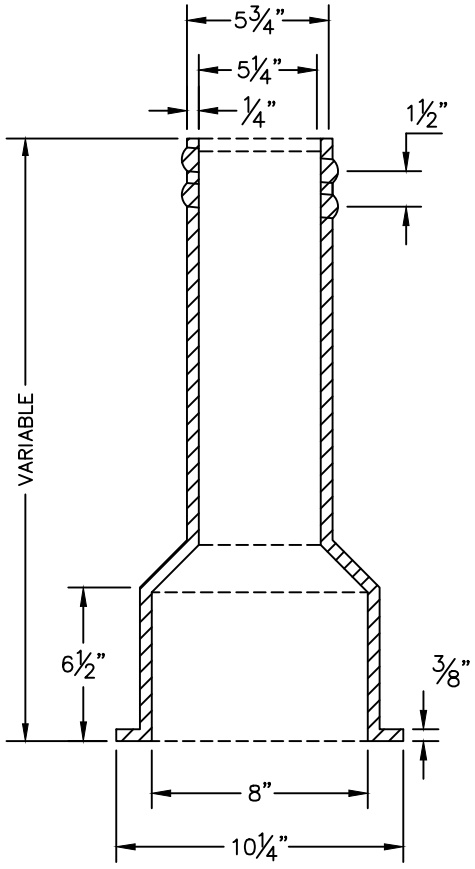
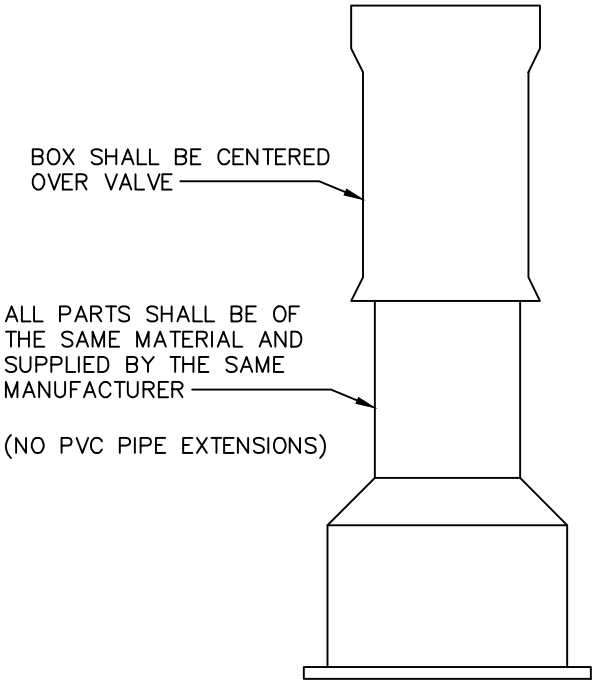


BOTTOM SECTION



COMPLETE BOX

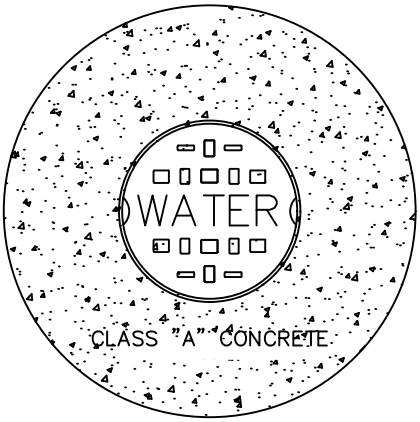
NOTES:

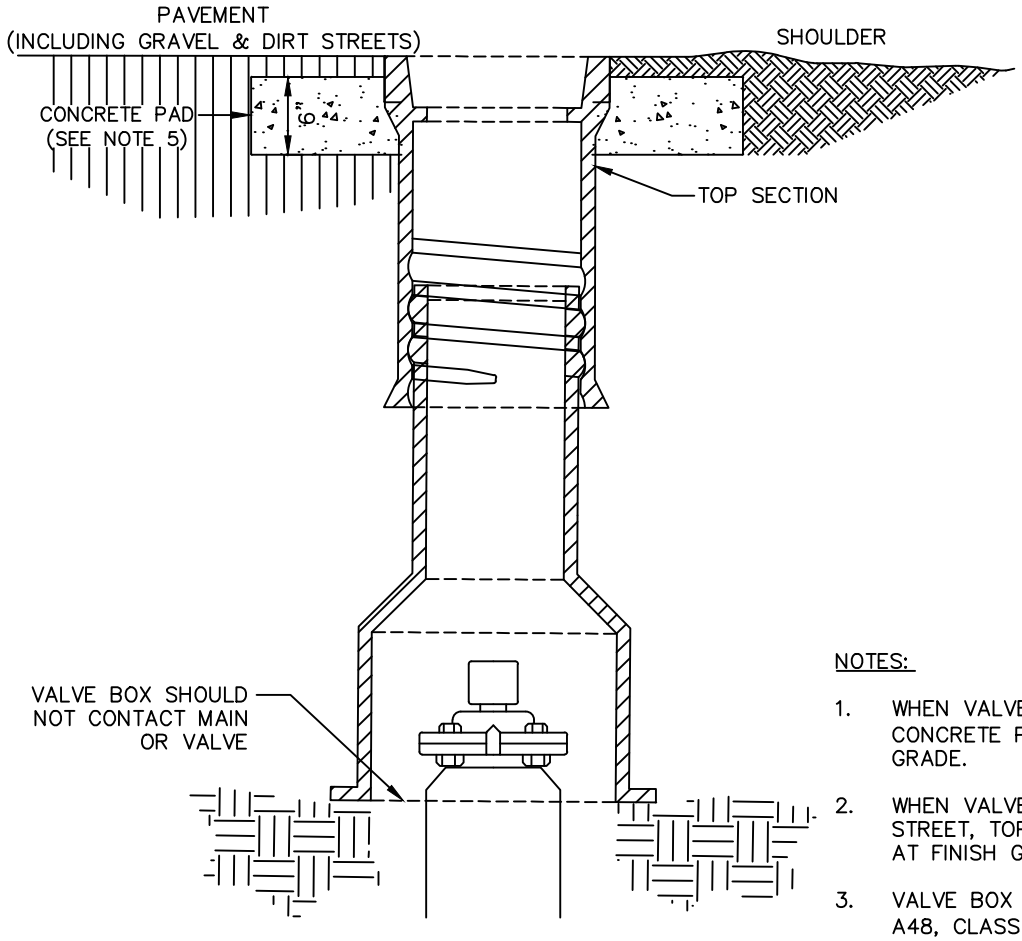
1. VALVE BOX WILL CONFORM TO ASTM A48, CLASS 35 B.

2. MINIMUM WEIGHTS:
   COVER.....13 LBS
   TOP SECTION.....60 LBS
   BOTTOM SECTION...49 LBS
   TOTAL...122 LBS

3. COVERS LOCATED IN CONCRETE OR PAVEMENT SHALL HAVE SKIRTS MIN. 4" DEEP AND COVERS SHALL WEIGH MIN. OF 24 LBS.

TOWN OF MOORESVILLE STANDARD DETAIL	WATER SYSTEMS CAST IRON VALVE BOX	June 2018 Revision 2 NTS | W - 14.0

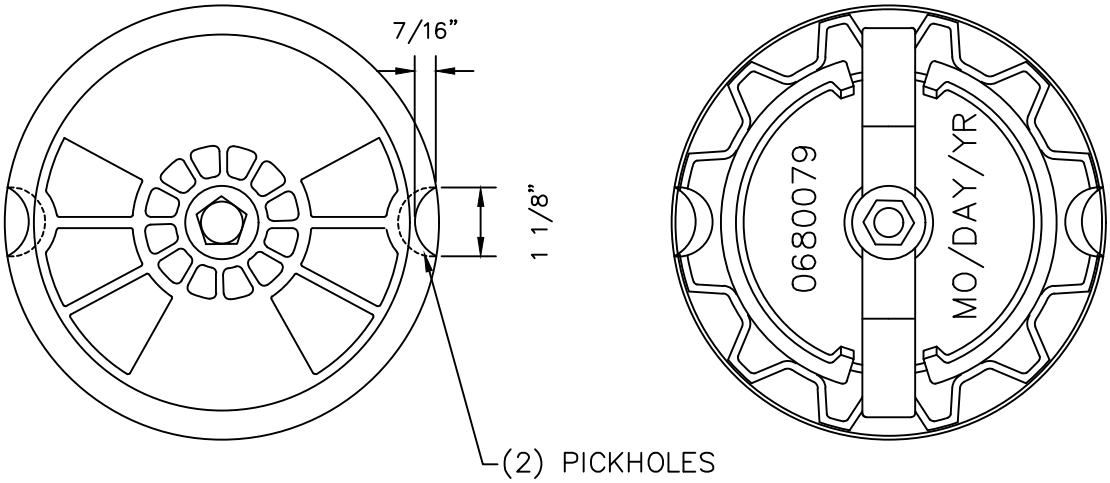




NOTES:

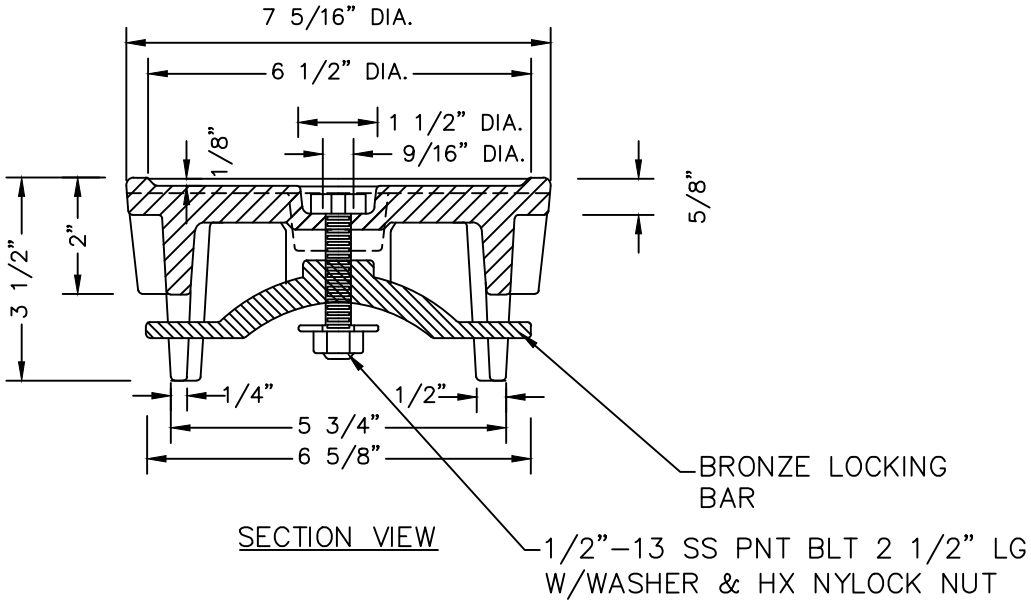
1. WHEN VALVE IS IN PAVEMENT TOP OF CONCRETE PAD TO BE 2" BELOW FINISH GRADE.
2. WHEN VALVE IS ON GRAVEL OR DIRT STREET, TOP OF CONCRETE PAD TO BE AT FINISH GRADE.
3. VALVE BOX WILL CONFORM TO ASTM A48, CLASS 30B. SEE SECTION 3.1(e).
4. IF VALVE BOX IS TO BE EXTENDED, ONLY DIP MAY BE USED.
5. BLACK COLORED CONCRETE SHALL BE USED FOR THE COLLAR WHEN LOCATED IN ASPHALT PAVEMENT.

TOWN OF MOORESVILLE STANDARD DETAIL	WATER SYSTEMS ROUND TOP VALVE BOX INSTALLATION	June 2018 Revision 2 NTS | W - 15.0



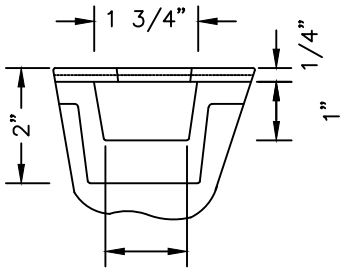
TOP VIEW

BOTTOM VIEW



SECTION VIEW

NOTE:
LOCKING LIDS ARE REQUIRED IN VICINITY OF PRIVATE WATER SYSTEMS OR AS DIRECTED BY THE DIRECTOR OF ENGINEERING.



1 1/2"
PICK HOLE DETAIL

TOWN OF MOORESVILLE STANDARD DETAIL	WATER SYSTEMS LOCKING VALVE BOX LID	March 2013 Revision 2	
		NTS	W - 16.0

BACKFLOW PREVENTION DETAILS:

BF-1.0 REDUCED PRESSURE PRINCIPLE ASSEMBLY
3/4"-2" ABOVE GROUND

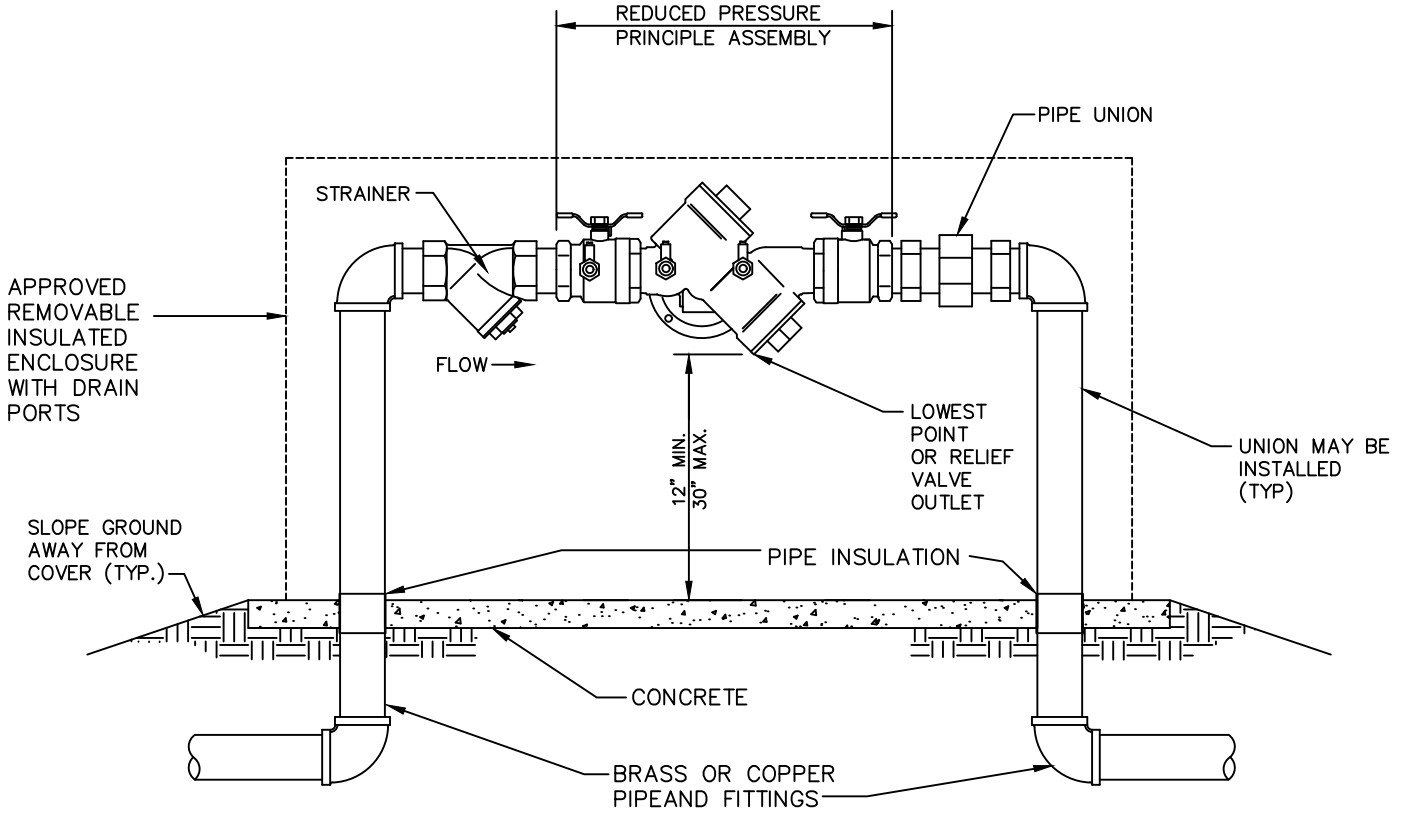
BF-1.0A DOUBLE CHECK VALVE ASSEMBLY
3/4"-2" ABOVE GROUND

BF-2.0 REDUCED PRESSURE PRINCIPLE ASSEMBLY
4" AND LARGER ABOVE GROUND

BF-2.0A DOUBLE CHECK VALVE ASSEMBLY
4" AND LARGER ABOVE GROUND

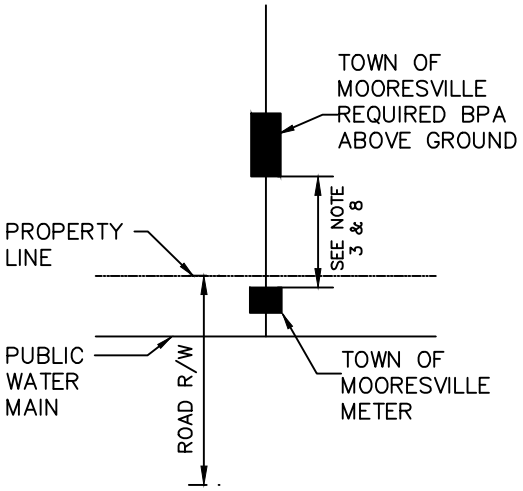
BF-3.0 FIRE SERVICE CONNECTION
ABOVE GROUND

BF-4.0 TEST COCK LOCATION



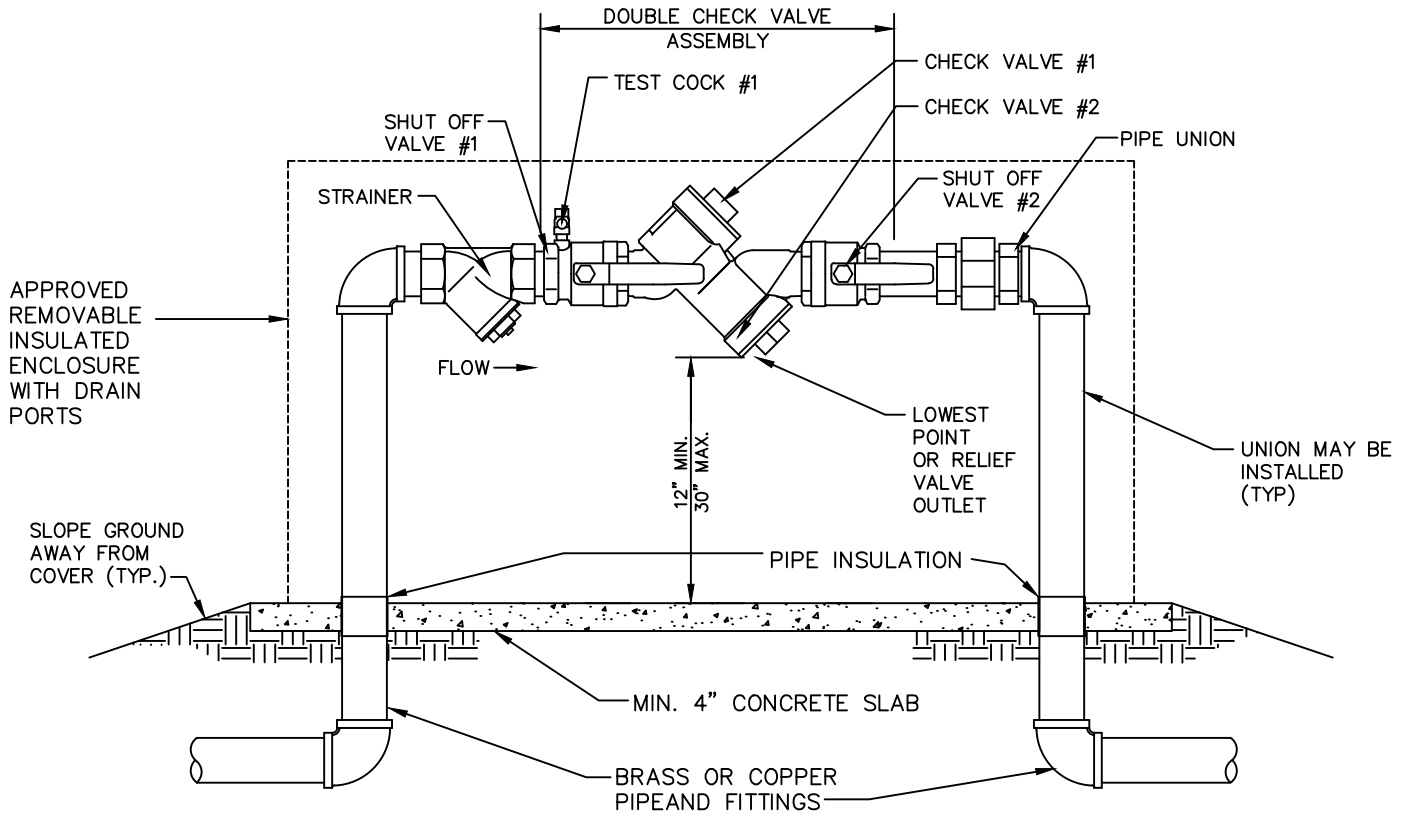
NOTES:

1. RESIDENTIAL IRRIGATION CONNECTIONS AND ALL COMMERCIAL CONNECTIONS MUST HAVE BACKFLOW PROTECTION. SEE BACKFLOW PREVENTION HANDBOOK FOR DETAILS.
2. REDUCED PRESSURE ZONE ASSEMBLIES (RP) MUST CONFORM TO TOWN OF MOORESVILLE SPECIFICATIONS.
3. ALL LOCATIONS FOR BPA'S REQUIRE APPROVAL OF THE DIRECTOR OF ENGINEERING AND MUST BE ON THE PROPERTY OWNER'S SIDE OF THE METER AND OUTSIDE OF THE RIGHT-OF-WAY AS CLOSE TO THE METER AS POSSIBLE.
4. EACH BPA IS REQUIRED TO BE TESTED BY AN APPROVED CERTIFIED TESTER PRIOR TO PLACING THE WATER SYSTEM IN SERVICE.
5. PIPE MATERIAL AND FITTINGS SHALL BE AS SPECIFIED IN TOWN OF MOORESVILLE LAND DEVELOPMENT DESIGN STANDARDS MANUAL.
6. ALL BACKFLOW PREVENTORS SHALL BE IN ACCORDANCE WITH APPENDIX B OF THE NC RULES GOVERNING PUBLIC WATER SYSTEMS.
7. A FIBER REINFORCED LIGHTWEIGHT PRECAST CONCRETE PAD MAY BE USED IN LIEU OF A CAST-IN-PLACE CONCRETE PAD.
8. THERE SHALL BE NO TAPS, PIPING BRANCHES, UNAPPROVED BYPASS PIPING, HYDRANTS, FIRE DEPT. CONNECTION POINTS, OR OTHER WATER USING APPURTENANCES CONNECTED TO THE SUPPLY LINE BETWEEN ANY WATER METER AND BACKFLOW PREVENTER.



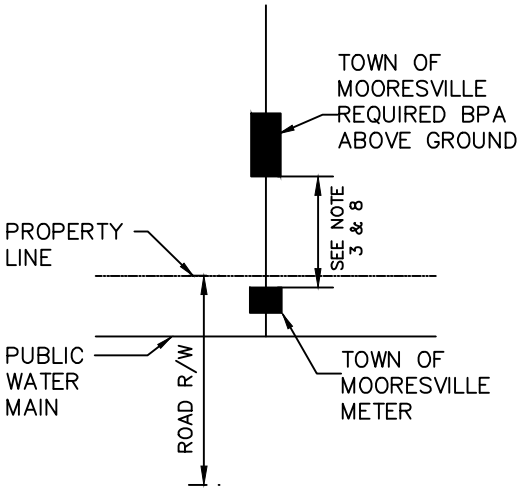
TYPICAL LOCATION REQUIREMENT
FOR ABOVE GROUND INSTALLATION
N.T.S.

TOWN OF MOORESVILLE STANDARD DETAIL	WATER SYSTEMS BACKFLOW PREVENTION REDUCED PRESSURE PRINCIPLE ASSEMBLY (RP) 3/4"-2" ABOVE GROUND	June 2018 Revision 3	
		NTS	BF-1.0



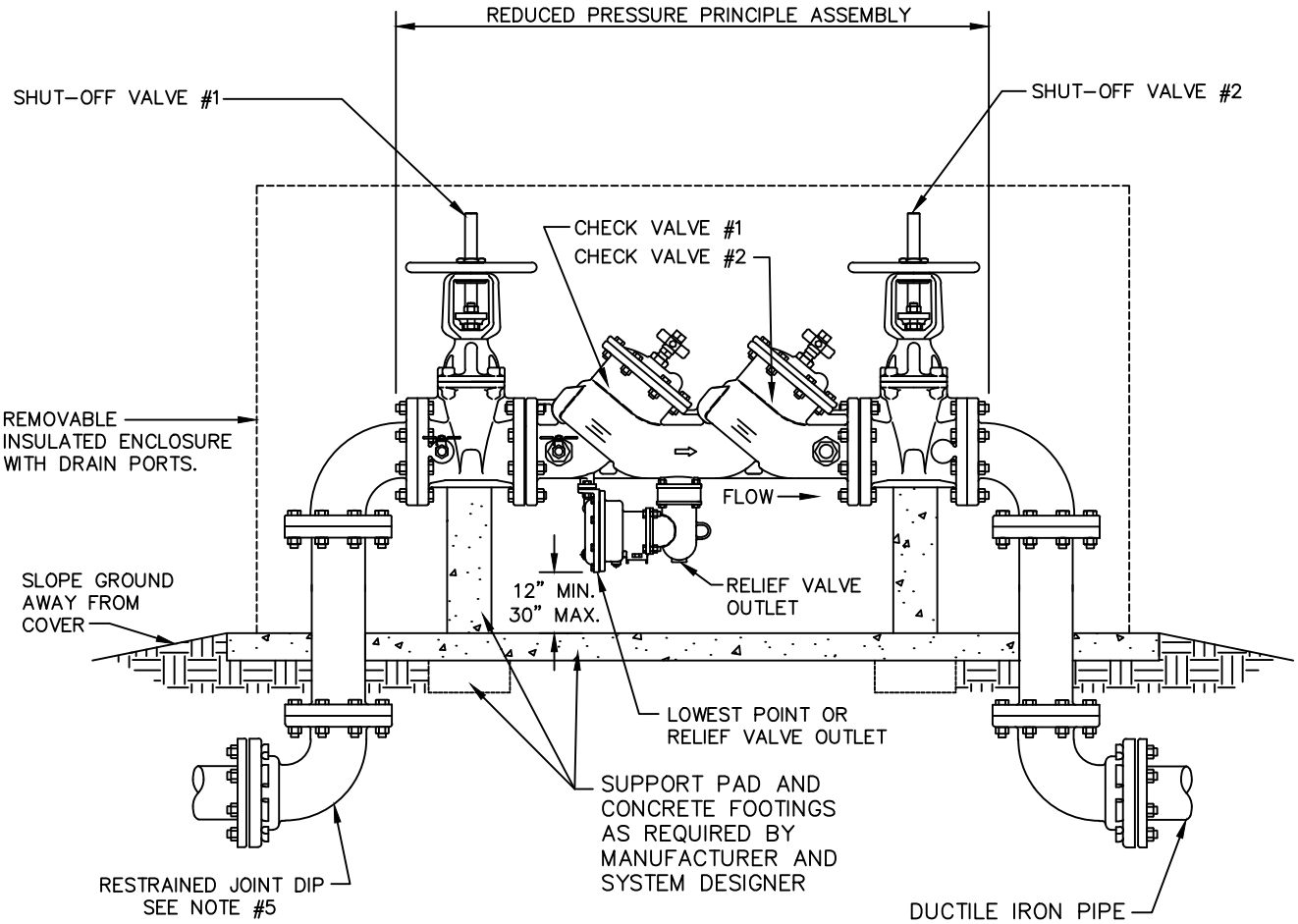
NOTES:

1. RESIDENTIAL IRRIGATION CONNECTIONS AND ALL COMMERCIAL CONNECTIONS MUST HAVE BACKFLOW PROTECTION. SEE BACKFLOW PREVENTION HANDBOOK FOR DETAILS.
2. DOUBLE CHECK VALVE ASSEMBLIES MUST CONFORM TO TOWN OF MOORESVILLE SPECIFICATIONS.
3. ALL LOCATIONS FOR BPA'S REQUIRE APPROVAL OF THE DIRECTOR OF ENGINEERING AND MUST BE ON THE PROPERTY OWNER'S SIDE OF THE METER AND OUTSIDE OF THE RIGHT-OF-WAY AS CLOSE TO THE METER AS POSSIBLE.
4. EACH BPA IS REQUIRED TO BE TESTED BY AN APPROVED CERTIFIED TESTER PRIOR TO PLACING THE WATER SYSTEM IN SERVICE.
5. PIPE MATERIAL AND FITTINGS SHALL BE AS SPECIFIED IN TOWN OF MOORESVILLE LAND DEVELOPMENT DESIGN STANDARDS MANUAL.
6. ALL BACKFLOW PREVENTORS SHALL BE IN ACCORDANCE WITH APPENDIX B OF THE NC RULES GOVERNING PUBLIC WATER SYSTEMS.
7. A FIBER REINFORCED LIGHTWEIGHT PRECAST CONCRETE PAD MAY BE USED IN LIEU OF A CAST-IN-PLACE CONCRETE PAD.
8. THERE SHALL BE NO TAPS, PIPING BRANCHES, UNAPPROVED BYPASS PIPING, HYDRANTS, FIRE DEPT. CONNECTION POINTS, OR OTHER WATER USING APPURTENANCES CONNECTED TO THE SUPPLY LINE BETWEEN ANY WATER METER AND BACKFLOW PREVENTER.



TYPICAL LOCATION REQUIREMENT FOR ABOVE GROUND INSTALLATION
N.T.S.

TOWN OF MOORESVILLE STANDARD DETAIL	WATER SYSTEMS BACKFLOW PREVENTION DOUBLE CHECK VALVE ASSEMBLY (DC) 3/4"-2" ABOVE GROUND	June 2018 Revision 1 NTS / BF-1.0A



NOTES:

1. RESIDENTIAL IRRIGATION CONNECTIONS AND ALL COMMERCIAL CONNECTIONS MUST HAVE BACKFLOW PROTECTION. SEE BACKFLOW PREVENTION HANDBOOK FOR DETAILS.

2. REDUCED PRESSURE ZONE ASSEMBLIES (RP) MUST CONFORM TO TOWN OF MOORESVILLE SPECIFICATIONS.

3. ALL LOCATIONS FOR BPA'S REQUIRE APPROVAL OF THE DIRECTOR OF ENGINEERING AND MUST BE ON THE PROPERTY OWNER'S SIDE OF THE METER AND OUTSIDE OF THE RIGHT–OF–WAY AS CLOSE TO THE METER AS POSSIBLE.

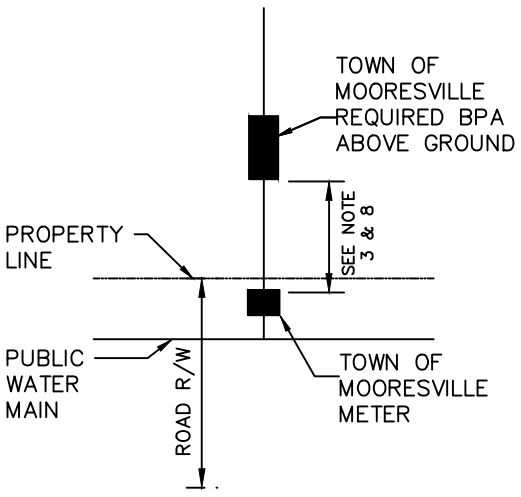
4. EACH BPA IS REQUIRED TO BE TESTED BY AN APPROVED CERTIFIED TESTER PRIOR TO PLACING THE WATER SYSTEM IN SERVICE.

5. DUCTILE IRON PIPE CONNECTIONS ARE TO BE RESTRAINED MECHANICAL JOINT BELOW GRADE, AND FLANGE CONNECTIONS ABOVE GRADE.

6. ALL BACKFLOW PREVENTORS SHALL BE IN ACCORDANCE WITH APPENDIX B OF THE NC RULES GOVERNING PUBLIC WATER SYSTEMS.

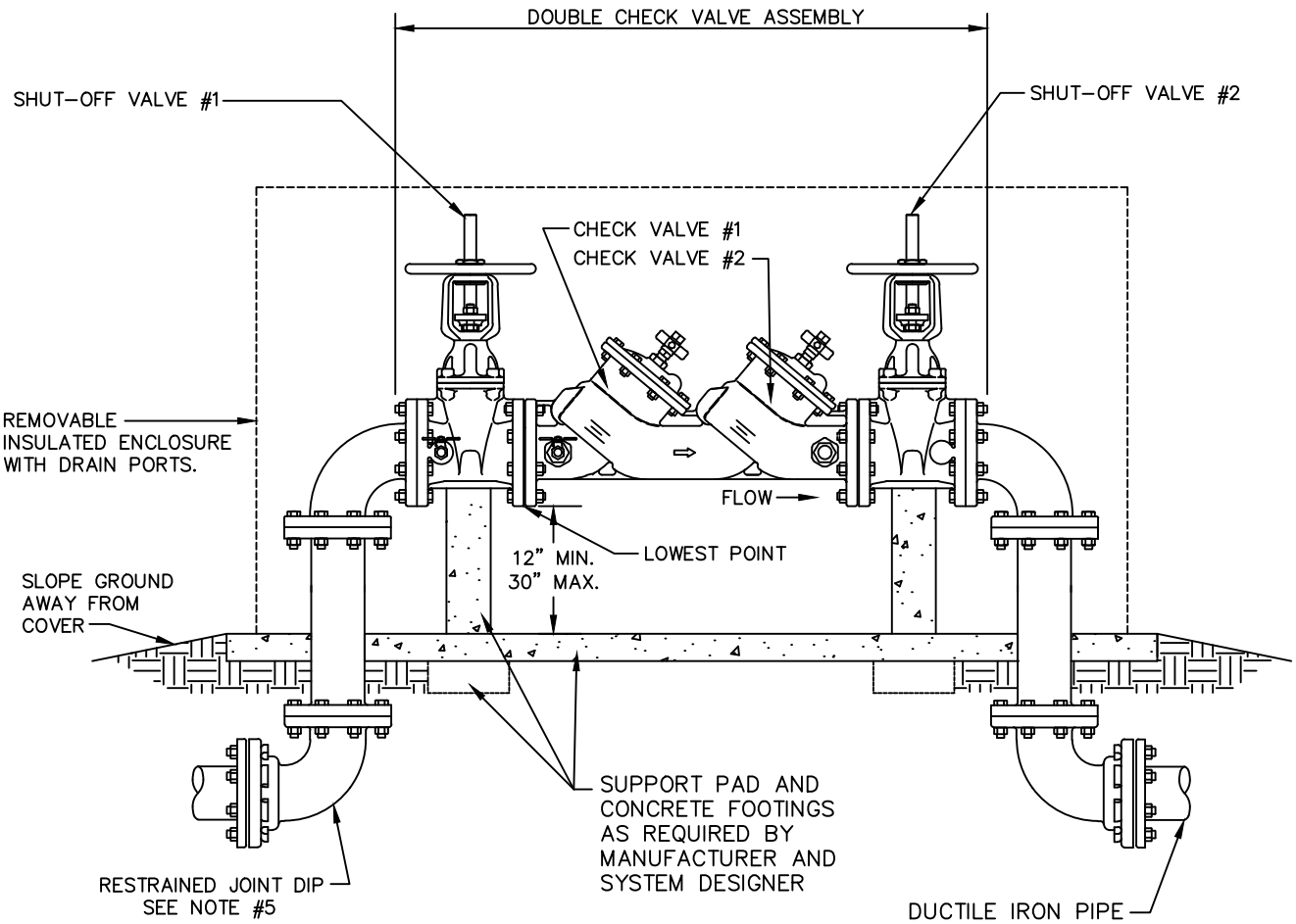
7. A FIBER REINFORCED LIGHTWEIGHT PRECAST CONCRETE PAD MAY BE USED IN LIEU OF A CAST–IN–PLACE CONCRETE PAD.

8. THERE SHALL BE NO TAPS, PIPING BRANCHES, UNAPPROVED BYPASS PIPING, HYDRANTS, FIRE DEPT. CONNECTION POINTS, OR OTHER WATER USING APPURTENANCES CONNECTED TO THE SUPPLY LINE BETWEEN ANY WATER METER AND BACKFLOW PREVENTER.



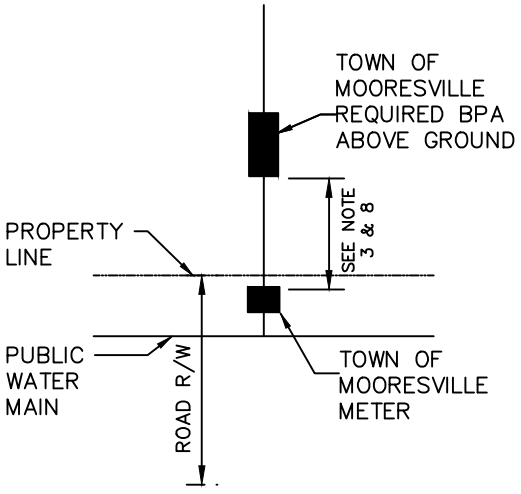
TYPICAL LOCATION REQUIREMENT FOR ABOVE GROUND INSTALLATION
N.T.S.

TOWN OF MOORESVILLE STANDARD DETAIL	WATER SYSTEMS BACKFLOW PREVENTION REDUCED PRESSURE PRINCIPLE ASSEMBLY (RP) 4" AND LARGER ABOVE GROUND	June 2018 Revision 3 NTS / BF-2.0



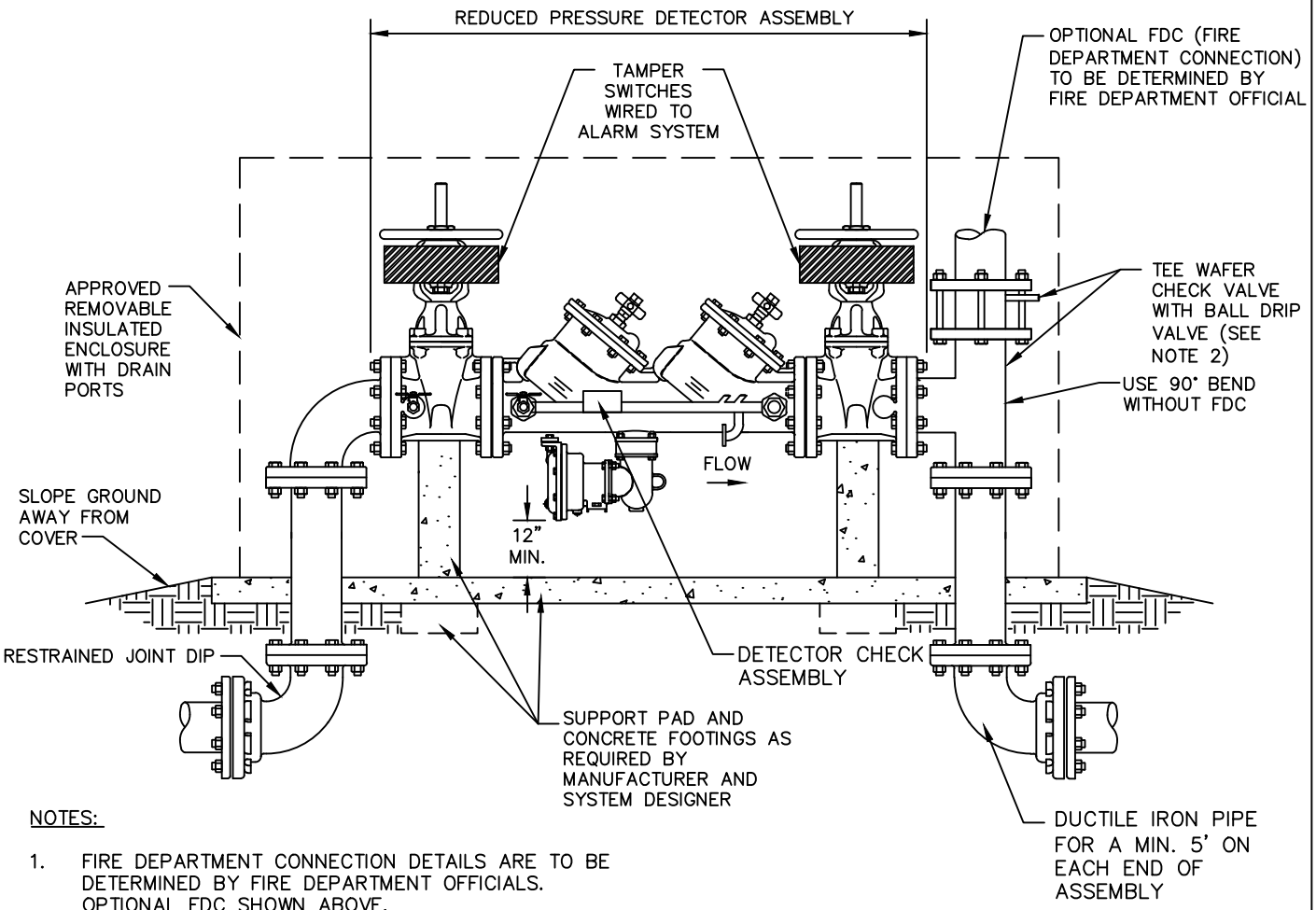
NOTES:

1. RESIDENTIAL IRRIGATION CONNECTIONS AND ALL COMMERCIAL BACKFLOW PREVENTION HANDBOOK FOR DETAILS.
2. DOUBLE CHECK VALVE ASSEMBLIES (DCVA) MUST CONFORM TO TOWN OF MOORESVILLE SPECIFICATIONS.
3. ALL LOCATIONS FOR BPA'S REQUIRE APPROVAL OF THE DIRECTOR OF ENGINEERING AND MUST BE ON THE PROPERTY OWNER'S SIDE OF THE METER AND OUTSIDE OF THE RIGHT-OF-WAY AS CLOSE TO THE METER AS POSSIBLE.
4. EACH BPA IS REQUIRED TO BE TESTED BY AN APPROVED CERTIFIED TESTER PRIOR TO PLACING THE WATER SYSTEM IN SERVICE.
5. DUCTILE IRON PIPE CONNECTIONS ARE TO BE RESTRAINED MECHANICAL JOINT BELOW GRADE, AND FLANGE CONNECTIONS ABOVE GRADE.
6. ALL BACKFLOW PREVENTORS SHALL BE IN ACCORDANCE WITH APPENDIX B OF THE NC RULES GOVERNING PUBLIC WATER SYSTEMS.
7. A FIBER REINFORCED LIGHTWEIGHT PRECAST CONCRETE PAD MAY BE USED IN LIEU OF A CAST-IN-PLACE CONCRETE PAD.
8. THERE SHALL BE NO TAPS, PIPING BRANCHES, UNAPPROVED BYPASS PIPING, HYDRANTS, FIRE DEPT. CONNECTION POINTS, OR OTHER WATER USING APPURTENANCES CONNECTED TO THE SUPPLY LINE BETWEEN ANY WATER METER AND BACKFLOW PREVENTER.



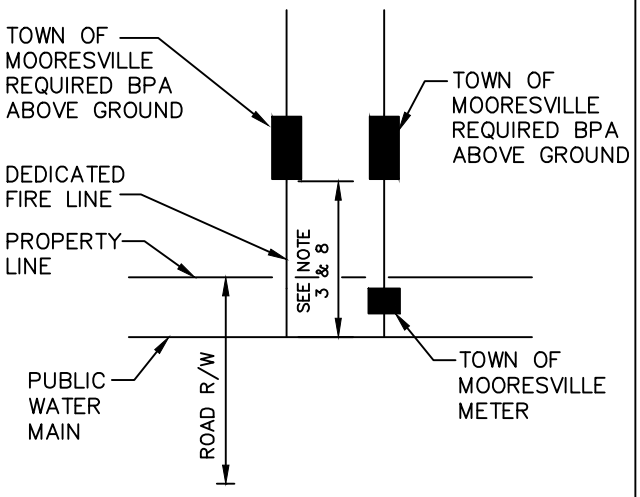
TYPICAL LOCATION REQUIREMENT FOR ABOVE GROUND INSTALLATION
N.T.S.

TOWN OF MOORESVILLE STANDARD DETAIL	WATER SYSTEMS BACKFLOW PREVENTION DOUBLE CHECK VALVE ASSEMBLY (DCVA) 4" AND LARGER ABOVE GROUND	June 2018 Revision 1 NTS / BF-2.0A



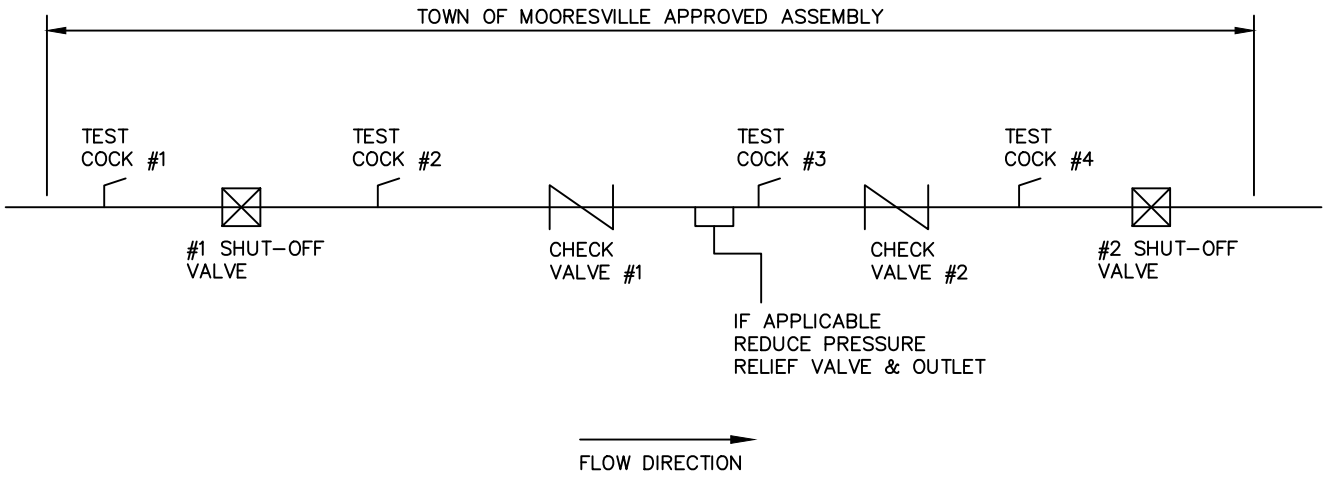
NOTES:

1. FIRE DEPARTMENT CONNECTION DETAILS ARE TO BE DETERMINED BY FIRE DEPARTMENT OFFICIALS. OPTIONAL FDC SHOWN ABOVE.
2. WATER CHECK VALVE MUST BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S REQUIREMENTS FOR HORIZONTAL OR VERTICAL INSTALLATION.
3. REDUCED PRESSURE ZONE ASSEMBLIES (RP) MUST CONFORM TO TOWN OF MOORESVILLE SPECIFICATIONS.
4. ALL LOCATIONS FOR BPA's REQUIRE APPROVAL OF THE DIRECTOR OF ENGINEERING AND MUST BE ON THE PROPERTY OWNER'S SIDE OF THE METER AND OUTSIDE OF THE RIGHT-OF-WAY AS CLOSE TO THE WATERLINE TAP OR TEE AS POSSIBLE.
5. EACH BPA IS REQUIRED TO BE TESTED BY AN APPROVED CERTIFIED TESTER PRIOR TO PLACING THE WATER SYSTEM IN SERVICE.
6. ALL BACKFLOW PREVENTORS SHALL BE IN ACCORDANCE WITH APPENDIX B OF THE NC RULES GOVERNING PUBLIC WATER SYSTEMS.
7. A FIBER REINFORCED LIGHTWEIGHT PRECAST CONCRETE PAD MAY BE USED IN LIEU OF A CAST-IN-PLACE CONCRETE PAD.
8. THERE SHALL BE NO TAPS, PIPING BRANCHES, UNAPPROVED BYPASS PIPING, HYDRANTS, FIRE DEPT. CONNECTION POINTS, OR OTHER WATER USING APPURTENANCES CONNECTED TO THE SUPPLY LINE BETWEEN ANY FIRE LINE TAP AND BACKFLOW PREVENTER.



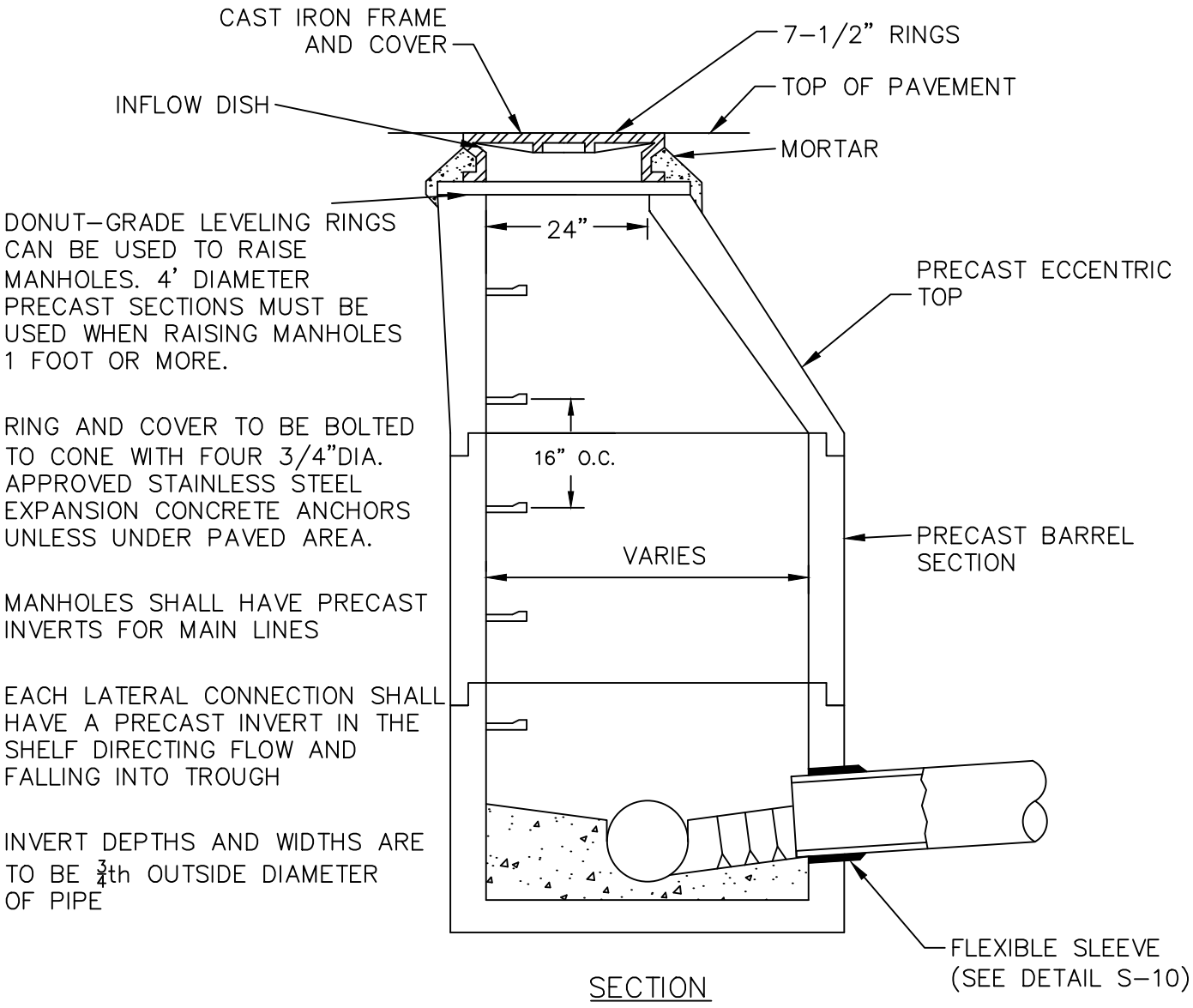
TYPICAL LOCATION REQUIREMENT
FOR ABOVE GROUND INSTALLATION
N.T.S.

TOWN OF MOORESVILLE STANDARD DETAIL	WATER SYSTEMS BACKFLOW PREVENTION FIRE SERVICE CONNECTION ABOVE GROUND	June 2018 Revision 4	
		NTS	BF-3.0



TOWN OF MOORESVILLE STANDARD DETAIL	WATER SYSTEMS BACKFLOW PREVENTION TEST COCK LOCATIONS	January 2009 Revision 1	
		NTS	BF-4.0

STANDARD SEWER SYSTEM DETAILS:

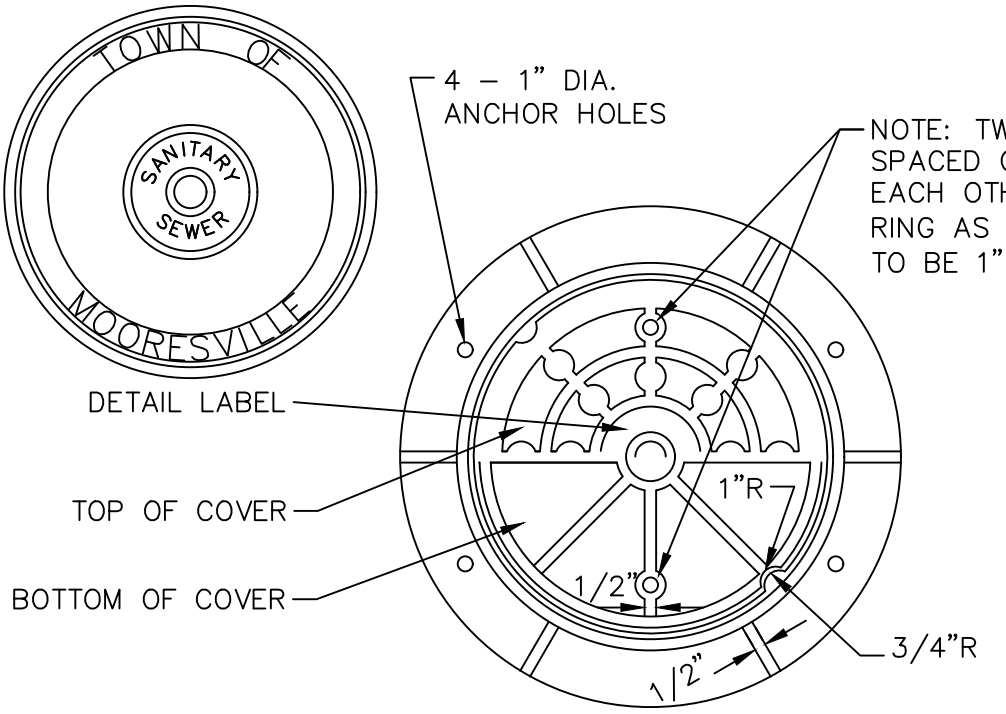


SECTION

NOTES:

1. PRECAST MANHOLE SHALL CONFORM TO ASTM C478, WITH AASHTO M198 BUTYL SEALS BETWEEN JOINTS AND 6" ADHESIVE BUTYL TAPE ON THE OUTSIDE OF JOINTS.
2. MANHOLE RIM SHALL BE FLUSH WITH PAVED SURFACES AND LAWNS AND 2 TO 3 FEET ABOVE GRADE IN UNIMPROVED AREAS.
3. SEE DETAIL S–9 FOR PRECAST MANHOLE INVERTS.
4. MANHOLES SHALL BE BEDDED ON 8" STABILIZATION STONE AS OR AS DIRECTED BY THE INSPECTOR OR SOIL ENGINEER.
5. ALL VENTED MANHOLES SHALL HAVE AN MANHOLE INSERT DISH. SEE STANDARDS 4.4 b FOR DETAILS.

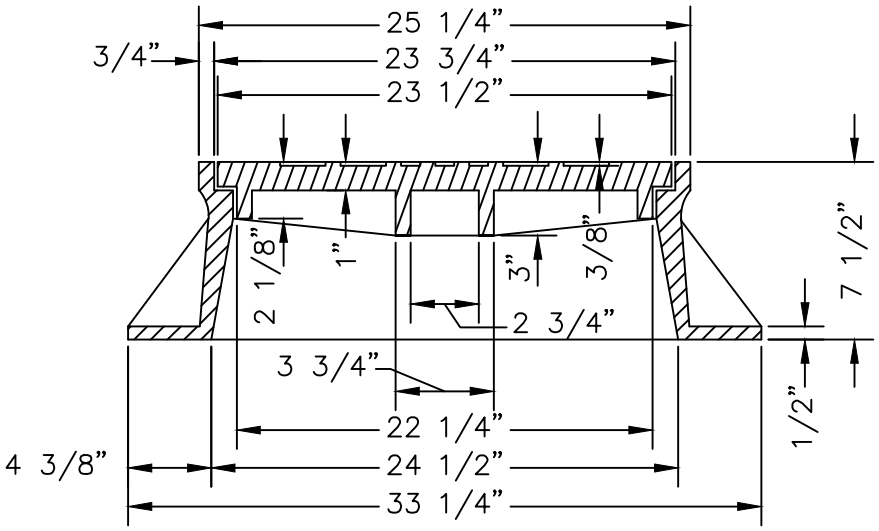
TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS STANDARD MANHOLE	January 2009 Revision 1	
		NTS	S - 1.0



MINIMUM AVERAGE WEIGHTS

RING	190 LBS.
COVER	120 LBS.
	310 LBS.

PLAN



SECTION

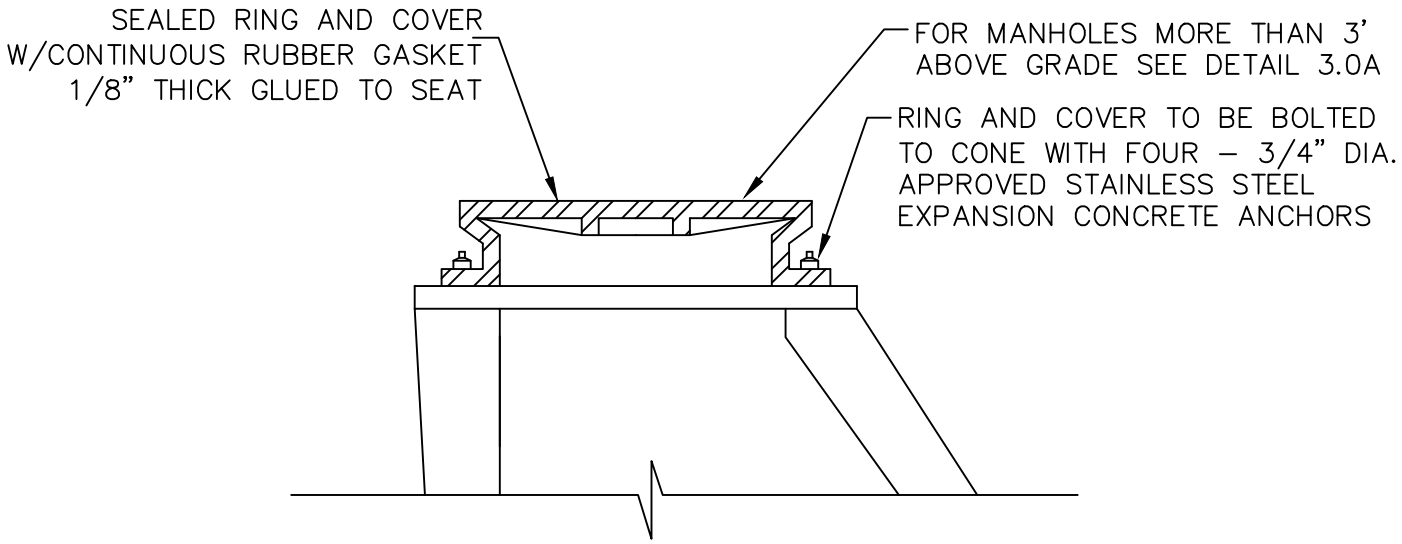
NOTES:

1. RING AND COVER WILL HAVE MACHINED SEAT AND WILL CONFORM TO ASTM A48, CLASS 35B. RING AND COVER WILL BE DESIGNED TO SUPPORT AN H–20 WHEEL LOAD ALSO MEETING NCDOT STANDARD 840.54.

2. DIMENSIONS MAY VARY BUT MANHOLE RING AND COVER ARE TO BE INTERCHANGEABLE WITH DIMENSIONS SHOWN.

3. FOUR–INCH RINGS IN ROADWAYS MUST BE APPROVED BY THE DIRECTOR OF ENGINEERING, AND SHALL BE BOLTED TO THE CONE WITH FOUR 3/4–INCH DIA. STAINLESS STEEL ANCHORS.

TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS STANDARD RING & COVER	January 2014 Revision 2	
		NTS	S-2.0

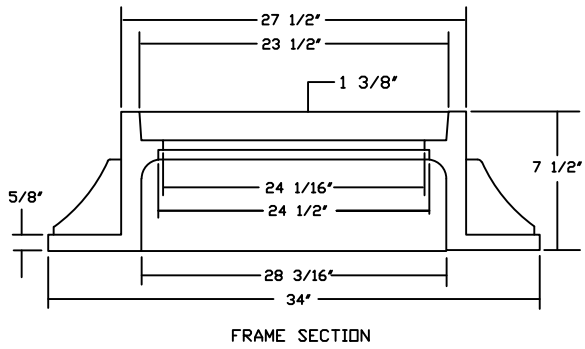


SECTION

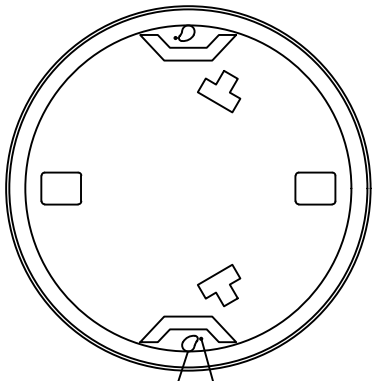
NOTE:

1. SEE DETAIL S–1 FOR MANHOLE DETAILS.

TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS SEALED MANHOLE	January 2012 Revision 2 NTS | S-3.0

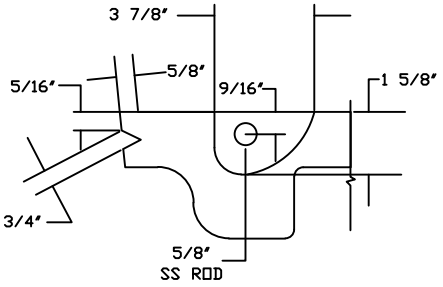


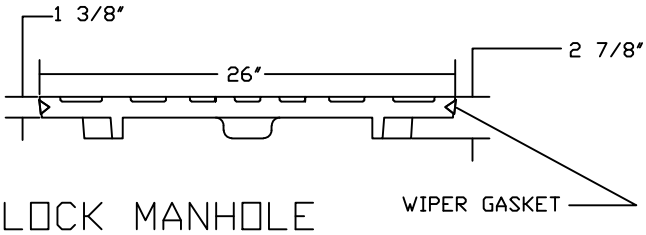
FRAME SECTION



(2) CAM LOCKS

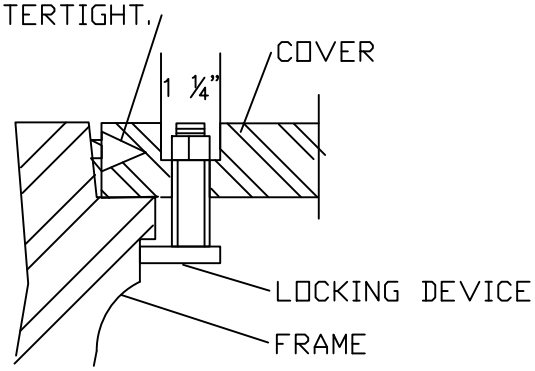
(2) SS ROLL PINS
1/2" DIA x 1 3/4"



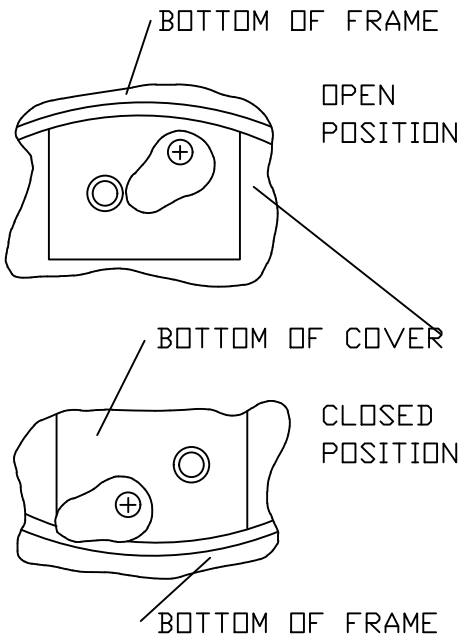


TYPICAL CAM LOCK MANHOLE

FINNED GASKET IN VERTICAL FACE OF COVER TO MAKE WATERTIGHT.

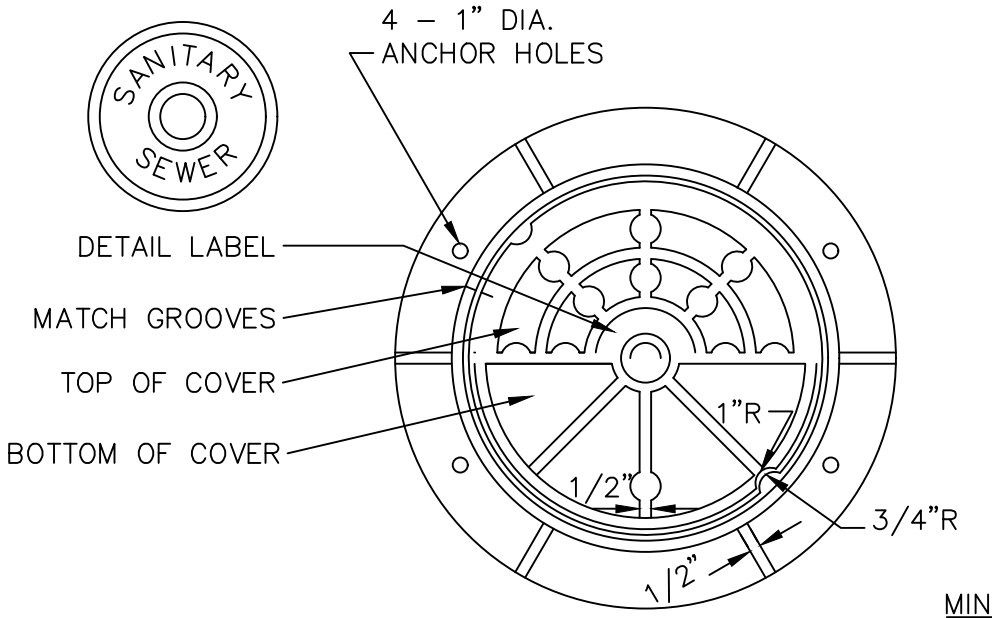


STANDARD - PENTAGON HEAD S.S.
OPTIONAL - S.S. HEX HEAD BOLT



TYPICAL LOCKING DEVICE
(FOR SEALED OR SECURED MANHOLES)

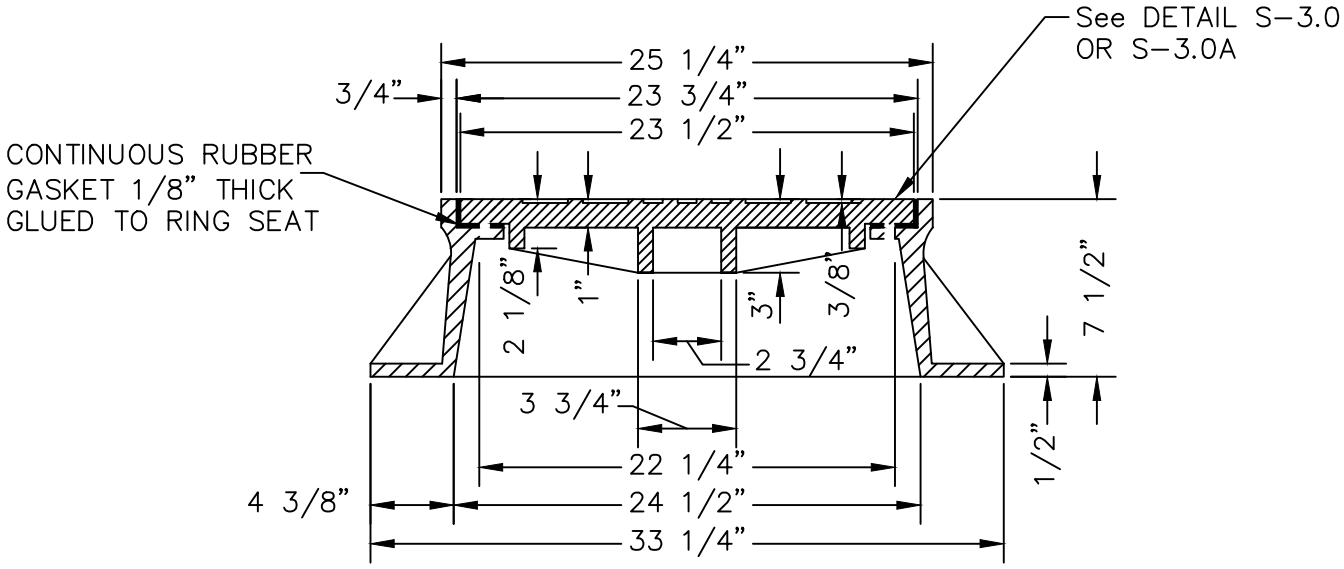
TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS CAMLOCK DETAILS	January 2014 Revision 3 NTS | S-3.0A



MINIMUM AVERAGE WEIGHTS

RING	190 LBS.
COVER	120 LBS.
	310 LBS.

PLAN

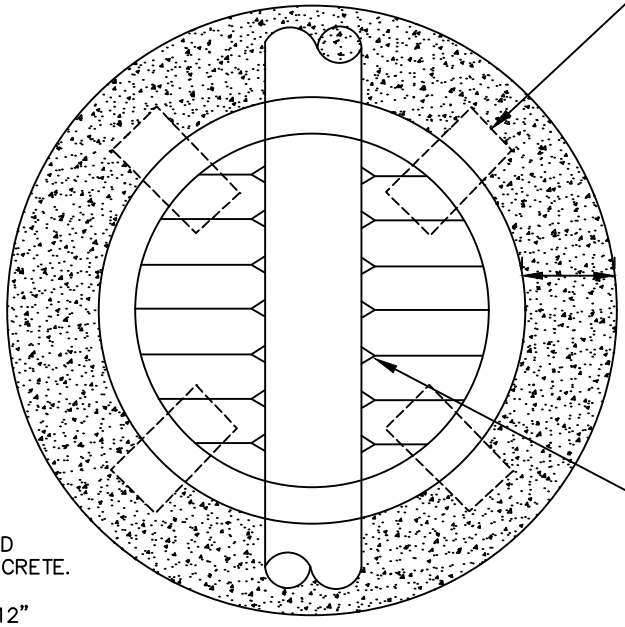


SECTION

NOTES:

1. RING AND COVER WILL HAVE MACHINED SEAT AND WILL CONFORM TO ASTM A48, CLASS 35B. RING AND COVER WILL BE DESIGNED TO SUPPORT AN H–20 WHEEL LOAD ALSO MEETING NCDOT STANDARD 840.54.
2. DIMENSIONS MAY VARY BUT MANHOLE RING AND COVER ARE TO BE INTERCHANGEABLE WITH DIMENSIONS SHOWN.
3. SEE DETAIL S–3.0A FOR CAMLOCK DETAILS.

TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS SEALED RING & COVER	June 2018 Revision 2	
		NTS	S-4.0



PLAN

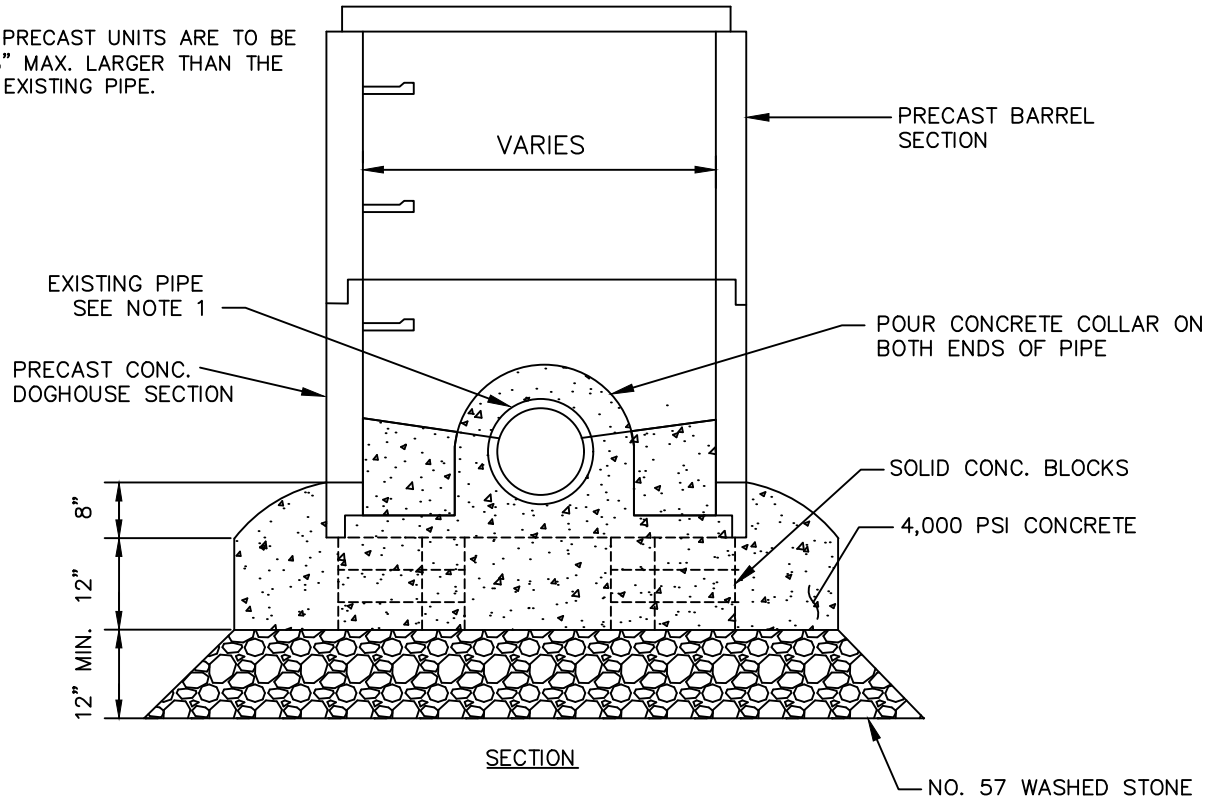
NOTES:

1. FILL DOGHOUSE OPENING AROUND EXISTING PIPE WITH 4,000 PSI CONCRETE.

2. ALLOW CONC. TO FLOW A MIN. 12" BEYOND BASE OF STRUCTURE.

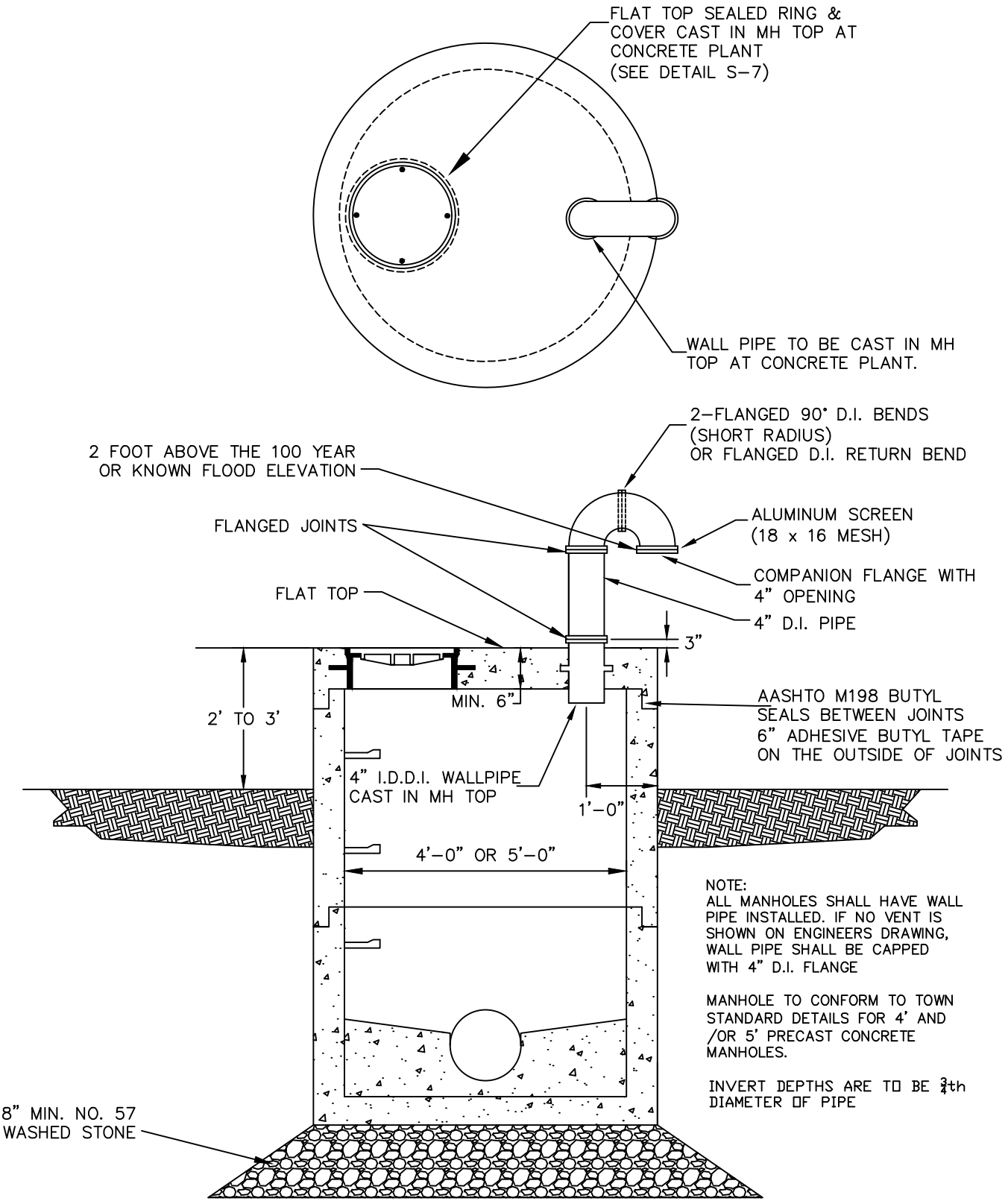
3. MANHOLE TO BE BUILT IN ACCORDANCE WITH TOWN STANDARD DETAILS FOR 4' AND/OR 5' MANHOLES.

4. HOLES IN PRECAST UNITS ARE TO BE 4" MIN. TO 8" MAX. LARGER THAN THE O.D. OF THE EXISTING PIPE.

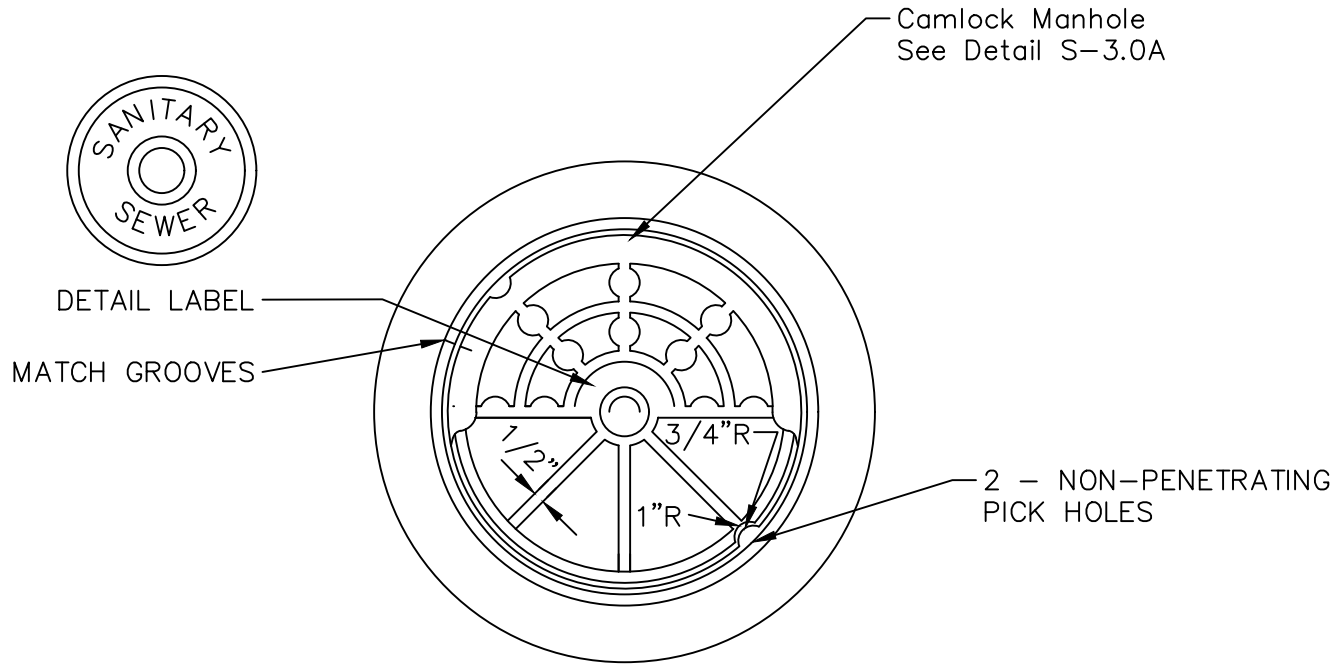


SECTION

TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS DOGHOUSE MANHOLE	January 2009 Revision 1
		NTS / S - 5.0



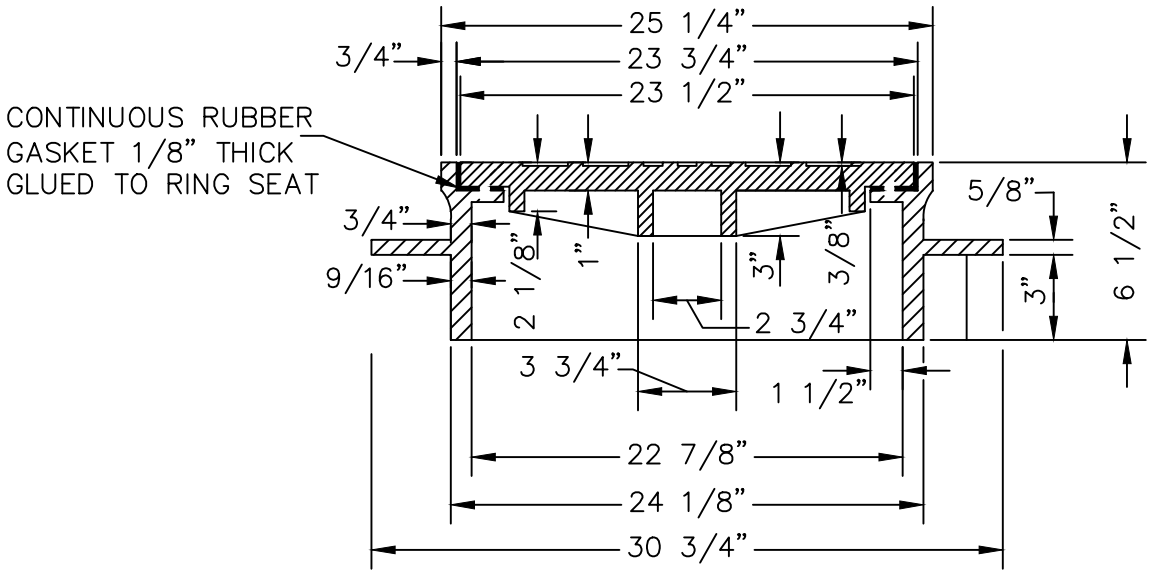
TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS FLAT TOP SEALED AND VENTED MANHOLE	January 2009 Revision 1 NTS | S - 6.0



PLAN

MINIMUM AVERAGE WEIGHTS

RING	190 LBS.
COVER	120 LBS.
	310 LBS.



SECTION

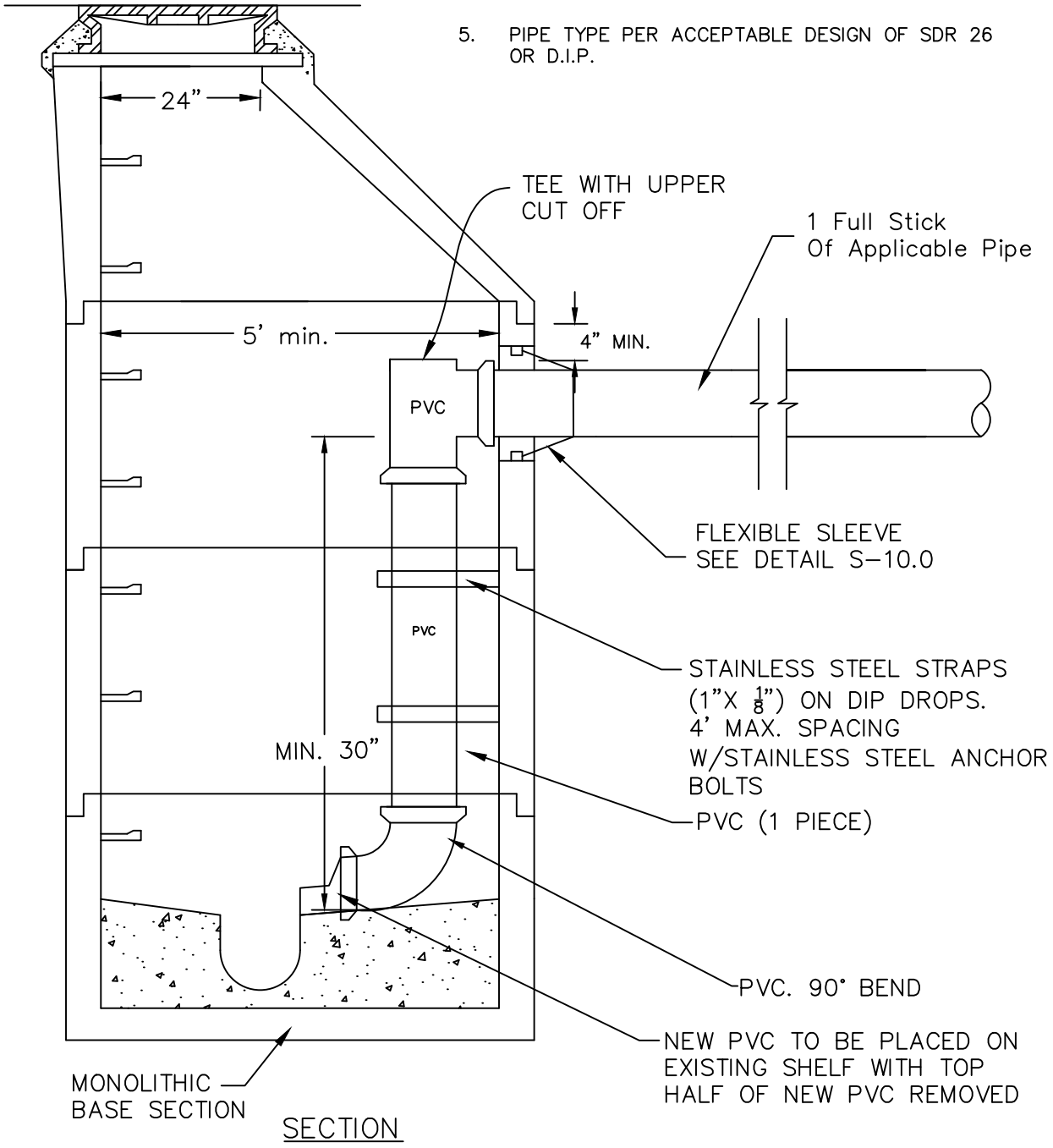
NOTES:

1. RING AND COVER WILL HAVE MACHINED SEAT AND WILL CONFORM TO ASTM A48, CLASS 35B. RING AND COVER WILL BE DESIGNED TO SUPPORT AN H-20 WHEEL LOAD ALSO MEETING NCDOT STANDARD 840.54.
2. DIMENSIONS MAY VARY BUT MANHOLE RING AND COVER ARE TO BE INTERCHANGEABLE WITH DIMENSIONS SHOWN.
3. SEE DETAIL S-3.0A FOR CAMLOCK DETAILS.

TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS FLAT TOP SEALED RING & COVER	June 2018 Revision 1 NTS | S-7.0

NOTES:

1. INSIDE DROPS ALLOWED ONLY UNDER CIRCUMSTANCES WHERE OUTSIDE DROPS ARE IMPOSSIBLE DUE TO EXISTING UTILITIES OR OTHER CONFLICTS AS APPROVED BY THE DIRECTOR OF ENGINEERING.
2. MANHOLE TO BE BUILT IN ACCORDANCE WITH TOWN STANDARD DETAILS, 5' DIAMETER OR GREATER MANHOLES.
3. TEE AND 90 DEGREE BENDS CONNECTED TO PIPE WITH MEGA-LUG TYPE RIGID RESTRAINTS
4. PIPE SIZE NOT TO EXCEED 24"
5. PIPE TYPE PER ACCEPTABLE DESIGN OF SDR 26 OR D.I.P.

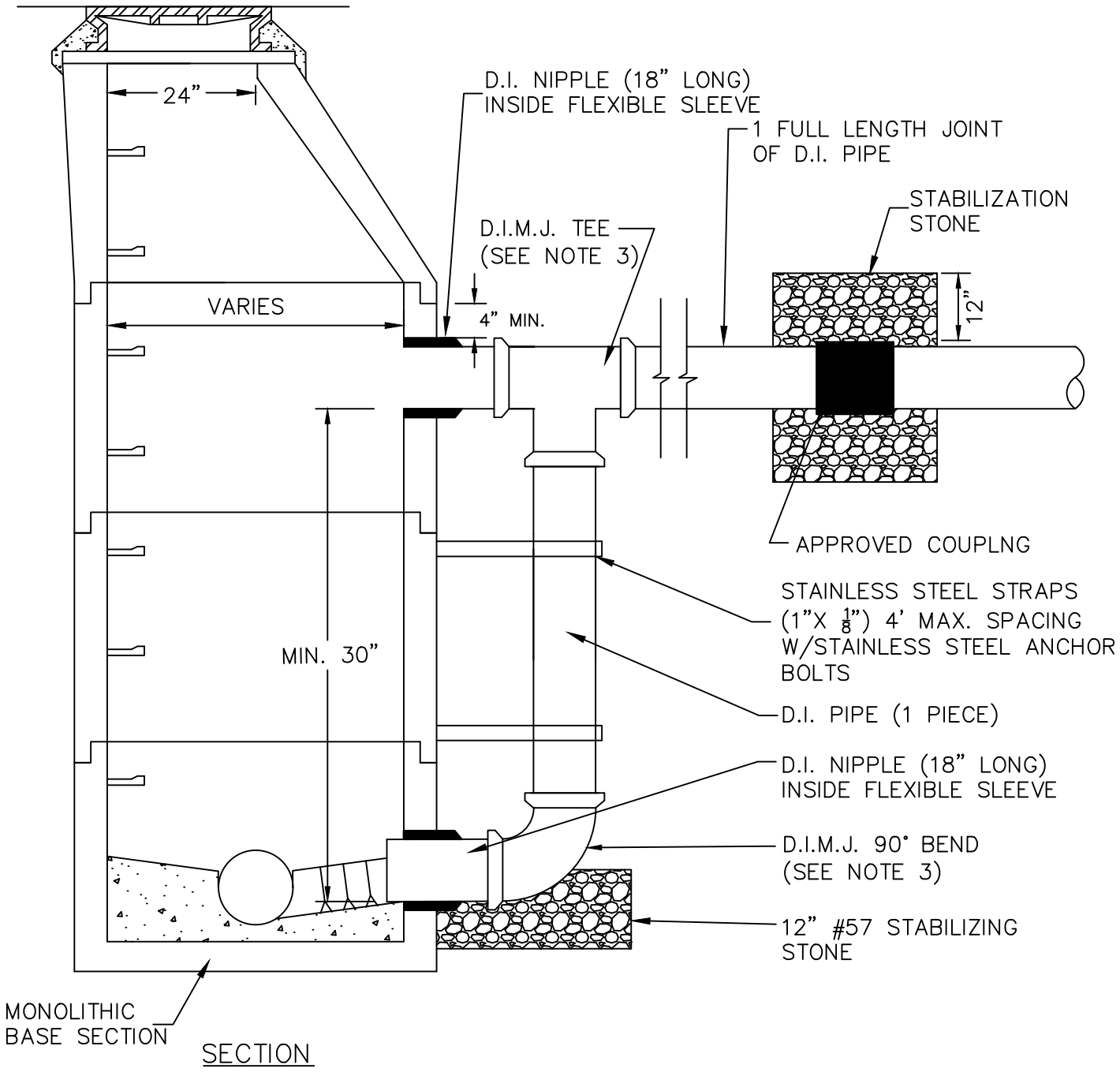


SECTION

TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS INSIDE DROP MANHOLE	June 2018 Revision 4	
		NTS	S-8.0

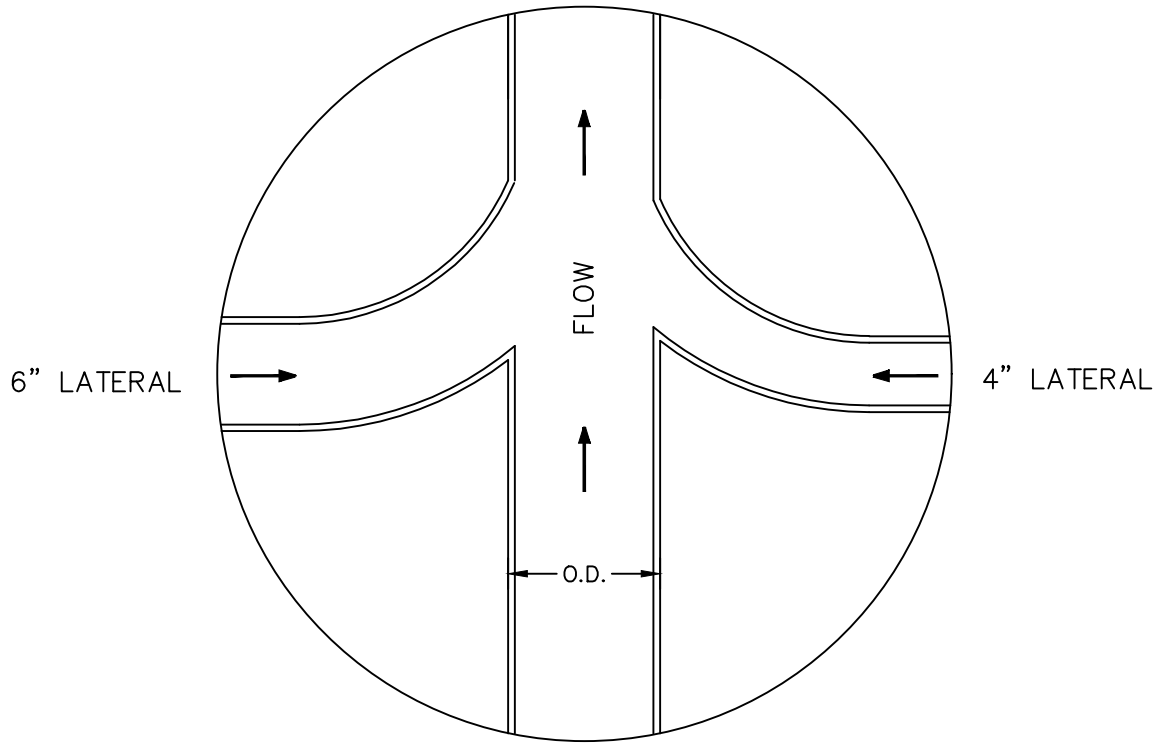
NOTES:

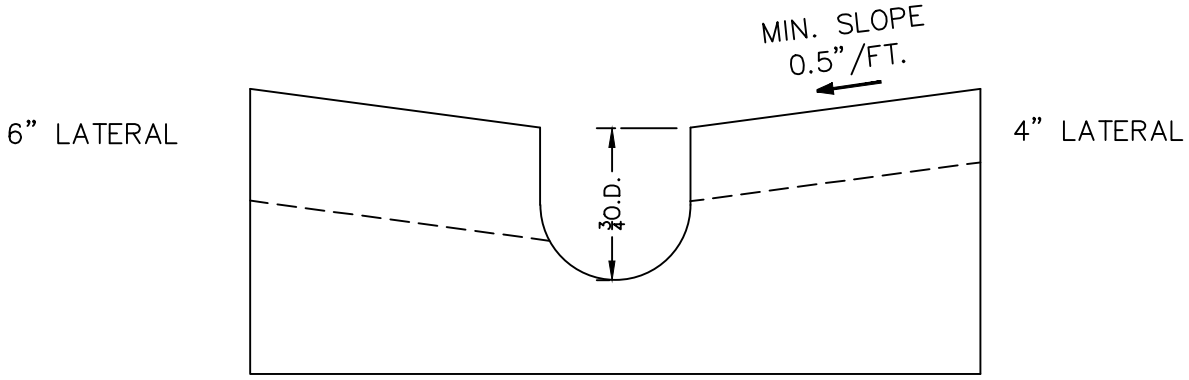
1. MANHOLE TO BE BUILT IN ACCORDANCE WITH TOWN STANDARD DETAILS FOR 4' AND/OR 5' MANHOLES.
2. OUTSIDE DROP SHALL NOT ENTER MANHOLE IN CONE SECTION.
3. TEE AND 90° BEND CONNECTED TO PIPE WITH MEGA-LUG TYPE RIGID RESTRAINTS.



SECTION

TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS OUTSIDE DROP MANHOLE	June 2018 Revision 2	
		NTS	S-8.5





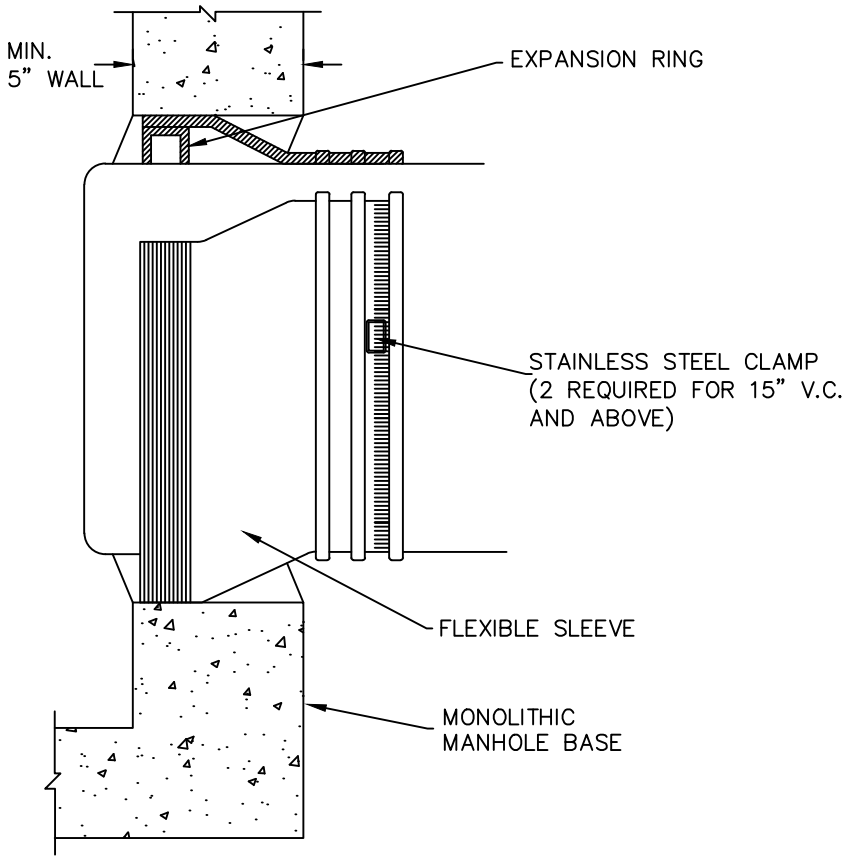
NOTES:

1. O.D. = SEWER MAIN OUTSIDE PIPE DIAMETER. (MIN. 8 INCHES)

2. MANHOLES SHALL HAVE PRECAST, 4000 PSI CONCRETE INVERTS.
   INVERT DEPTH = OUTSIDE DIAMETER OF PIPE
   INVERT WIDTH = OUTSIDE DIAMETER OF PIPE

3. EACH LATERAL CONNECTION SHALL HAVE A PRECAST INVERT DIRECTING FLOW IN THE DIRECTION OF THE SEWER.
   INVERT DEPTH = OUTSIDE DIAMETER OF PIPE
   INVERT WIDTH = OUTSIDE DIAMETER OF PIPE

TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS MANHOLE INVERTS	January 2014 Revision 2 NTS | S - 9.0



NOTES:

1. FLEXIBLE MANHOLE SLEEVES SHALL CONFORM TO ASTM 923. SLEEVES BY PRESS-SEAL GASKET CORPORATION, EPCO INC. OR NPC INC. OR EQUIVALENT ARE ACCEPTABLE. MAXIMUM DEFLECTION FOR SLEEVE IS 7° (12%). SLOPES GREATER THAN 12% MUST HAVE SLEEVES DESIGNED FOR HIGHER DEFLECTION.

2. 1/2" x 3" RUBBER LINER ADAPTER GASKET BY PRESS-SEAL GASKET CORP. MUST BE USED FOR D.I. PIPE. IF FLEXIBLE SLEEVE IS DESIGNED FOR V.C. PIPE GASKET TO BE INSTALLED UNDER S.S. CLAMP BETWEEN PIPE AND FLEXIBLE SLEEVE.

TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS FLEXIBLE MANHOLE SLEEVE	January 2009 Revision 1 NTS | S - 10.0

TOWN OF MOORESVILLE

STANDARD DETAIL

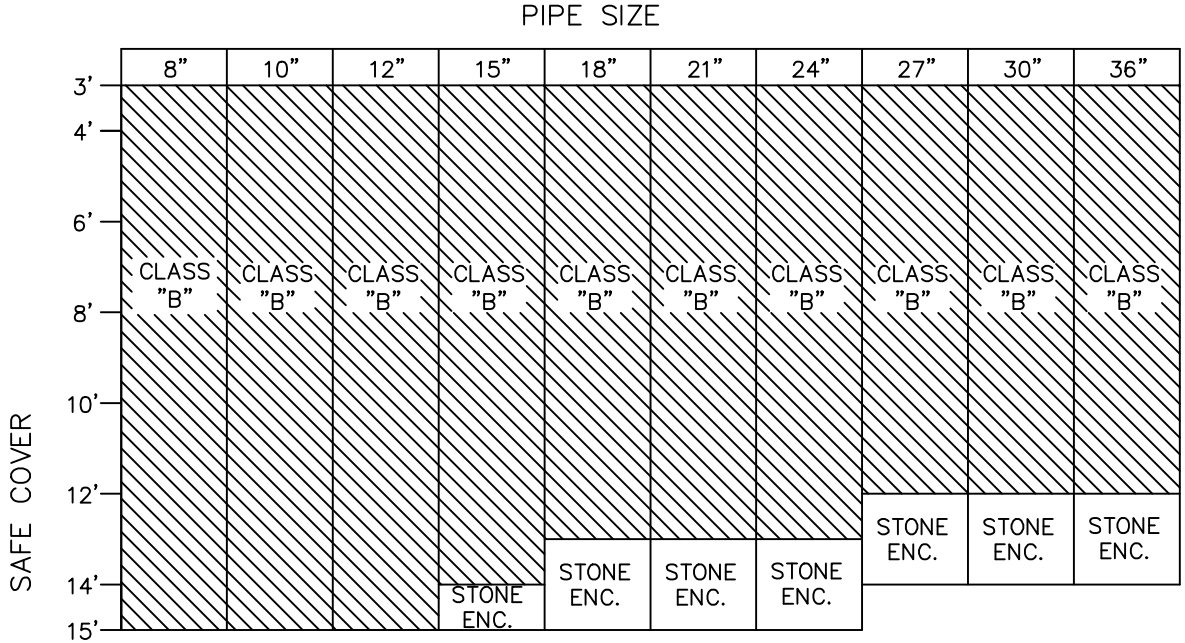
SEWER SYSTEMS

VITRIFIED CLAY PIPE BEDDING

January 2009
Revision 1

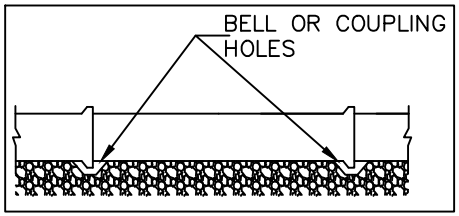
NTS

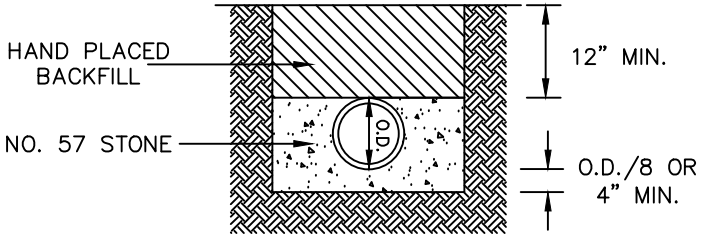
S-11.0



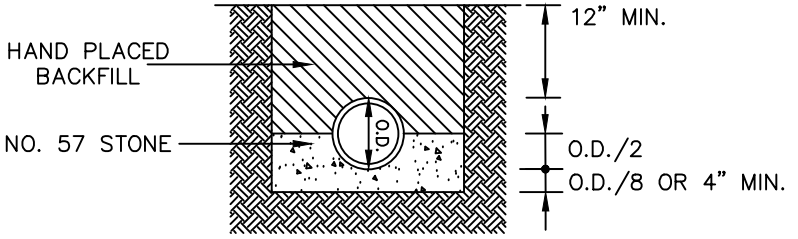
NOTES:

1. O.D. = OUTSIDE DIAMETER OF PIPE
2. ALL PIPES SHALL BE BEDDED USING BELL OR COUPLING HOLES.
3. DETAIL IS ACCORDING TO THE CLAY PIPE ENGINEERING MANUAL ASSUMING SILT AND CLAY SOIL WITH A LIQUID LIMIT LESS THAN 50.

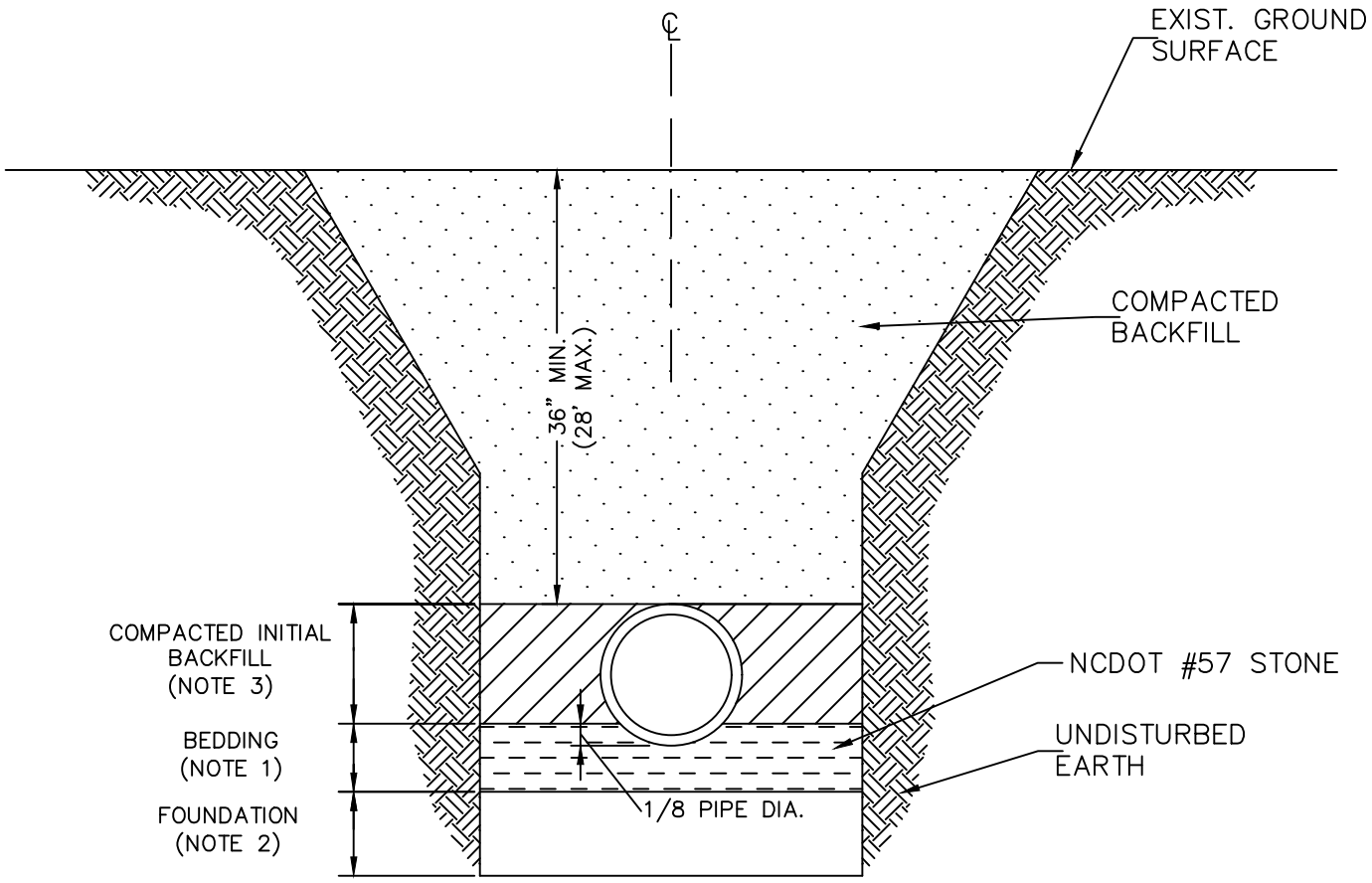




STONE ENCASEMENT



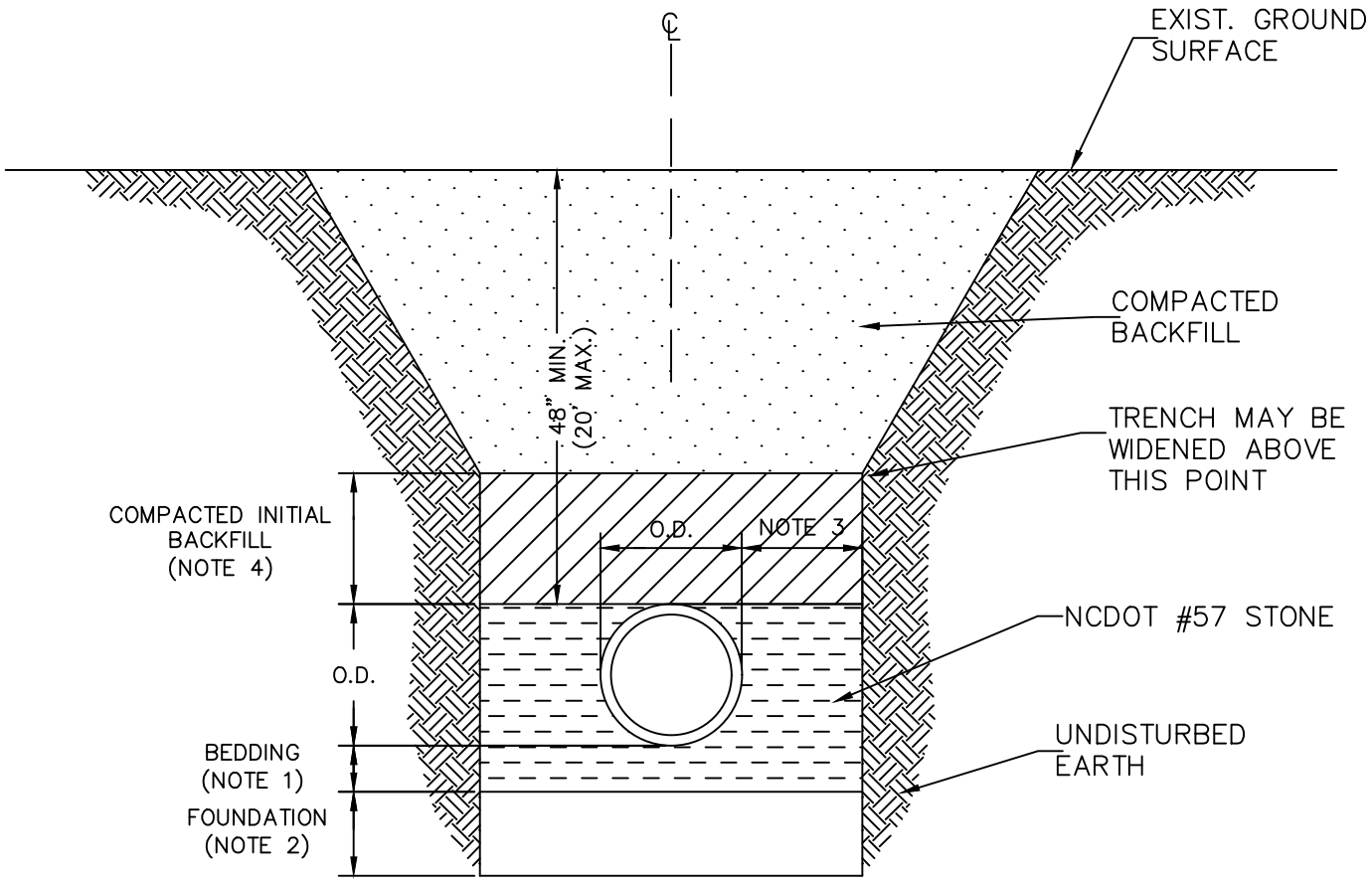
CLASS "B"



NOTES:

1. 4" TYPICAL, 6" DEPTH IF IN ROCK.
2. FOUNDATION STONE REQUIRED WHEN SOIL CONDITIONS ARE UNSTABLE.
3. INITIAL BACKFILL SHALL BE PLACED IN 6" LIFTS AND COMPACTED. INITIAL BACKFILL SHALL CONTAIN NO MATERIAL OVER 1 1/2" IN DIAMETER, FROZEN LUMPS, OR DEBRIS.
4. BACKFILL SHALL BE COMPACTED TO 95% STANDARD PROCTOR DENSITY UP TO 1' BELOW SUBGRADE. REFER TO ROADWAY STANDARD FOR FINAL 1'.

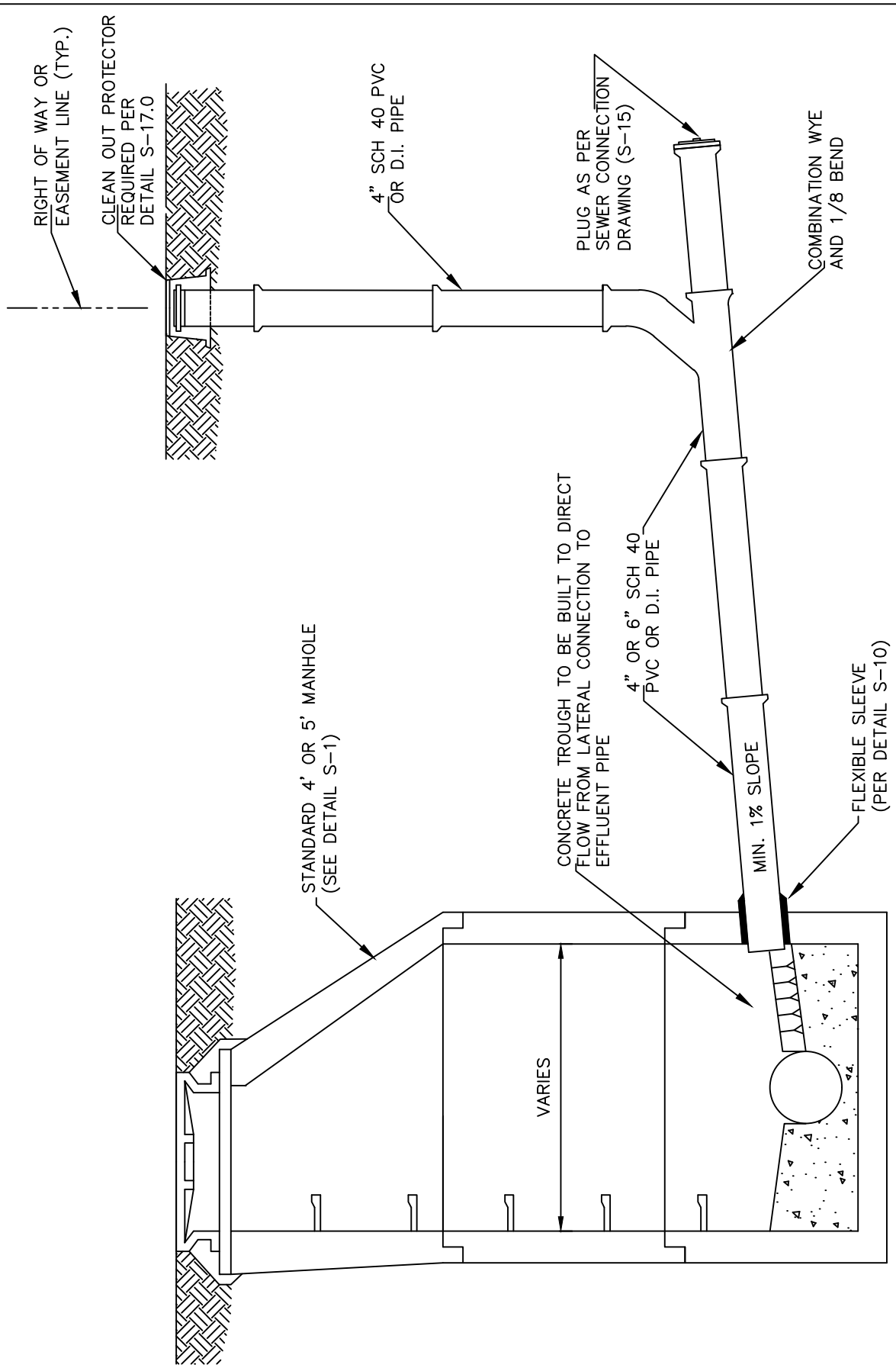
TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS DUCTILE IRON PIPE SEWER BEDDING (UP TO 12" DIAMETER)	January 2014 Revision 2	
		NTS	S - 12.0



NOTES:

1. 4" TYPICAL, 6" DEPTH IF IN ROCK.
2. FOUNDATION STONE REQUIRED WHEN SOIL CONDITIONS ARE UNSTABLE.
3. CLEAR DISTANCE NOT LESS THAN 6" OR MORE THAN 12" EACH SIDE.
4. INITIAL BACKFILL SHALL BE PLACED IN 6" LIFTS AND COMPACTED. INITIAL BACKFILL SHALL CONTAIN NO MATERIAL OVER 1 1/2" IN DIAMETER, FROZEN LUMPS, OR DEBRIS.
5. BACKFILL SHALL BE COMPACTED TO 95% STANDARD PROCTOR DENSITY UP TO 1' BELOW SUBGRADE. REFER TO ROADWAY STANDARD FOR FINAL 1'.
6. PVC PIPE MATERIAL SHALL BE ASTM 03034 WITH A DR OF 26 OR LESS, OR AWWA C900 DR 18.

TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS PVC SEWER PIPE BEDDING (UP TO 15" DIAMETER)	January 2014 Revision 2	
		NTS	S - 13.0



TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS SEWER LATERAL TO MANHOLE	June 2018 Revision 2 NTS | S - 14.0

TOWN OF MOORESVILLE

STANDARD DETAIL

SEWER SYSTEMS

4" SEWER LATERAL TO MAIN

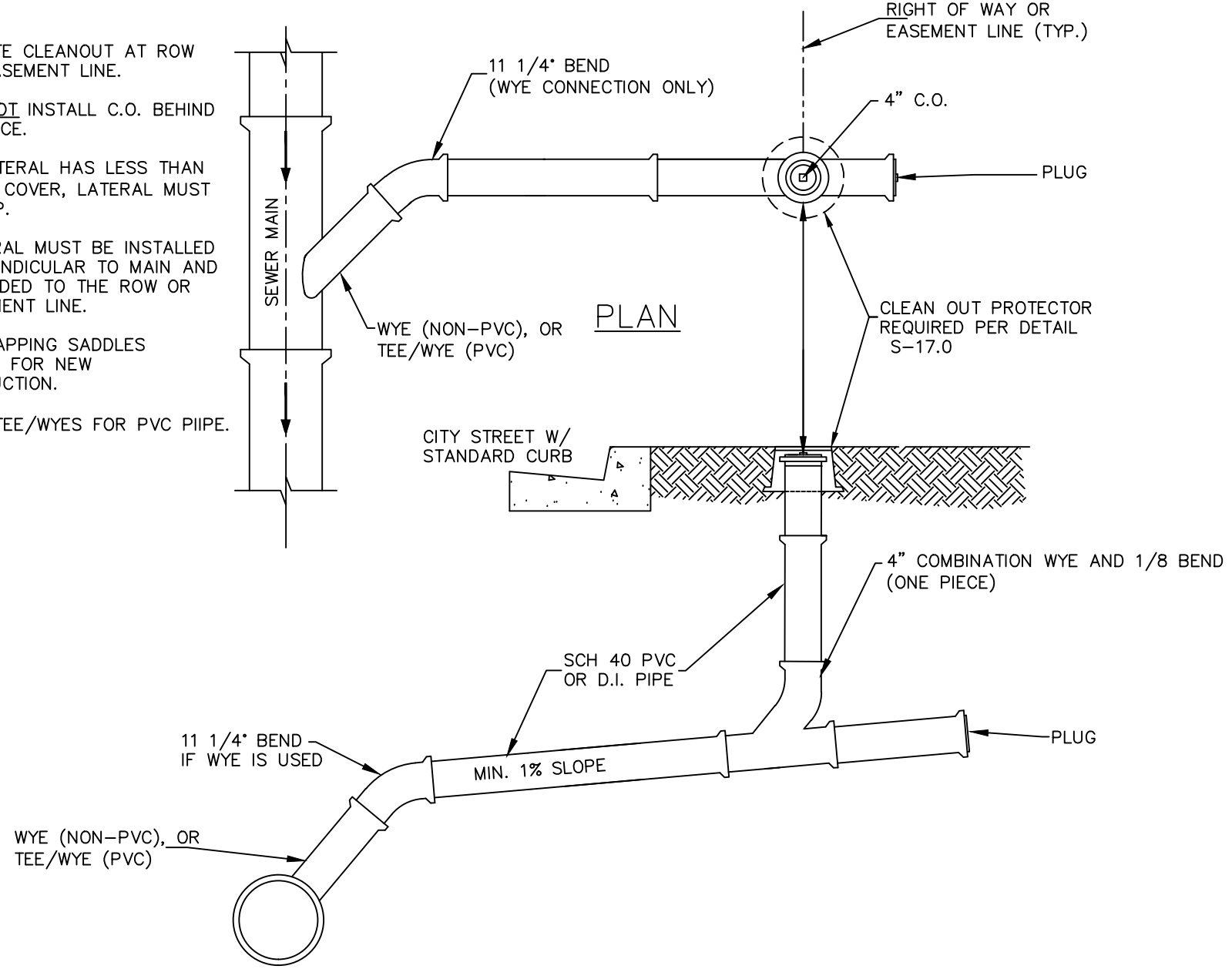
NTS

January 2009
Revision 1

S - 15.0

NOTES:

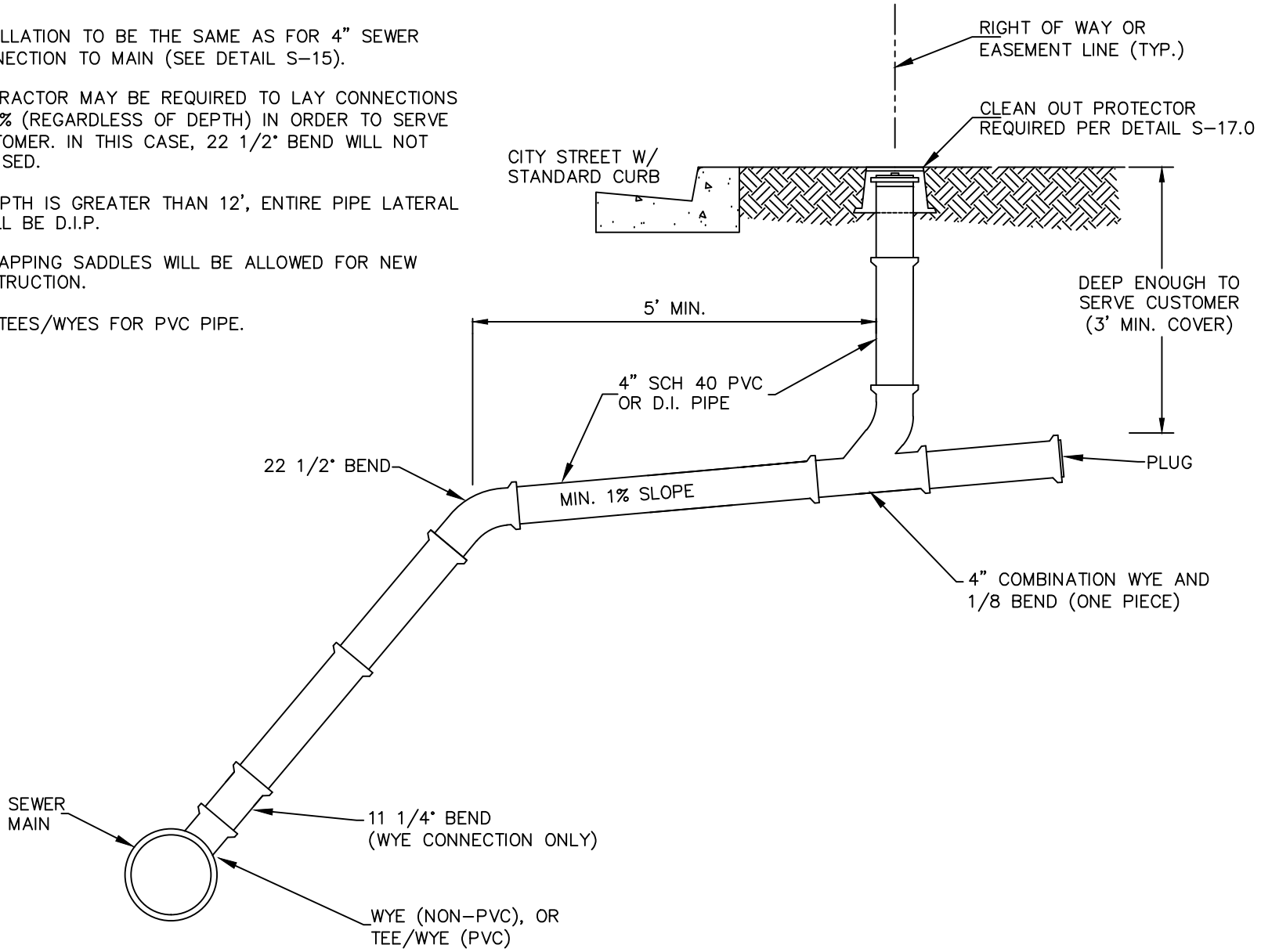
1. LOCATE CLEANOUT AT ROW OR EASEMENT LINE.
2. DO NOT INSTALL C.O. BEHIND A FENCE.
3. IF LATERAL HAS LESS THAN 3' OF COVER, LATERAL MUST BE DIP.
4. LATERAL MUST BE INSTALLED PERPENDICULAR TO MAIN AND EXTENDED TO THE ROW OR EASEMENT LINE.
5. NO TAPPING SADDLES ALLOWED FOR NEW CONSTRUCTION.
6. USE TEE/WYES FOR PVC PIIPE.



TOWN OF MOORESVILLE

STANDARD DETAIL

NOTES:
1. INSTALLATION TO BE THE SAME AS FOR 4" SEWER CONNECTION TO MAIN (SEE DETAIL S–15).
2. CONTRACTOR MAY BE REQUIRED TO LAY CONNECTIONS AT 1% (REGARDLESS OF DEPTH) IN ORDER TO SERVE CUSTOMER. IN THIS CASE, 22 1/2° BEND WILL NOT BE USED.
3. IF DEPTH IS GREATER THAN 12', ENTIRE PIPE LATERAL SHALL BE D.I.P.
4. NO TAPPING SADDLES WILL BE ALLOWED FOR NEW CONSTRUCTION.
5. USE TEES/WYES FOR PVC PIPE.



SECTION

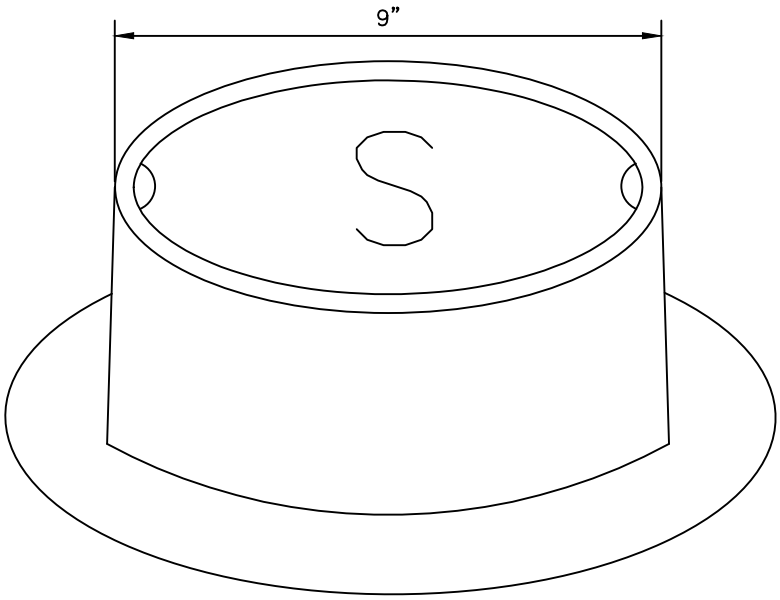
SEWER SYSTEMS

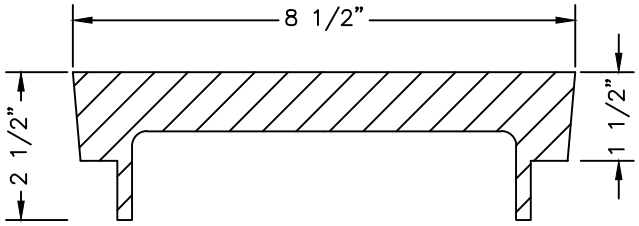
DEEP 4" SEWER LATERAL

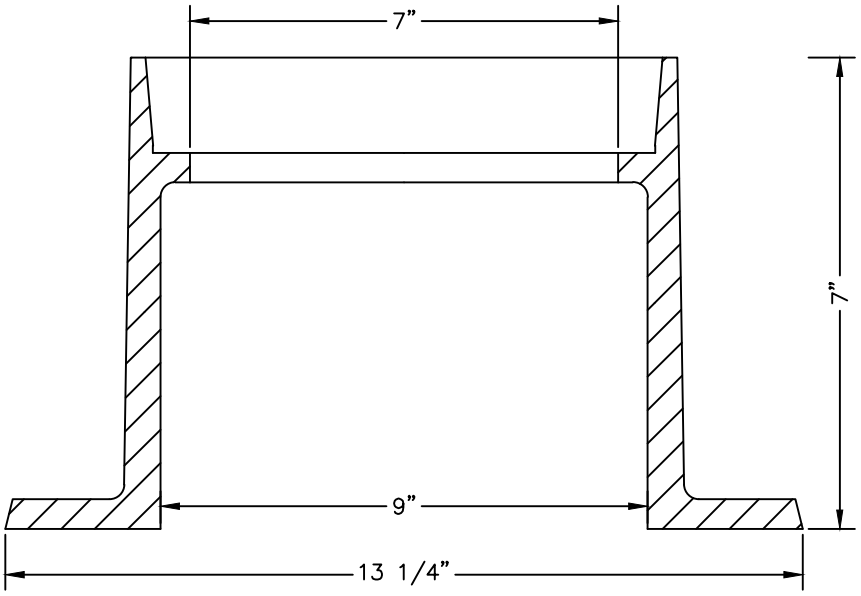
January 2009
Revision 1

NTS

S - 16.0





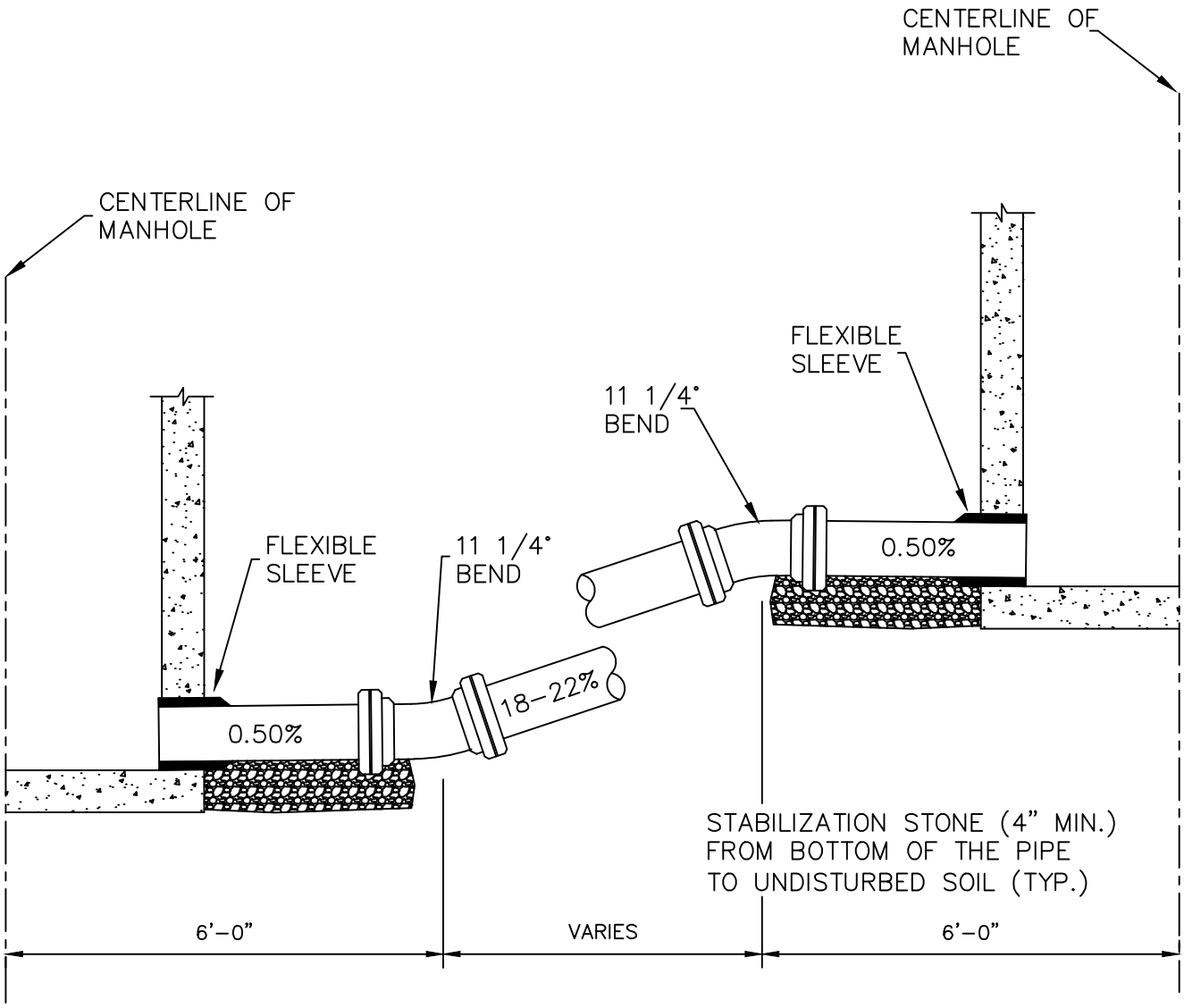


NOTES:
1. MIN. TOTAL WEIGHT SHALL BE 55 LBS.

2. CAST IRON CLEAN OUT PROTECTORS REQUIRED FOR ALL NEW CONSTRUCTION.

3. EAST JORDAN iRON WORKS (PART NO. 1566)
   US FOUNDRY & MANUFACTURING CORP. (PART NO. 7610)

TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS CLEAN OUT PROTECTOR	January 2009 Revision 1 NTS | S - 17.0

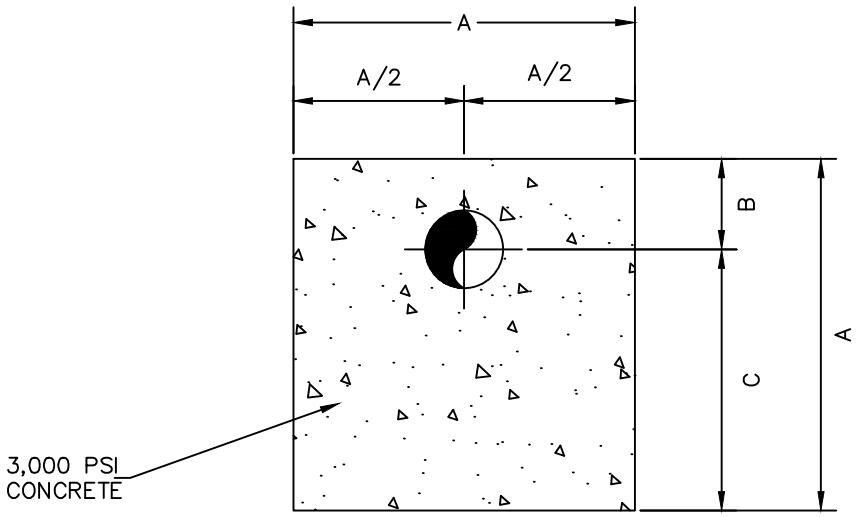


NOTES:
1. GRADE CALCULATED FROM CENTER OF 11 1/4° BENDS

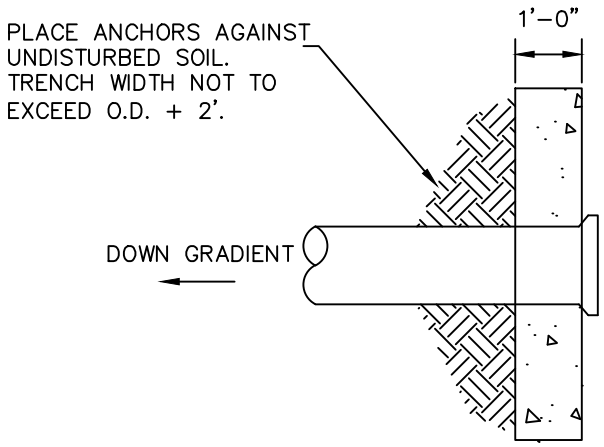
2. ALL PIPES AND BENDS SHALL BE DUCTILE IRON.

3. THIS DETAIL MAY ONLY BE USED WITH APPROVAL OF THE DIRECTOR OF ENGINEERING.

TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS 18 - 22% SLOPE SEWER MAIN	January 2009 Revision 1 NTS | S - 18.0



SECTION



PLAN

	"A" DIMENSION	"B" DIMENSION	"C" DIMENSION
8" DIP	3'	1'	2'

NOTES:
1. ANCHORS REQUIRED FOR SEWERS WITH SLOPES GREATER THAN 18%.
2. ANCHORS SHALL BE PLACED DIRECTLY BEHIND THE BELL WITH THE BELL FACING UPSTREAM.
3. MINIMUM SPACING: SLOPES 18% TO 35% – 36 FEET
   SLOPES 36% TO 50% – 18 FEET

TOWN OF MOORESVILLE

STANDARD DETAIL

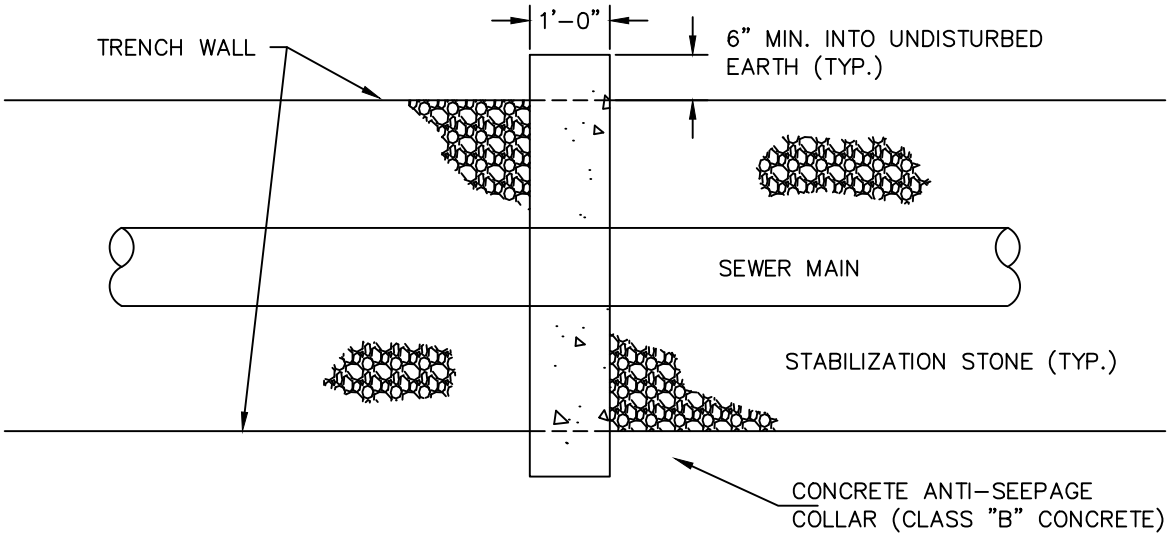
SEWER SYSTEMS

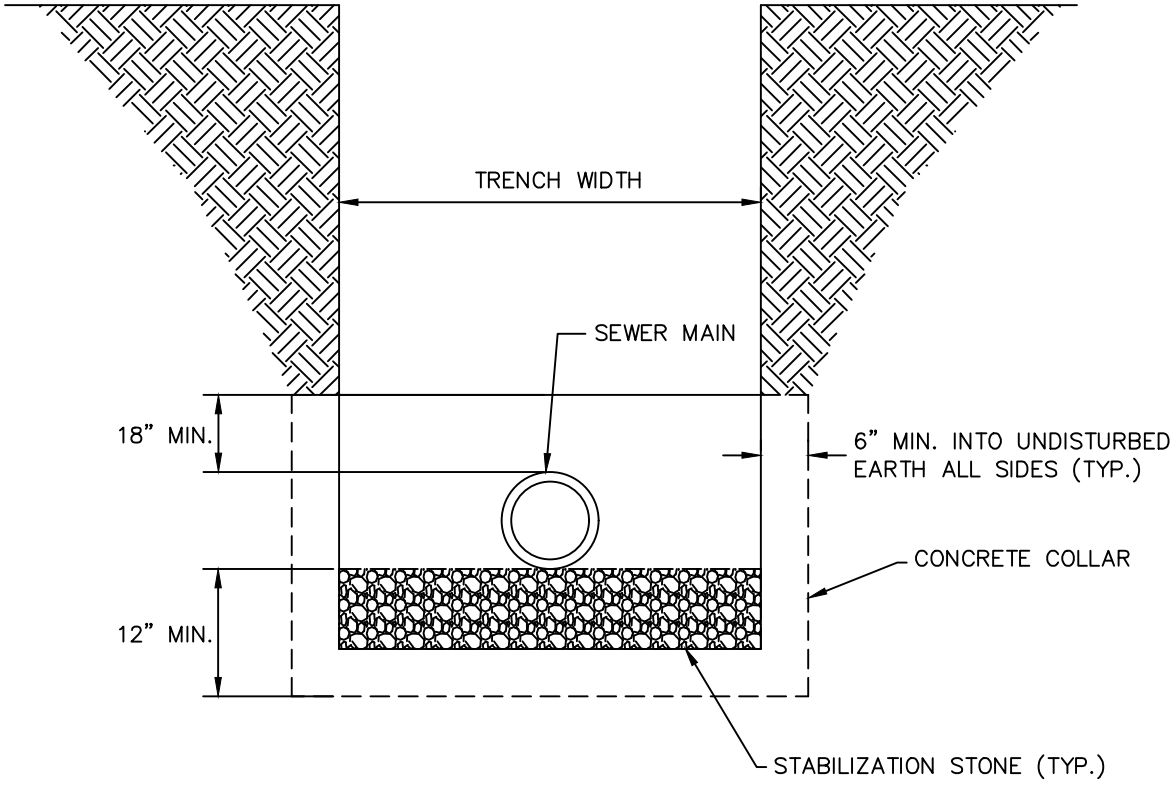
STEEP SEWER PIPE RESTRAINT

January 2009
Revision 1

NTS

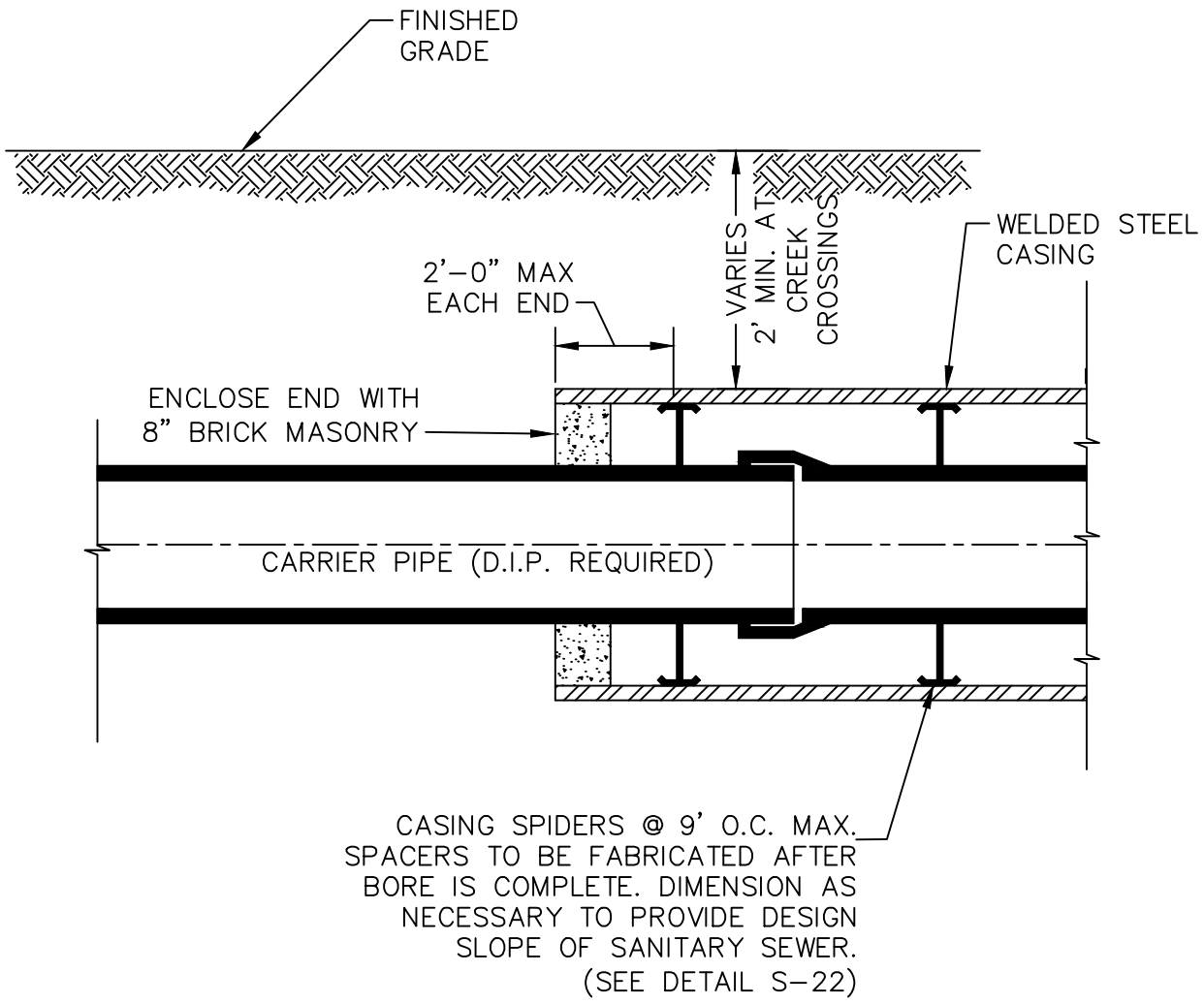
S - 19.0





NOTE:
COLLAR TO BE INSTALLED AS DIRECTED BY DIRECTOR OF ENGINEERING.

TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS ANTI-SEEPAGE CONCRETE COLLAR	January 2009 Revision 1 NTS | S - 20.0



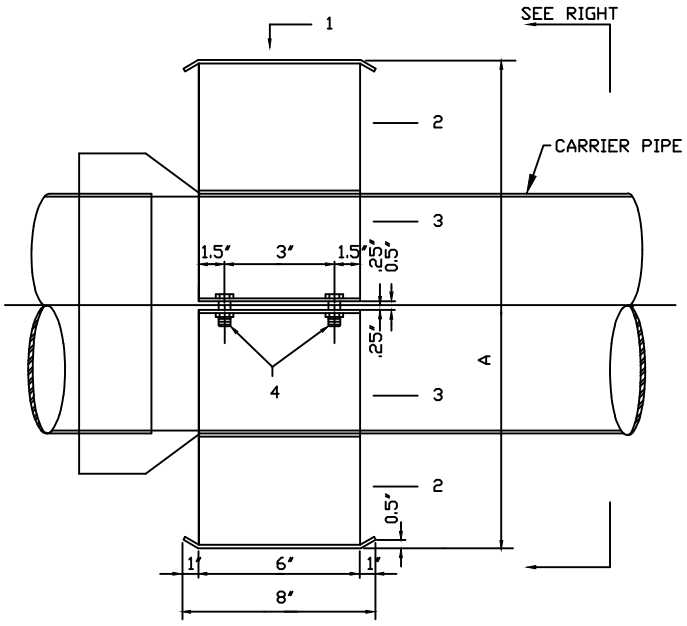
NOTES:

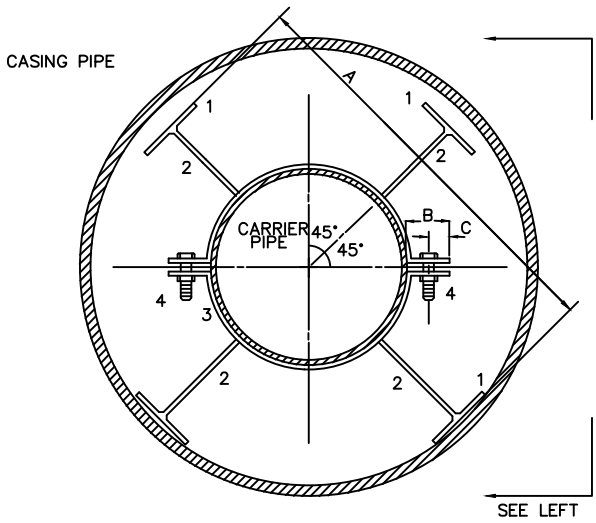
1. CASING SHALL MEET THE REQUIREMENTS OF N.C. DEPARTMENT OF TRANSPORTATION, RAILROAD OR OTHER APPLICABLE REGULATORY AGENCY.

2. CASING SPIDERS TO BE APPROVED BY DIRECTOR OF ENGINEERING.

3. ALL CARRIER PIPE SHALL BE RESTRAINED JOINT D.I.P.

TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS CASING	March 2013 Revision 2 NTS | S - 21.0





CARRIER PIPE		DIMENSIONS		
NOMINAL DIA.	O. D.	A	B	C
6"	6.90"	11"	1 1/4"	5/8"
8"	9.05"	16 1/2"	2 1/4"	1"
12"	13.20"	22 1/2"	3"	1 1/4"
16"	17.40"	28 1/2"	3 1/2"	1 1/2"
24"	25.80"	34 1/4"	4"	2"

	PIPE SUPPORT ASSEMBLY MARK NUMBER			
NOMINAL DIA.	1	2	3	4
6"	8" x 2" x 1/4" PL	6" x 1 1/2" x 1/4"PL	6" x 1/4"PL	3/8" NUT & BOLT
8"	8" x 3" x 1/4" PL	6" x 3 1/4" x 1/4"PL	6" x 1/4"PL	1/2" NUT & BOLT
12"	8" x 4" x 1/4" PL	6" x 3 5/8" x 3/8"PL	6" x 3/8"PL	1/2" NUT & BOLT
16"	8" x 4" x 3/8" PL	6" x 4 3/4" x 3/8"PL	6" x 3/8"PL	1/2" NUT & BOLT
24"	8" x 4" x 3/8" PL	6" x 5 1/2" x 3/8"PL	6" x 3/8"PL	1/2" NUT & BOLT

NOTES:
1. PROVIDE TWO SPIDERS PER JOINT OF CARRIER PIPE.
2. SPIDERS, NUTS, & WASHERS SHALL BE STAINLESS STEEL.
   Alternative spiders may be used for cathodic protection conditions.
3. ADJUST HEIGHT OF SPIDERS AS NECESSARY TO MAINTAIN SPECIFIED SLOPE.
4. CASING PIPE NOT SHOWN.
5. LEGS ROTATED OUT OF POSITION FOR CLARITY.

TOWN OF MOORESVILLE

STANDARD DETAIL

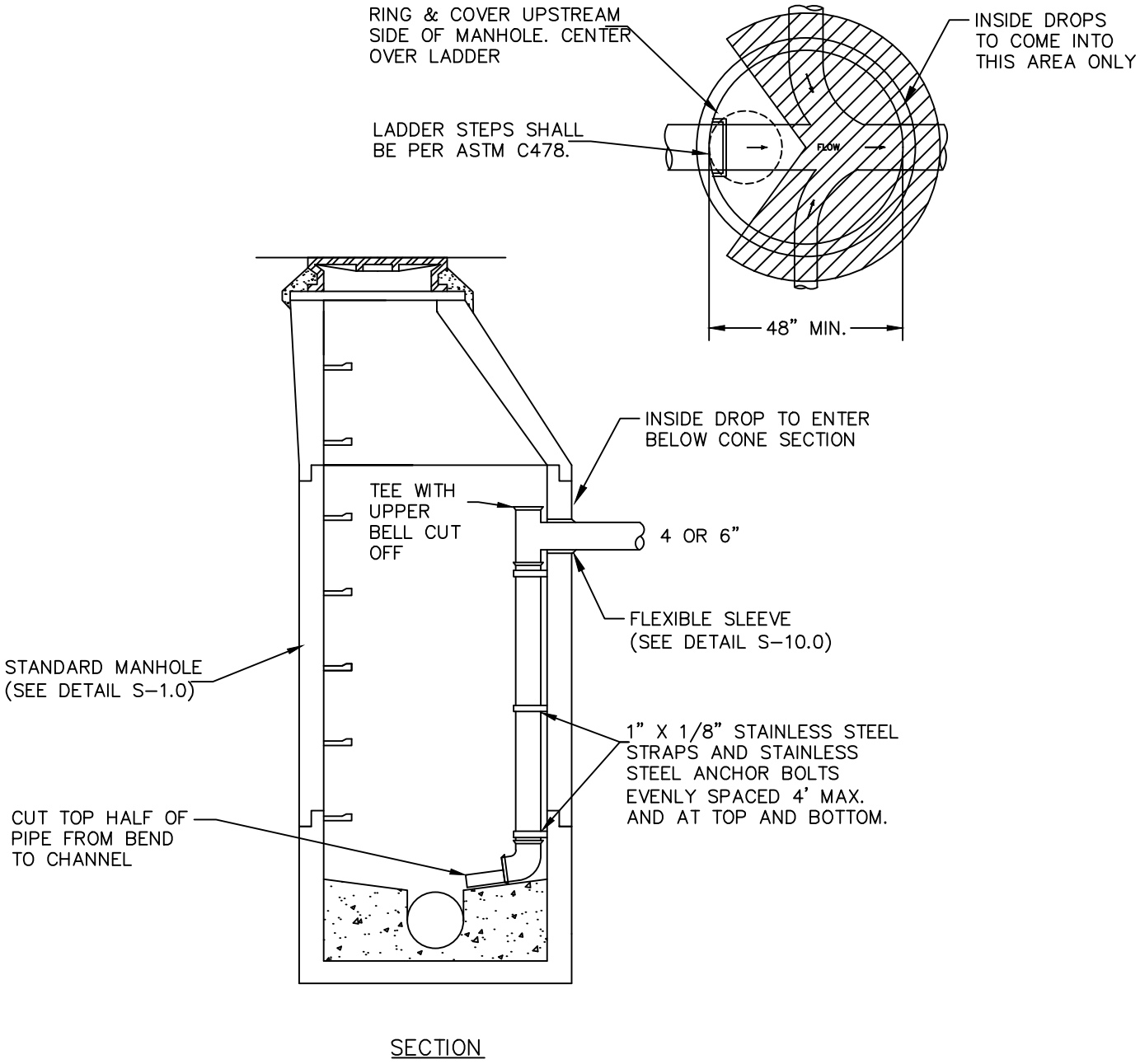
SEWER SYSTEMS

CASING SPIDER

January 2009
Revision 1

NTS

S - 22.0

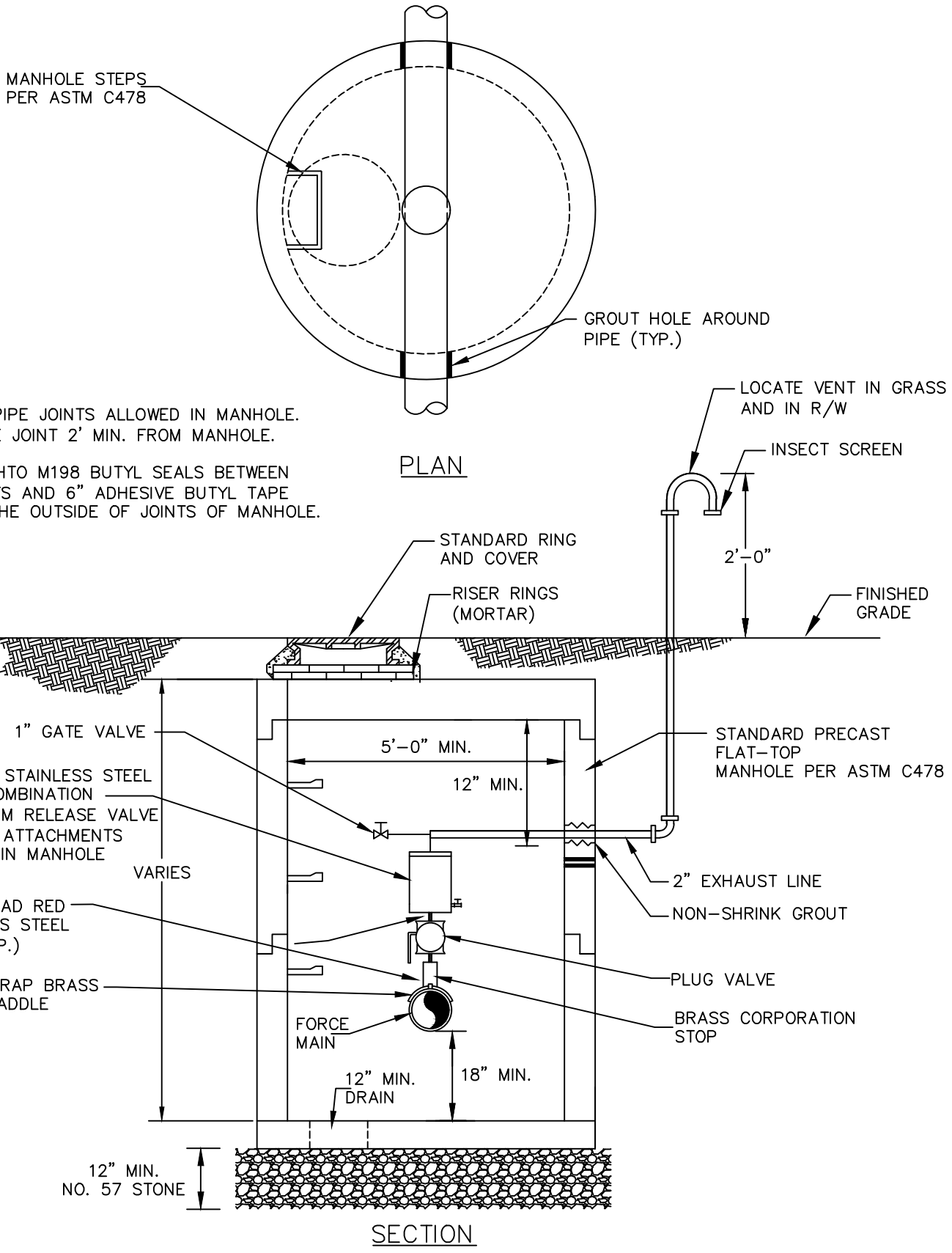


SECTION

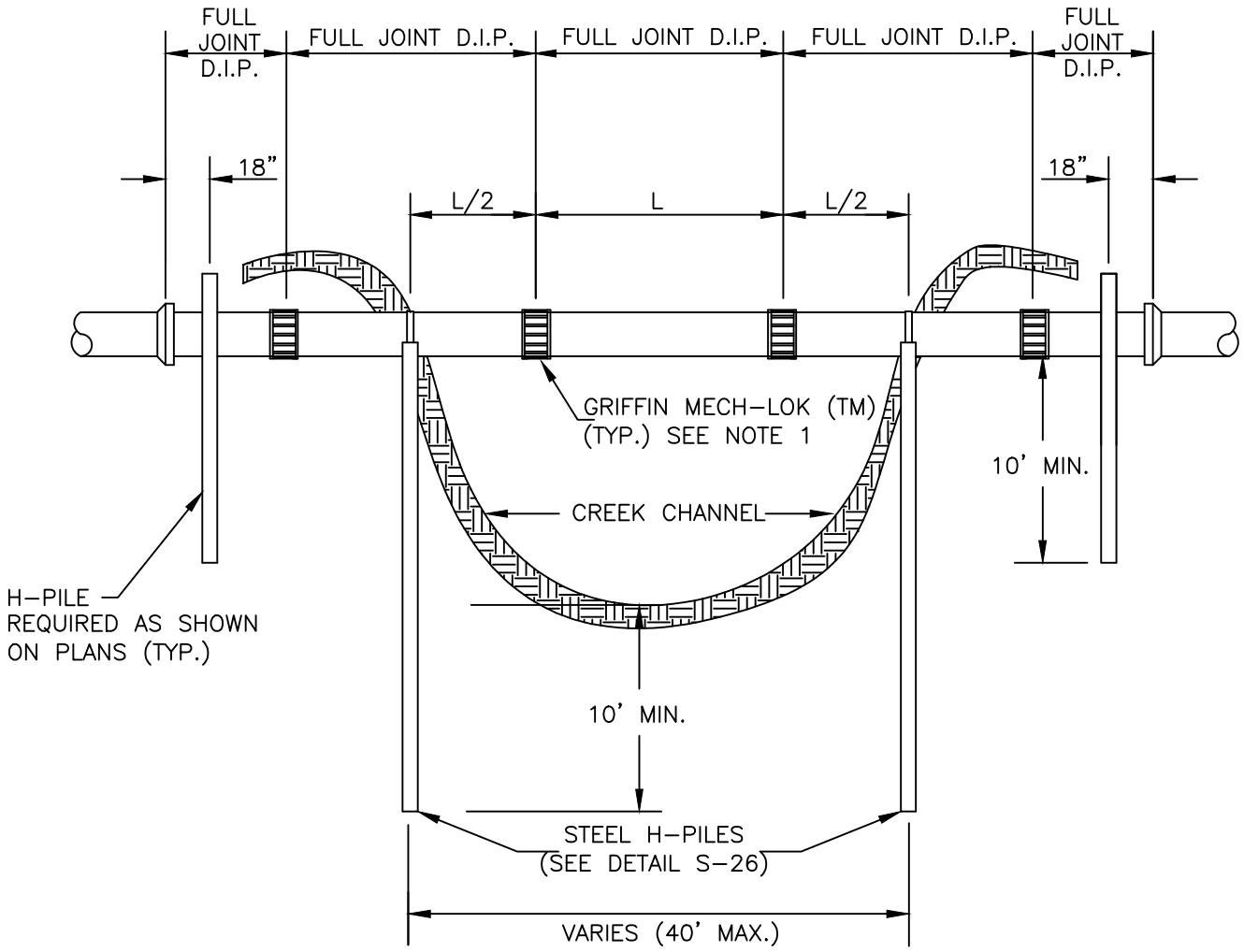
NOTES

1. DROP CONNECTION PIPE DIAMETER AND FITTINGS SHALL BE EQUAL TO OR GREATER THAN THE DIAMETER OF THE SEWER SERVICE. PIPE MATERIALS AND FITTINGS SHALL MEET THE REQUIREMENTS OF THE TOWN STANDARD SPECIFICATIONS FOR SEWER SERVICE LINES.

TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS INSIDE DROP SERVICE CONNECTION	June 2018 Revision 2	
		NTS	S - 23.0



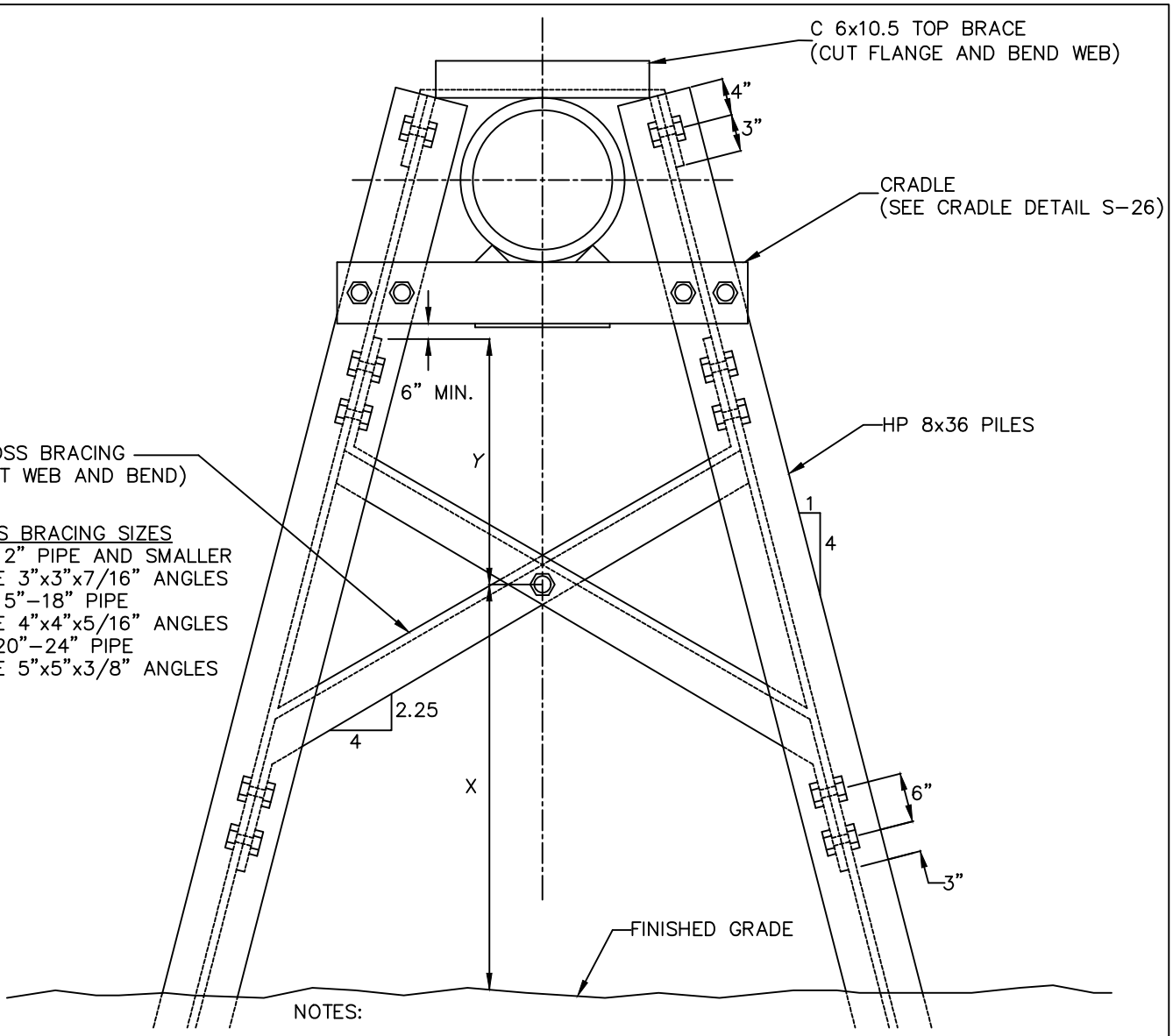
TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS AIR RELEASE MANHOLE	June 2018 Revision 2	
		NTS	S - 24.0



NOTES:

1. ALL JOINTS AND PIPE BETWEEN SUPPORTS SHALL BE GRIFFIN MECH-LOK (TM) OR APPROVED EQUIVALENT.
2. MINIMUM DEPTHS SHALL BE IN UNDISTURBED SOIL.
3. MAXIMUM HEIGHT FROM PIPE TO UNDISTURBED SOIL IS 20 FEET.
4. MAX. CLEAR SPAN IS 40' AND MAX. DIAMETER IS 36".
5. AERIAL CROSSING SHALL BE AVOIDED AND MUST BE APPROVED BY THE DIRECTOR OF ENGINEERING.

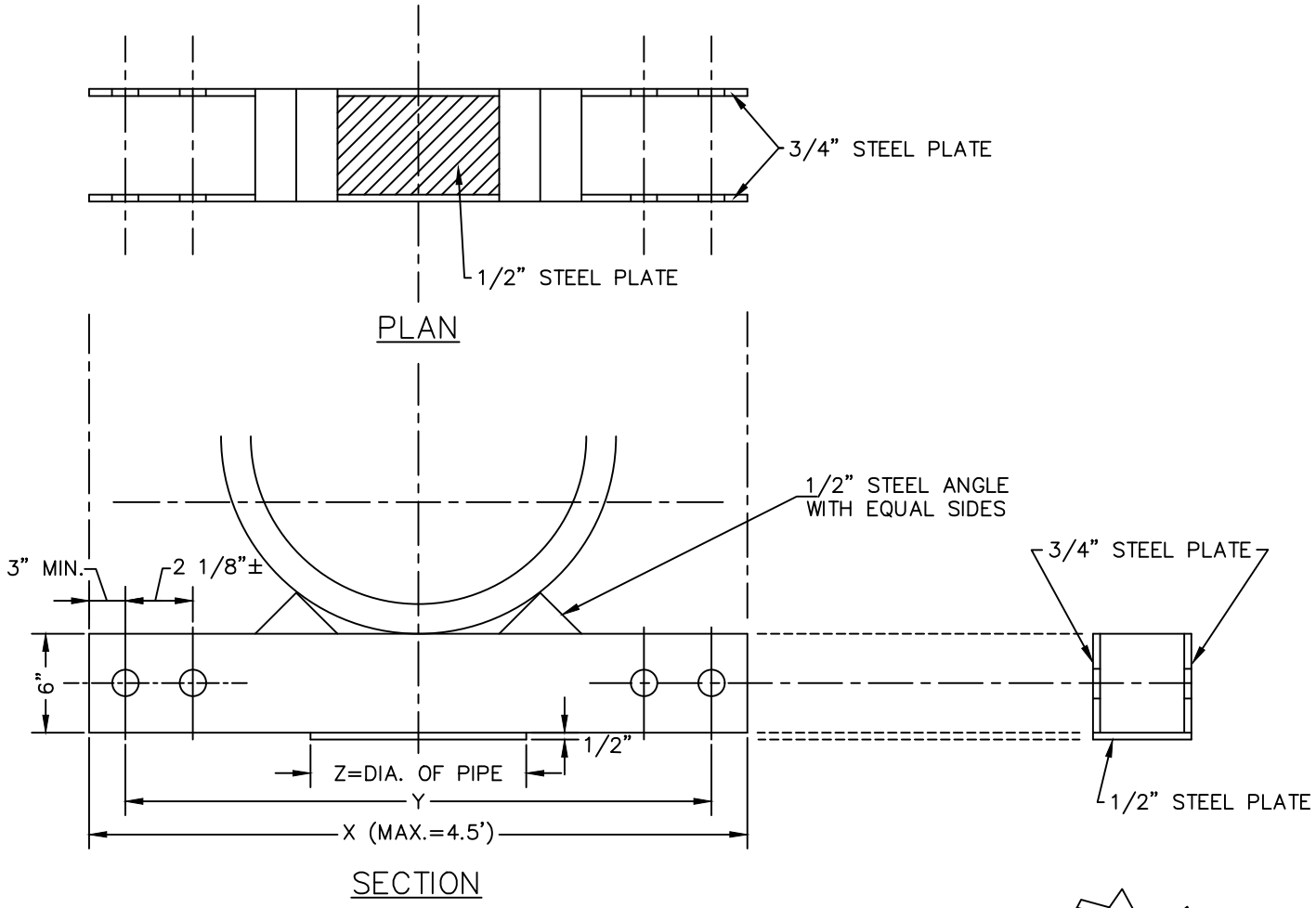
TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS AERIAL CREEK CROSSING ON STEEL H-PILES	March 2014 Revision 2	
		NTS	S - 25.0



NOTES:

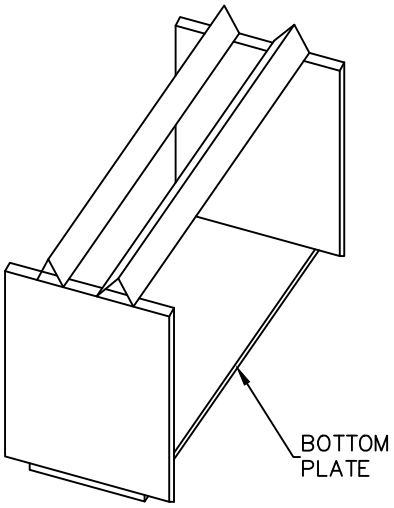
1. MAXIMUM HEIGHT FROM PIPE TO UNDISTURBED SOIL IS 20 FEET.
2. PIPE SHALL FIT SNUGLY.
3. X SHALL EQUAL Y OR AS APPROVED.
4. FOR 8 INCH TO 18 INCH PIPE ALL BOLTS SHALL BE 7/8" IN DIAMETER AND MEET ASTM A325. FOR 24" PIPE, BOLTS ON THE CRADLE SHALL BE 1" IN DIAMETER AND MEET ASTM A490. BOLTS SHALL BE AT LEAST 2 1/2" LONG. PLAIN ROUND WASHERS WILL BE REQUIRED.
5. BOLT HOLES SHALL BE 1/16" LARGER THAN THE DIAMETER OF THE BOLT AND SHALL BE DRILLED.
6. ALL STEEL SHALL BE A36 STEEL.
7. SEE STEEL H-PILE SPECIFICATIONS.
8. PILES SHALL BE DRIVEN TO A MINIMUM DEPTH OF TEN (10) FEET BELOW GROUND OR AS DIRECTED BY THE ENGINEER.
9. PILES SHALL BE DRIVEN TO A DEPTH AT WHICH PILE BEARING CAPACITY IS TWENTY (20) TONS OR AS APPROVED BY THE ENGINEER.
10. THESE PIERS SHALL BE USED FOR DUCTILE IRON PIPE OR HIGH STRENGTH STEEL PIPE ONLY.
11. CONTRACTOR MAY SUBSTITUTE W8x35 FOR HP8x36 FOR THE PILES.
12. ALL PARTS OF THE PILE MUST BE COATED TO 2' BELOW GROUND LEVEL, W/ CARBOLINE BITUMASTIC 300M (OR EQUAL), TWO-PART COAL TYPE COATING

TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS STEEL H - PILES PIERS FOR PIPES 24" AND SMALLER	January 2009 Revision 1 NTS | S - 26.0



NOTES:

1. DIMENSIONS X AND Y VARY ACCORDING TO PIPE SIZE AND ELEVATION OF PIPE. THE MAXIMUM LENGTH OF X IS 4.5'.
2. DIMENSION Z IS EQUAL TO THE DIAMETER OF THE PIPE.
3. ALL STEEL PLATES SHALL MEET ASTM A36.
4. FOR 8 INCH – 18 INCH PIPE ALL BOLTS SHALL BE 7/8" IN DIAMETER AND MEET ASTM A325. FOR 24 INCH PIPE, BOLTS ON THE CRADLE SHALL BE 1" DIAMETER AND MEET ASTM A490. BOLTS SHALL BE AT LEAST 2 1/2" LONG. PLAIN ROUND WASHERS WILL BE REQUIRED.
5. BOLT HOLES SHALL BE 1/16" LARGER THAN THE DIAMETER OF THE BOLT AND SHALL BE DRILLED.
6. THIS CRADLE SHALL NOT BE USED FOR PIPE LARGER THAN 24" DIAMETER.
7. ATTACH THE CRADLE TO THE PILES WITH FOUR (4) BOLTS ON EACH SIDE [TOTAL OF EIGHT (8) BOLTS].
8. ATTACH BOTTOM PLATE TO CRADLE SIDES WITH A CONTINUOUS 3/8" FILLET WELD.
9. THE 1/2" STEEL ANGLES SHALL BE SPOT WELDED TO THE SIDES OF THE CRADLE.
10. ALL PARTS OF THE PILE MUST BE COATED TO 2' BELOW GROUND LEVEL, W/ CARBOLINE BITUMASTIC 300M (OR EQUAL), TWO–PART COAL TYPE COATING



TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS PIER CRADLE 24" PIPE & SMALLER	January 2009 Revision 1 NTS | S - 27.0

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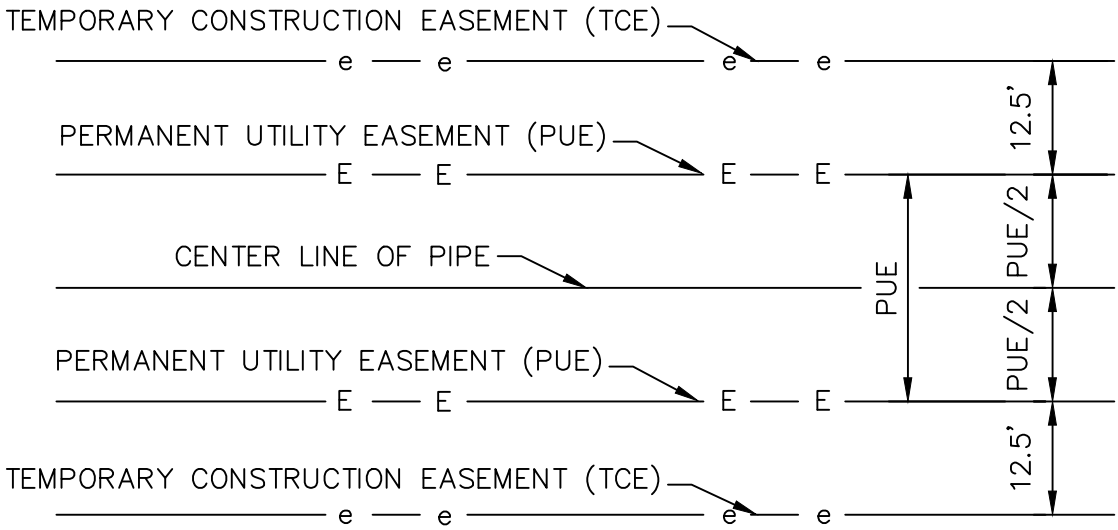


PIPE SIZE	PERMANENT UTILITY EASEMENT WIDTH (PUE)
8"	25'
12"	25'
15"	25'
18"	25'
24"	30'
30"	35'
36"	35'
42"	40'

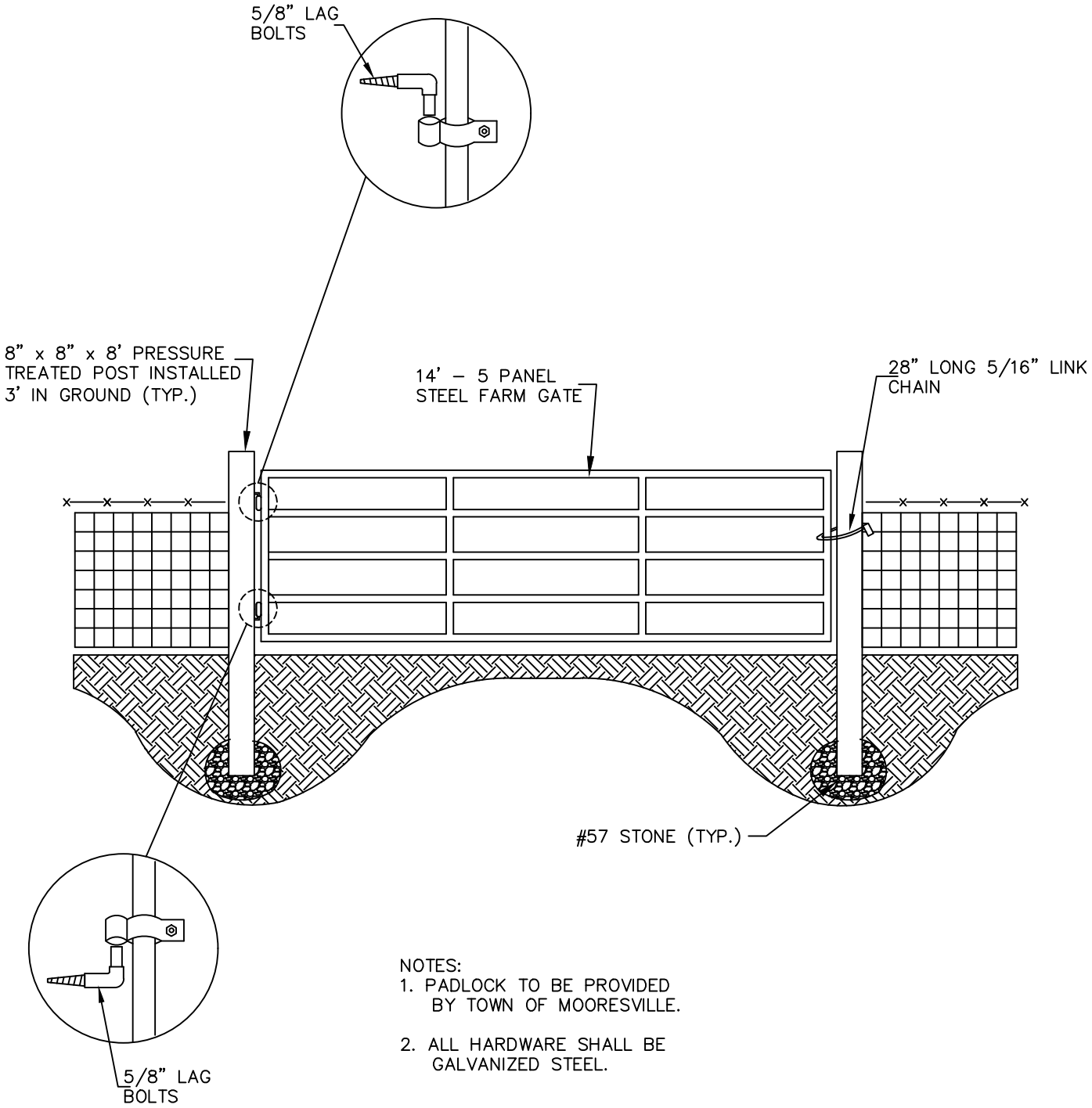
NOTES:

1. EASEMENTS SHOWN ARE MINIMUM FOR TOWN OWNED UTILITIES. ADDITIONAL EASEMENTS MAY BE REQUIRED FOR DEEPER THAN AVERAGE OR LARGE LINES.

2. FOR PARALLEL LINES, EASEMENT SHALL BE PUE/2 FEET FROM CENTER OF EACH LINE.

3. TCE OF 12.5' ON EACH SIDE OF PUE.

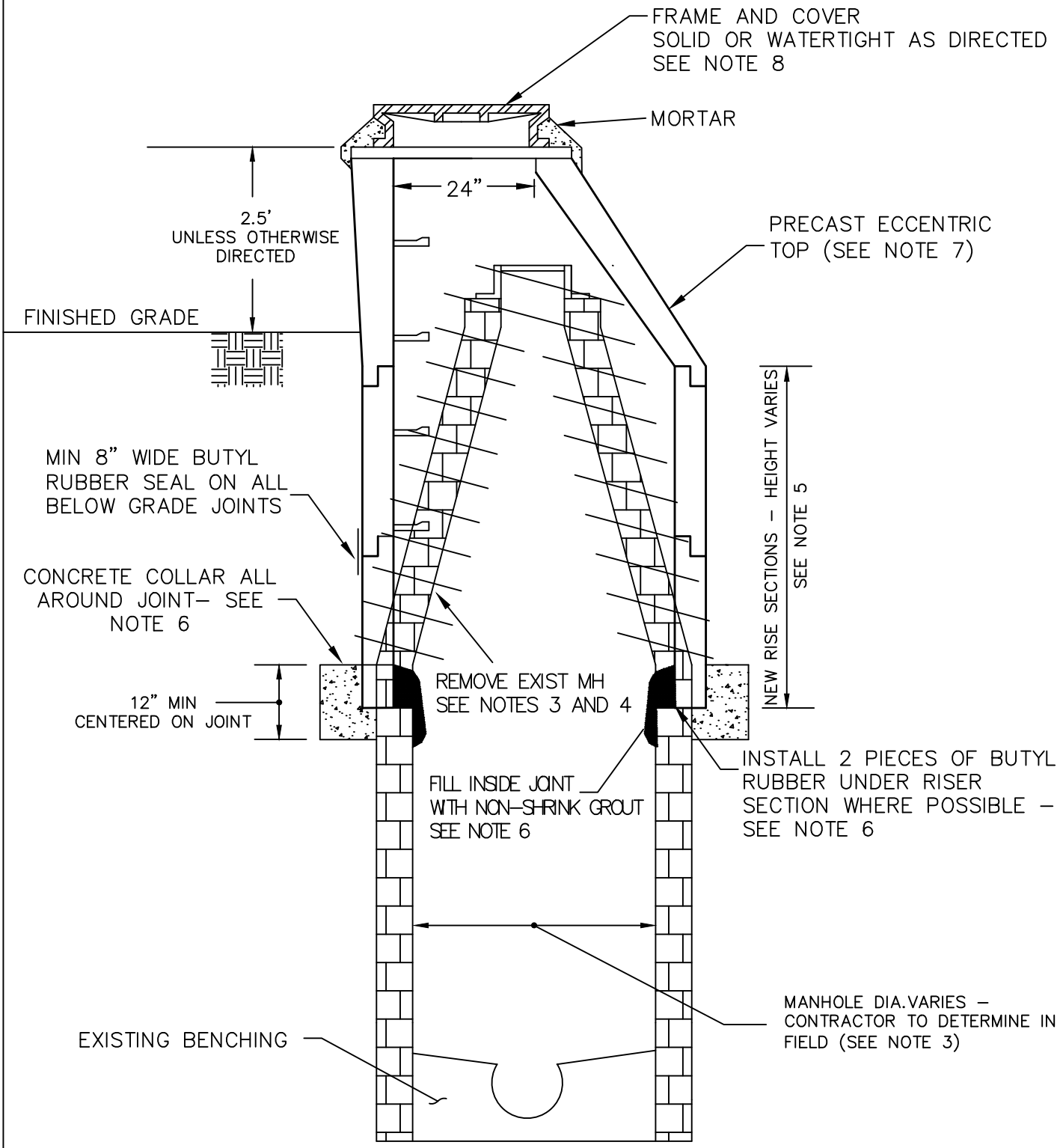
TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEM SEWER EASEMENT	January 2009 Revision 1 NTS | S - 33.0



NOTES:
1. PADLOCK TO BE PROVIDED BY TOWN OF MOORESVILLE.

2. ALL HARDWARE SHALL BE GALVANIZED STEEL.

TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS FENCE GATE SEWER OUTFALLS	January 2009 Revision 1 NTS | S - 34.0



TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS REHABILITATION OF MANHOLE AND TOP SECTION (WITH CONE SECTION)	January 2014 NTS | S - 35.0A

NOTES:

1. ALL WORK AND MATERIALS TO BE ACCORDANCE WITH MOST CURRENT T.O.M STANDARD SPECIFICATIONS AND DETAILS.

2. DETAIL S–35.0A DEPICTS EXISTING BRICK MANHOLE WITH TYPICAL CHIMNEY SECTION SOME MANHOLES MAY BE PRECAST CONCRETE WITH CONE SECTIONS.

3. CONTRACTORS TO MEASURE THE INSIDE DIAMETER OF EXISTING MANHOLE TO SELECT APPROPRIATE DIAMETER OF NEW RISERS.

4. CONTRACTOR TO REMOVE EXISTING WALLS TO SOLID STRUCTURE (TO AT LEAST BELOW THE CONE OR CHIMNEY SECTION) OR TO THE SPECIFIED LOCATION. THE LIMITS OF REMOVAL SHALL BE APPROVED BY THE ENGINEER IN THE FIELD. THE CONTRACTOR IS TO REMOVE EXISTING FRAMES AND COVERS, VENT PIPES, AND ALL APPURTENANCES, STEPS, ETC. CONTRACTOR TO DISPOSE OF ALL MATERIALS OFF–SITE.

   NO DEBRIS SHALL BE DROPPED INTO THE SEWER. IF DEBRIS ENTERS THE SEWER, THE CONTRACTOR WILL BE REQUIRED TO CLEAN THE SEWER AT NO ADDITIONAL COST TO THE OWNER.

5. CONTRACTOR TO INSTALL NEW RISER AND CONE SECTIONS AS NECESSARY TO EXTEND THE MANHOLE TO THE SPECIFIED/APPROVED ELEVATION. THE FINAL ELEVATION MAY BE HIGHER THAN, LOWER THAN OR EQUAL TO THE EXISTING ELEVATION. DETAIL S–35.0A ILLUSTRATES A HIGHER ELEVATION. THE CONTRACTOR SHALL DETERMINE THE REQUIRED RISER AND CONE HEIGHTS TO MEET THE SPECIFIED ELEVATION. ENGINEER SHALL APPROVE FINAL ELEVATIONS IN THE FIELD. BOTTOM RISER TO PROVIDED WITH A FLAT JOINT UNLESS OTHERWISE APPROVED.

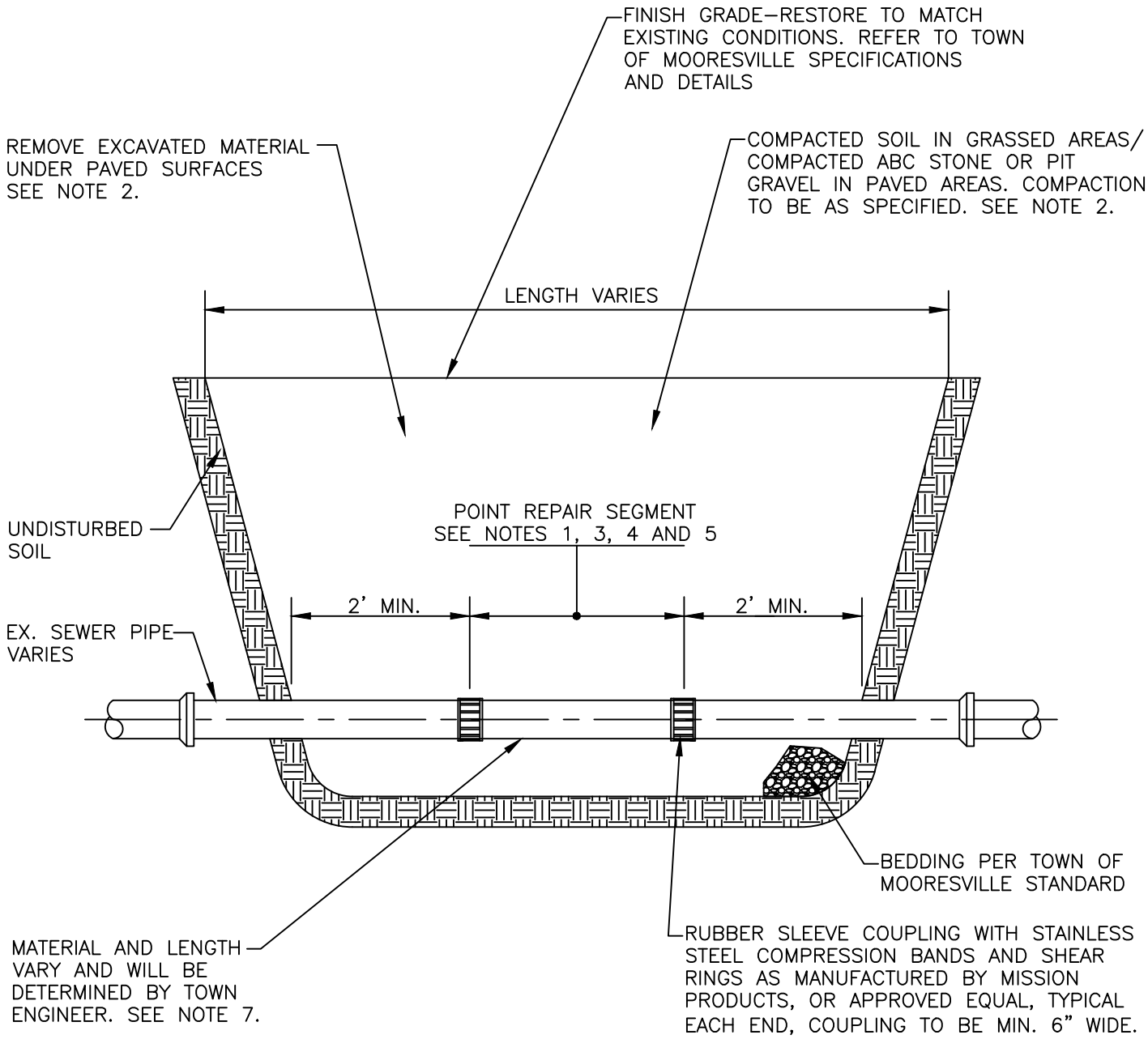
6. CONTRACTOR TO SEAL NEW RISER SECTION/EXISTING WALL JOINT TO PROVIDE A LEAK–TIGHT JOINT. THE CONTRACTOR SHALL PERFORM ALL WORK NECESSARY TO PROVIDE A LEAK–TIGHT SEAL. WHERE POSSIBLE, BUTYL RUBBER SEALANT SHALL BE PROVIDED UNDER THE NEW RISER SECTION. IN ALL CASES, A CONCRETE COLLAR SHALL BE POURED AROUND THE JOINT. COLLAR TO BE MINIMUM 6 WIDE AND 12 INCHES HIGH CENTERED ON JOINT ALL AROUND.

   ON THE INSIDE OF THE JOINT, CONTRACTOR TO SEAL JOINT WITH NON–SHRINK GROUT. GROUT TO COMPLETELY FILL JOINT AND SHALL EXTEND AT LEAST 6 INCHES EACH SIDE OF JOINT ALL AROUND. GROUT TO BE TAPERED TO THE EXISTING WALL SECTION BELOW THE JOINT. GROUT TO BE RESISTANT TO HYDROGEN–SULFIDE

7. NEW CONE SECTIONS TO BE INSTALLED ON TOP OF NEW RISER SECTIONS UNLESS SPECIFIED OTHERWISE. FRAMES TO BE BOLTED ONTO CONE SECTIONS PER TOM STANDARD DETAILS. REFER TO DETAIL S–1.0 FOR ALL WORK IN PAVED AREAS. SEE NOTE 8

8. COVERS SHALL BE CAM LOCK WATERTIGHT COVERS OR SOLID COVERS AS DIRECTED BY THE ENGINEER. CAM–LOCK WATERTIGHT FRAMES/COVERS SHALL BE INSTALLED PER DETAIL S–3.0A OF THE TOM STANDARD DETAILS

TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS NOTES FOR REHABILITATION OF MANHOLE AND TOP SECTION (WITH CONE SECTION)	June 2018 Revision 1	
		NTS	S - 35.0B



TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS TYPICAL POINT REPAIR	February 2014 . NTS | S - 36.0A

NOTES:

1. THE SEQUENCE OF WORK FOR PERFORMING POINT REPAIRS SHALL BE AS FOLLOWS:
   1.A. BYPASS PUMP FLOWS AROUND POINT REPAIR SEGMENT.
   1.B. EXCAVATE TO 8" BELOW EXISTING SEWER.
   1.C. NEATLY CUT EXISTING SEWER AT EACH END OF POINT REPAIR AND REMOVE EXISTING SEWER COMPLETELY.
   1.D. INSTALL BEDDING PER TOWN OF MOORESVILLE STANDARD.
   1.E. INSTALL NEW SEWER AT CONSTANT SLOPE BETWEEN THE TWO EXISTING PIPE ENDS. CONNECT THE NEW SEWER TO THE EXISTING WITH RUBBER SLEEVE COUPLINGS AND FILL VOIDS UNDER PIPE WITH STONE.
   1.F. RETURN FLOW THROUGH PIPE.
   1.G. BACKFILL AND COMPACT AS SHOWN.

2. UNDER PAVED SURFACES ONLY, CONTRACTOR SHALL REMOVE EXCAVATED SOIL AND DISPOSE OF IT OFFSITE. CONTRACTOR SHALL IMPORT ABC STONE OR PIT GRAVEL FOR BACKFILLING FROM TOP OF #67 STONE TO PAVEMENT SUBGRADE. PAYMENT FOR ABC STONE OR PIT GRAVEL SHALL BE BASED ON THE LENGTH OF POINT REPAIR. ALL COSTS OF THIS WORK SHALL BE INCLUDED IN THE UNIT PRICES BID.

3. SERVICE LATERALS LOCATED WITHIN POINT REPAIR SEGMENTS SHALL BE CONNECTED TO NEW SEWER WITH A TEE.

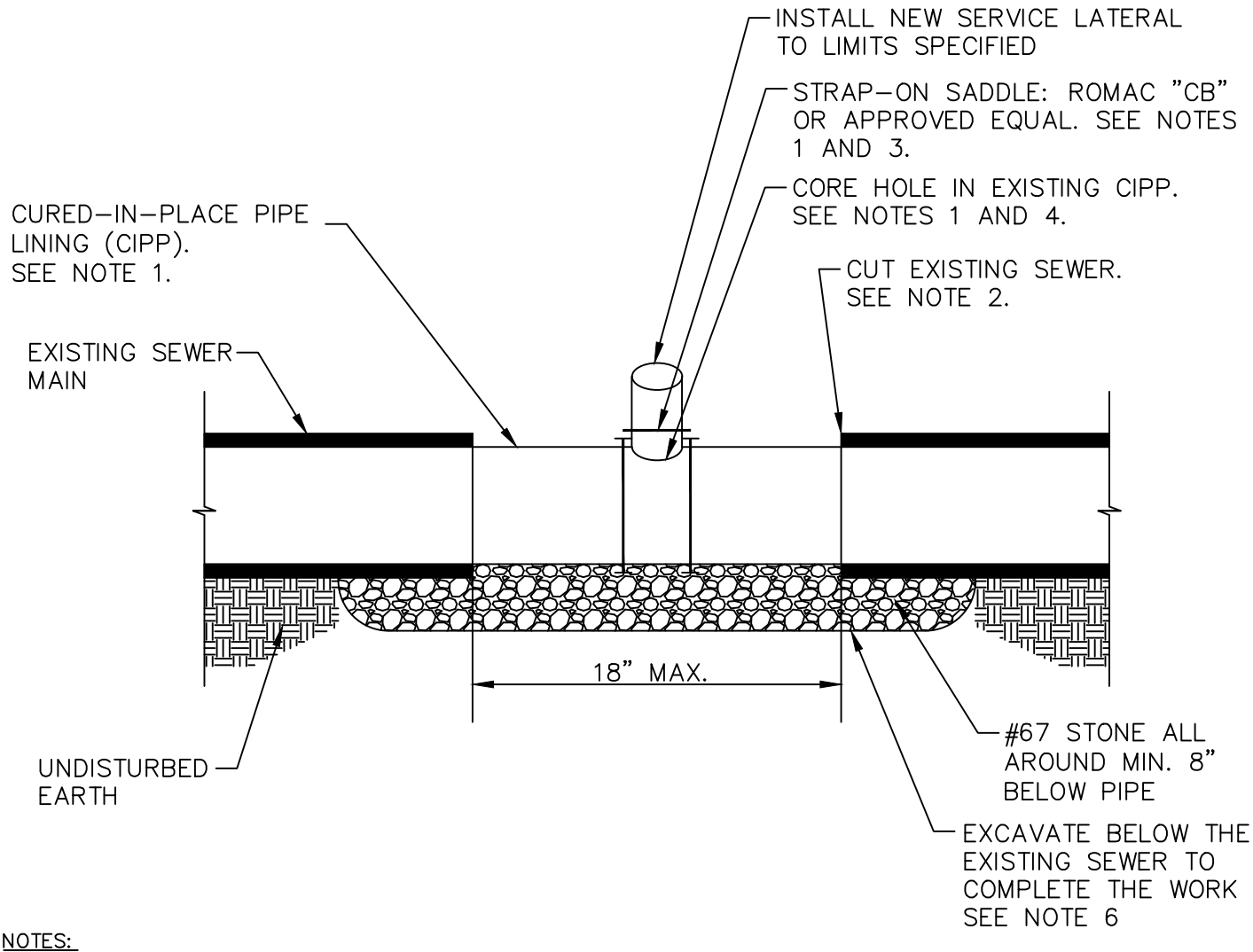
4. LENGTH OF POINT REPAIR WILL BE DETERMINED BY THE CONTRACTOR AND/OR THE ENGINEER AFTER REVIEWING THE TELEVISION INSPECTION DATA. THE CONTRACTOR SHALL EXTEND POINT REPAIRS IN THE FIELD AS NECESSARY AND APPROVED BY THE ENGINEER TO CONNECT TO SOLID PIPE.

5. THE CONTRACTOR SHALL USE A TRENCH BOX OR SHEETING AND SHORING IN ACCORDANCE WITH OSHA REGULATIONS TO SUPPORT THE TRENCH WALLS DURING THIS WORK. THE CONTRACTOR WILL NOT BE ALLOWED TO SLOPE TRENCH WALLS.

6. REFER TO TOWN OF MOORESVILLE STANDARDS FOR CONNECTING TO EXISTING MANHOLES.

7. ALL PIPE USED FOR POINT REPAIRS SHALL BE DETERMINED BY ENGINEER.

TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS TYPICAL POINT REPAIR SPECIFICATIONS	January 2014 .	
		NTS	S - 36.0B



NOTES:

1. REFER TO THIS DETAIL TO CONNECT NEW SERVICE LATERALS AFTER THE SEWERS HAVE BEEN LINED WITH CIPP. THIS DETAIL SHALL ALSO BE USED WHEN RECONNECTING SERVICES FOLLOWING PIPE BURSTING. IN THAT SITUATION, ALL REFERENCES TO CIPP IN THIS DETAIL SHALL BE HDPE.

2. NEATLY CUT THE EXISTING SEWER WITH A CUTTER SPECIFICALLY DESIGNED FOR CUTTING THAT SPECIFIC PIPE MATERIAL TO EXPOSE THE CIPP. FOR VCP AND CONCRETE SEWERS, USE A CHAIN CUTTER TO NEATLY SCORE THE PIPE AND THEN BREAK THE PIPE AWAY. REGARDLESS OF THE CUTTER USED, USE EXTREME CAUTION TO PREVENT DAMAGE TO THE CIPP. REPAIR ANY DAMAGE TO THE CIPP. REPAIR ANY DAMAGE AS APPROVED BY THE ENGINEER.

3. STRAP–ON SADDLE SHALL BE A ROMAC "CB" SADDLE AS MANUFACTURED BY ROMAC INDUSTRIES, INC. OR APPROVED EQUAL. ANY PROPOSED EQUAL SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL. SADDLE SHALL BE PROVIDED FOR THE SPECIFIC TYPE OF LATERAL PIPE BEING INSTALLED.
4. CAREFULLY REMOVE THE EXISTING LATERAL TO LIMIT DAMAGE TO THE CIPP, INCREASE THE OPENING IN THE CIPP AS NECESSARY AND TO PROVIDE A CIRCULAR OPENING, BRUSH THE CIPP IN THE OPENING SMOOTH TO REMOVE ALL BURRS, INSTALL STRAP–ON SADDLE AND REPLACE LATERAL TO THE SPECIFIED LIMITS. WHERE POSSIBLE, IMPROVE THE CONFIGURATION OF THE CONNECTION.

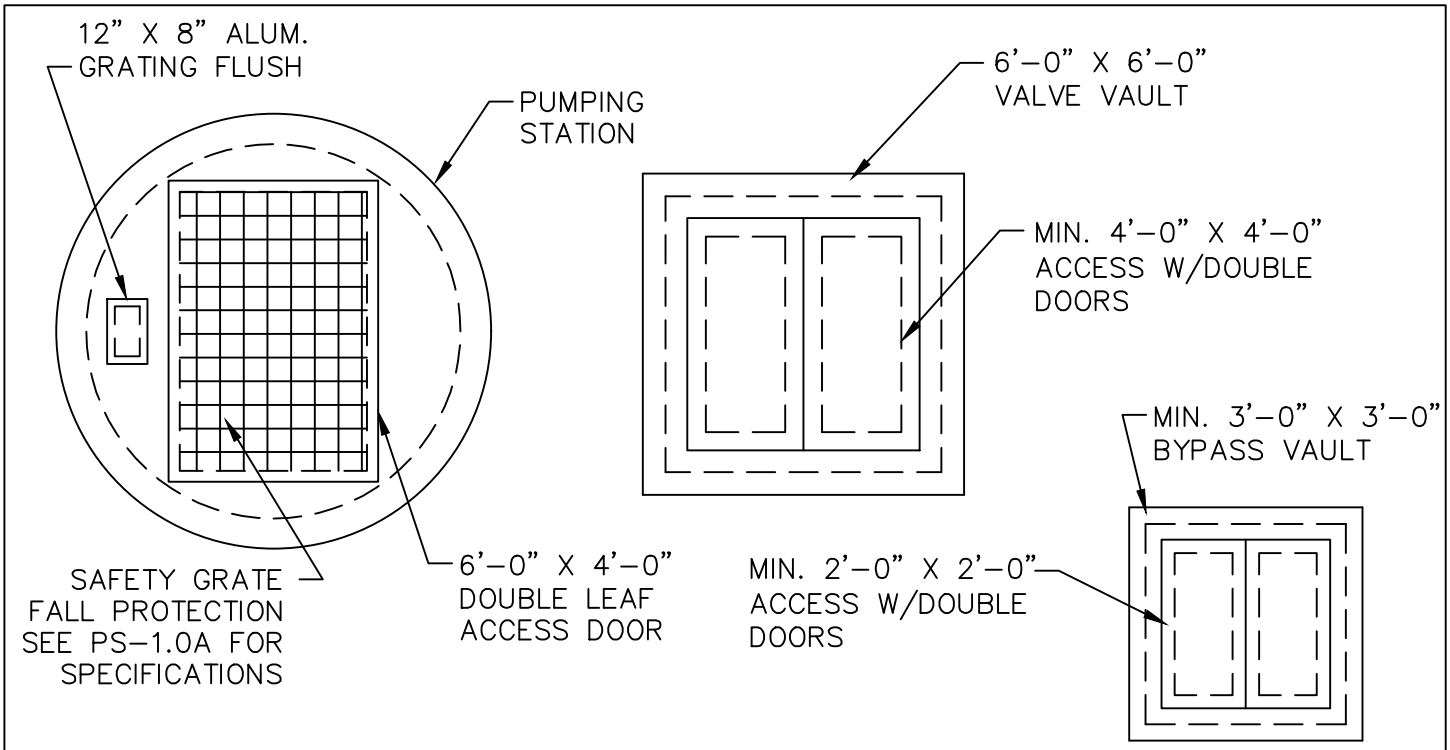
5. IF THE CIPP IS DAMAGED FROM OVERCUTTING THE NEW SERVICE CONNECTION, THEN THE NEXT LARGER SIZE HOLE SHALL BE CUT AND A SERVICE SADDLE WITH A BELL REDUCER SHALL BE INSTALLED FOR CONNECTING BACK TO THE SERVICE DIAMETER.

6. SUPPORT THE EXISTING SEWER DURING THIS WORK AS NECESSARY.

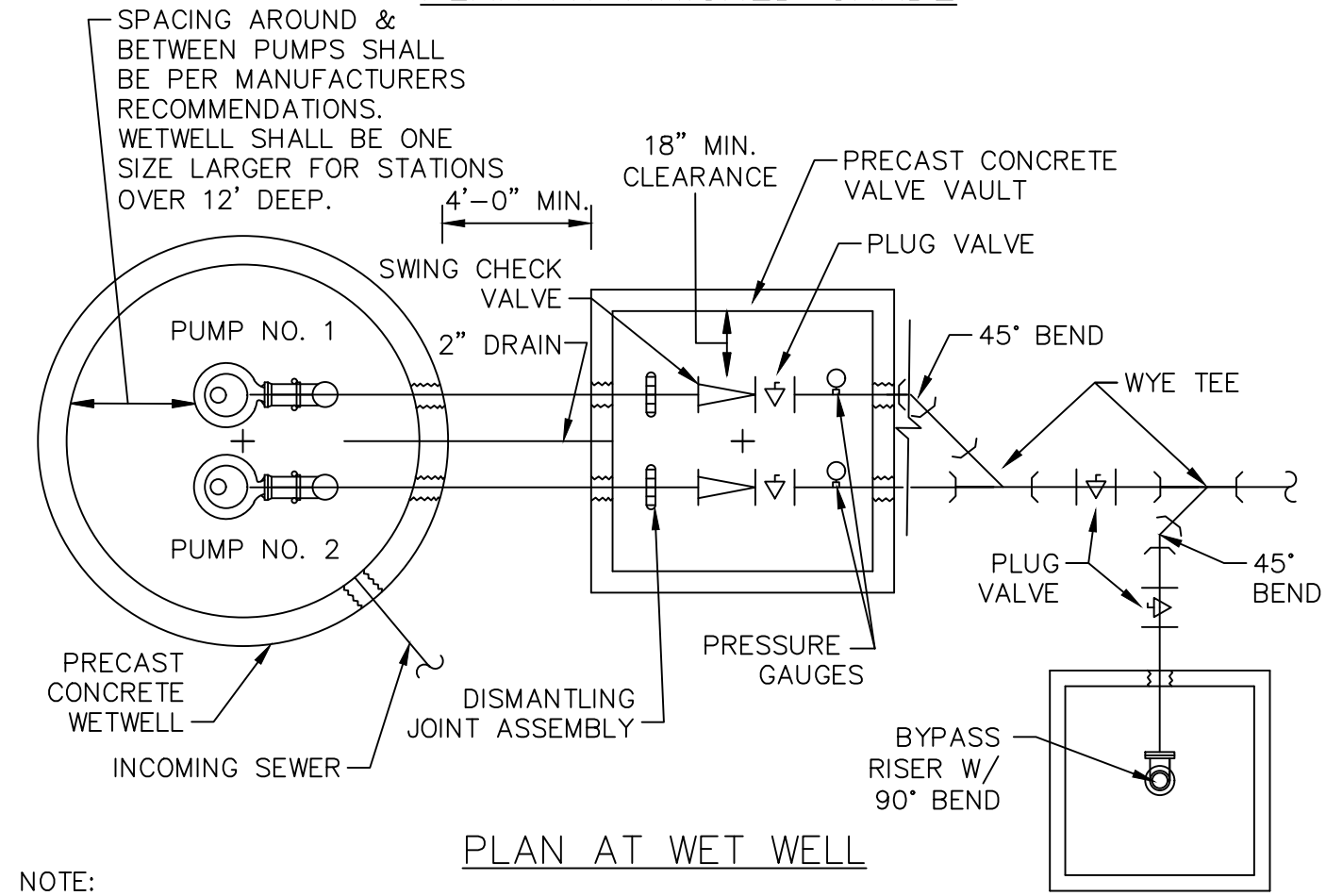
7. DEFECTS IDENTIFIED FROM THE POST–CIPP CCTV INSPECTIONS SHALL BE REPAIRED BY THE CONTRACTOR TO THE SATISFACTION OF THE ENGINEER.

TOWN OF MOORESVILLE STANDARD DETAIL	SEWER SYSTEMS	February 2014 .	
	SERVICE LATERAL CONNECTING TO CURED-IN-PLACE PIPE LINING (CIPP)	NTS	S - 37.0

PUMP STATION DETAILS:



PLAN AT FINISHED GRADE



PLAN AT WET WELL

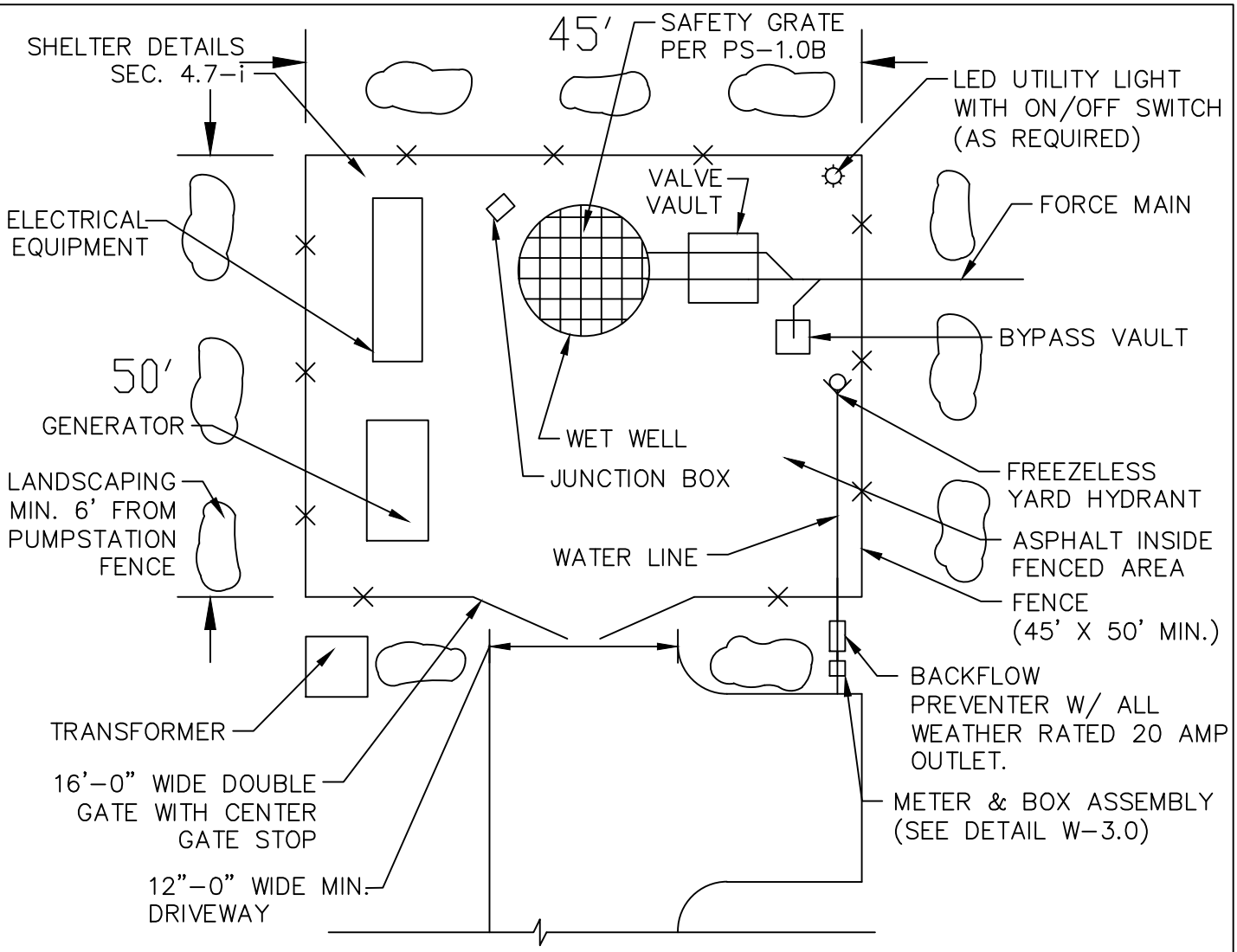
NOTE:
1. LAYOUT VARIES BASED ON SITE CONDITIONS

TOWN OF MOORESVILLE STANDARD DETAIL	PUMP STATIONS PLAN DUPLEX PUMP STATION	June 2018 Revision 2	
		NTS	PS - 1.0

SPECIFICATIONS:

1. ALUMINUM SAFETY GRATING TO HALLIDAY OR APPROVED EQUAL
2. MINIMUM 3" (76 MM) ALUMINUM "I" BAR CONSTRUCTION
3. ALL HARDWARE TO BE T-316 STAINLESS STEEL
4. GRATING SHALL BE LOCKABLE WITH OWNER-SUPPLIED PADLOCK
5. GRATING SHALL BE HINGED WITH A POSITIVE LATCH TO MAINTAIN UPRIGHT POSITION
6. GRATING SHALL BE H20 LOAD RATED
7. GRATING SHALL HAVE A SAFETY ORANGE POWDER-COATED FINISH

TOWN OF MOORESVILLE STANDARD DETAIL	PUMP STATIONS SAFETY GRATING SPECIFICATIONS	January 2014 .	
		NTS	PS - 1.0A

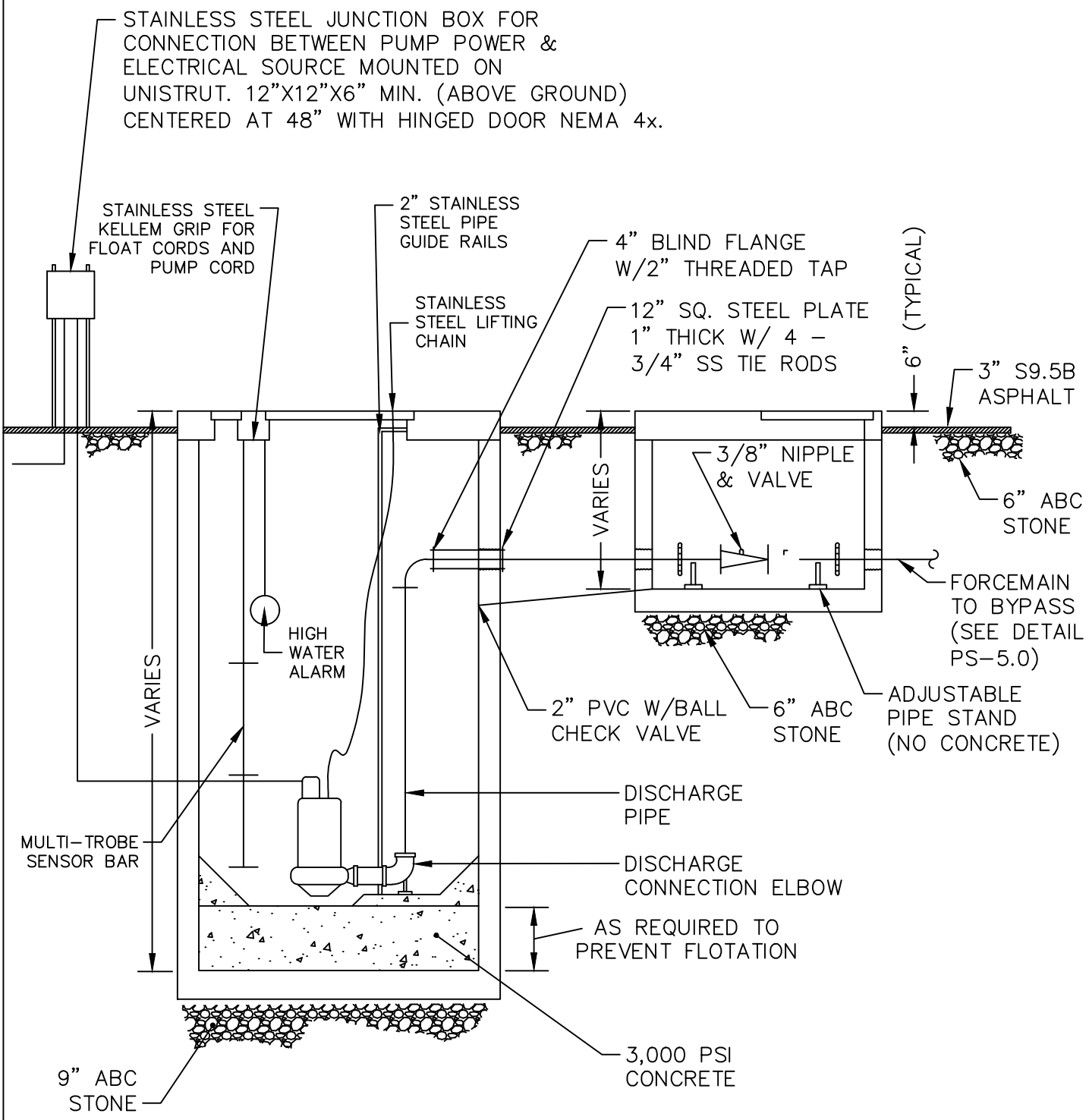


FOR REFERENCE ONLY

NOTES:

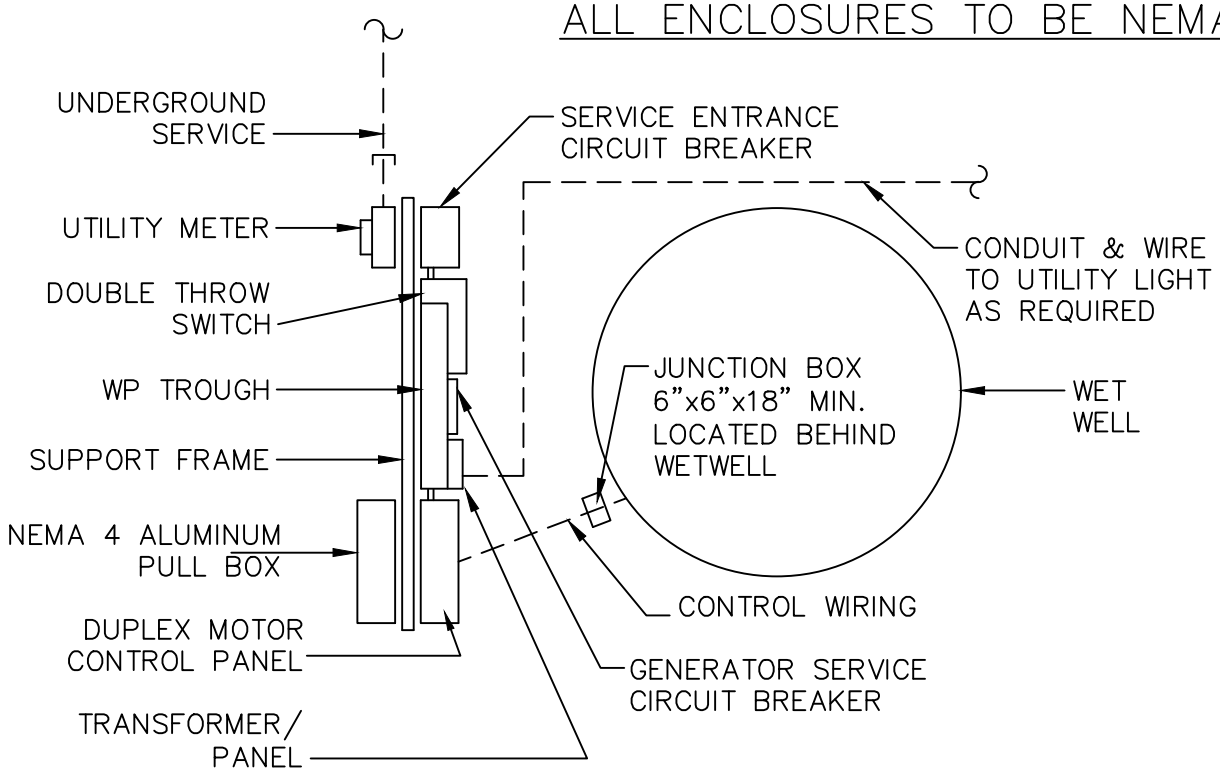
1. WATER SERVICE TO THE PUMP STATION SHALL INCLUDE A 3/4" METER & RPZ AT THE STREET RIGHT OF WAY AND 1" K-SOFT COPPER LINE TO THE YARD HYDRANT.
2. PUMP STATION COMPONENTS SHALL BE POSITIONED SUCH THAT A TOWN TRUCK CAN BE BACKED UP TO THE ELECTRICAL EQUIPMENT, WET WELL AND VALVE VAULT. GATE TO BE CENTERED ON WET WELL.
3. DRIVEWAY SHALL BE CONSTRUCTED WITH 8" ABC AND 3" S9.5B.
4. FENCE SHALL BE 6 FT. VINYL FENCE. ALL POSTS SHALL BE SET IN 12 INCH HOLES 2 FT. DEEP WITH 3,000 PSI CONCRETE.
5. AREA INSIDE FENCE SHALL BE CONSTRUCTED WITH 10" ABC AND 3" S9.5B AND SLOPED AT APPROXIMATELY 1/4 INCH PER FOOT AWAY FROM STRUCTURES.
6. FENCE SHALL BE SURROUNDED WITH LANDSCAPING CONSISTING OF 4' O.C. CRYPTOMERIA OR OTHER APPROVED BUSHES TO MATCH AREA LANDSCAPING.
7. PUMP STATION PROPERTY AND ACCESS SHALL BE DEDICATED TO THE TOWN OF MOORESVILLE FOR PUMP STATIONS MAINTAINED BY THE TOWN OF MOORESVILLE.
8. A PERMANENT GENERATOR SHALL BE PROVIDED AT THE SITE CONNECTED TO THE TRANSFER SWITCH AS SHOWN ON PS-4.0.
9. SITE SHALL BE DESIGNED SPECIFIC PER PROJECT. THIS IS INTENDED TO DEFINE LEVEL OF QUALITY ONLY.

TOWN OF MOORESVILLE STANDARD DETAIL	PUMP STATIONS TYPICAL PUMP STATION REFERENCE FIGURE	June 2018 Revision 5	
		NTS	PS - 2.0

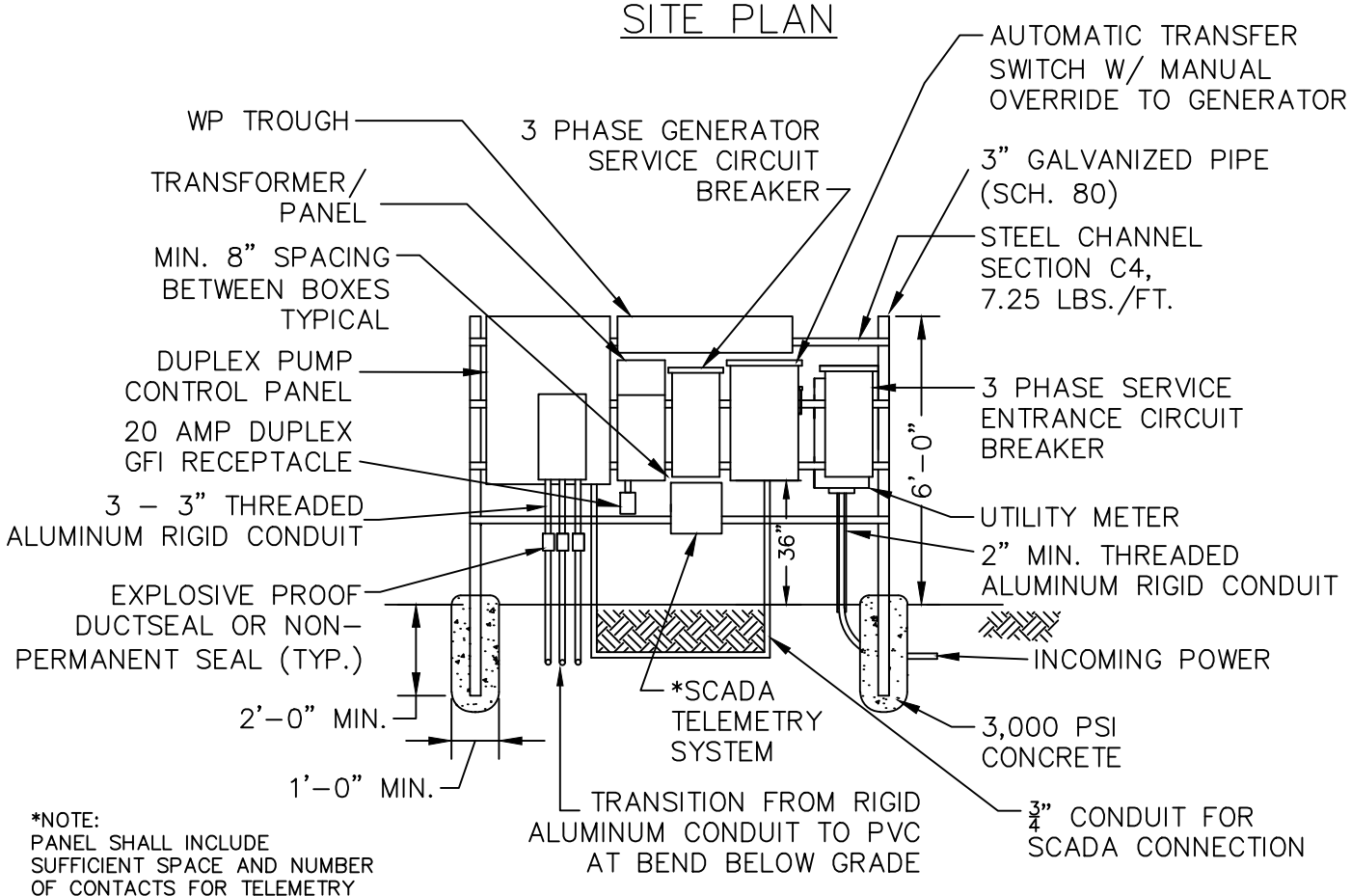


TOWN OF MOORESVILLE STANDARD DETAIL	PUMP STATIONS SECTION DUPLEX PUMP STATION	June 2018 Revision 4	
		NTS	PS - 3.0

ALL ENCLOSURES TO BE NEMA 4X



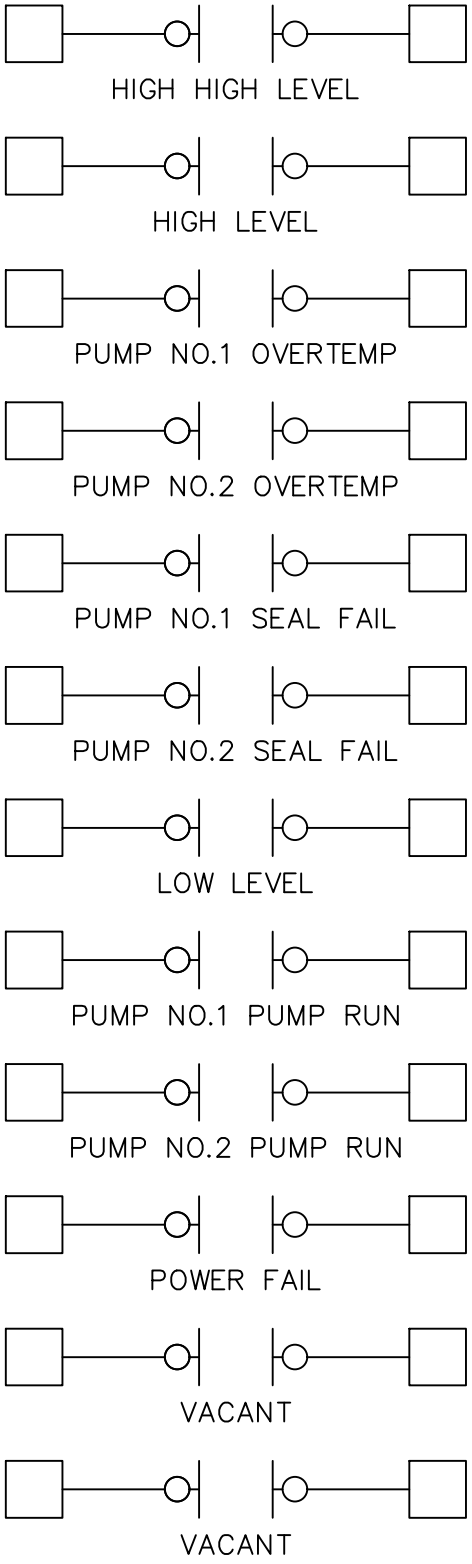
SITE PLAN



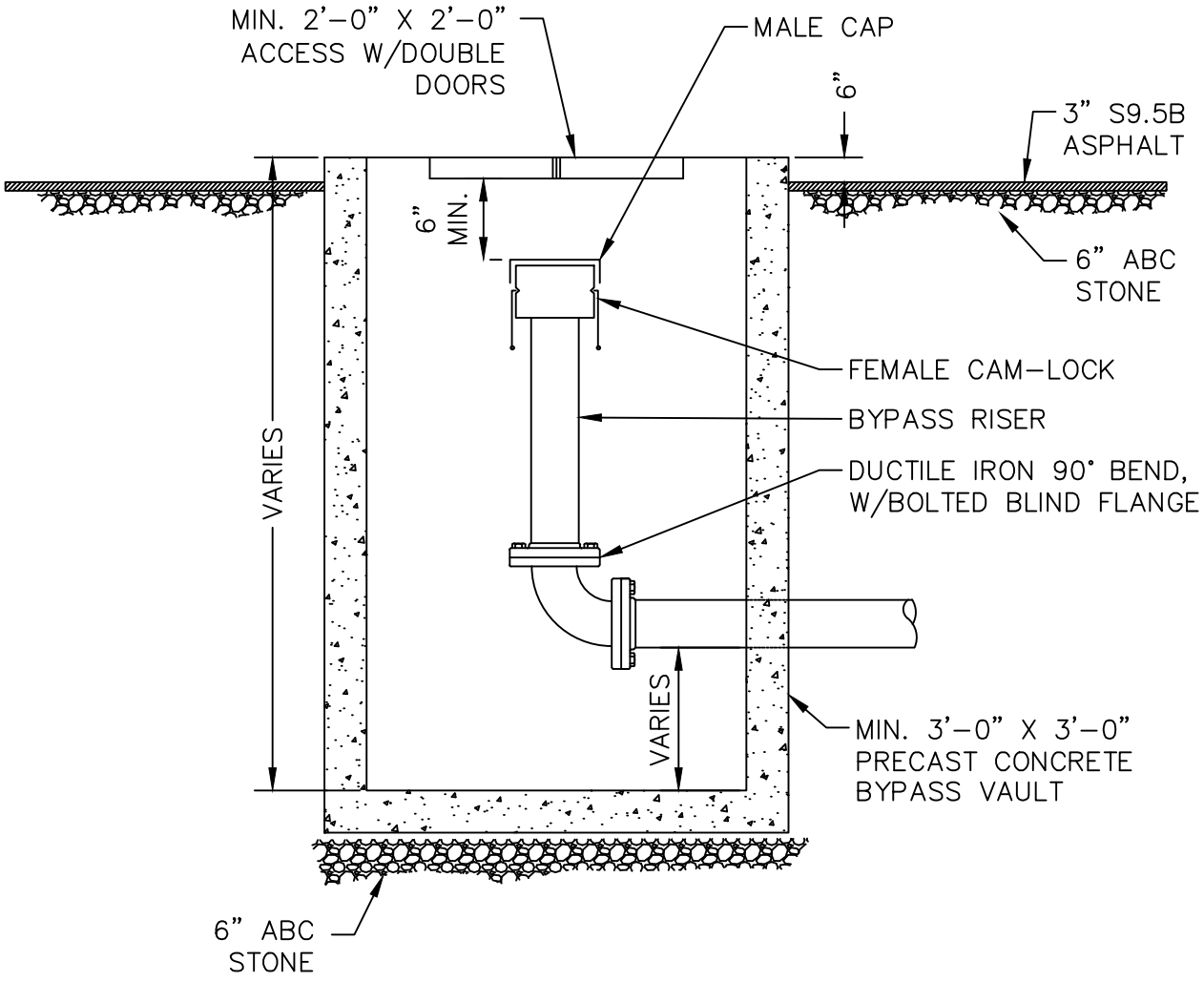
*NOTE:
PANEL SHALL INCLUDE SUFFICIENT SPACE AND NUMBER OF CONTACTS FOR TELEMETRY INSTALLATION BY TOWN.

SUPPORT FRAME DETAIL

TOWN OF MOORESVILLE STANDARD DETAIL	PUMP STATIONS ELECTRICAL DUPLEX PUMP STATION	June 2018 Revision 2 NTS | PS - 4.0



TOWN OF MOORESVILLE STANDARD DETAIL	PUMP STATIONS ELECTRICAL SCADA ALARM CONTACTS	June 2018 Revision 2 NTS | PS - 4.0A



TOWN OF MOORESVILLE STANDARD DETAIL	PUMP STATIONS SECTION BYPASS RISER	June 2018 Revision 1 NTS | PS - 5.0

STANDARD ROADWAY DETAILS:

TOWN OF MOORESVILLE

STANDARD DETAIL

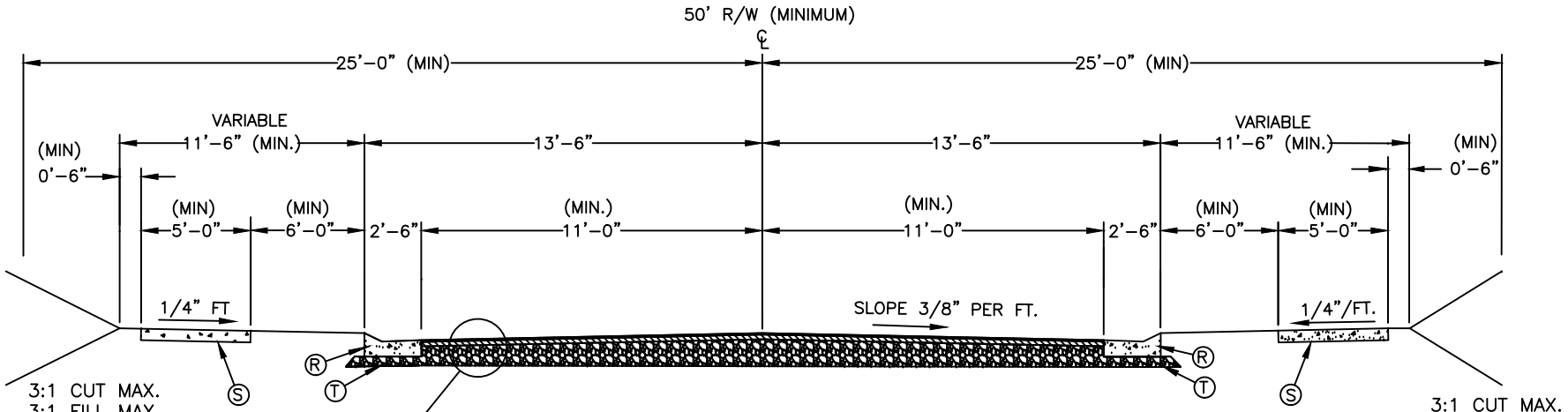
ROAD SYSTEMS

LOCAL RESIDENTIAL STREET
TYPICAL SECTION

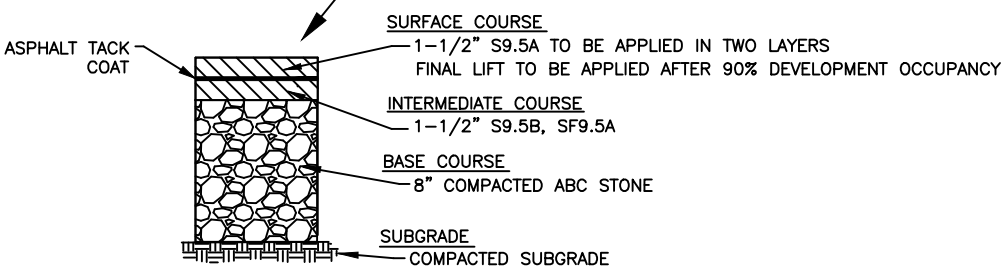
NTS

June 2018
Revision 4

R - 1.0



LOCAL RESIDENTIAL STREET



TYPICAL PAVEMENT SECTION

KEY

Ⓡ 2'-6" RESIDENTIAL CURB & GUTTER

Ⓢ 4" CONCRETE SIDEWALK

Ⓣ 4" COMPACTED ABC STONE UNDER CURB MINIMUM

NOTES:

1. SIDEWALK SHALL BE PROVIDED ON BOTH SIDES OF STREET A MINIMUM OF 6' FROM BACK OF CURB.
2. AN ALTERNATIVE PAVEMENT DESIGN MAY BE REQUIRED BY TOWN OF MOORESVILLE BASED ON SPECIFIC TRAFFIC PARAMETERS.
3. DEVELOPER MAY SUBMIT AN ALTERNATIVE PAVEMENT DESIGN OF EQUAL OR GREATER STRENGTH TO DIRECTOR OF ENGINEERING FOR APPROVAL.

TOWN OF MOORESVILLE

STANDARD DETAIL

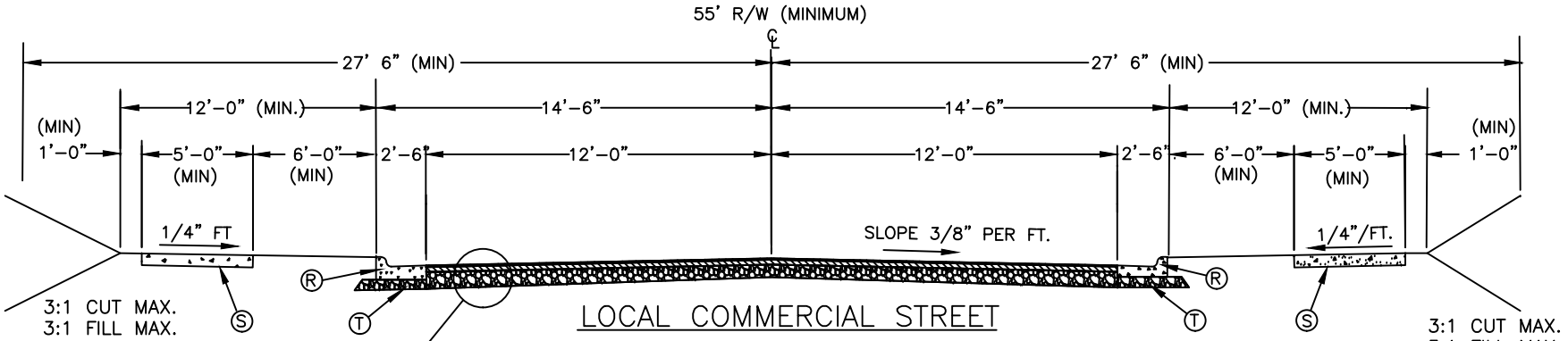
ROAD SYSTEMS

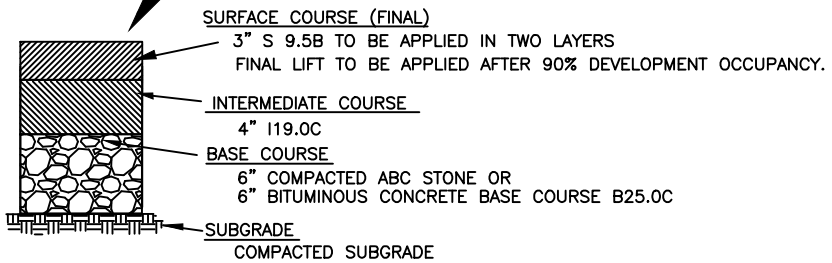
LOCAL COMMERCIAL STREET TYPICAL SECTION

NTS

January 2013
Revision 3

R - 2.0





TYPICAL MINIMUM PAVEMENT SECTION
(SEE NOTE 2.)

KEY

- (R) 2'-6" CURB AND GUTTER
- (S) 4" CONCRETE SIDEWALK
- (T) 10" COMPACTED ABC STONE OR 6" BITUMINOUS CONCRETE BASE COURSE B25.0C

NOTES:

1. SIDEWALK SHALL BE PROVIDED ON BOTH SIDES OF STREET A MINIMUM OF 6' FROM BACK OF CURB.
2. AN ALTERNATIVE PAVEMENT DESIGN MAY BE REQUIRED BY TOWN OF MOORESVILLE BASED ON SPECIFIC TRAFFIC PARAMETERS.
3. DEVELOPER MAY SUBMIT AN ALTERNATIVE PAVEMENT DESIGN OF EQUAL OR GREATER STRENGTH TO DIRECTOR OF ENGINEERING FOR APPROVAL.

TOWN OF MOORESVILLE

STANDARD DETAIL

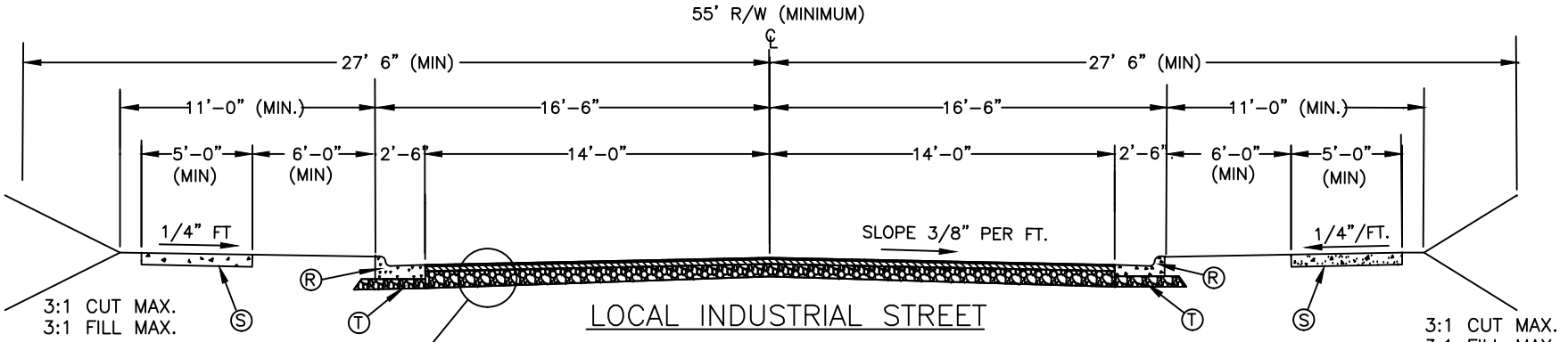
ROAD SYSTEMS

LOCAL INDUSTRIAL STREET TYPICAL SECTION

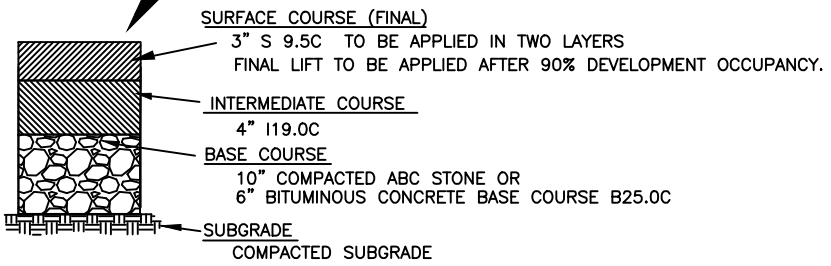
NTS

January 2012
Revision 2

R - 3.0



LOCAL INDUSTRIAL STREET



TYPICAL MINIMUM PAVEMENT SECTION
(SEE NOTE 2.)

KEY

Ⓡ 2'-6" CURB AND GUTTER

Ⓢ 4" CONCRETE SIDEWALK

Ⓣ 10" COMPACTED ABC STONE OR 6" BITUMINOUS CONCRETE BASE COURSE B25.0C

NOTES:

1. SIDEWALK SHALL BE PROVIDED ON BOTH SIDES OF STREET A MINIMUM OF 6' FROM BACK OF CURB.
2. AN ALTERNATIVE PAVEMENT DESIGN MAY BE REQUIRED BY TOWN OF MOORESVILLE BASED ON SPECIFIC TRAFFIC PARAMETERS.
3. DEVELOPER MAY SUBMIT AN ALTERNATIVE PAVEMENT DESIGN OF EQUAL OR GREATER STRENGTH TO DIRECTOR OF ENGINEERING FOR APPROVAL.

TOWN OF MOORESVILLE

STANDARD DETAIL

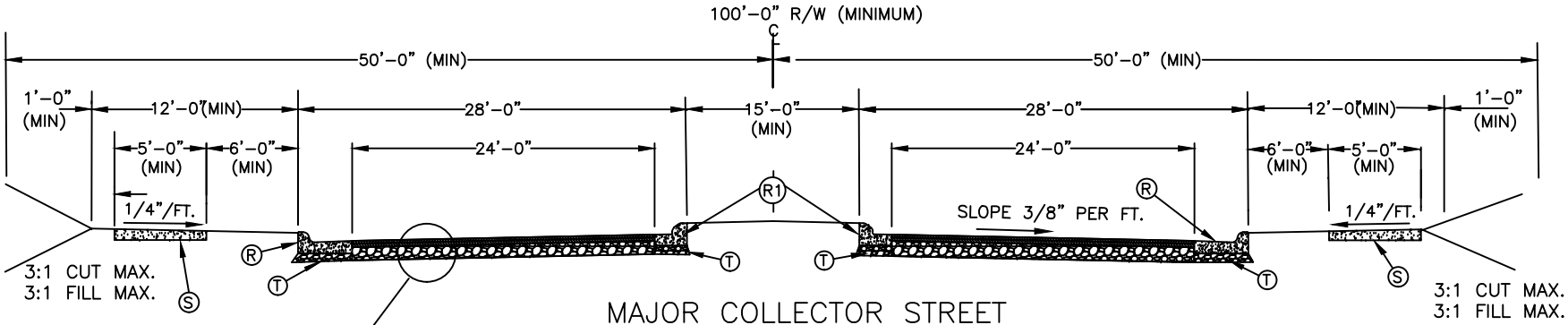
ROAD SYSTEMS

MAJOR COLLECTOR STREET TYPICAL SECTION

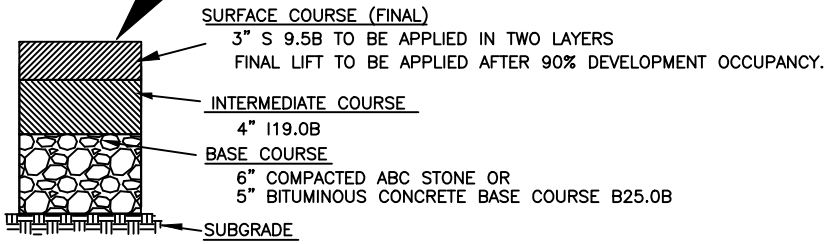
NTS

January 2012
Revision 2

R - 4.0



MAJOR COLLECTOR STREET



TYPICAL MINIMUM PAVEMENT SECTION
(SEE NOTE 2.)

KEY

- (R) 2'-6" CURB AND GUTTER
- (S) 4" CONCRETE SIDEWALK
- (R1) 1'-6" MOUNTABLE CURB
- (T) 6" COMPACTED ABC STONE OR 5" BITUMINOUS CONCRETE BASE COURSE B25.0B

NOTES:

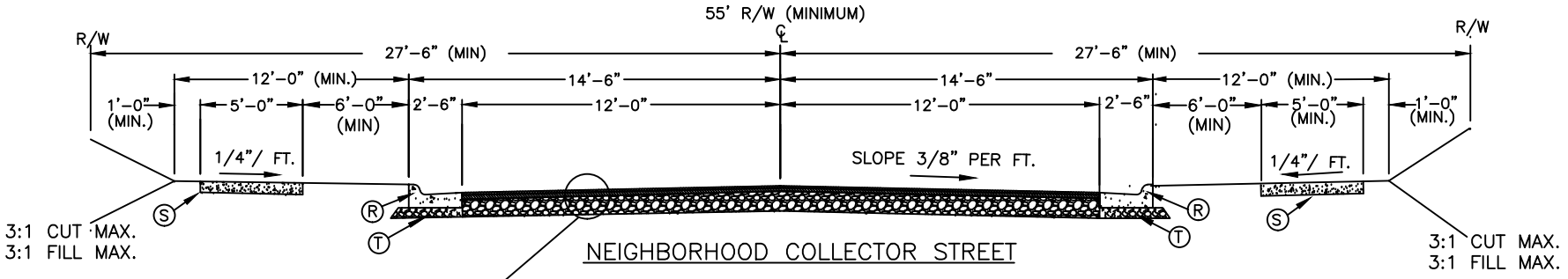
1. SIDEWALK SHALL BE PROVIDED ON BOTH SIDES OF STREET A MINIMUM OF 6' FROM BACK OF CURB.
2. AN ALTERNATIVE PAVEMENT DESIGN MAY BE REQUIRED BY TOWN OF MOORESVILLE BASED ON SPECIFIC TRAFFIC PARAMETERS.
3. DEVELOPER MAY SUBMIT AN ALTERNATIVE PAVEMENT DESIGN OF EQUAL OR GREATER STRENGTH TO DIRECTOR OF ENGINEERING FOR APPROVAL.
4. SUBDRAINS ARE REQUIRED ON ALL MEDIANS. (TO BE TIED INTO STORM DRAINAGE SYSTEM) SEE STD. NO. L-12.0
5. CURB RETURN RADIUS DIMENSIONS AT INTERSECTIONS MAY VARY DEPENDING ON MEDIAN WIDTH AND WILL BE REVIEWED ON A CASE BY CASE BASIS.
6. MEDIAN PLANTINGS TO BE APPROVED BY DIRECTOR OF ENGINEERING FOR SIGHT DISTANCE.

TOWN OF MOORESVILLE

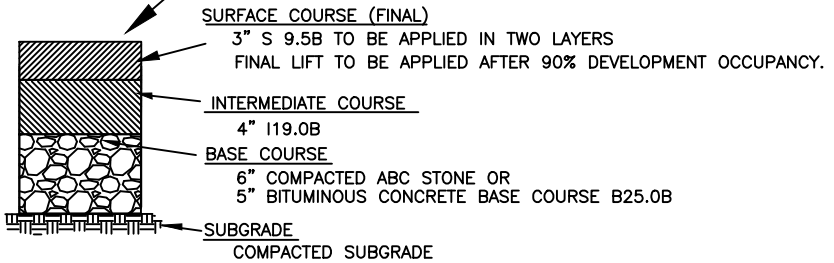
STANDARD DETAIL

ROAD SYSTEMS

NEIGHBORHOOD COLLECTOR STREET TYPICAL SECTION



NEIGHBORHOOD COLLECTOR STREET



TYPICAL MINIMUM PAVEMENT SECTION
(SEE NOTE 2.)

KEY

- (R) 2'-6" CURB AND GUTTER
- (S) 4" CONCRETE SIDEWALK
- (T) 6" COMPACTED ABC STONE OR 5" BITUMINOUS CONCRETE BASE COURSE B25.0B

NOTES:

1. SIDEWALK SHALL BE PROVIDED ON BOTH SIDES OF STREET A MINIMUM OF 6' FROM BACK OF CURB.
2. AN ALTERNATIVE PAVEMENT DESIGN MAY BE REQUIRED BY TOWN OF MOORESVILLE BASED ON SPECIFIC TRAFFIC PARAMETERS.
3. DEVELOPER MAY SUBMIT AN ALTERNATIVE PAVEMENT DESIGN OF EQUAL OR GREATER STRENGTH TO DIRECTOR OF ENGINEERING FOR APPROVAL.

January 2012
Revision 2

NTS

R - 5.0

TOWN OF MOORESVILLE

STANDARD DETAIL

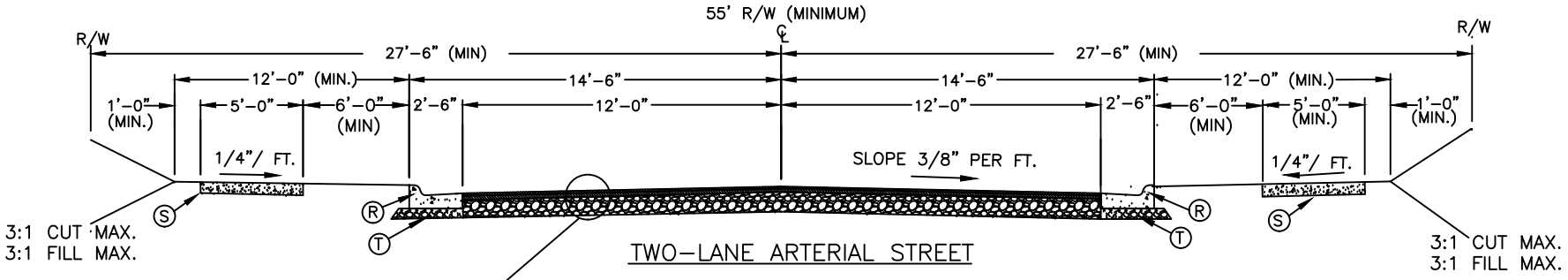
ROAD SYSTEMS

TWO-LANE ARTERIAL STREET TYPICAL SECTION

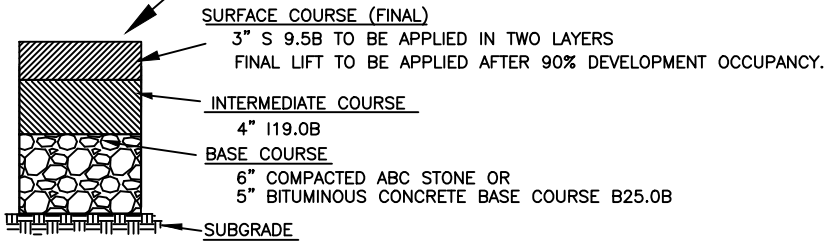
NTS

R - 6.0

January 2012
Revision 2



TWO-LANE ARTERIAL STREET



TYPICAL MINIMUM PAVEMENT SECTION
(SEE NOTE 2.)

KEY

- (R) 2'-6" CURB AND GUTTER
- (S) 4" CONCRETE SIDEWALK
- (T) 6" COMPACTED ABC STONE OR 5" BITUMINOUS CONCRETE BASE COURSE B25.0B

NOTES:

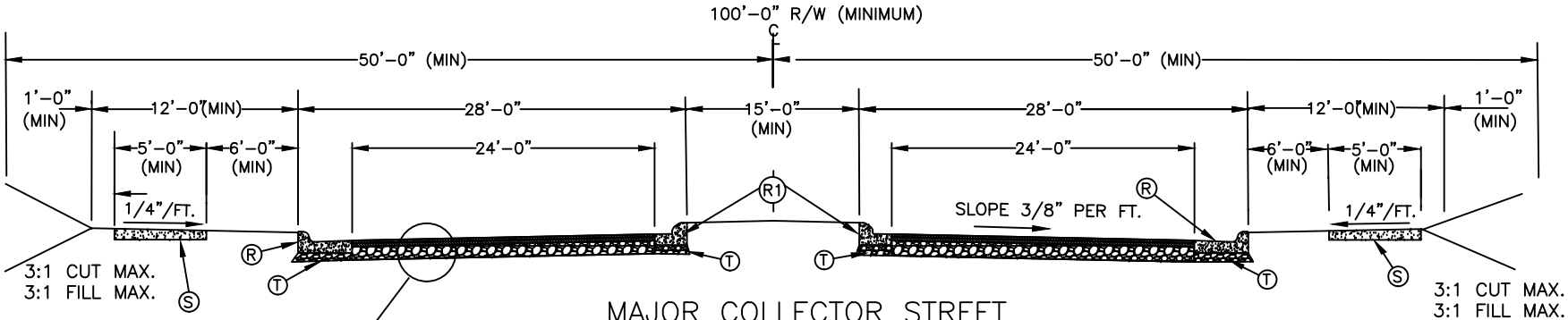
1. SIDEWALK SHALL BE PROVIDED ON BOTH SIDES OF STREET A MINIMUM OF 6' FROM BACK OF CURB.
2. AN ALTERNATIVE PAVEMENT DESIGN MAY BE REQUIRED BY TOWN OF MOORESVILLE BASED ON SPECIFIC TRAFFIC PARAMETERS.
3. DEVELOPER MAY SUBMIT AN ALTERNATIVE PAVEMENT DESIGN OF EQUAL OR GREATER STRENGTH TO DIRECTOR OF ENGINEERING FOR APPROVAL.

TOWN OF MOORESVILLE

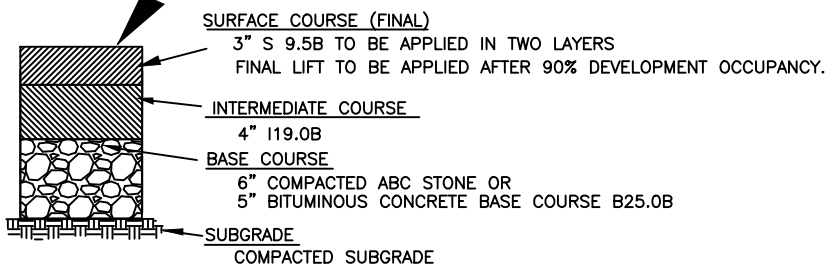
STANDARD DETAIL

ROAD SYSTEMS

FOUR-LANE ARTERIAL STREET TYPICAL SECTION



MAJOR COLLECTOR STREET



TYPICAL MINIMUM PAVEMENT SECTION
(SEE NOTE 2.)

KEY

- (R) 2'-6" CURB AND GUTTER
- (S) 4" CONCRETE SIDEWALK
- (R1) 1'-6" MOUNTABLE CURB
- (T) 6" COMPACTED ABC STONE OR 5" BITUMINOUS CONCRETE BASE COURSE B25.0B

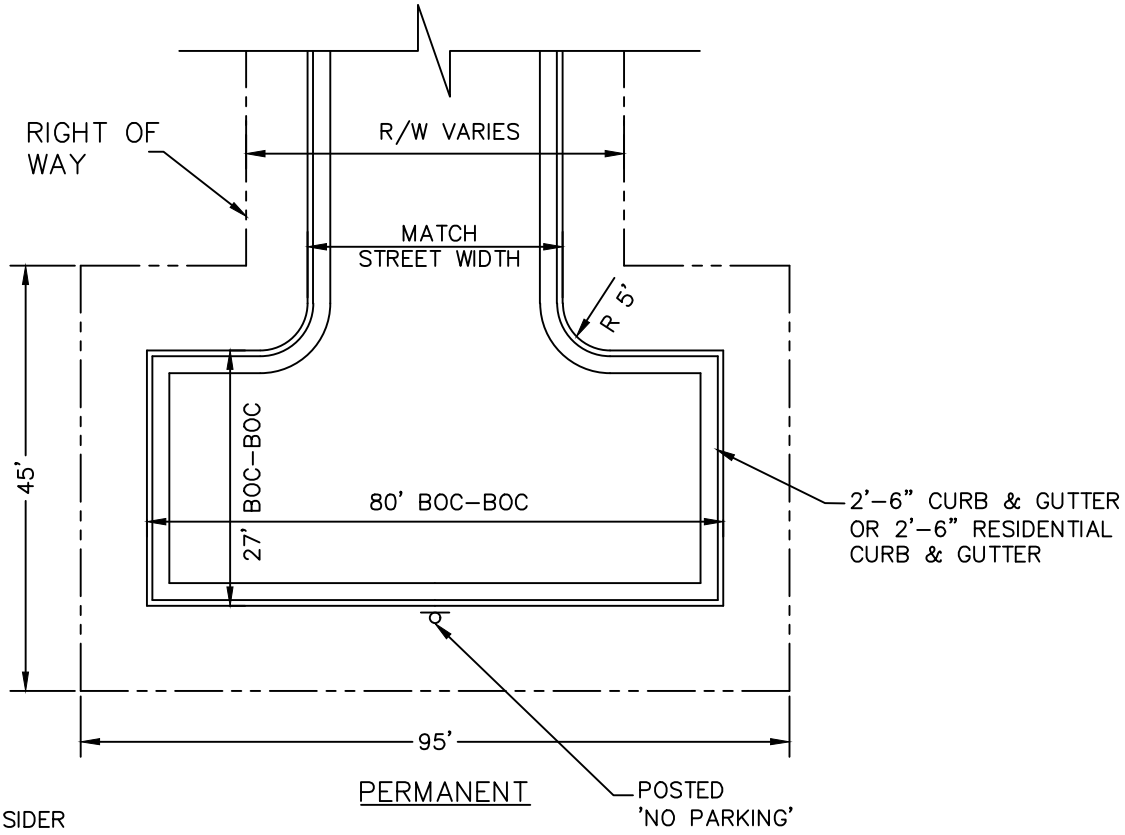
NOTES:

1. SIDEWALK SHALL BE PROVIDED ON BOTH SIDES OF STREET A MINIMUM OF 6' FROM BACK OF CURB.
2. AN ALTERNATIVE PAVEMENT DESIGN MAY BE REQUIRED BY TOWN OF MOORESVILLE BASED ON SPECIFIC TRAFFIC PARAMETERS.
3. DEVELOPER MAY SUBMIT AN ALTERNATIVE PAVEMENT DESIGN OF EQUAL OR GREATER STRENGTH TO DIRECTOR OF ENGINEERING FOR APPROVAL.
4. SUBDRAINS ARE REQUIRED ON ALL MEDIANS. (TO BE TIED INTO STORM DRAINAGE SYSTEM) SEE STD. NO. L-12.0
5. CURB RETURN RADIUS DIMENSIONS AT INTERSECTIONS MAY VARY DEPENDING ON MEDIAN WIDTH AND WILL BE REVIEWED ON A CASE BY CASE BASIS.
6. MEDIAN PLANTINGS TO BE APPROVED BY DIRECTOR OF ENGINEERING FOR SIGHT DISTANCE.

NTS

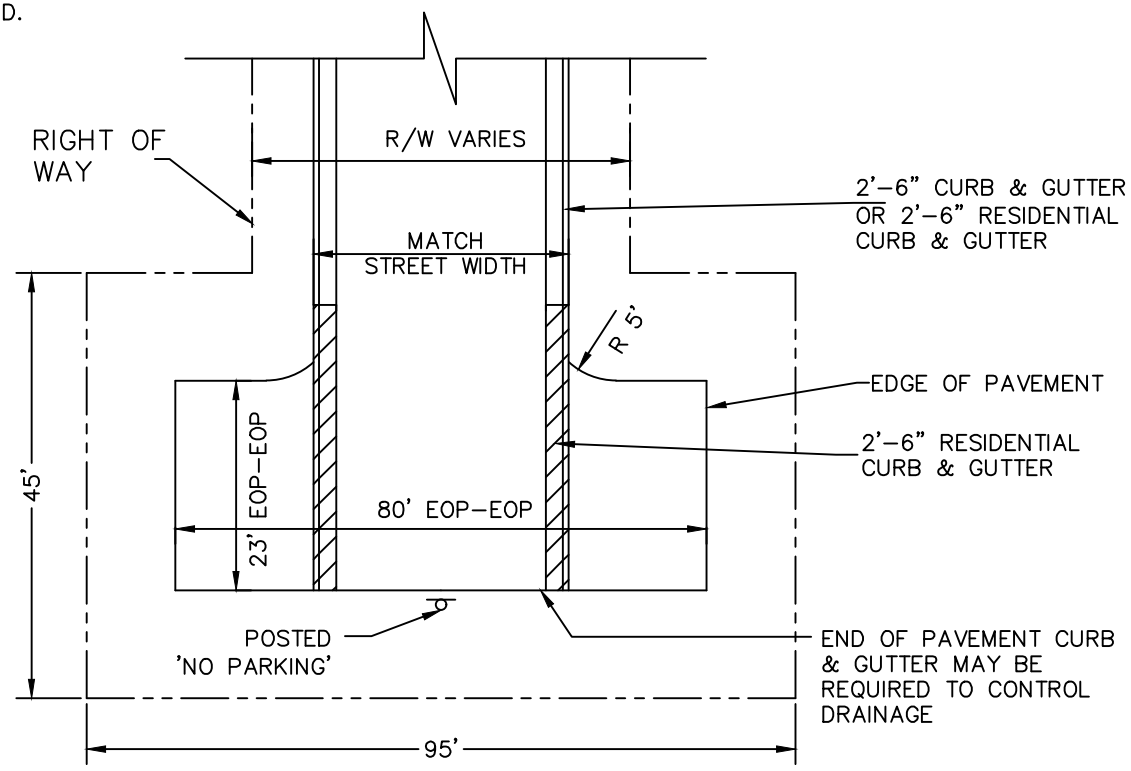
January 2012
Revision 2

R - 7.0



PERMANENT

NOTE:
DESIGNER MUST CONSIDER AND ALLOW FOR DRAINAGE OF THE TURNAROUND.



TEMPORARY

COMMERCIAL 'T' TURN AROUND SHALL BE 120' IN LIEU OF 57'

TOWN OF MOORESVILLE STANDARD DETAIL	ROAD SYSTEMS STANDARD 'T' TURN AROUND RESIDENTIAL	June 2018 Revision 2 NTS | R - 8.0

TOWN OF MOORESVILLE

STANDARD DETAIL

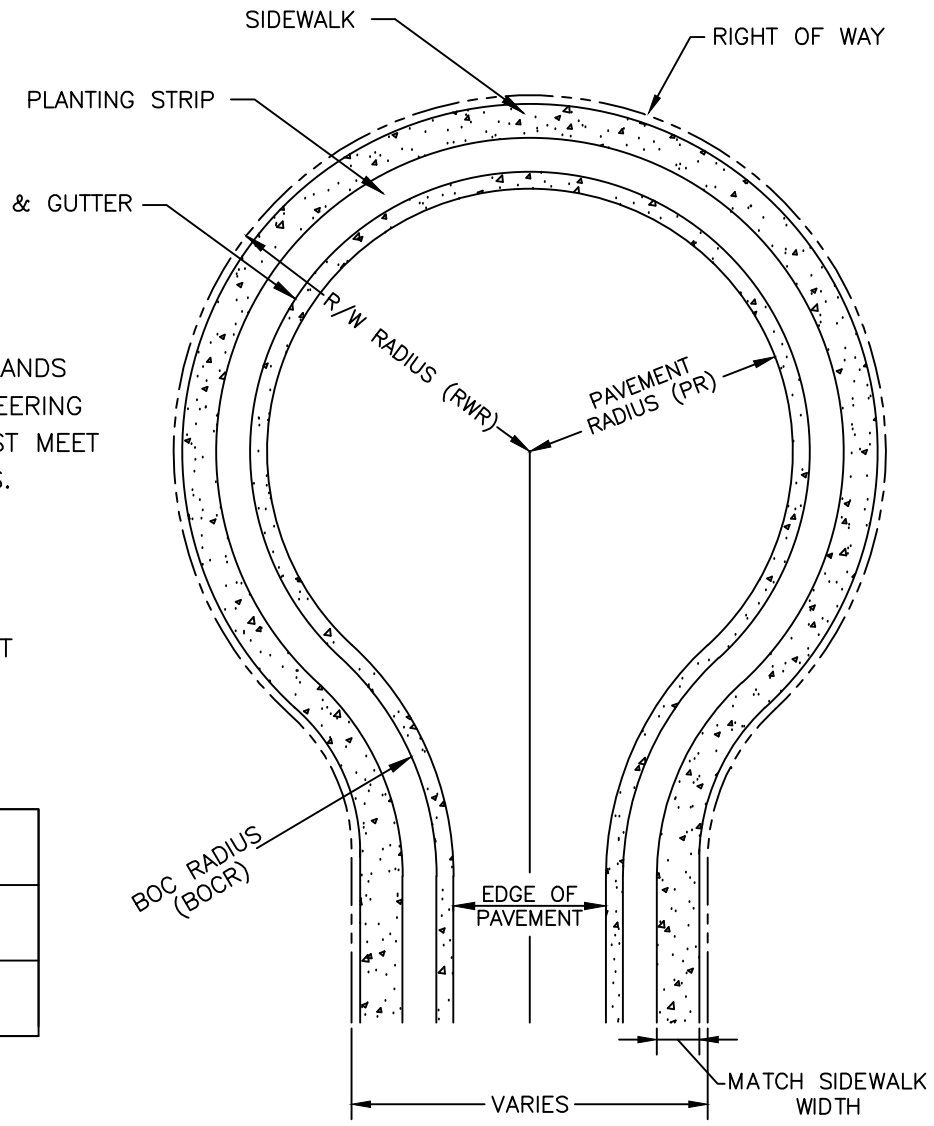
ROAD SYSTEMS

CUL-DE-SAC DETAIL

December 2016
Revision 3

NTS

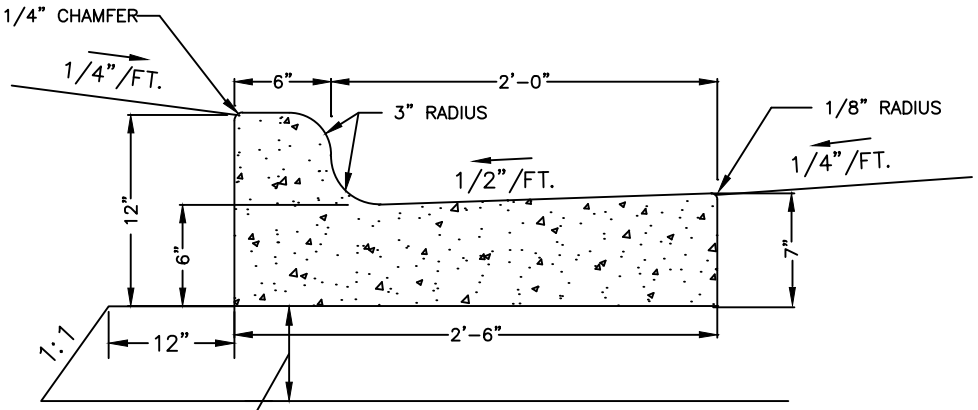
R - 9.0



NOTES:

1. ALTERNATIVE CUL–DE–SAC DESIGNS, INCLUDING ISLANDS SHALL BE SUBMITTED TO THE DIRECTOR OF ENGINEERING FOR REVIEW AND APPROVAL. ANY ALTERNATIVE MUST MEET THE TURNING REQUIREMENTS OF SERVICE VEHICLES.
2. PAVEMENT SECTION SHALL CONFORM WITH THE DESIGN REQUIREMENTS FOR COMMERCIAL OR RESIDENTIAL STREETS.
3. THE CROWN FOR PAVEMENT SHALL BE 3/8" PER FT FROM THE CENTER OF THE CUL–DE–SAC.
4. NO PARKING ALLOWED.

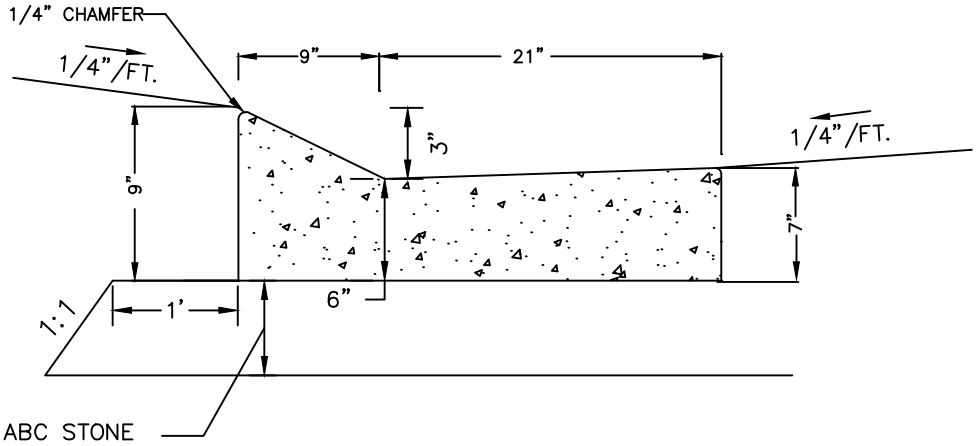
STREET CLASSIFICATION	PR	RWR	BOCR
COMMERCIAL	42'	52'	35'
RESIDENTIAL	38'	50'	20'



COLLECTOR STREET
6" COMPACTED ABC STONE
OR 5" BITUMINOUS CONCRETE
BASE COURSE B25.0B

2'-6" CURB AND GUTTER

COMMERCIAL STREET/THOROUGHFARE
10" COMPACTED ABC STONE
OR 6" MIN. BITUMINOUS CONCRETE
BASE COURSE B25.0C



6" COMPACTED ABC STONE

2'-6" RESIDENTIAL CURB & GUTTER

NOTES:

1. CONTRACTION JOINTS SHALL BE PROVIDED AT 10' INTERVALS FOR ALL CURB AND GUTTER TYPES AND METHODS OF PLACEMENT. ON REPAIR SECTIONS 5' MIN. INTERVALS ARE REQUIRED.
2. PROVIDE 1/2" EXPANSION JOINTS AT 90' INTERVALS AND AT ALL STRUCTURES.
3. DRIVEWAY LOCATIONS MUST BE ESTABLISHED AND INSTALLED WHEN CURB IS POURED. SEE DETAIL R-18.0.

TOWN OF MOORESVILLE STANDARD DETAIL	ROAD SYSTEMS CURB AND GUTTER	March 2013 Revision 2	
		NTS	R - 10.0

TOWN OF MOORESVILLE

STANDARD DETAIL

ROAD SYSTEMS

CURB TRANSITION

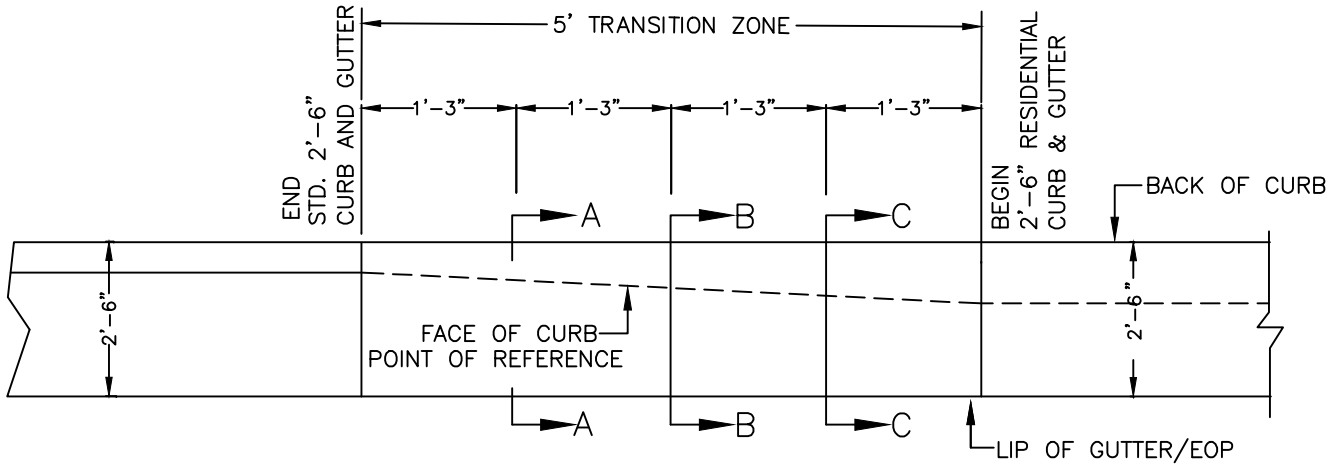
2'-6" CURB AND GUTTER TO 2'-6" RESIDENTIAL C & G

January 2015

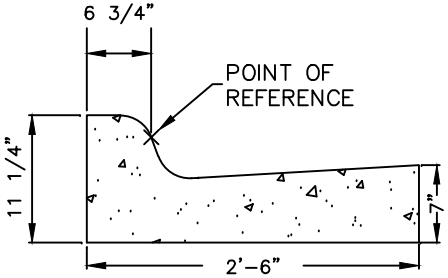
Revision 1

NTS

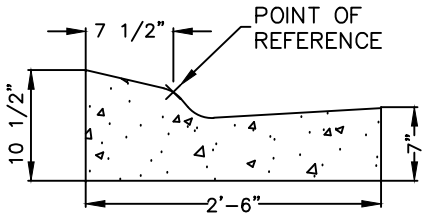
R - 11.0



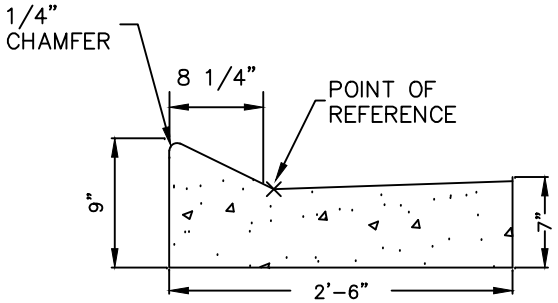
PLAN VIEW



SECTION A–A



SECTION B–B



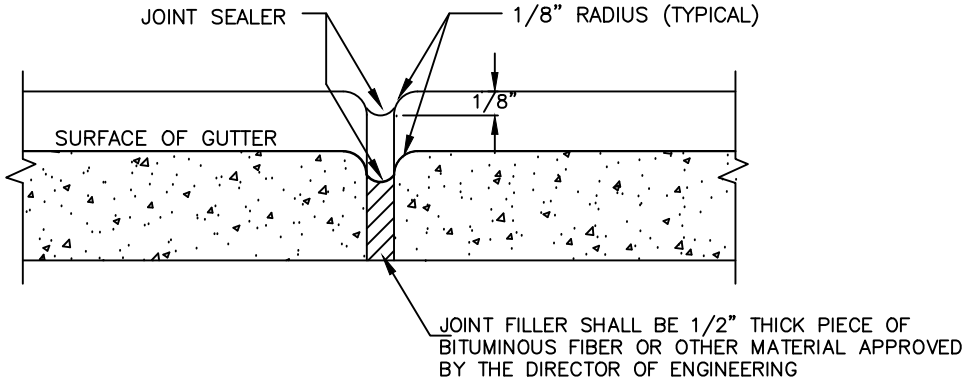
SECTION C–C

NOTES:

1. TRANSITION IS NOT TO BE LOCATED WITHIN THE CURB RADIUS.
2. NO CATCH BASINS ARE ALLOWED INSIDE THE TRANSITION ZONE.

TOWN OF MOORESVILLE

STANDARD DETAIL



TRANSVERSE EXPANSION JOINT

NOTES:

1. CONTRACTION JOINTS SHALL BE SPACED AT 10–FOOT INTERVALS. JOINT SPACING MAY BE ALTERED BY THE ENGINEER TO PREVENT UNCONTROLLED CRACKING.
2. CONTRACTION JOINTS MAY BE INSTALLED BY THE USE OF TEMPLATES OR FORMED BY OTHER APPROVED METHODS. WHERE SUCH JOINTS ARE NOT FORMED BY TEMPLATES, A MINIMUM DEPTH OF 1 1/2" SHALL BE OBTAINED.
3. ALL EXPANSION JOINTS SHALL BE SPACED AT 90–FOOT INTERVALS, AND ADJACENT TO ALL RIGID OBJECTS. JOINTS IN SIDEWALK SHALL MATCH JOINTS IN CURB. (WITH OR WITHOUT PLANTING STRIP)
4. CONCRETE COMPRESSIVE STRENGTH SHALL BE 3600 P.S.I. IN 28 DAYS.
5. CURB SHALL BE DEPRESSED AT INTERSECTIONS TO PROVIDE FOR FUTURE ACCESSIBLE RAMPS.
6. TOP 6" OF SUBGRADE BENEATH THE CURB AND GUTTER SHALL BE COMPACTED TO 100% STANDARD PROCTOR DENSITY.

ROAD SYSTEMS

CURB AND GUTTER
EXPANSION JOINT

January 2009
Revision 1

NTS

R - 12.0

TOWN OF MOORESVILLE

STANDARD DETAIL

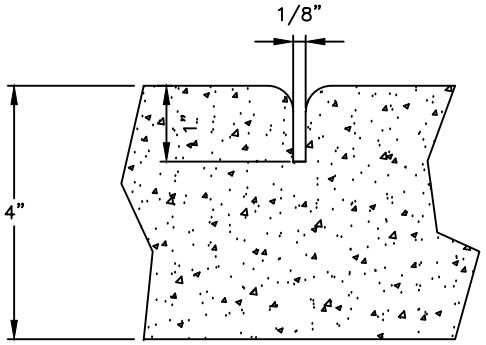
CONCRETE SIDEWALKS

ROAD SYSTEMS

NTS

January 2009
Revision 1

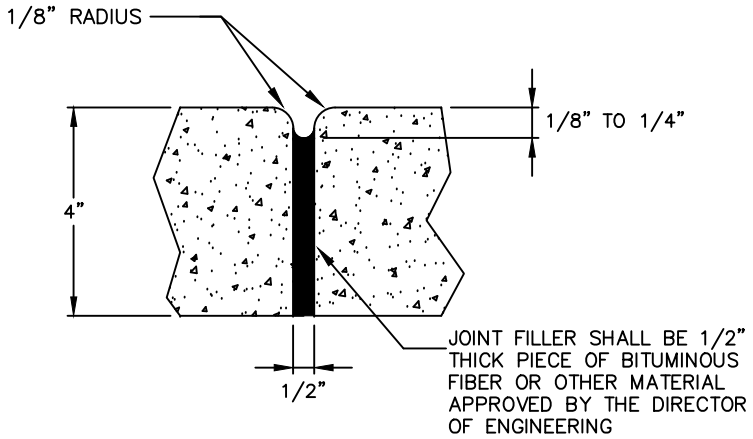
R - 13.0



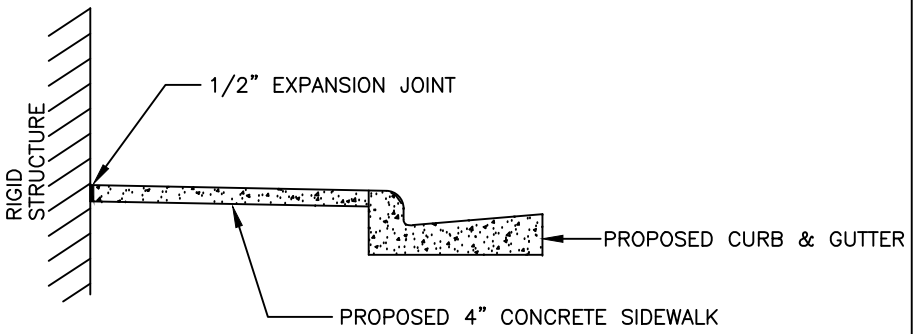
CONTRACTION JOINT IN SIDEWALK

GENERAL NOTES:

1. A CONTRACTION JOINT 1" DEEP WITH 1/8" RADII SHALL BE REQUIRED IN THE CONCRETE SIDEWALK AT 5' INTERVALS. ONE 1/2" EXPANSION JOINT WILL BE REQUIRED AT 45' INTERVALS NOT TO EXCEED 50' AND MATCHING EXPANSION/CONSTRUCTION JOINT IN ADJACENT CURB AND GUTTER. A SEALED 1/2" EXPANSION JOINT WILL BE REQUIRED WHERE THE SIDEWALK JOINS ANY RIGID STRUCTURE.
2. SIDEWALK AT DRIVEWAY ENTRANCES SHALL BE 6" THICK.
3. WIDTH OF SIDEWALKS SHALL BE A MINIMUM OF 5'.
4. SIDEWALK TO BE POURED TO END OF RADIUS AT INTERSECTING STREETS.
5. CONCRETE COMPRESSIVE STRENGTH SHALL BE 3600 PSI. IN 28 DAYS.



TRANSVERSE EXPANSION JOINT IN SIDEWALK



DETAILS SHOWING EXPANSION JOINTS IN CONCRETE SIDEWALK

TOWN OF MOORESVILLE

STANDARD DETAIL

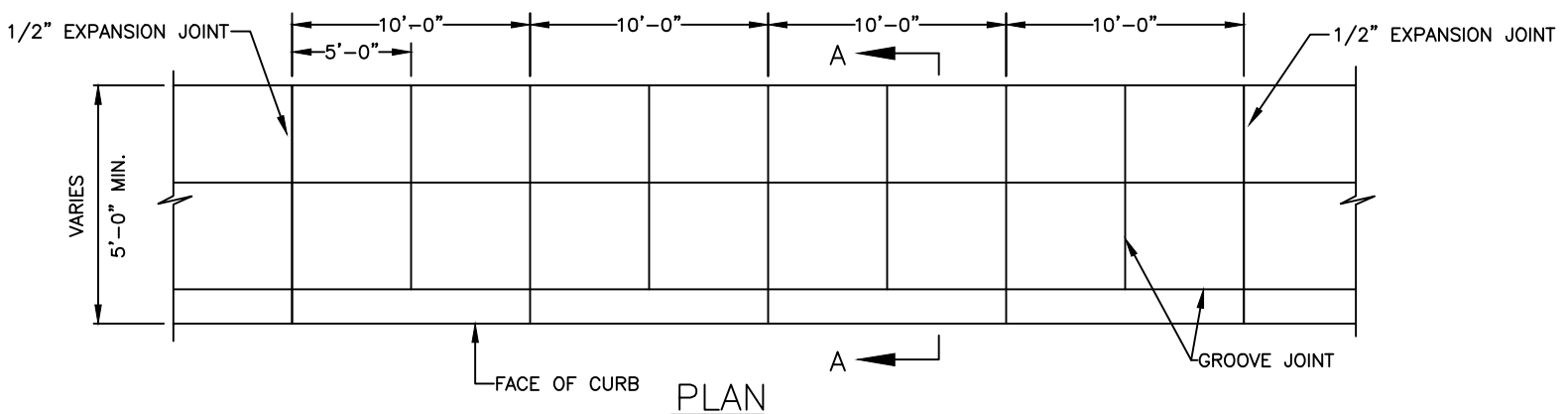
ROAD SYSTEMS

MONOLITHIC CONCRETE CURB AND SIDEWALK

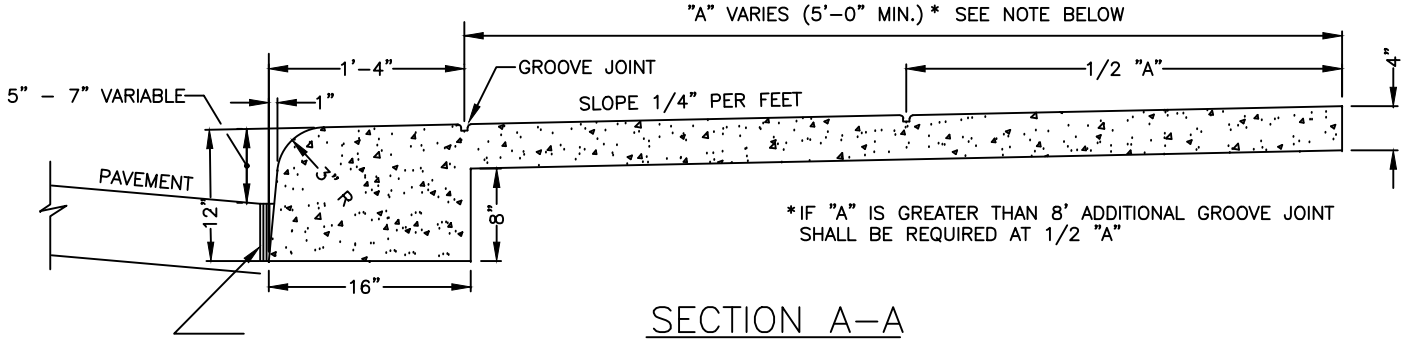
NTS

January 2009
Revision 1

R - 14.0



PLAN



SECTION A-A

TWO 1/2" THICK PIECES BITUMINOUS FIBER REQUIRED IF SUBBASE IS CONCRETE. MUST BE SEALED WITH APPROVED JOINT SEALER.

GENERAL NOTES:

1. A GROOVE JOINT 1" DEEP WITH 1/3" RADII SHALL BE REQUIRED IN THE CONCRETE SIDEWALK AT 5' INTERVALS. ONE 1/2" EXPANSION JOINT WILL BE REQUIRED AT 45' INTERVALS. A 1/2" EXPANSION JOINT WILL BE REQUIRED WHERE THE SIDEWALK JOINS ANY RIGID STRUCTURE.
2. ALL CONCRETE TO BE 3600 P.S.I. COMPRESSIVE STRENGTH.
3. SEE STANDARD R-12.0 FOR DETAIL OF EXPANSION JOINT AND GROOVE JOINT.
4. SEE STANDARD R-15.0 FOR DETAIL OF DRIVEWAY.
5. MONOLITHIC CURB AND SIDEWALK TO BE CONSTRUCTED ONLY WHEN REPLACING GRANITE CURB OR AT LOCATIONS APPROVED BY THE DIRECTOR OF ENGINEERING.

TOWN OF MOORESVILLE

STANDARD DETAIL

ROAD SYSTEMS

DRIVEWAY WITH SIDEWALK ABUTTING CURB (2'-6" CURB AND GUTTER)

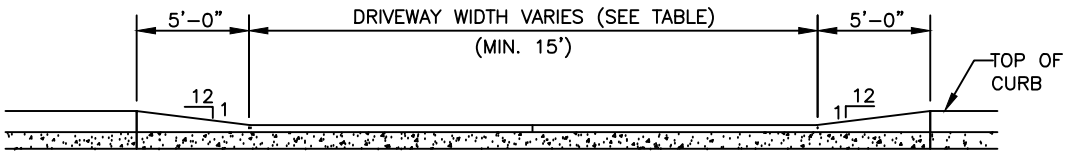
January 2009
Revision 1

NTS

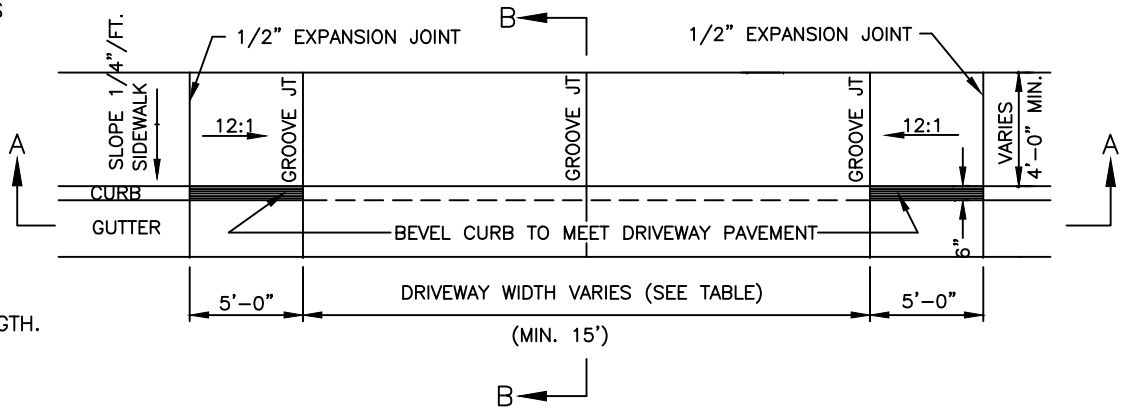
R - 15.0

NOTE:

1. 1/2" EXPANSION JOINTS REQUIRE INSTALLATION OF ONE 1/2" THICK PIECE OF BITUMINOUS FIBER OR OTHER APPROVED MATERIAL THROUGH THE THE ENTIRE SLAB.
2. ALL DRIVEWAYS MUST MEET THE CURRENT TOWN DRIVEWAY REGULATIONS AND NCDOT REQUIREMENTS FOR SPACING, SIGHT DISTANCE AND OFFSETS FROM PROPERTY LINES AND INTERSECTIONS.



SECTION A – A



PLAN

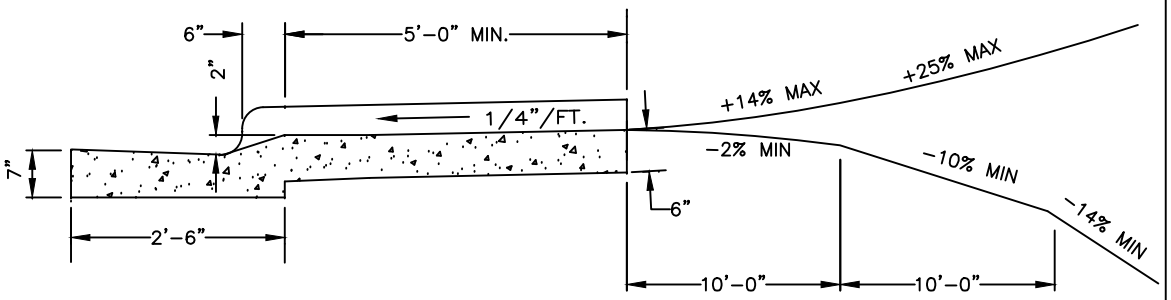
GENERAL NOTES:

ALL CONCRETE TO BE 3600 P.S.I. COMPRESSIVE STRENGTH.

ALL CURB OR CURB AND GUTTER AND SIDEWALKS ARE TO BE REMOVED TO THE NEAREST JOINT BEYOND NEW CONSTRUCTION OR CUT WITH A SAW AND REMOVED. SAW CUT OR JOINT TO BE PERPENDICULAR TO EDGE OF EXISTING PAVEMENT.
SEE STD. R–12.0 FOR DETAIL OF EXPANSION JOINT AND CONTRACTION JOINT.

DRIVEWAY WIDTHS		
TYPE	MIN.	MAX.
RESIDENTIAL	15'	30'
COMMERCIAL	20'*	50'

*24' MIN. WIDTH REQUIRED FOR TWO–WAY TRAFFIC



SECTION B – B

TOWN OF MOORESVILLE

STANDARD DETAIL

ROAD SYSTEMS

DROP CURB DRIVEWAY
MONOLITHIC CONCRETE
CURB AND SIDEWALK

NTS

January 2009
Revision 1

R - 16.0

GENERAL NOTES:

ALL CONCRETE TO BE 3600 P.S.I. COMPRESSIVE STRENGTH.

A 1/2" EXPANSION JOINT WILL BE REQUIRED WHERE WHERE THE SIDEWALK JOINS ANY RIGID STRUCTURE. SEE STANDARD R–12.0.

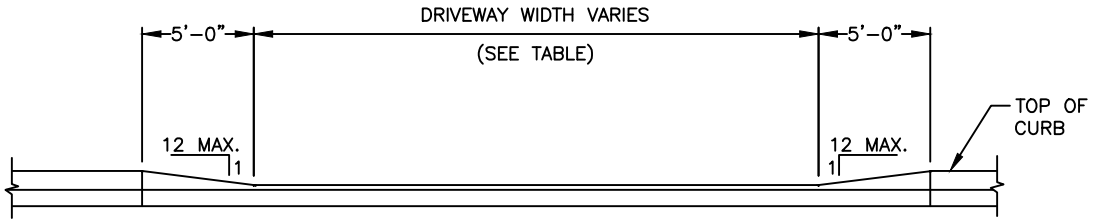
THIS DETAIL TO BE USED ONLY IN CONJUNCTION WITH MONOLITHIC SIDEWALK AS ON STANDARD NO. R–14.0.

NOTES:

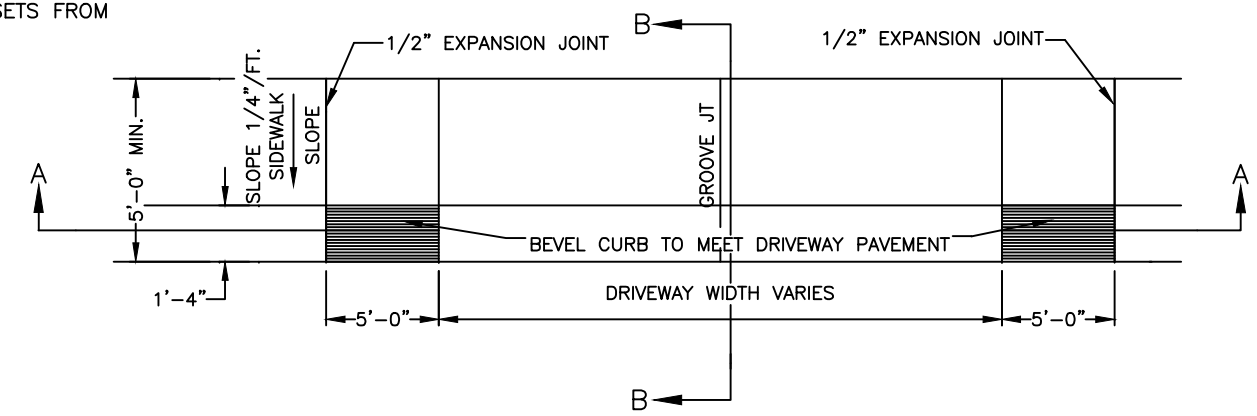
1. ALL DRIVEWAYS MUST MEET THE CURRENT TOWN DRIVEWAY REGULATIONS AND NCDOT REQUIREMENTS FOR SPACING, SIGHT DISTANCES, AND OFFSETS FROM PROPERTY LINES AND INTERSECTIONS.

DRIVEWAY WIDTHS		
TYPE	MIN.	MAX.
RESIDENTIAL	15'	30'
COMMERCIAL	20'*	50'

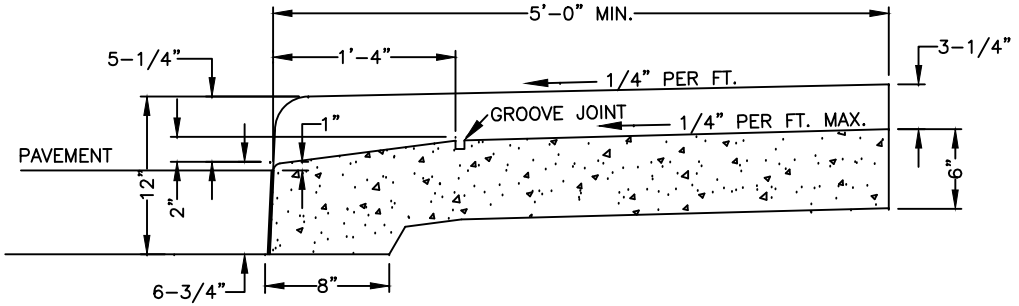
*24' MIN. WIDTH REQUIRED FOR TWO–WAY TRAFFIC



SECTION A–A



PLAN



SECTION B–B

TOWN OF MOORESVILLE

STANDARD DETAIL

ROAD SYSTEMS

DROP CURB COMMERCIAL DRIVEWAY WITH PLANTING STRIP (2'-6" CURB AND GUTTER)

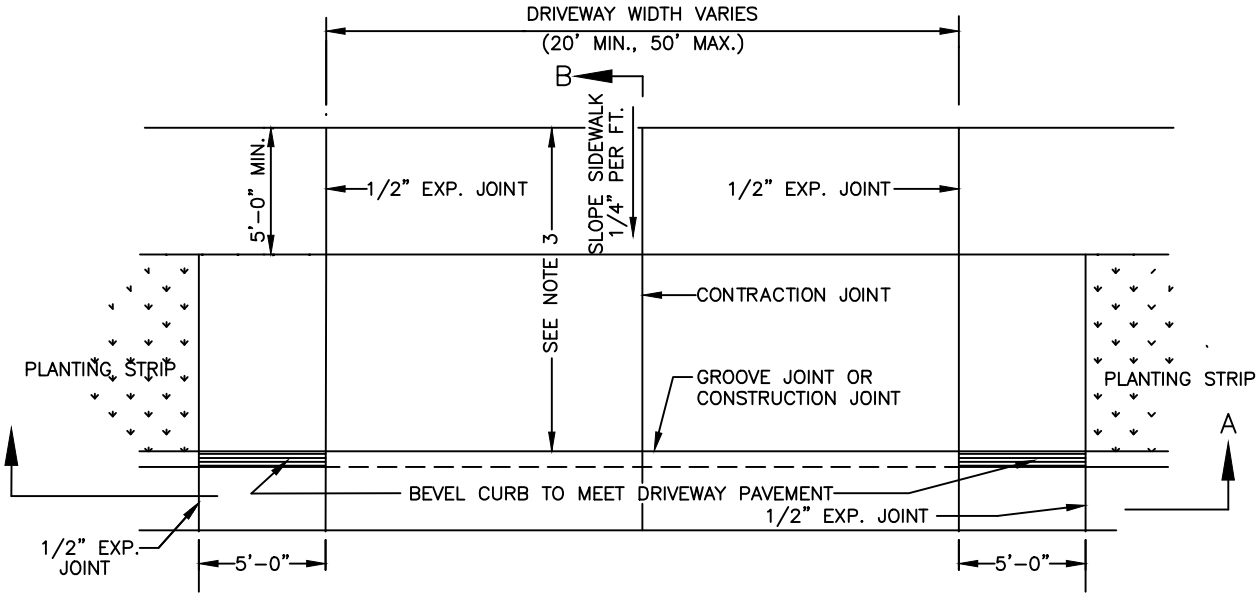
NTS

June 2018
Revision 2

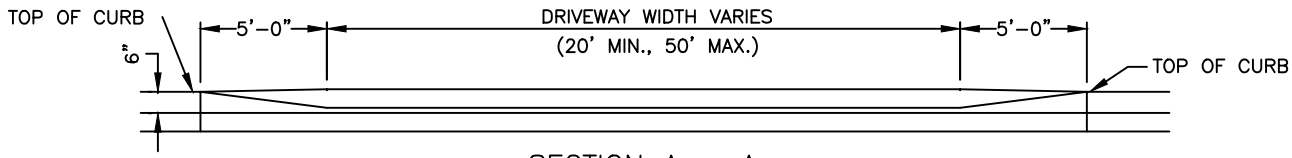
R - 17.0

NOTES:

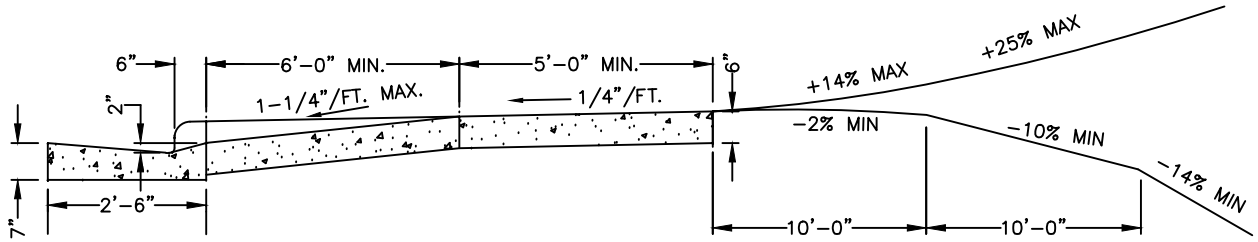
1. ALL CONCRETE TO BE 3600 P.S.I.
2. ALL CURB AND GUTTER AND SIDEWALKS ARE TO BE REMOVED TO NEAREST JOINT BEYOND NEW CONSTRUCTION OR CUT WITH A SAW AND REMOVED. SAW CUT OR JOINT TO BE PERPENDICULAR TO EDGE OF EXISTING PAVEMENT. SEE STD. NO. R-12.0 FOR JOINT DETAIL.
3. ALL DRIVEWAYS MUST MEET THE CURRENT NCDOT REQUIREMENTS FOR SPACING, SIGHT DISTANCE AND OFFSETS FROM PROPERTY LINES AND INTERSECTIONS.
4. DRIVEWAYS SHALL BE FREE FROM ALL OBSTRUCTIONS SUCH AS WATER METERS, CLEANOUTS, CURB OR ACCESSIBLE RAMPS AND STORM DRAINAGE STRUCTURES.



PLAN VIEW



SECTION A – A



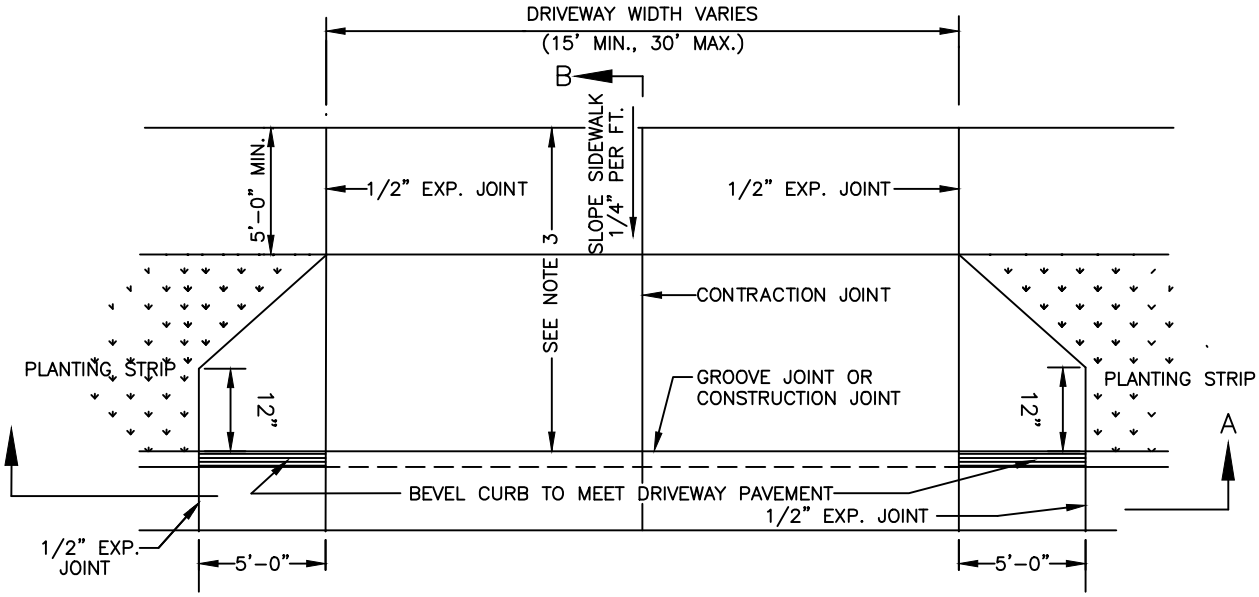
SECTION B – B

TOWN OF MOORESVILLE

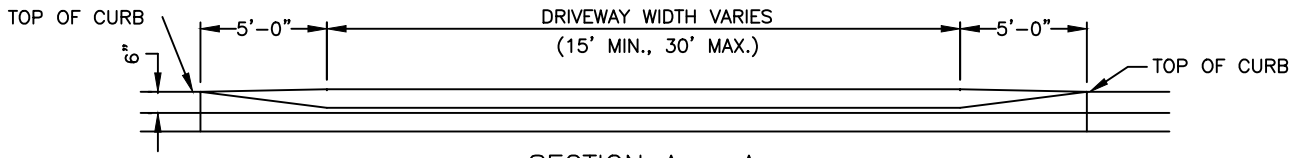
STANDARD DETAIL

NOTES:

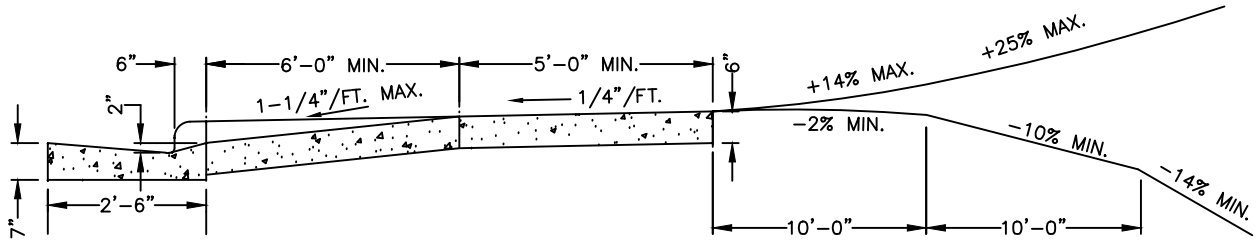
1. ALL CONCRETE TO BE 3600 P.S.I.
2. ALL CURB AND GUTTER AND SIDEWALKS ARE TO BE REMOVED TO NEAREST JOINT BEYOND NEW CONSTRUCTION OR CUT WITH A SAW AND REMOVED. SAW CUT OR JOINT TO BE PERPENDICULAR TO EDGE OF EXISTING PAVEMENT. SEE STD. NO. R-12.0 FOR JOINT DETAIL.
3. ALL DRIVEWAYS MUST MEET THE CURRENT NCDOT REQUIREMENTS FOR SPACING, SIGHT DISTANCE AND OFFSETS FROM PROPERTY LINES AND INTERSECTIONS.
4. DRIVEWAYS SHALL BE FREE FROM ALL OBSTRUCTIONS SUCH AS WATER METERS, CLEANOUTS, CURB OR ACCESSIBLE RAMPS AND STORM DRAINAGE STRUCTURES.
5. DRIVEWAY LOCATION MUST BE ESTABLISHED AND INSTALLED WHEN CURB IS POURED. SEE DETAIL R-10.0.



PLAN VIEW



SECTION A – A



SECTION B – B

ROAD SYSTEMS

DROP CURB RESIDENTIAL DRIVEWAY WITH PLANTING STRIP (2'-6" CURB AND GUTTER)

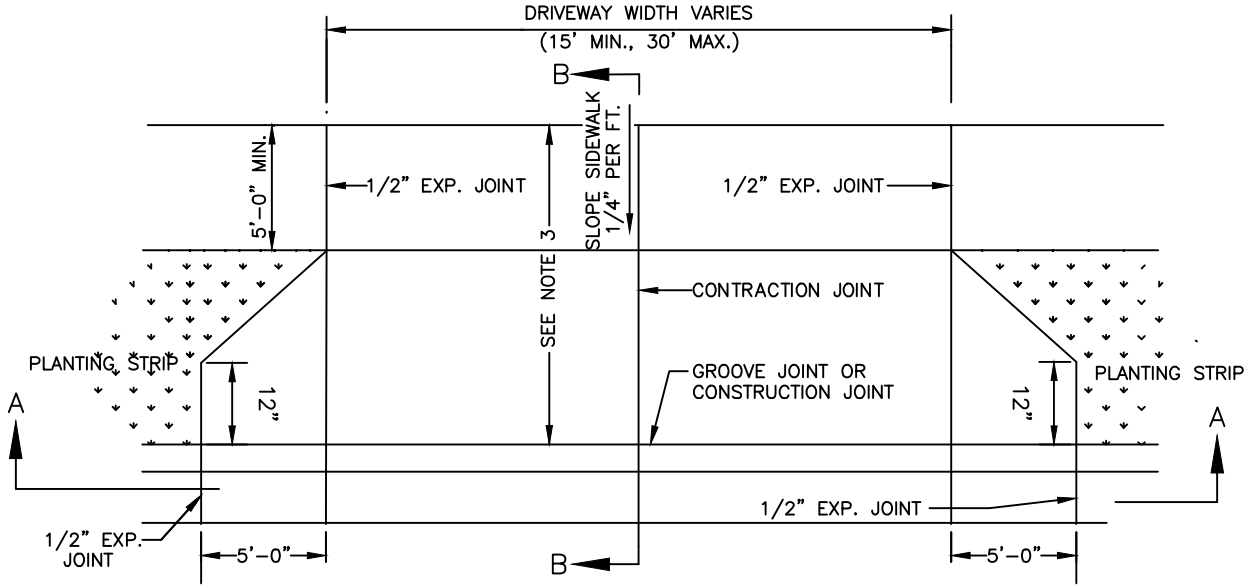
NTS	June 2018
R - 18.0	Revision 3

TOWN OF MOORESVILLE

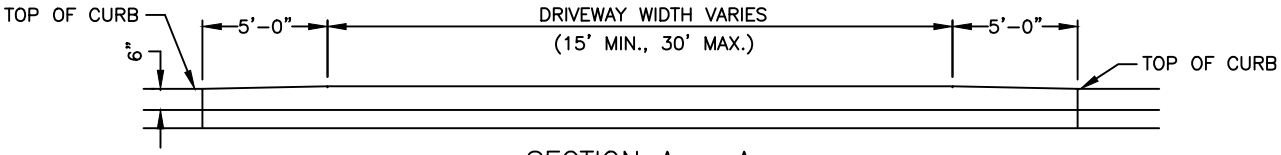
STANDARD DETAIL

NOTES:

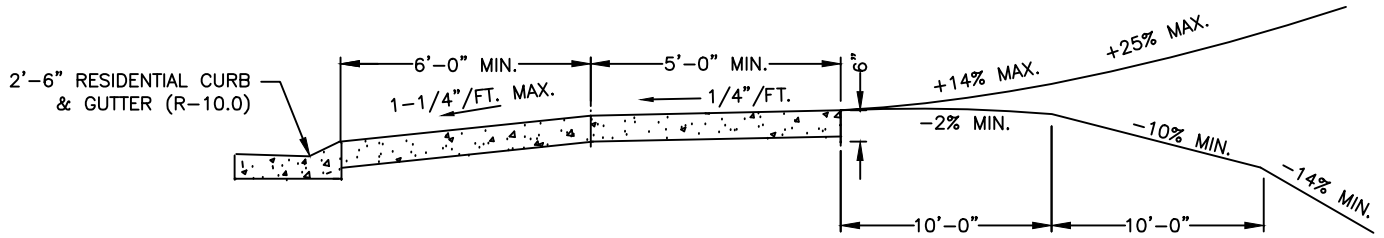
1. ALL CONCRETE TO BE 3600 P.S.I.
2. ALL CURB AND GUTTER AND SIDEWALKS ARE TO BE REMOVED TO NEAREST JOINT BEYOND NEW CONSTRUCTION OR CUT WITH A SAW AND REMOVED. SAW CUT OR JOINT TO BE PERPENDICULAR TO EDGE OF EXISTING PAVEMENT. SEE STD. NO. R-12.0 FOR JOINT DETAIL.
3. ALL DRIVEWAYS MUST MEET THE CURRENT NCDOT REQUIREMENTS FOR SPACING, SIGHT DISTANCE AND OFFSETS FROM PROPERTY LINES AND INTERSECTIONS.
4. DRIVEWAYS SHALL BE FREE FROM ALL OBSTRUCTIONS SUCH AS WATER METERS, CLEANOUTS, CURB OR ACCESSIBLE RAMPS AND STORM DRAINAGE STRUCTURES.



PLAN VIEW



SECTION A – A



SECTION B – B

ROAD SYSTEMS

RESIDENTIAL

DRIVEWAY WITH PLANTING STRIP

(RESIDENTIAL CURB AND GUTTER)

June 2018

Revision 1

NTS

R - 18.0A

TOWN OF MOORESVILLE

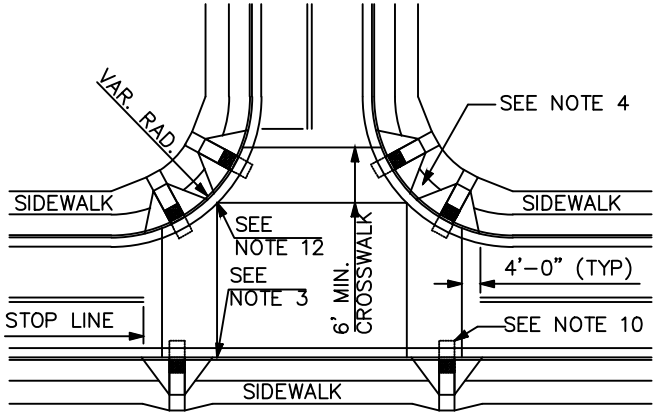
STANDARD DETAIL

ROAD SYSTEMS
ACCESSIBLE RAMP LOCATION STANDARD

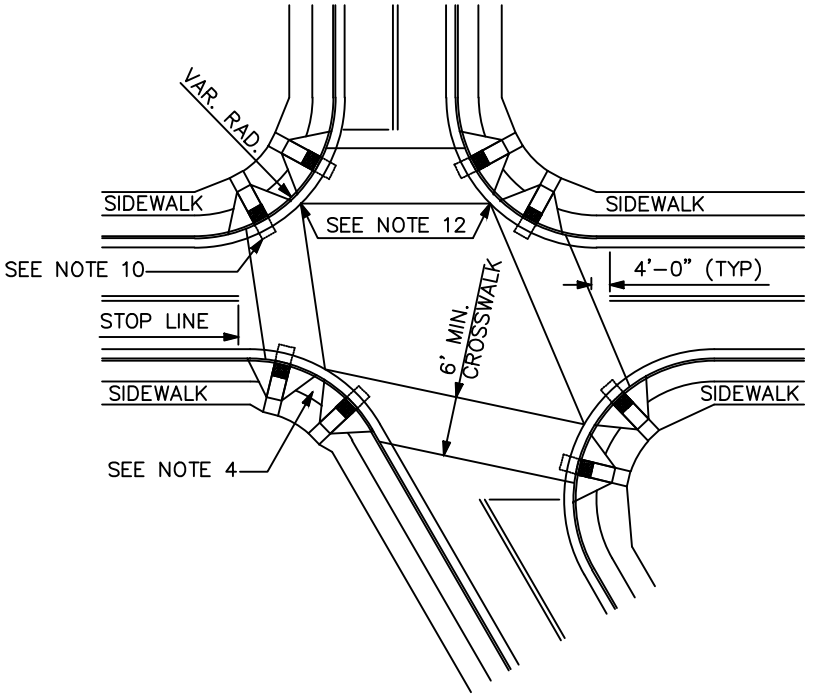
NTS

R - 19.0

June 2018
Revision 1



DETAIL SHOWING TYPICAL LOCATION OF CURB RAMPS, PEDESTRIAN CROSSWALKS AND STOP LINES FOR TEE INTERSECTIONS



DETAIL SHOWING TYPICAL LOCATION OF CURB RAMPS, PEDESTRIAN CROSSWALKS AND STOP LINES

ROADWAY PLAN SYMBOL
CR
FOR PROPOSED CURB RAMP

PROPOSED CURB RAMP W/ LANDING
PROPOSED OR FUTURE SIDEWALK

ALLOWABLE LOCATIONS

DUAL RAMP RADII.....ANY

NOTES:

1. REFER TO NCDOT STANDARDS 848.05.
2. RAMP SECTIONS ARE NOT TO BE INSTALLED IN ANY DRIVEWAYS.

TOWN OF MOORESVILLE

STANDARD DETAIL

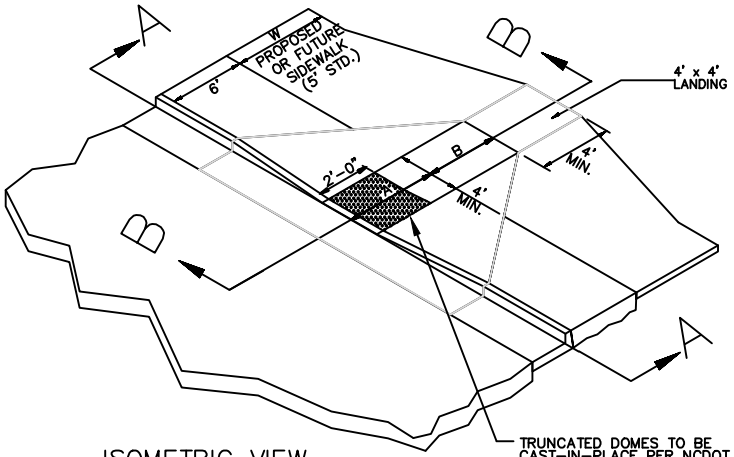
ROAD SYSTEMS

ACCESSIBLE RAMP STANDARD WITH PLANTING STRIP (2'-6" CURB AND GUTTER)

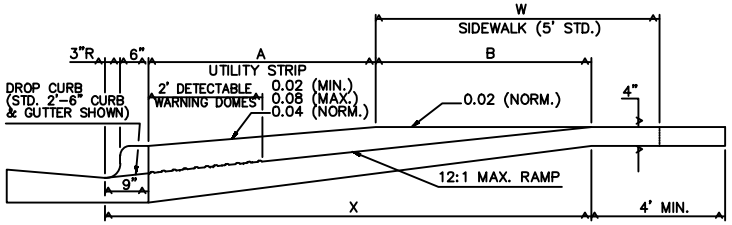
June 2018
Revision 3

NTS

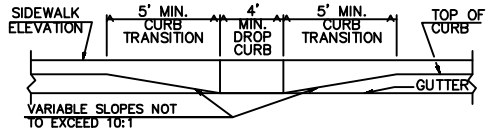
R - 19.0A



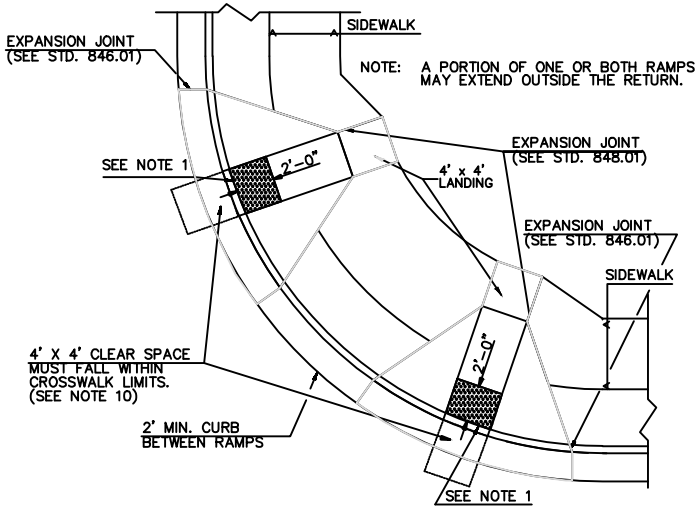
ISOMETRIC VIEW



SECTION B–B



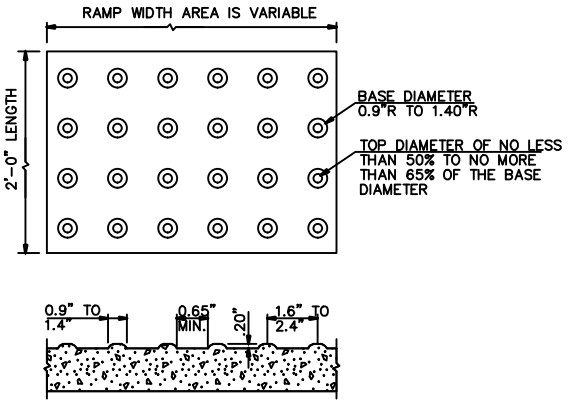
SECTION A–A



PLAN VIEW

DUAL RAMPS
ANY RADII
(4' MIN. FLOOR WIDTH)

NOTES:
1. DETECTABLE WARNING DOMES WILL COVER 2'–0" LENGTH AND FULL WIDTH OF THE RAMP FLOOR AS SHOWN ON THE DETAILS.
2. DETECTABLE WARNING DOMES WILL CONTRAST VISIBILITY WITH ADJOINING SURFACE, EITHER LIGHT–ON–DARK, OR DARK–ON–LIGHT SEQUENCE COVERING THE ENTIRE RAMP.



DETECTABLE WARNING DOMES

W	A	W+A+9"	X	B
5'	0.0'	5.8'	5.8'	5.0'*
6'	0.0'	6.8'	6.8'	6.0'**
7'	0.0'	7.8'	7.3'	6.5'**
8'	0.0'	8.8'	7.3'	6.5'**
5'	2.0'	7.8'	7.8'	5.0'
5'	2.5'	8.3'	8.1'	4.8'
5'	3.0'	8.8'	8.3'	4.4'
5'	3.5'	9.3'	8.4'	4.1'
5'	4.0'	9.8'	8.6'	3.8'
5'	4.5'	10.3'	8.7'	3.4'
5'	5.0'	10.8'	8.9'	3.1'
5'	6.0'***	11.8'	9.2'	2.5'

B = X–(A+9")
B = DISTANCE FROM FRONT EDGE OF SIDEWALK TO BACK POINT OF 12:1 (8.33%) SLOPE.
* BACK OF SIDEWALK DROP REQUIRED FOR ALL SIDEWALK SLOPES.
** BACK OF SIDEWALK DROP REQUIRED FOR SIDEWALK SLOPES 0.04.

*** TOWN OF MOORESVILLE STANDARD PLANTING STRIP WIDTH IS 6'–0"

NOTES:
1. REFER TO NCDOT STANDARDS 848.05.
2. SEE R–19.0 FOR STANDARD LOCATION DETAIL.

NOTES:

1. CONSTRUCT THE RAMP SURFACE TO BE STABLE, FIRM, AND SLIP RESISTANT. CONSTRUCT THE CURB RAMP TYPE AS SHOWN IN THE PAVEMENT MARKING PLANS OR AS DIRECTED BY THE ENGINEER.

2. LOCATE CURB RAMPS AND PLACE PEDESTRIAN CROSSWALK MARKINGS AS SHOWN IN THE PAVEMENT MARKING PLANS. WHEN FIELD ADJUSTMENTS REQUIRE MOVING CURB RAMPS OR MARKINGS AS SHOWN, CONTACT THE SIGNING AND DELINEATION UNIT OR LOCATE AS DIRECTED BY THE ENGINEER.

3. COORDINATE THE CURB RAMP AND THE PEDESTRIAN CROSSWALK MARKINGS SO A 4'x4' CLEAR SPACE AT THE BASE OF THE CURB RAMP WILL FALL WITHIN THE PEDESTRIAN CROSSWALK LINES.

4. SET BACK DISTANCE FROM INSIDE CROSSWALK MARKING TO NEAREST EDGE OF TRAVEL LANE IS 4'MINIMUM.

5. REFER TO THE PAVEMENT MARKING PLANS FOR STOP BAR LOCATIONS AT SIGNALIZED INTERSECTIONS. IF A PAVEMENT MARKING PLAN IS NOT PROVIDED, CONTACT THE SIGNAL DESIGN SECTION FOR THE STOP BAR LOCATIONS OR LOCATE AS DIRECTED BY THE ENGINEER.

6. TERMINATE PARKING A MINIMUM OF 20'BACK OF A PEDESTRIAN CROSSWALK.

7. CONSTRUCT CURB RAMPS A MINIMUM OF 4'WIDE.

8. CONSTRUCT THE RUNNING SLOPE OF THE RAMP 8.33% MAXIMUM.

9. ALLOWABLE CROSS SLOPE ON SIDEWALKS AND CURB RAMPS WILL BE 2% MAXIMUM.

10. CONSTRUCT THE SIDE FLARE SLOPE A MAXIMUM OF 10% MEASURED ALONG THE CURB LINE.

11. CONSTRUCT THE COUNTER SLOPE OF THE GUTTER OR STREET AT THE BASE OF THE CURB RAMP A MAXIMUM OF 5% AND MAINTAIN A SMOOTH TRANSITION.

12. CONSTRUCT LANDINGS FOR SIDEWALK A MINIMUM OF 4'x4' WITH A MAXIMUM SLOPE OF 2% IN ANY DIRECTION. CONSTRUCT LANDINGS FOR MEDIAN ISLANDS A MINIMUM OF 5'x5'WITH A MAXIMUM SLOPE OF 2% IN ANY DIRECTION.

13. TO USE A MEDIAN ISLAND AS A PEDESTRIAN REFUGE AREA, MEDIAN ISLANDS WILL BE A MINIMUM OF 6'WIDE. CONSTRUCT MEDIAN ISLANDS TO PROVIDE PASSAGE OVER OR THROUGHT THE ISLAND.

14. SMALL CHANNELIZATION ISLANDS THAT CAN NOT PROVIDE A 5'X5' LANDING AT THE TOP OF A RAMPS, WILL BE CUT THROUGH LEVEL WITH THE SURFACE STREET.

15. CURB RAMPS WITH RETURNED CURBS MAY BE USED ONLY WHERE PEDESTRIANS WOULD NOT NORMALLY WALK ACROSS THE RAMP. THE ADJACENT SURFACE IS PLANTING OR OTHER NON–WALKING SURFACE OR THE SIDE APPROACH IS SUBSTANTIALLY OBSTRUCTED.

16. PLACE A ½" EXPANSION JOINT WHERE THE CONCRETE CURB RAMP JOINS THE CURB AS SHOWN IN ROADWAY STANDARD DRAWING 848.01

17. PLACE ALL PEDESTRIAN PUSH BUTTON ACTUATORS AND CROSSING SIGNALS AS SHOWN IN THE PLANS OR AS SHOWN IN THE MUTCD.

18. CURB RAMPS THROUGH MEDIAN ISLANDS, SINGLE RAMPS AT DUAL CROSSWALKS OR LIMITED R/W SITUATIONS, WILL BE HANDLED BY SPECIAL DETAILS. CONTACT THE CONTRACT STANDARDS AND DEVELOPMENT UNIT FOR THE DETAILS OR FOR A SPECIAL DESIGN.

* REFER TO NCDOT STANDARDS 848.05.

TOWN OF MOORESVILLE STANDARD DETAIL	ROAD SYSTEMS CURB RAMP NOTES	June 2018 Revision 2	
		NTS	R - 19.0B

TOWN OF MOORESVILLE

STANDARD DETAIL

ROAD SYSTEMS

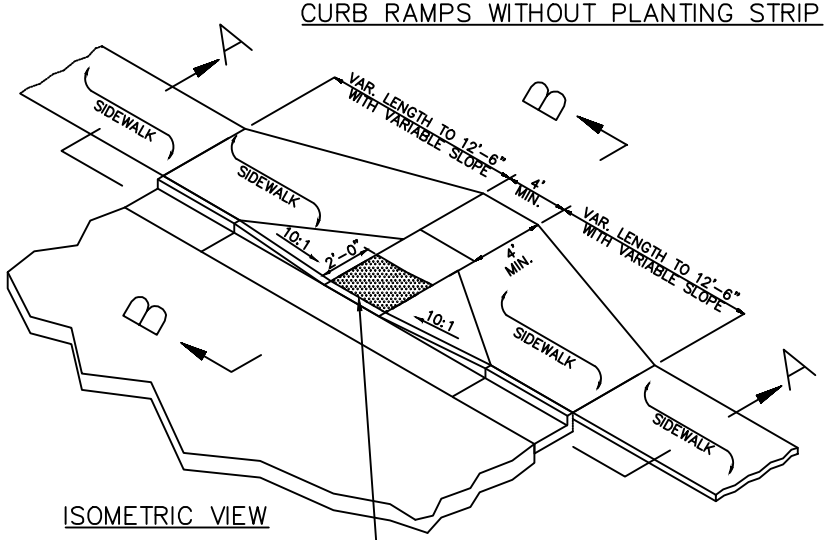
ACCESSIBLE RAMP STANDARD WITHOUT PLANTING STRIP (2'-6" CURB AND GUTTER)

NTS

June 2018
Revision 3

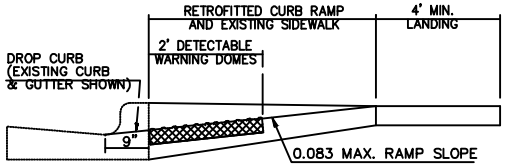
R - 20.0

CURB RAMPS WITHOUT PLANTING STRIP

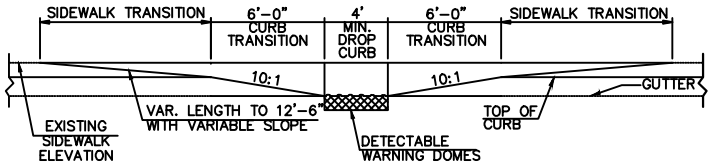


ISOMETRIC VIEW

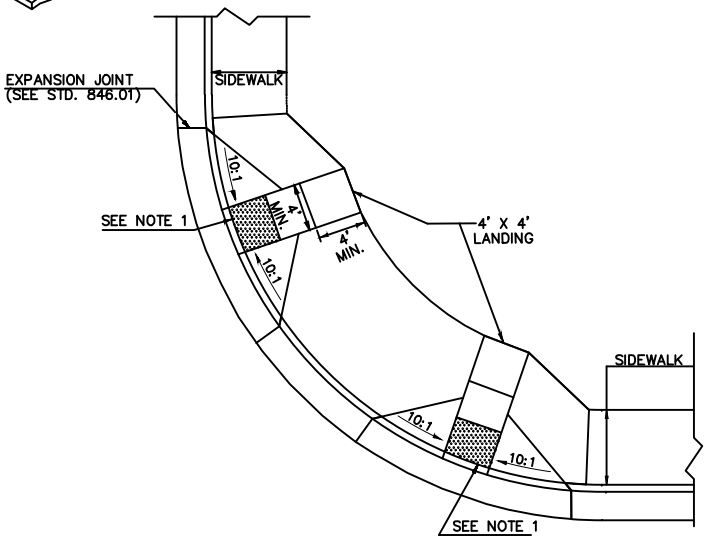
TRUNCATED DOMES TO BE CAST-IN-PLACE PER NCDOT STANDARD AND COLORED YELLOW OR RED.



SECTION B–B

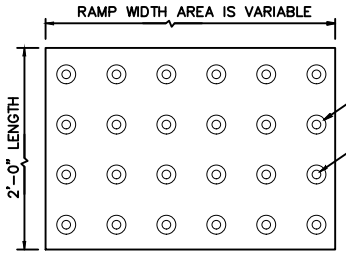


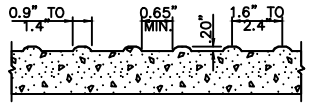
SECTION A–A



PLAN VIEW

DUAL RAMPS
ANY RADII
(40" MIN. FLOOR WIDTH)

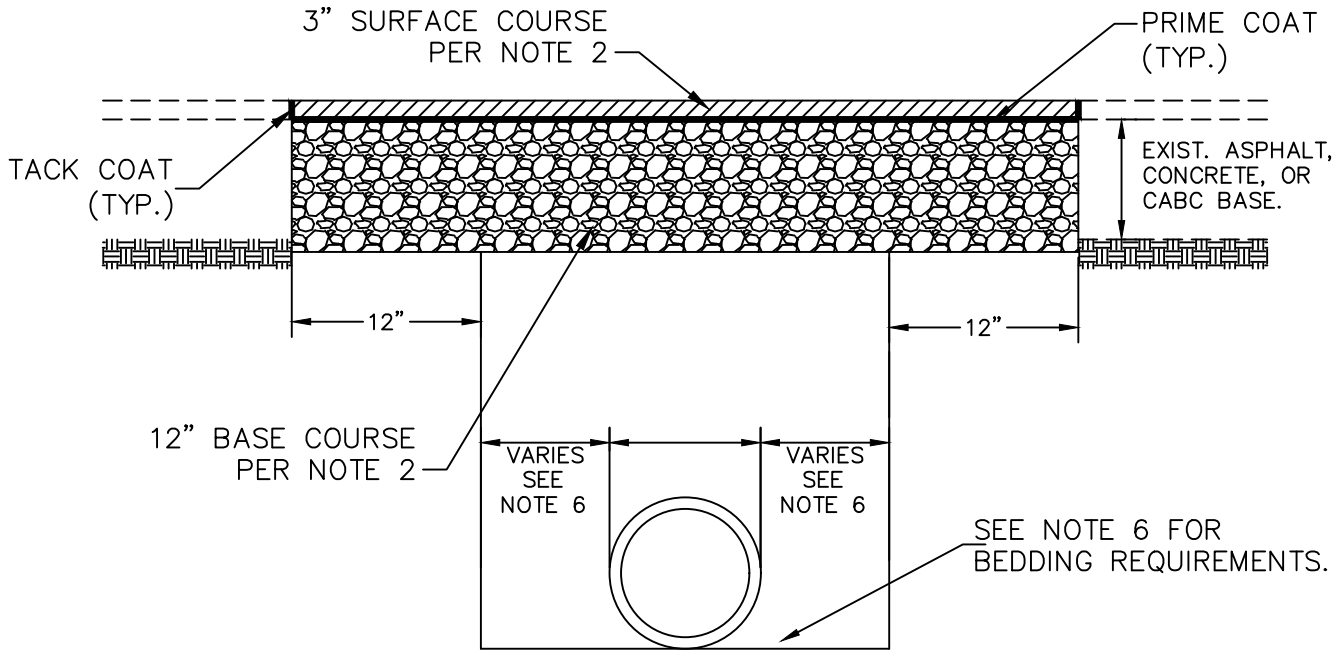




NOTES:
1. PLACE DETECTABLE WARNING DOMES TO COVER 2'–0" LENGTH AND FULL WIDTH OF THE RAMP FLOOR AS SHOWN ON THE DETAILS.
2. OBTAIN VISIBLE CONTRAST WITH ADJOINING SURFACE, EITHER LIGHT–ON–DARK, OR DARK–ON–LIGHT SEQUENCE COVERING THE ENTIRE RAMP.

DETECTABLE WARNING DOMES

NOTES:
1. REFER TO NCDOT STANDARDS 848.05.



ELEVATION SECTION

NOTES

1. ALL CONCRETE AND ASPHALT PAVEMENT, INCLUDING DRIVEWAYS, TO BE CUT WITH A SAWCUT A MINIMUM DEPTH OF 3".
2. REQUIRED SURFACE AND BASE COURSE:

STREET TYPE	SURFACE	BASE
RESIDENTIAL STREET	S 9.5B	ABC STONE
COLLECTOR STREET	S 9.5B	B25.0B
COMMERCIAL/THOROUGHFARE	S 9.5C	B25.0C

3. ALL PAVEMENT REPAIRS ARE SUBJECT TO APPROVAL BY THE TOWN OF MOORESVILLE OR NCDOT AS APPLICABLE.
4. 12–INCH MINIMUM CUT OUTSIDE TRENCH IS ALSO REQUIRED FOR SLOPED WALLS.
5. SHORING REQUIRED IN ACCORDANCE WITH OSHA STANDARDS PART 1926, SUBPART P.
6. SEE THE LAND DEVELOPMENT STANDARDS MANUAL SEWER DETAILS S–11.0, S–12.0, OR S–13.0, OR WATER DETAILS W–8.0 AS APPROPRIATE FOR TRENCH WIDTH, BEDDING AND BACKFILL REQUIREMENTS.
7. WHEN PAVEMENT REPAIR IS ADJACENT TO THE CURB, THE SAW CUT MUST BE 2' FROM THE LIP OF CURB.
8. ANY PAVEMENT REPLACEMENT OTHER THAN THE SECTION ABOVE MUST BE APPROVED BY THE DIRECTOR OF ENGINEERING.

TOWN OF MOORESVILLE STANDARD DETAIL	ROAD SYSTEMS PAVEMENT REPAIR DETAIL	January 2009 Revision 1	
		NTS	R - 21.0

TOWN OF MOORESVILLE

STANDARD DETAIL

ROAD SYSTEMS

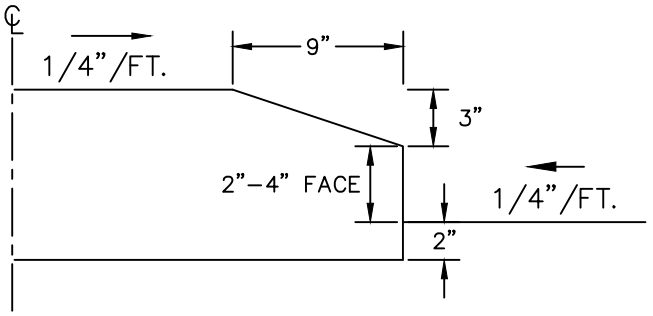
RIGHT IN / RIGHT OUT ISLAND

NTS

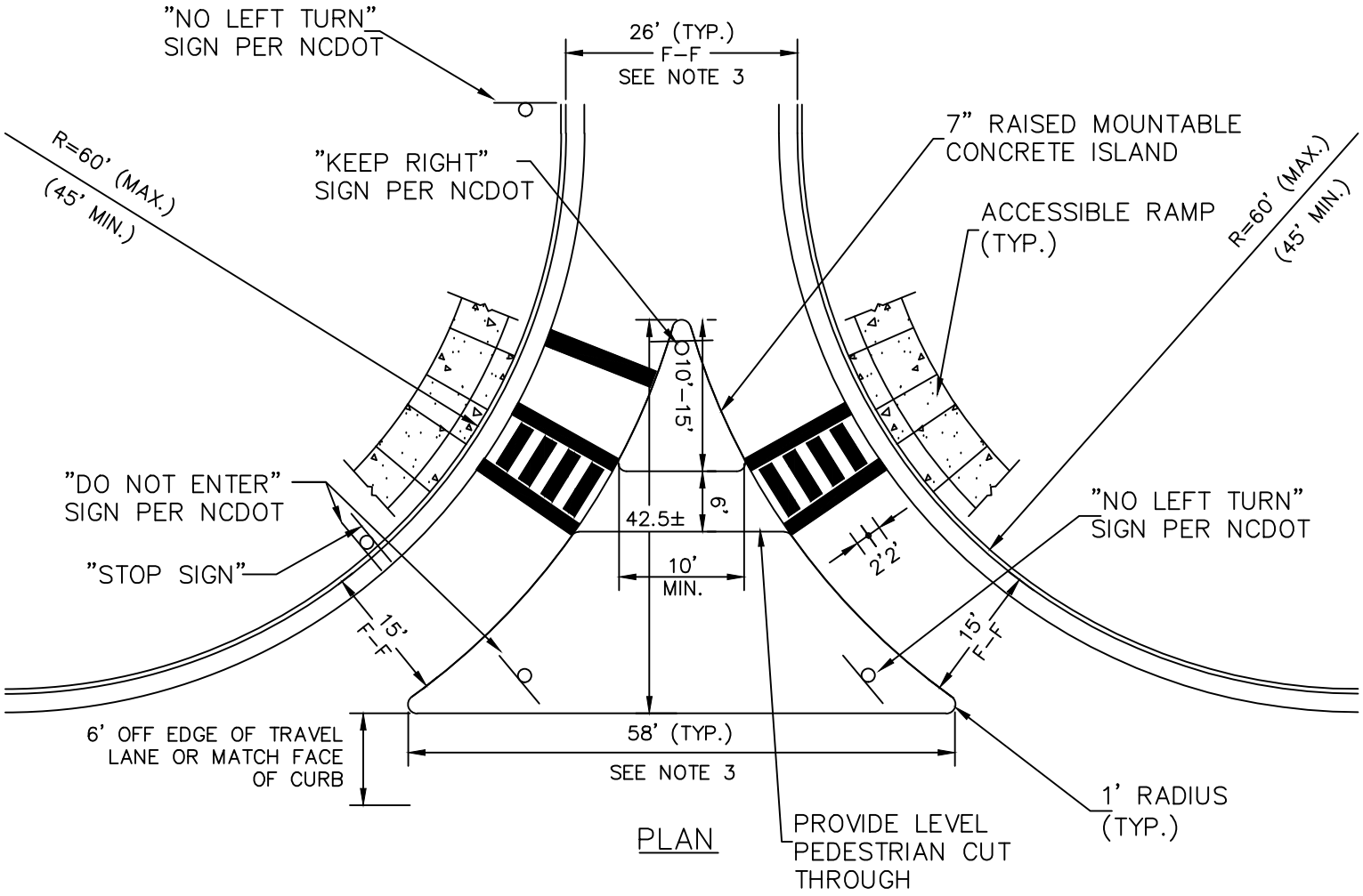
June 2018
Revision 2

R - 22.0

ISLAND NOTES:
1. 7" TOTAL THICKNESS IF DOWELLED INTO ASPHALT PER NCDOT STD. 852.01.
2. 9" TOTAL THICKNESS IF KEYED INTO ASPHALT PER NCDOT STD. 852.01.
3. ISLAND WIDTH VARIES DIRECTLY WITH APPROACH ROAD WIDTH.



ISLAND SECTION



PLAN

TOWN OF MOORESVILLE

STANDARD DETAIL

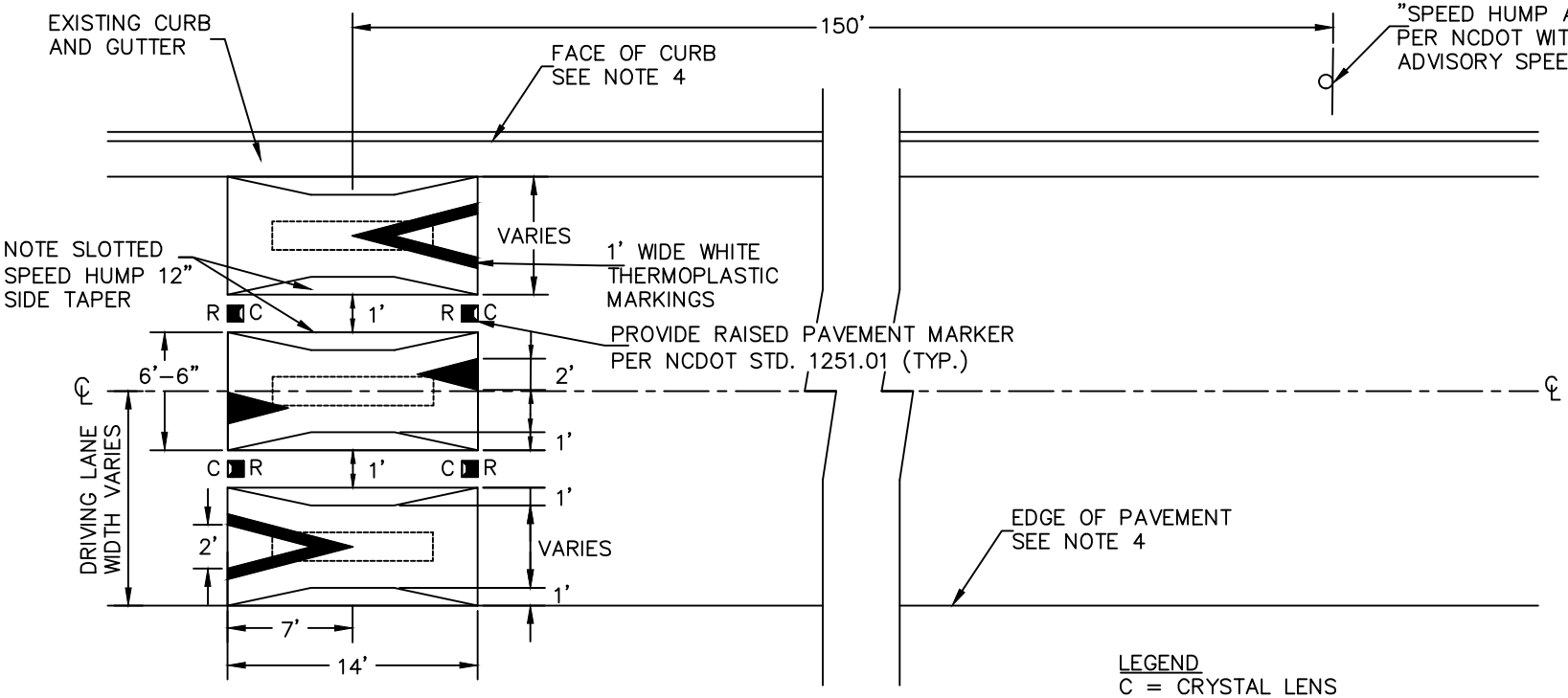
ROAD SYSTEMS

SLOTTED ASPHALT SPEED HUMP MARKING AND SIGNAGE

NTS

June 2018
Revision 2

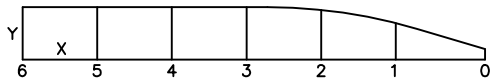
R - 23.0



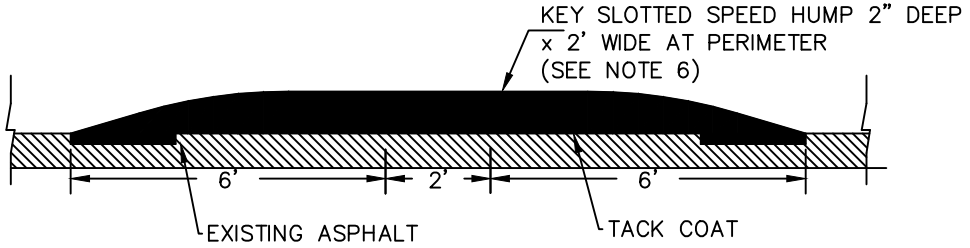
LEGEND
C = CRYSTAL LENS
R = RED LENS

SLOTTED SPEED HUMP

X (FT)	Y (IN)
0	0.00
1	1.25
2	2.00
3	2.25
4	2.75
5	3.00
6	3.00



VERTICAL DIMENSION CHART



SLOTTED SPEED HUMP SECTION

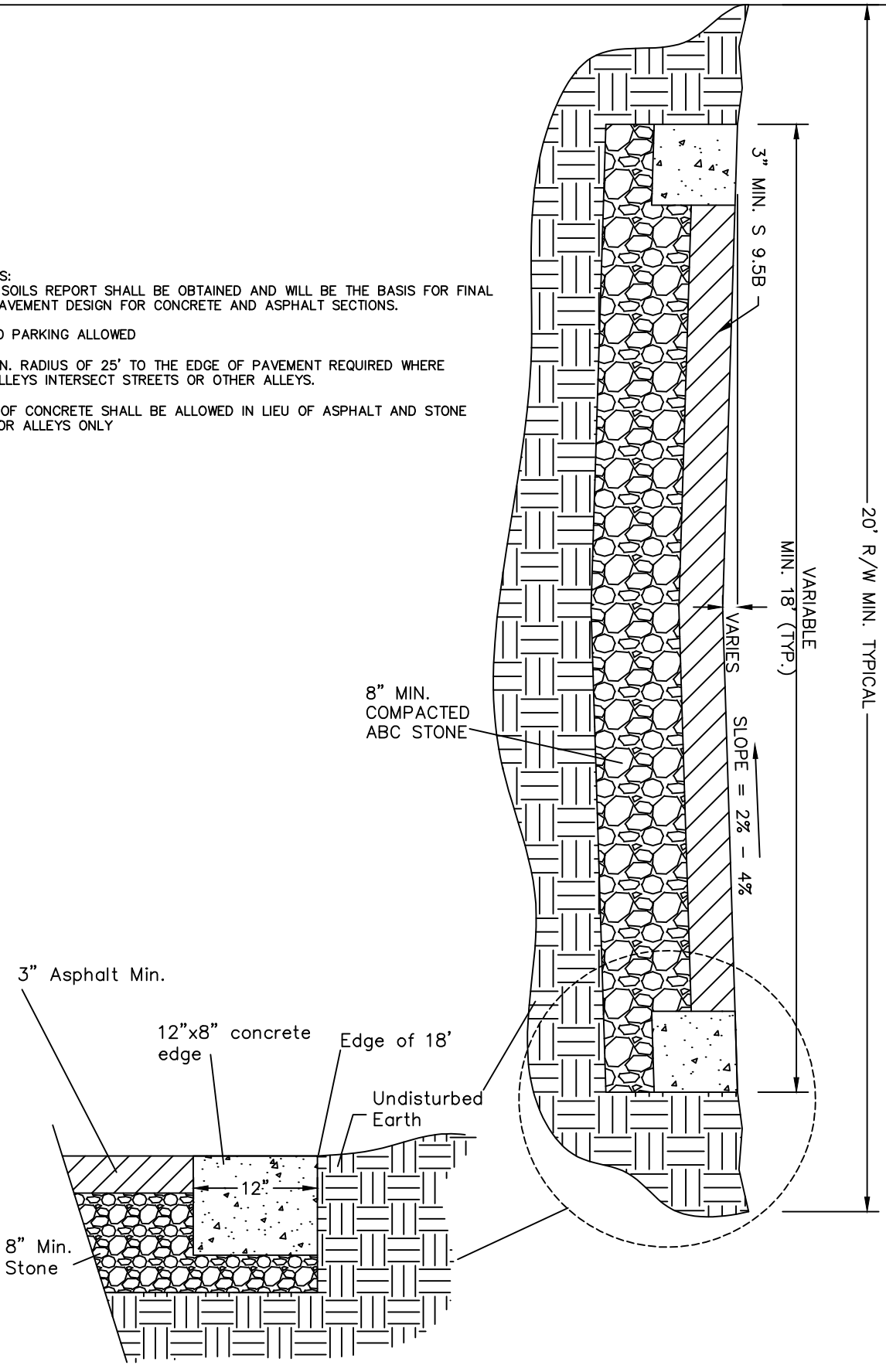
NOTES:
1. PAVEMENT MARKINGS TYPICAL IN BOTH DIRECTION OF TRAVEL.
2. ALL SLOTTED SPEED HUMP MARKINGS SHALL BE THERMOPLASTIC.
3. WHEN PLACED ON ROADWAY WITH NO CURB AND GUTTER, EDGE OF SPEED HUMP EXTENDS TO EDGE OF PAVEMENT.
4. WHEN PLACED ON ROADWAY WITH CURB AND GUTTER, EDGE OF SPEED HUMP TO BE PLACED 2' FROM FACE OF CURB.
5. NOTE SIDE TAPER ON SPEED HUMP.
6. EXISTING ROADWAY SHALL BE MILLED A WIDTH OF 24" AND A MINIMUM DEPTH OF 2" AROUND THE PERIMETER OF SPEED HUMP.
7. SPEED HUMPS SHALL NOT BE PLACED OVER MANHOLES, WATER VALVES, SURVEY MONUMENTS, JUNCTION CHAMBERS, IN CONFLICT WITH DRIVEWAYS, OR ADJACENT TO FIRE HYDRANTS.
8. SPEED HUMP LOCATIONS MUST BE APPROVED BY THE DIRECTOR OF ENGINEERING.
9. CONTRACTOR MUST PROVIDE VERIFICATION OF CROSS-SECTION DIMENSIONS.
10. SPEED HUMPS TO BE CONSTRUCTED OF APPROVED ASPHALT SURFACE COURSE MATERIAL.

NOTES:
1. A SOILS REPORT SHALL BE OBTAINED AND WILL BE THE BASIS FOR FINAL PAVEMENT DESIGN FOR CONCRETE AND ASPHALT SECTIONS.

2. NO PARKING ALLOWED

3. MIN. RADIUS OF 25' TO THE EDGE OF PAVEMENT REQUIRED WHERE ALLEYS INTERSECT STREETS OR OTHER ALLEYS.

4. 8"OF CONCRETE SHALL BE ALLOWED IN LIEU OF ASPHALT AND STONE FOR ALLEYS ONLY

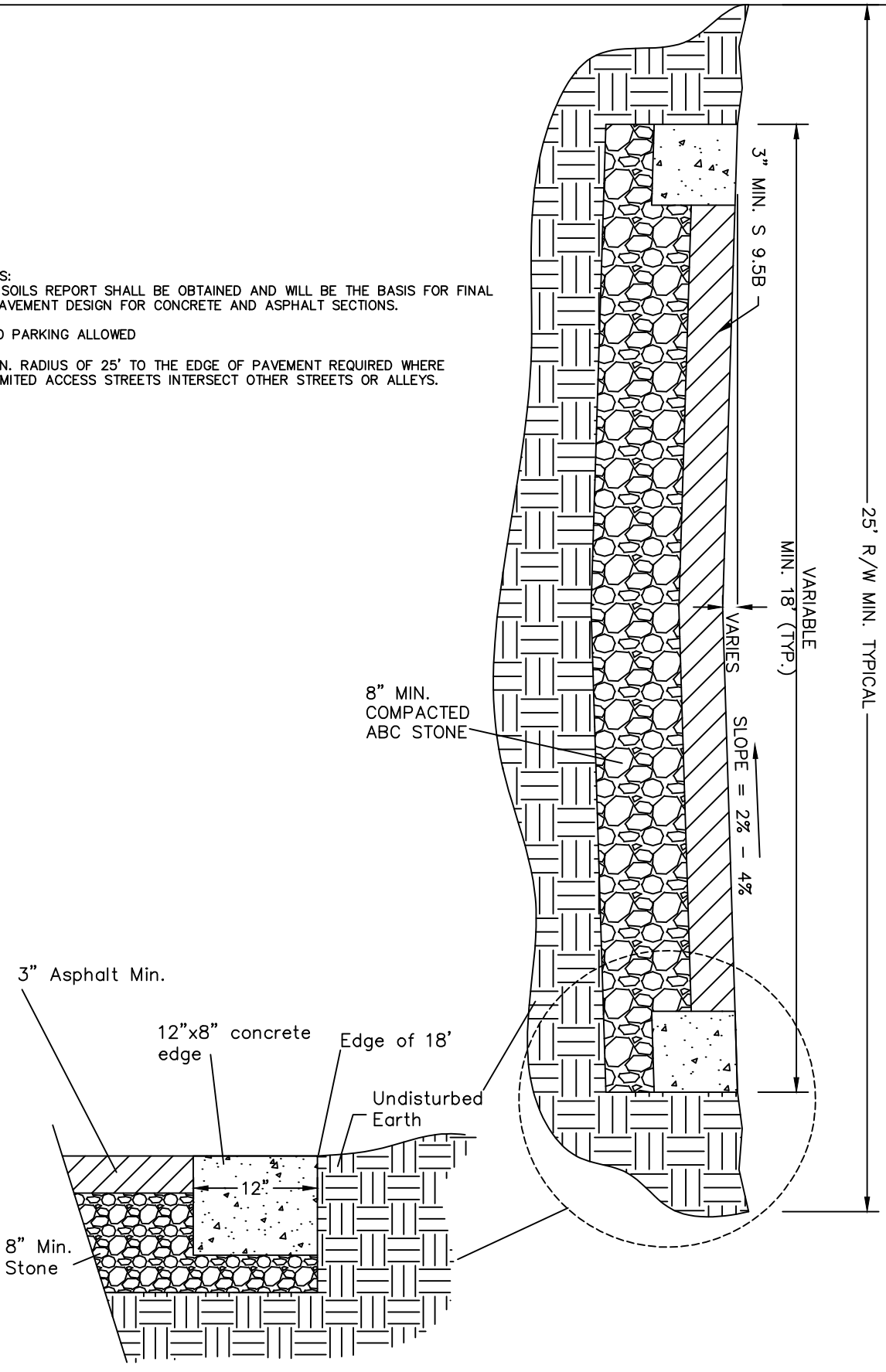


TOWN OF MOORESVILLE STANDARD DETAIL	ROAD SYSTEMS TYPICAL ALLEY SECTION	January 2009 Revision 1	
		NTS	R - 24.0

NOTES:
1. A SOILS REPORT SHALL BE OBTAINED AND WILL BE THE BASIS FOR FINAL PAVEMENT DESIGN FOR CONCRETE AND ASPHALT SECTIONS.

2. NO PARKING ALLOWED

3. MIN. RADIUS OF 25' TO THE EDGE OF PAVEMENT REQUIRED WHERE LIMITED ACCESS STREETS INTERSECT OTHER STREETS OR ALLEYS.



TOWN OF MOORESVILLE STANDARD DETAIL	ROAD SYSTEMS LIMITED ACCESS STREET SECTION	December 2016 .	
		NTS	R - 24.0A

TOWN OF MOORESVILLE

STANDARD DETAIL

ROAD SYSTEMS

INDUSTRIAL DRIVEWAY ENTRANCE

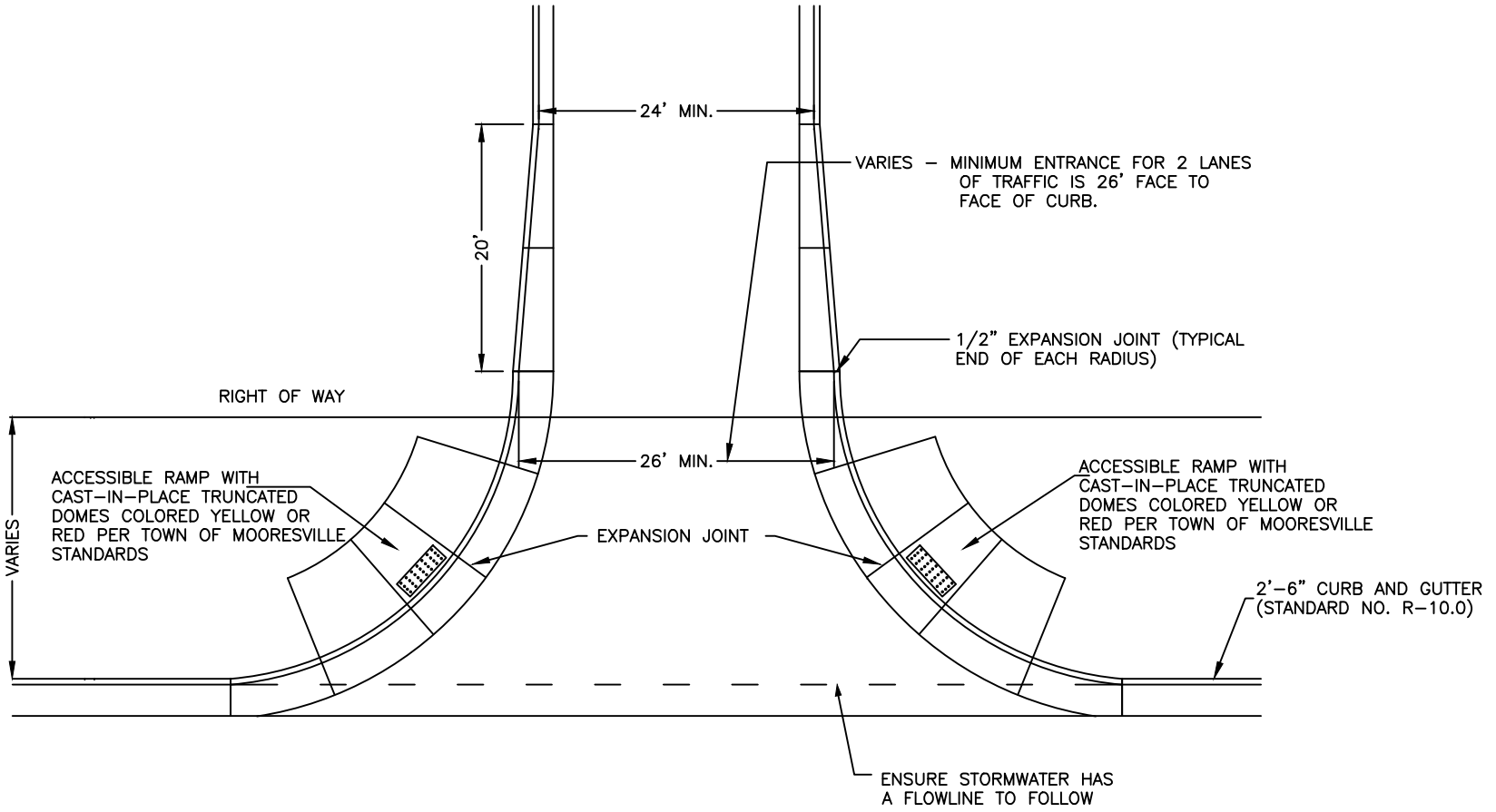
June 2018
Revision 3

NTS

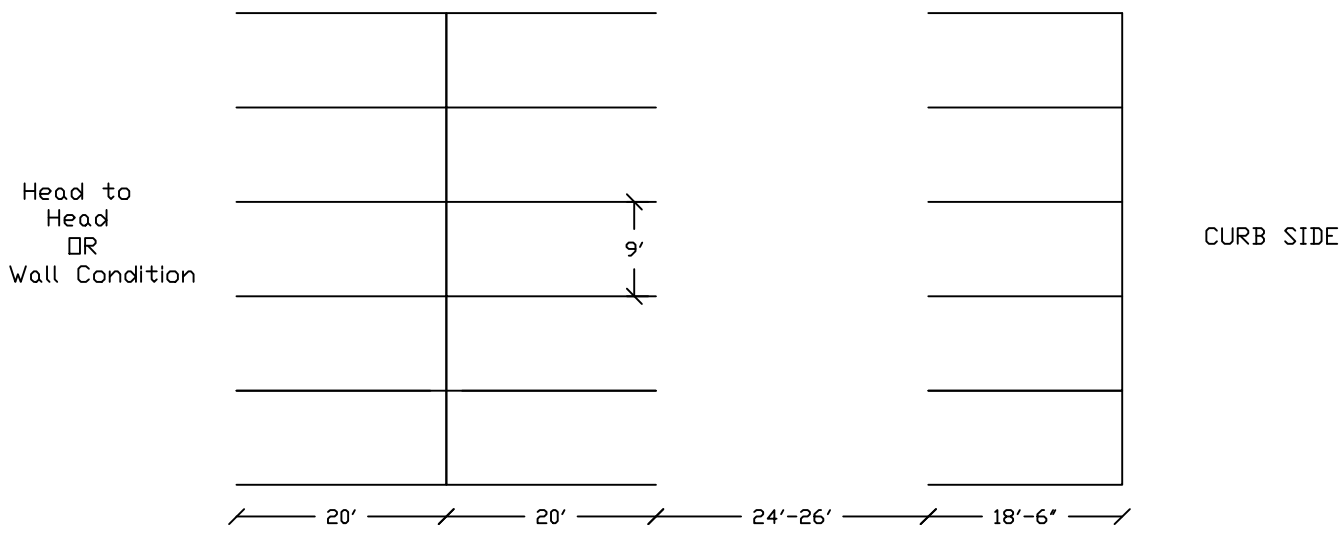
R - 25.0

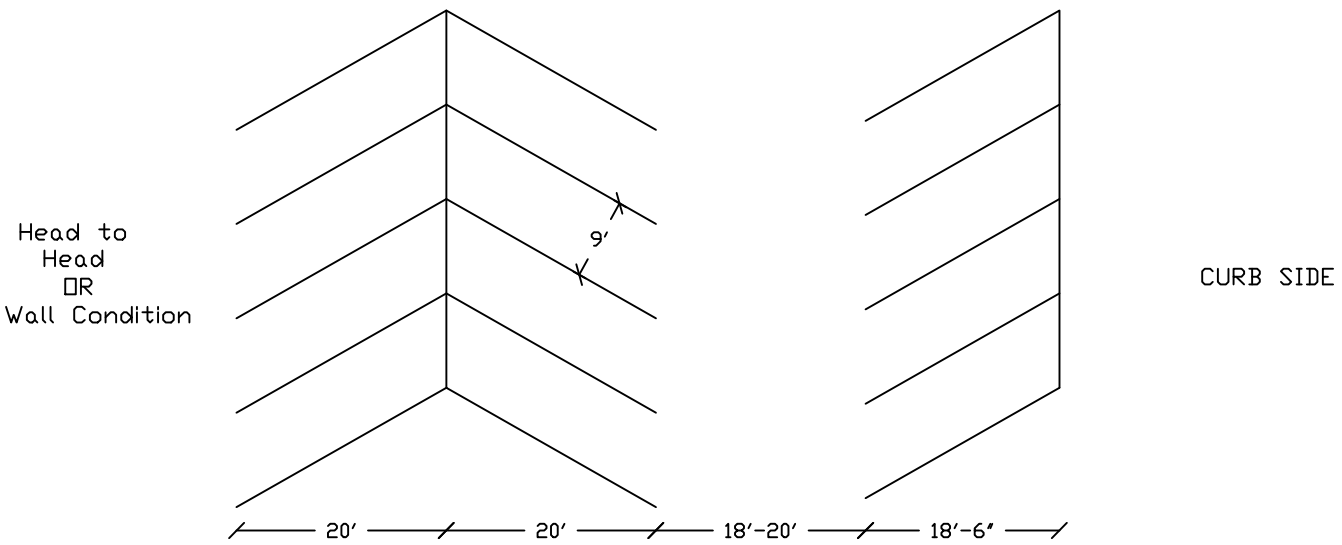
NOTES:

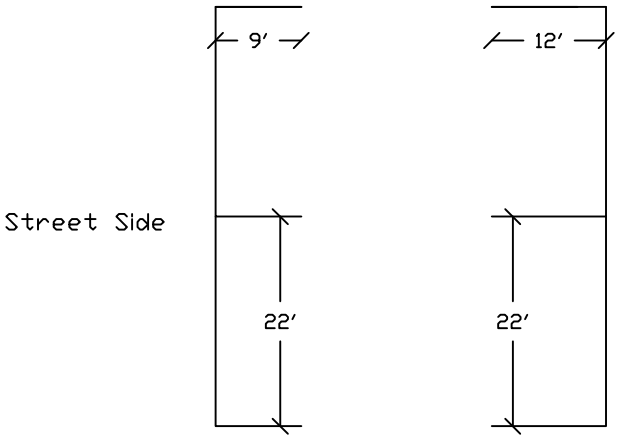
1. THE DRIVEWAY MUST RISE 6" FROM THE GUTTER LINE TO PREVENT RUNOFF FROM ENTERING DRIVEWAY.
2. ALL DRIVEWAYS MUST MEET THE CURRENT TOWN DRIVEWAY REGULATIONS AND NCDOT REQUIREMENTS FOR SPACING, SIGHT DISTANCE, AND OFFSETS FROM PROPERTY LINES AND INTERSECTIONS.
3. SEE R-19.0 FOR STANDARD ACCESSIBLE RAMP LOCATION DETAIL.



PLAN



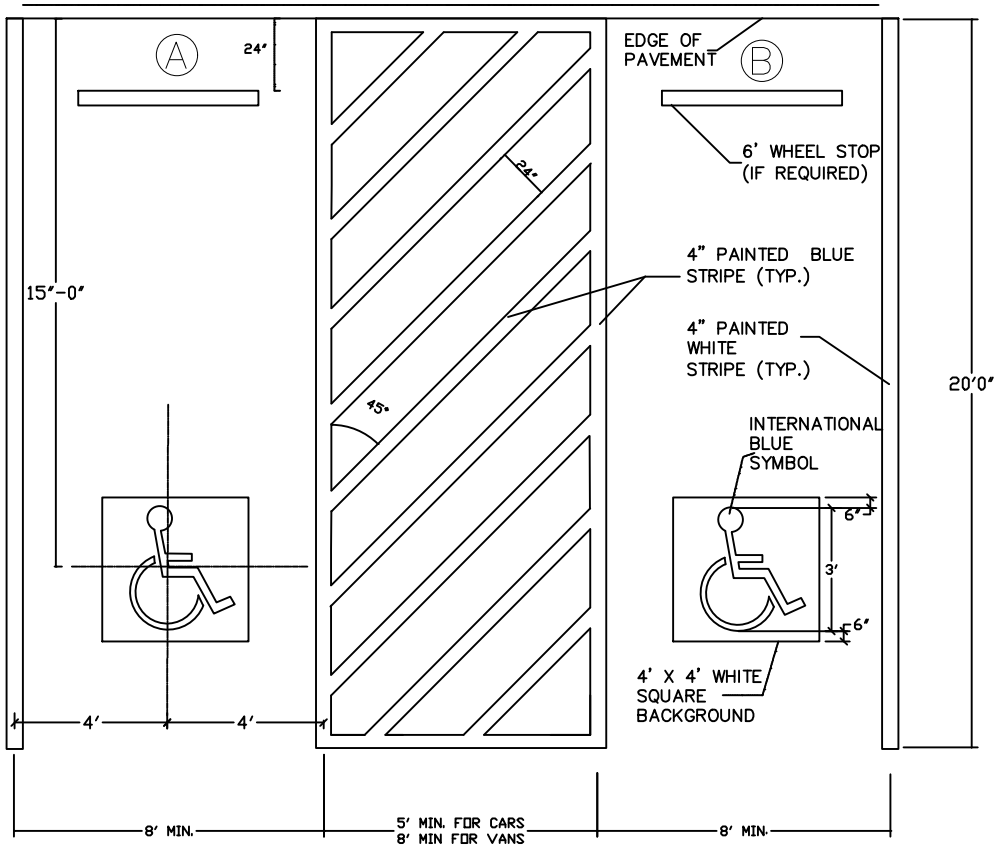




Note:
One way aisle width 13' min.
Two way aisle width 18'20' min.

TOWN OF MOORESVILLE STANDARD DETAIL	ROAD SYSTEMS PARKING STANDARDS 90 Degrees, 60 Degrees, & Parallel	June 2018 Revision 2 NTS | R-26.0

ACCESSIBLE ROUTE (MIN. 48" WIDTH)



NOTE:

STRIPING AND CONSTRUCTION SHALL CONFORM TO ALL APPLICABLE FEDERAL AND STATE CODES AND SPECIFICATIONS

ONE OUT OF EVERY EIGHT (8)ACCESSIBLE SPACES, BUT NOT LESS THAN ONE, IS REQUIRED TO BE VAN ACCESSIBLE.

PARKING SPACE PAVEMENT MARKINGS

A

R7-8e
12"x6"

MUTCD
R7-8a
12"x18"

R7-8D
12"x9"

B

MUTCD
R7-8a
12"x18"

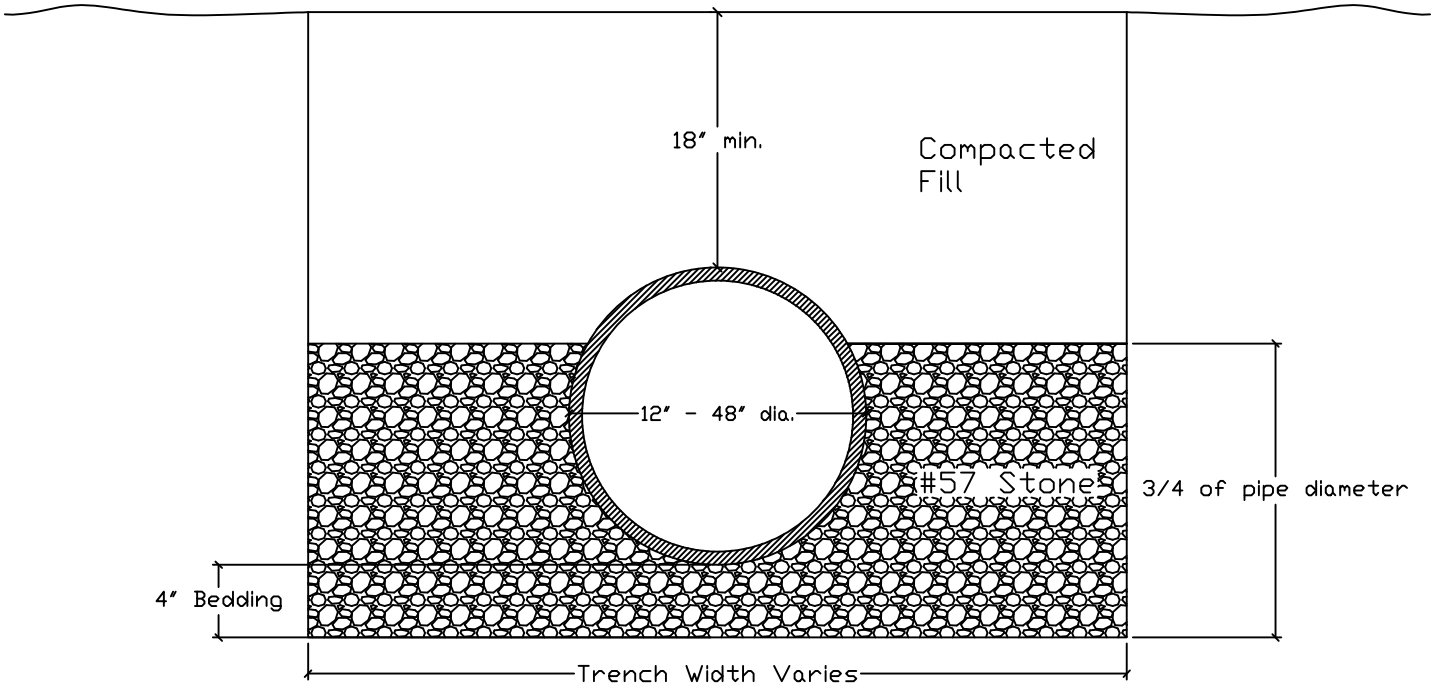
R7-8D
12"x9"

MUTCD
R7-1
12"x18"

NOTES:

1. ALL 12"x18" ACCESSIBLE SIGNS (R7-8a & R7-1) SHALL BE MOUNTED AT 7 FEET FROM GRADE TO BOTTOM EDGE OF SIGN FACE (MUTCD). MOUNTING HEIGHT CAN BE REDUCED TO 5 FEET IF PLACED IN AN AREA BETWEEN SIDEWALK AND BUILDING FACE IN WHICH PEDESTRIANS ARE NOT EXPECTED TO USE.
2. REFER TO MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, (MUTCD) US DEPARTMENT OF TRANSPORTATION & N.C. DEPARTMENT OF TRANSPORTATION SUPPLEMENT.
3. IF ACCESSIBLE ROUTE IS A RAISED SIDEWALK AREA, THEN RAMPS ARE REQUIRED AT LOADING ZONE AREA.

TOWN OF MOORESVILLE STANDARD DETAIL	ROAD SYSTEMS PARKING STANDARDS Accessible Parking Stalls	January 2010 Revision 1 NTS | R-27.0

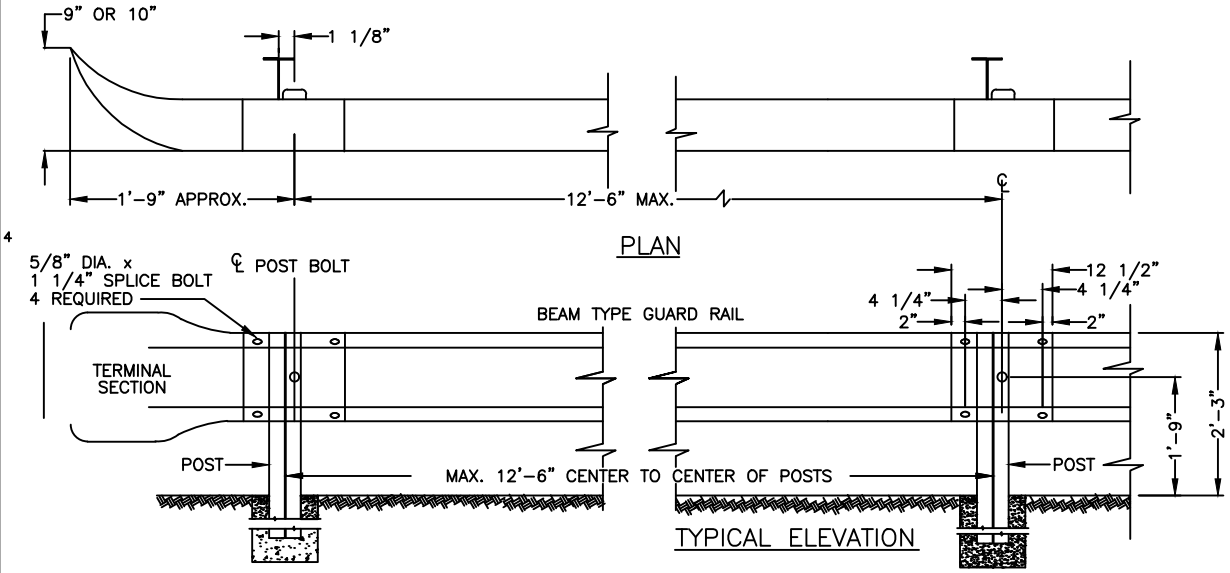


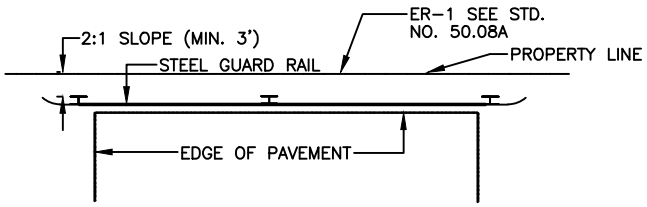
MINIMUM TRENCH WIDTHS:

INSIDE PIPE DIAMETER	TRENCH WIDTH
12"	30"
15"	34"
18"	38"
21"	43"
24"	46"
30"	55"
36"	63"

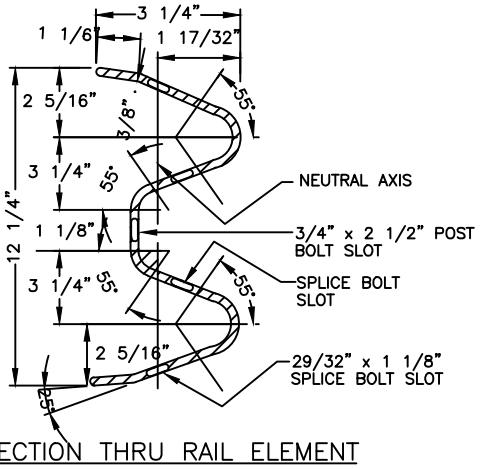
NOTES:
1. ALL OTHER PIPE NOT USED AS A CROSS DRAIN WITHIN THE RIGHT OF WAY SHALL BE INSTALLED PER THE PLASTIC PIPE INSTITUES (PPI) INSTALLATION GUIDELINES.

TOWN OF MOORESVILLE STANDARD DETAIL	ROAD SYSTEMS HDPE BEDDING Standards For Cross Drains	January 2010 Revision 1 NTS | R-28.0





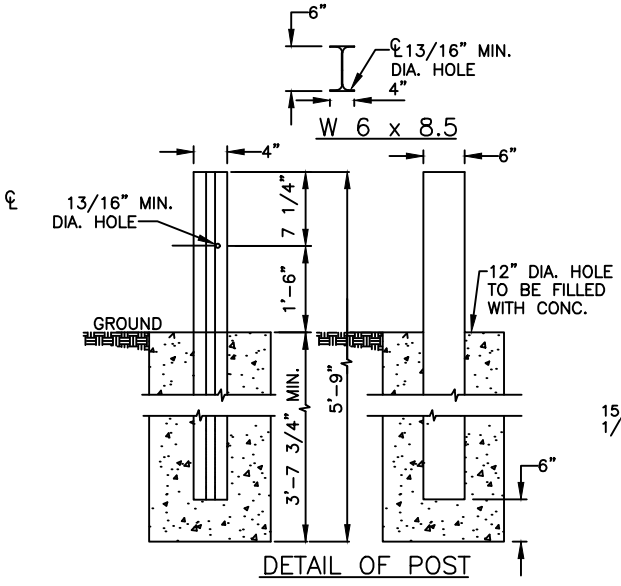
DEAD-END STREET BARRICADE



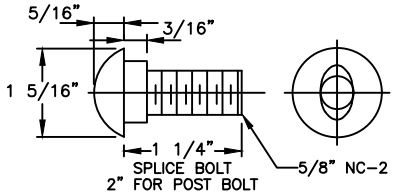
SECTION THRU RAIL ELEMENT

NOTE

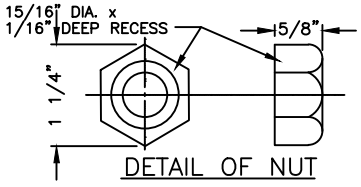
THIS DETAIL IS NOT A GUARDRAIL DETAIL. FOR ROADSIDE GUARDRAIL, SEE NCDOT STANDARD DRAWINGS 862.01-862.03



DETAIL OF POST



DETAIL OF BOLT



DETAIL OF NUT

TOWN OF MOORESVILLE STANDARD DETAIL	ROAD SYSTEMS DEAD END STREET BARRICADE	January 2014 . NTS | R-29.0

GENERAL NOTES:

1. STEEL BEAM TYPE GUARD RAILS SHALL BE INSTALLED AT THE END OF ALL DEAD–END STREETS, EXCEPT CUL–DE–SAC STREETS WHICH HAVE BEEN IMPROVED WITH A PERMANENT TURN–AROUND.

2. FOR STREETS 26' IN WIDTH THE GUARD RAIL SHALL CONSIST OF TWO(2) 12'–6" SECTIONS OR ONE(1) 25' SECTION, THREE (3) STEEL POSTS, AND TWO (2) TERMINAL SECTIONS. FOR STREETS GREATER THAN 25' IN WIDTH THE GUARD RAIL SHALL SPAN THE ENTIRE WIDTH OF THE STREET.

3. GUARD RAIL SHALL CONSIST OF RAIL ELEMENTS FABRICATED TO DEVELOP CONTINUOUS BEAM STRENGTH AND INSTALLED AS SHOWN.

4. MINIMUM THICKNESS OF GUARD RAIL SHALL BE 12 GAGE U.S. STANDARD. THE RAIL ELEMENT INCLUDING SPLICES, SHALL HAVE A MINIMUM ULTIMATE TENSILE STRENGTH OF 80,000 LBS. GUARD RAIL PARTS FURNISHED SHALL BE INTERCHANGEABLE WITH SIMILAR PARTS REGARDLESS OF THE SOURCE OF MANUFACTURER. THE HOLES FOR CONNECTING BOLTS SHALL BE PUNCHED OF DRILLED, BURNING WILL NOT BE PERMITTED.

5. THE GUARD, BOLTS, NUTS, STEEL POSTS. AND ALL OTHER METAL PARTS SHALL BE GALVANIZED TO CONFORM TO THE REQUIREMENTS 5. FOR THE COATING CLASS, (2.50 OUNCES PER SQUARE FOOT) OF THE CURRENT SPECIFICATIONS FOR ZINC–COATED (GALVANIZED) IRON, AND STEEL SHEETS, COILS, AND CUT LENGTHS, IN ACCORDANCE WITH ASTM 123A.

6. IF THE AVERAGE SPELTER COATING AS DETERMINED FROM THE REQUIRED SAMPLES IS LESS THAN TWO (2) OUNCES OF SPELTER PER SQUARE FOOT, OR IF ANY ONE SPECIMEN HAS LESS THAN 1.8 ONCES OF SPELTER PER SQUARE FOOT OF DOUBLE EXPOSED SURFACE, THE LOT SAMPLED SHALL BE REJECTED, THE FINISHED SHEETS SHALL BE OF FIRST CLASS COMMERCIAL QUALITY, FREE FROM INJURIOUS DEFECTS, SUCH AS BLISTERS, FLUX, AND UNCOATED SPOTS.

7. THE GUARD RAIL SHALL BE INSPECTED TO DETERMINE THAT THE MATERIAL, DIMENSIONS, AND WORKMANSHIP ARE IN ACCORDANCE WITH THIS PLAN.

8. WHERE A DEAD–END STREET REQUIRES GUARD RAIL, END OF ROADWAY MARKER SIGNS SHALL ALSO BE REQUIRED. (SEE R–30.0 & R–30.0A).

TOWN OF MOORESVILLE STANDARD DETAIL	ROAD SYSTEMS DEAD END STREET BARRICADE NOTES	January 2014 .	
		NTS	R-29.0A

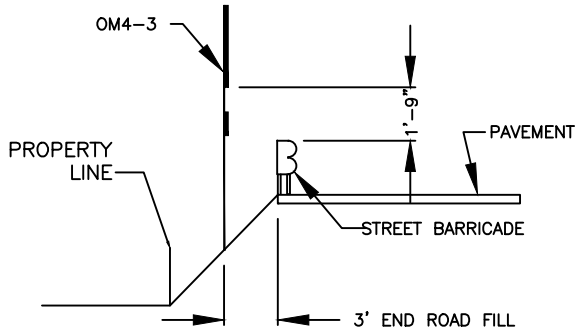
NOTES:

1. WHEN A DEAD–END OR STUBBED STREET REQUIRES A GUARDRAIL SECTION, END–OF–ROADWAY MARKER SIGNS (OM4–3, 24"x24", SOLID RED) SHALL BE PROVIDED.

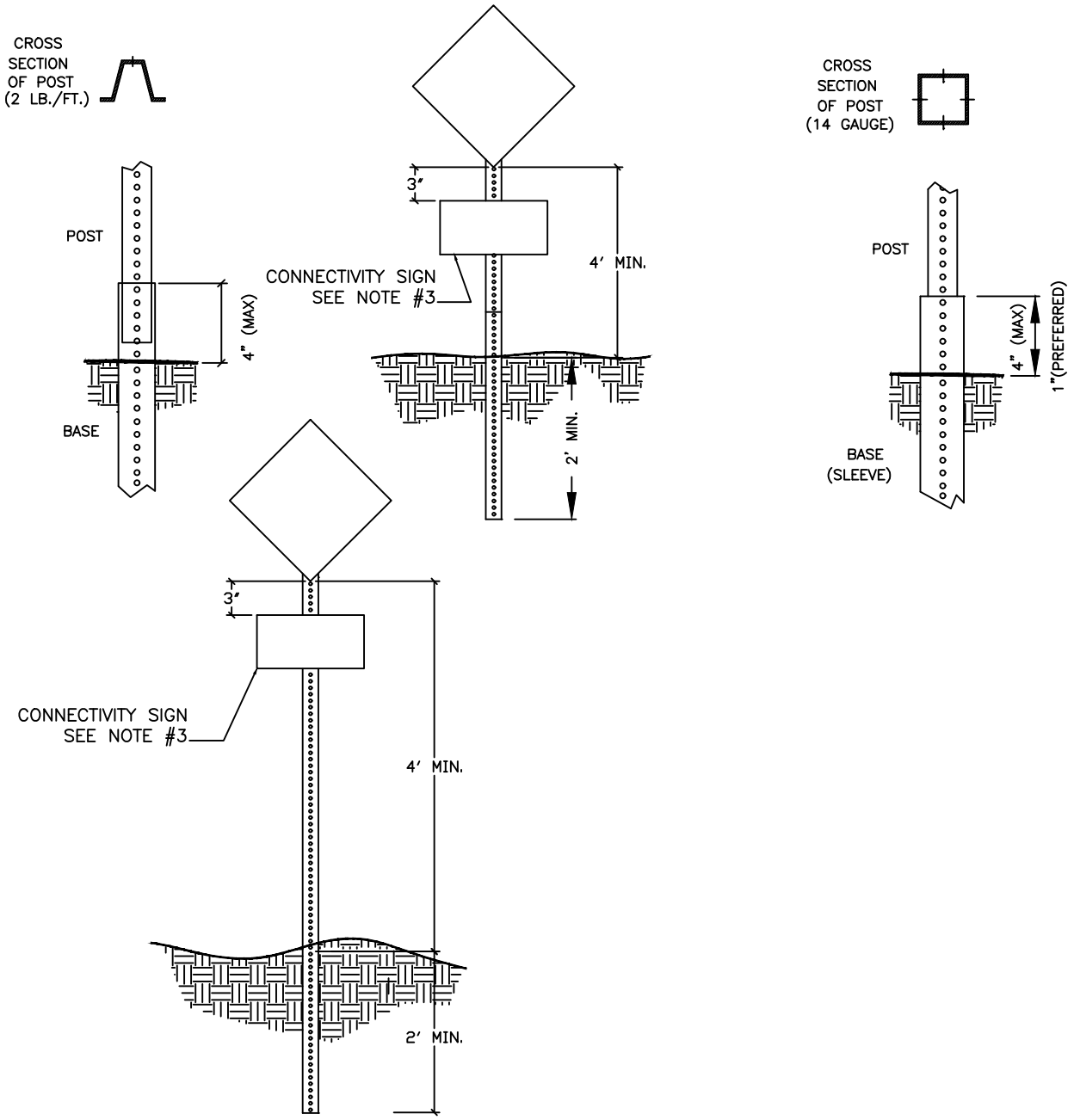
2. SIGNS ARE TO BE PLACED BEHIND THE BARRICADE (SEE DETAILS R29.0–R29.0A), EVENLY SPACED WITH ONE SIGN PLACED AT THE CENTERLINE LOCATION AND ADDITIONAL SIGNS AT 6' O.C. (MINIMUM OF 3 SIGNS, MAXIMUM OF 5 SIGNS).

3. WHEN BARRICADE IS USED ON A STREET STUB, THE SIGN AT THE CENTERLINE SHALL BE SUPPLEMENTED WITH A STREET CONNECTIVITY SIGN. SEE DETAIL R–30.0B.

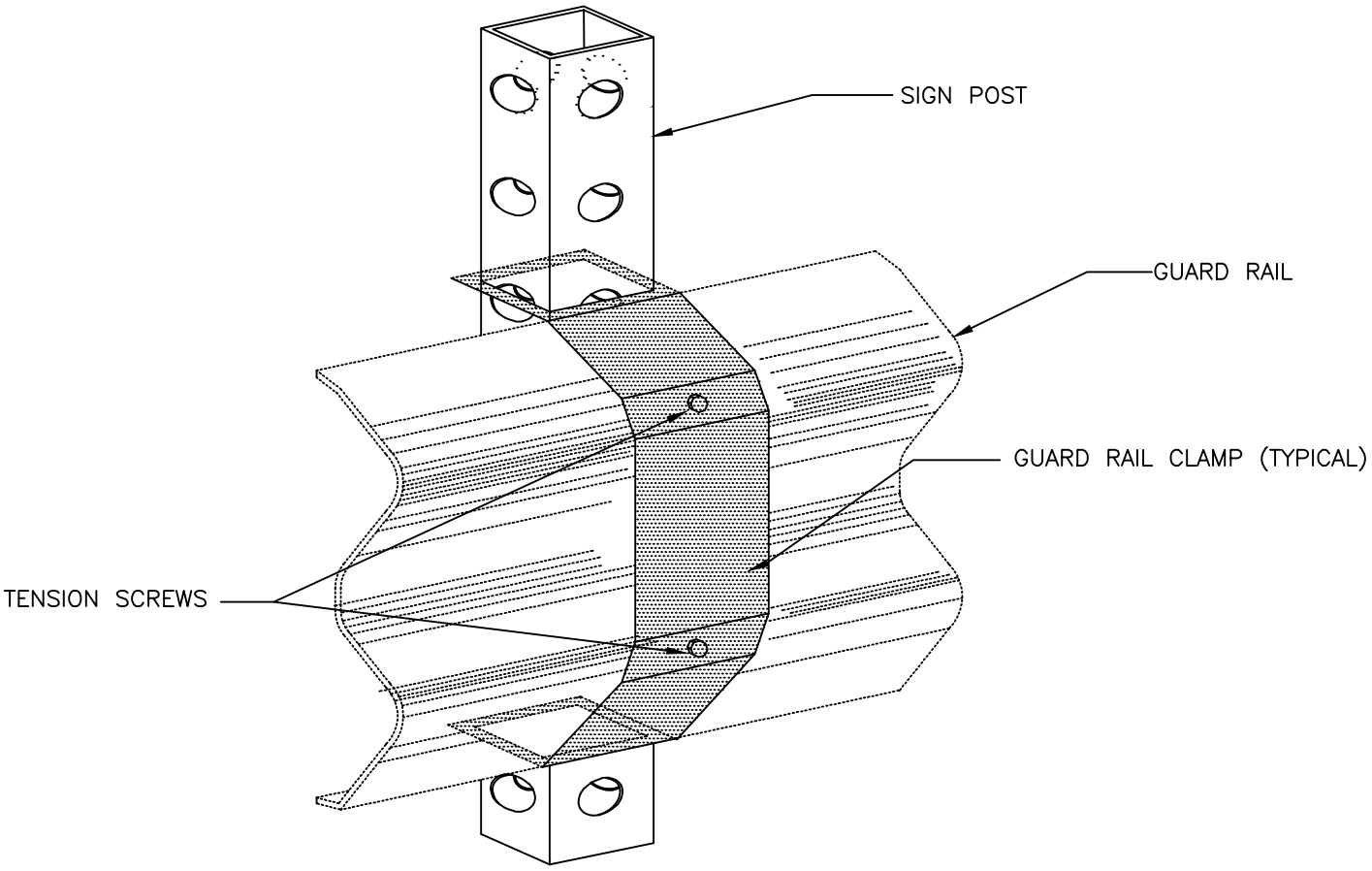
4. ALL SIGNS/MARKERS SHALL MEET OR EXCEED MUTCD STANDARDS FOR RETROREFLECTIVITY.



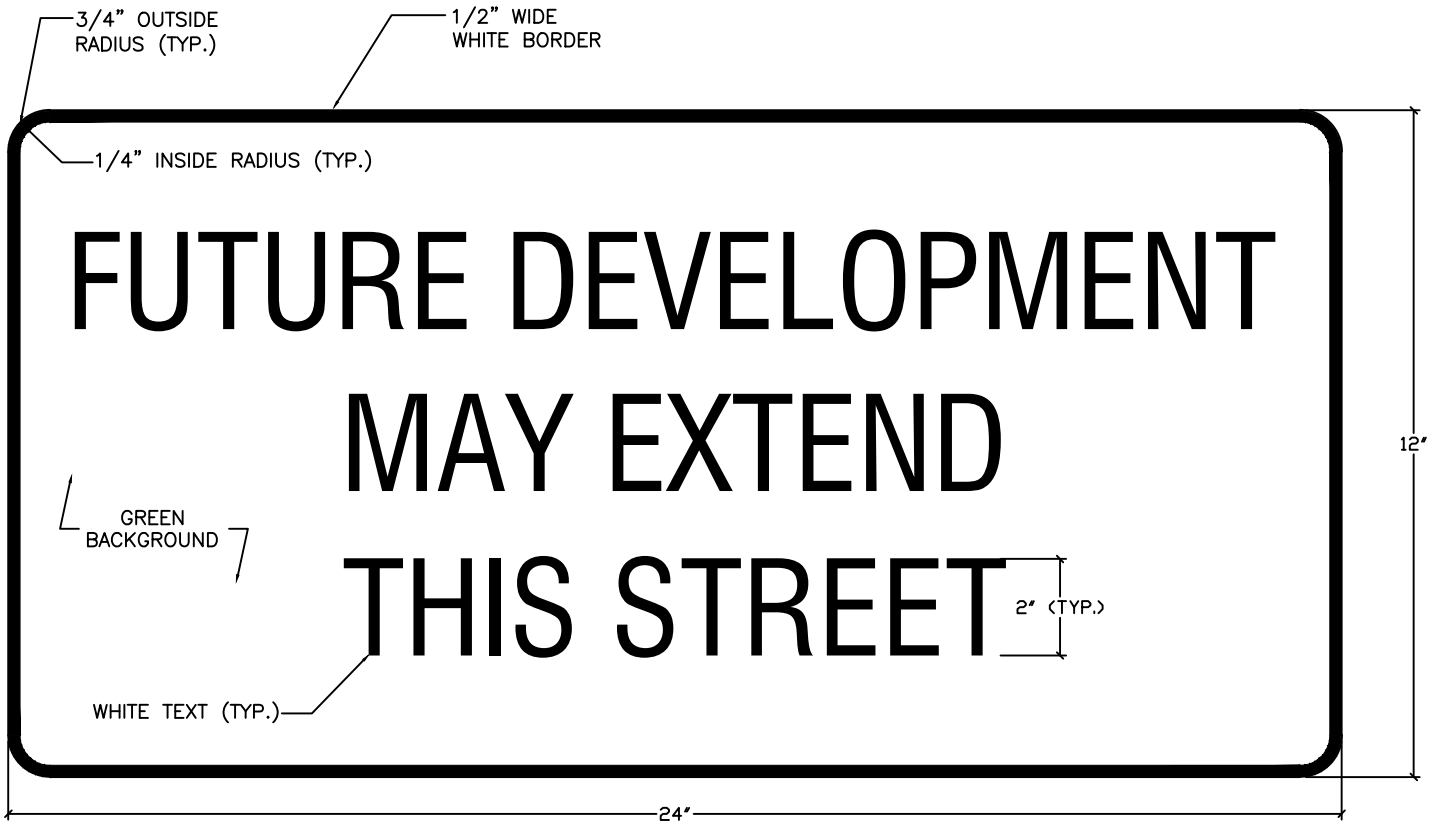
SIGN LOCATION DETAIL



TOWN OF MOORESVILLE STANDARD DETAIL	ROAD SYSTEMS END OF ROADWAY MARKER	January 2014 . NTS | R-30.0



TOWN OF MOORESVILLE STANDARD DETAIL	ROAD SYSTEMS END OF ROADWAY MARKER GUARDRAIL CLAMP INSTALLATION	January 2014 . NTS / R-30.0A



NOTES:

1. SIGN SHALL MEET OR EXCEED MUTCD STANDARDS FOR RETROREFLECTIVITY
2. SIGN MATERIAL SHALL BE 0.080" THICK ALUMINUM
3. ALL LETTERS SHALL BE SERIES B–2000 FROM THE 2004 STANDARD HIGHWAY SIGNS MANUAL (AND ANY REVISION THERETO) PUBLISHED BY THE FEDERAL HIGHWAY ADMINISTRATION.

TOWN OF MOORESVILLE STANDARD DETAIL	ROAD SYSTEMS STREET CONNECTIVITY SIGN FOR DEAD END STREET BARRICADE	January 2014 . NTS | R-30.0B

NOTES:

1. ALL CONCRETE TO BE 3600 P.S.I. COMPRESSIVE STRENGTH.
2. TYPE OF PIPE TO BE USED IS 1-5/8" MAX. O.D. BLACK IRON, LOW CARBON PIPE OR GALVANIZED.
3. ALL JOINTS TO HAVE A 1/2" FILLET WELD AT ALL JOINTS.
4. AFTER INSTALLATION PAINT ASSMBLY WITH BLACK ALL WEATHER ENAMEL.
5. SEE DETAIL R-31.0A FOR WARRANTS
6. ALTERNATIVE DESIGNS SHALL BE SENT TO MOORESVILLE ENGINEERING SERVICES DIRECTOR FOR APPROVAL.
7. HANDRAILS MUST EXTEND A MINIMUM OF 20'-0" PAST THE END OF THE WINGWALL.

TOWN OF MOORESVILLE STANDARD DETAIL	ROAD SYSTEMS SAFETY RAIL STANDARD	June 2018 - NTS | R - 31.0

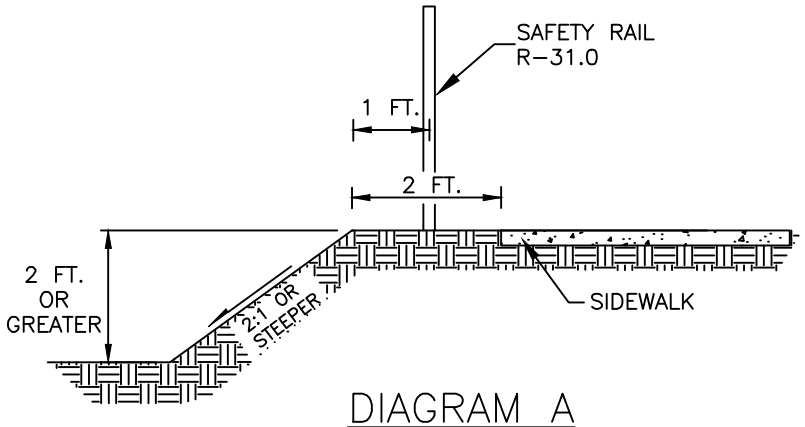


DIAGRAM A

SLOPED DROPOFF AT BACK OF SIDEWALK

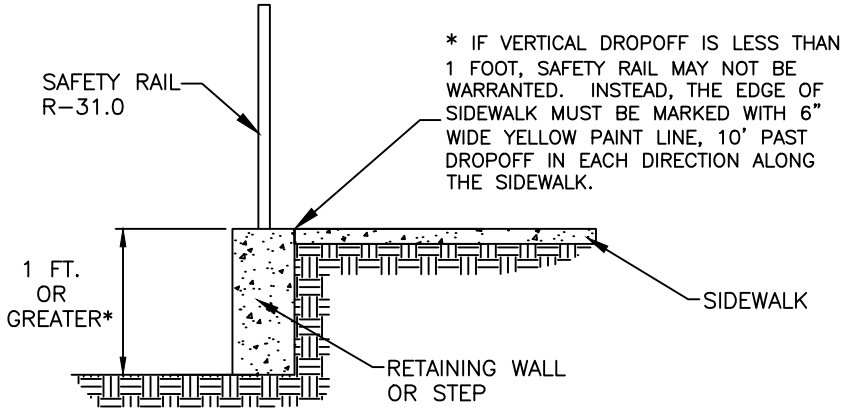


DIAGRAM B

VERTICAL DROPOFF AT BACK OF SIDEWALK

WARRANTS

STANDARD SAFETY RAIL (STD. R-31.0) SHALL BE INSTALLED UNDER ANY OF THE FOLLOWING CIRCUMSTANCES IN BOTH NEW CONSTRUCTION AND IN RETROFITTING OR RECONSTRUCTION OF EXISTING ROADWAYS OR SITES:

1. HANDRAILS SHALL BE INSTALLED BEHIND THE SIDEWALK UNLESS A 10-FOOT PEDESTRIAN CLEAR ZONE IS PROVIDED BEHIND THE SIDEWALK.
2. IF THERE IS A TWO FOOT OR GREATER DROPOFF WITHIN 2 FEET OF THE EDGE OF THE SIDEWALK (SEE DIAGRAM A).
3. IF THERE IS A 1-FOOT OR LARGER DROPOFF DIRECTLY ADJACENT TO THE SIDEWALK EDGE (SEE DIAGRAM B).
4. AT THE TOP OF ANY DROPOFF WITHIN THE PEDESTRIAN CLEAR ZONE OR WHERE PEDESTRIANS CAN REASONABLY BE EXPECTED IN THE VICINITY.
5. AT THE DIRECTION OF THE TOWN OF MOORESVILLE ENGINEERING SERVICES DIRECTOR BASED ON FIELD CONDITIONS.

DEFINITIONS

- DROPOFF -- A SLOPE OF 2:1 OR STEEPER. EXAMPLES INCLUDE HEADWALLS, RETAINING WALLS, AND CULVERTS.
- PEDESTRIAN CLEAR ZONE -- 10 FEET OF ANY COMBINATION OF SIDEWALK, SLOPE, AND SHOULDER SLOPED AT 6:1 OR FLATTER. SIDEWALK DOES NOT NEED TO BE PRESENT.
- SIDEWALK -- FOR PURPOSES OF THIS STANDARD, THE TERM "SIDEWALK" IS USED GENERICALLY AND SHALL MEAN ANY PATH OR SURFACE TO BE USED FOR BICYCLE AND/OR PEDESTRIAN TRANSPORTATION. EXAMPLES INCLUDE, BUT ARE NOT LIMITED TO, SIDEWALKS, BIKE PATHS, SHARED-USE PATHS, PEDESTRIAN PATHS, AND GREENWAYS.

TOWN OF MOORESVILLE STANDARD DETAIL	ROAD SYSTEMS SAFETY RAIL WARRANTS	June 2018 -	
		NTS	R - 31.0A

STANDARD STORM DRAINAGE DETAILS:

D–1.0 BRICK DOUBLE CATCH BASIN 15" THRU 24" PIPE

D–2.0A BRICK DOUBLE CATCH BASIN 30" THRU 36" PIPE

D–2.0B BRICK DOUBLE CATCH BASIN 30" THRU 36" PIPE

D–3.0A FLARED END SECTION PLAN, END, SKEWED VIEW AND INSTALLATION SECTION VIEW

D–3.0B FLARED END SECTION SECTION X–X, GENERAL NOTES AND DIMENSIONS

TOWN OF MOORESVILLE

STANDARD DETAIL

STORM DRAINAGE

BRICK DOUBLE CATCH BASIN
15" THRU 24" PIPE

NTS

D - 1.0

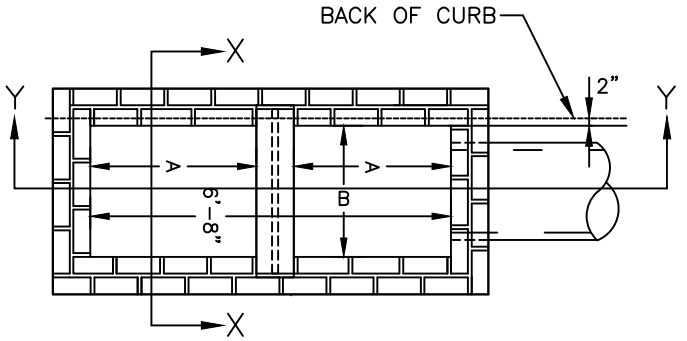
January 2009
Revision 1

GENERAL NOTES:

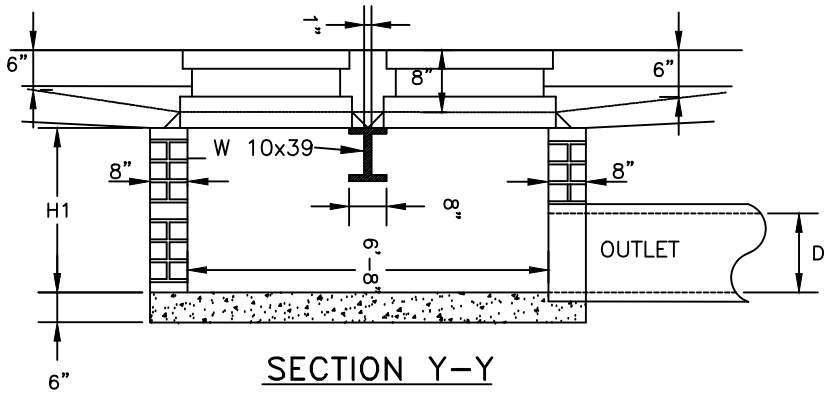
1. ALL CONCRETE TO BE 3600 PSI MIN. COMPRESSIVE STRENGTH.
2. MORTAR JOINTS SHOULD BE BETWEEN 3/8" AND 5/8" THICK.
3. ALL CATCH BASINS OVER 3'–6" IN DEPTH TO BE PROVIDED WITH STEPS AS DEFINED IN THE MATERIALS SECTION OF THE STANDARDS.
4. CONCRETE BRICK MAY BE USED IN LIEU OF HARD COMMON CLAY BRICK. JUMBO BRICK WILL BE PERMITTED.
5. FOR MANHOLE DEPTH OF 8'–0" OR LESS USE 8" WALL
   FOR MANHOLE DEPTH OVER 8'–0" USE 8" FROM TOP OF WALL AND 12" FOR REMAINING DEPTH. (SEE DETAIL "A" THIS SHEET)
6. FOR FRAME AND GRATE DETAIL SEE NCDOT STANDARD 840.03
7. ALL PIPE IN STORM DRAIN STRUCTURE SHALL BE STRUCK EVEN WITH THE INSIDE WALL, GROUTED AND BRUSHED SMOOTH.
8. WEEP HOLE(S) SHALL BE PLACED IN BACK WALL. A STONE DRAIN CONSISTING OF 1 (ONE) CUBIC FOOT OF NUMBER 78M STONE CONTAINED IN A BAG OF POROUS FABRIC SHALL BE PLACED AT EACH WEEP HOLE.
9. WHERE 2'–6" CURB AND GUTTER IS USED, CATCH BASINS MAY BE LOCATED AT THE END OF A RADIUS.
10. SEE NCDOT STD. NO. 840.01 FOR FURTHER INFORMATION.

DIMENSIONS OF BOX AND PIPE

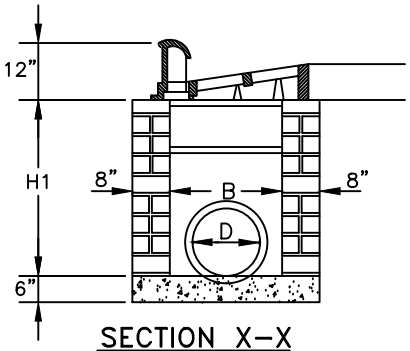
PIPE	SPAN	WIDTH	HEIGHT	W 10
D	A	B	MIN. H1	LENGTH
15"	3'–0"	2'–4"	2'–6"	2'–10"
18"	3'–0"	2'–4"	2'–10"	2'–10"
24"	3'–0"	2'–4"	3'–4"	2'–10"



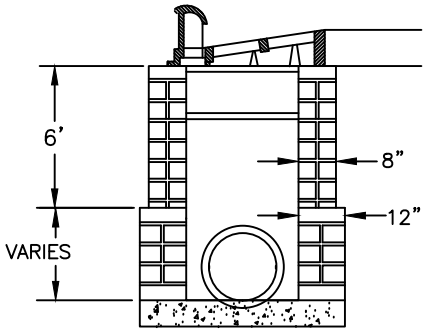
PLAN



SECTION Y–Y



SECTION X–X



DETAIL "A"

TOWN OF MOORESVILLE

STANDARD DETAIL

STORM DRAINAGE

BRICK DOUBLE CATCH BASIN
30" THRU 36" PIPE

NTS

D - 2.0A

January 2009
Revision 1

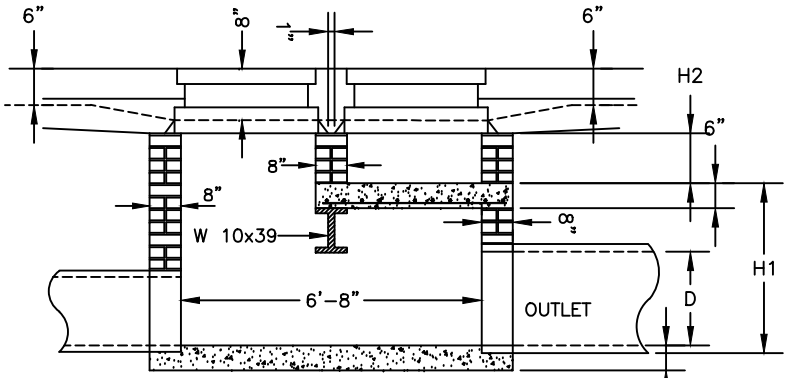
GENERAL NOTES:

1. ALL CONCRETE TO BE 3600 PSI MIN. COMPRESSIVE STRENGTH.
2. MORTAR JOINTS SHOULD BE BETWEEN 3/8" AND 5/8" THICK.
3. ALL CATCH BASINS OVER 3'–6" IN DEPTH TO BE PROVIDED WITH STEPS AS DEFINED IN THE MATERIALS SECTION OF THE STANDARDS.
4. CONCRETE BRICK MAY BE USED IN LIEU OF HARD COMMON CLAY BRICK. JUMBO BRICK WILL BE PERMITTED.
5. FOR MANHOLE DEPTH OF 6'–0" OR LESS USE 8" WALL FOR MANHOLE DEPTH OVER 6'–0" USE 8" FROM TOP OF WALL AND 12" FOR REMAINING DEPTH. (SEE DETAIL "A" THIS SHEET)
6. FOR FRAME AND GRATE DETAIL SEE NCDOT STANDARD 840.03
7. ALL PIPE IN STORM DRAIN STRUCTURE SHALL BE STRUCK EVEN WITH THE INSIDE WALL, GROUTED AND BRUSHED SMOOTH.
8. WEEP HOLE(S) SHALL BE PLACED IN BACK WALL. A STONE DRAIN CONSISTING OF 1 (ONE) CUBIC FOOT OF NUMBER 78M STONE CONTAINED IN A BAG OF POROUS FABRIC SHALL BE PLACED AT EACH WEEP HOLE.
9. SEE STANDARD NUMBER D–2.0B (SHEET 2 OF 2) FOR DIMENSION TABLE AND BAR SPECIFICATIONS

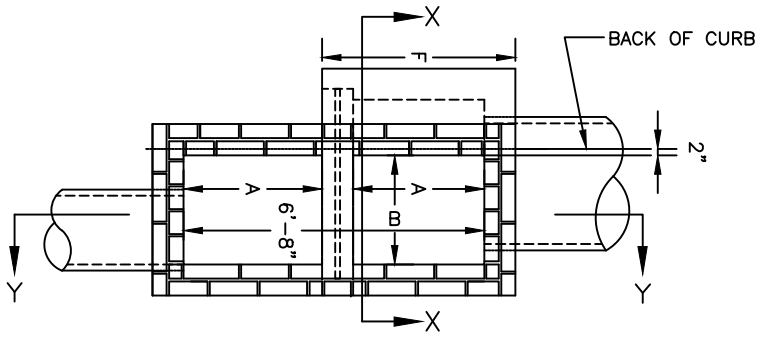
9A. SLAB PORTION MUST BE LOCATED BEHIND THE CURB.

10. SEE NCDOT STD. NO. 840.01 FOR FURTHER INFORMATION.

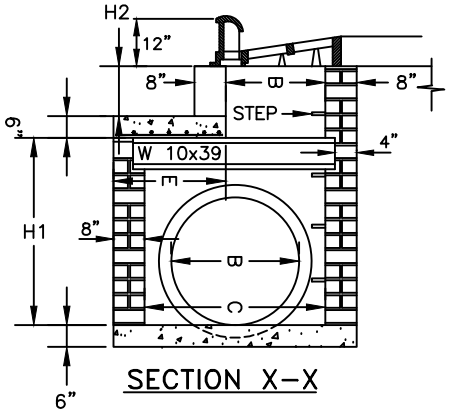
NOTE:
MINIMUM DEPTH (H1) TO BE DETERMINED BY SIZE OF OUTLET PIPE.



SECTION Y–Y



PLAN



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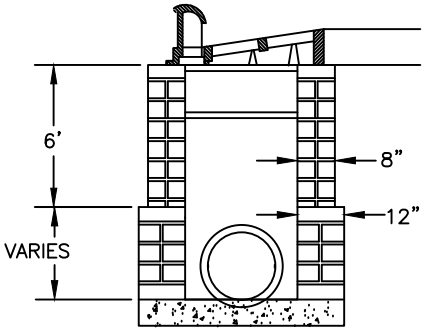


DETAIL "A"

TOWN OF MOORESVILLE

STANDARD DETAIL

STORM DRAINAGE

BRICK DOUBLE CATCH BASIN
30" THRU 36" PIPE

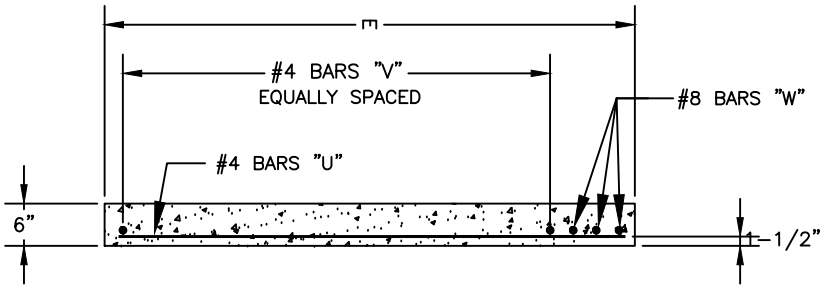
January 2009
Revision 1

NTS

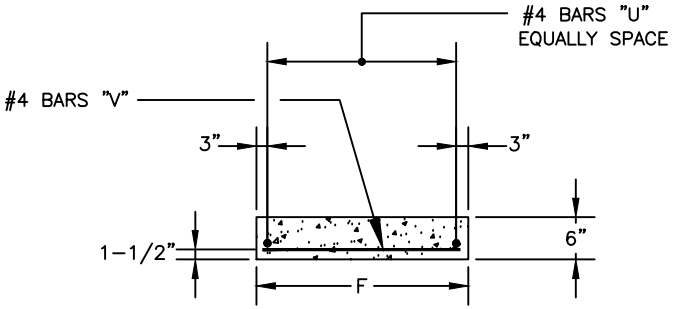
D - 2.0B

30" THRU 36" PIPE

DIMENSIONS OF BOX AND PIPE							COVER DIMENSION		TOP SLAB REINFORCMENT						
PIPE	SPAN	WIDTH	WIDTH	HEIGHT	HEIGHT	W 10			BARS – U		BARS – V		BARS – W		TOT.
D	A	B	C	MIN. H1	H2	LENGTH	E	F	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	LBS.
30"	3'–0"	2'–4"	3'–4"	3'–2"	VAR.	4'–0"	1'–10"	4'–4"	4	1'–6"	3	4'–1"	3	4'–1"	45
36"	3'–0"	2'–4"	3'–10"	3'–8"	VAR.	4'–6"	2'–4"	4'–4"	4	2'–0"	4	4'–1"	3	4'–1"	49



SECTION X–X



SECTION Y–Y

SEE STANDARD NUMBER D–2.0A (SHEET 1 OF 2) FOR PLAN AND SECTION VIEWS

TOWN OF MOORESVILLE

STANDARD DETAIL

STORM DRAINAGE

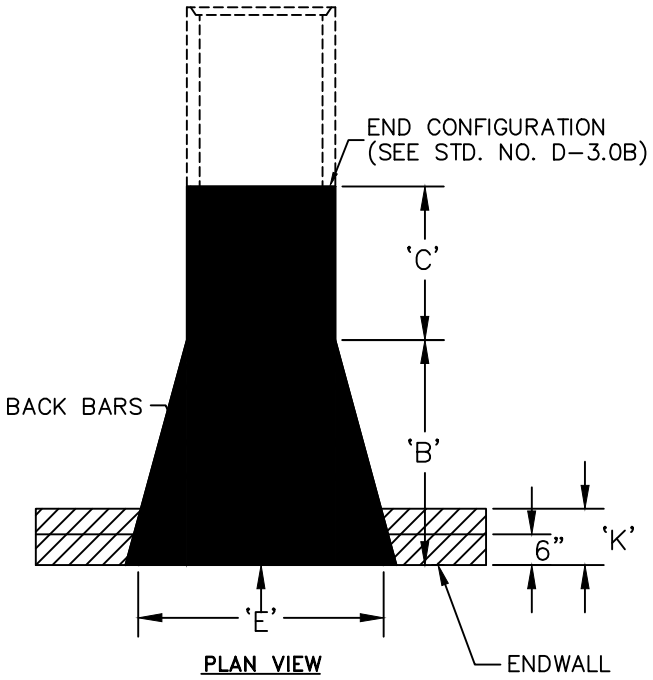
FLARED END SECTION

PLAN, END, SKEWED VIEW AND INSTALLATION SECTION VIEW

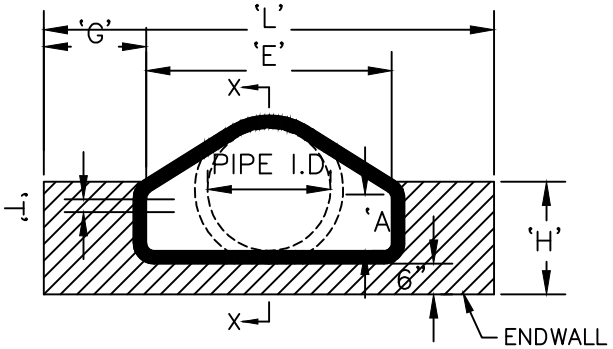
January 2009
Revision 1

NTS

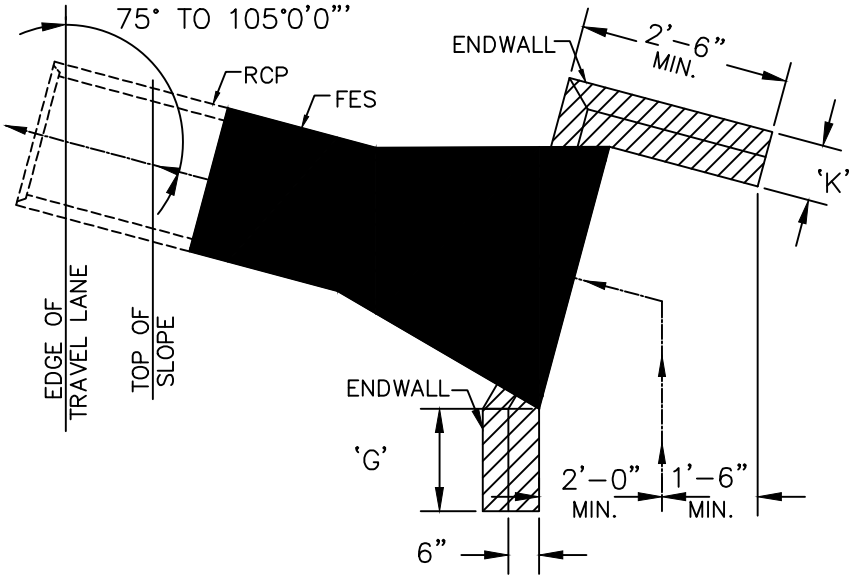
D - 3.0A



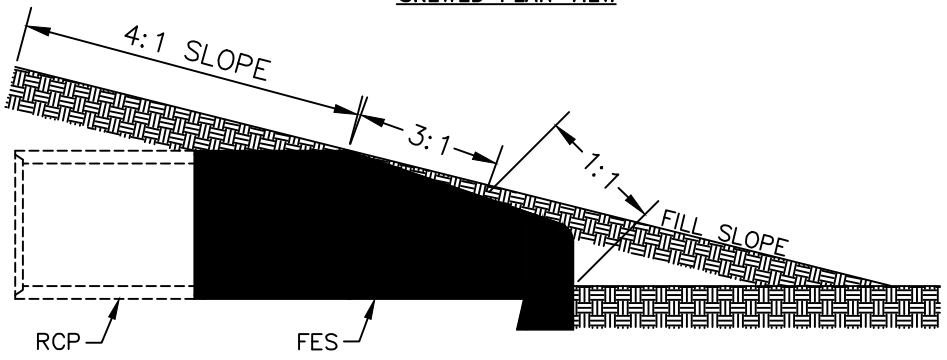
PLAN VIEW



END VIEW



SKEWED PLAN VIEW



INSTALLATION SECTION VIEW

SEE STD. NO D-3.0B FOR GENERAL NOTES, SECTION X-X AND DIMENSIONS

TOWN OF MOORESVILLE

STANDARD DETAIL

STORM DRAINAGE

FLARED END SECTION

SECTION X-X, GENERAL NOTES AND DIMENSIONS

NTS

January 2009
Revision 1

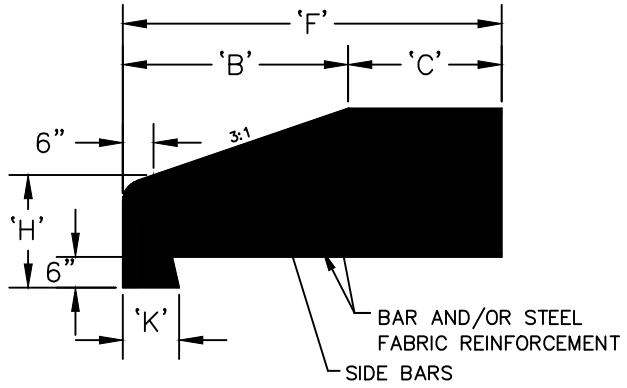
D - 3.0B

DIMENSIONS AND CONCRETE QUANTITIES FOR END SECTIONS AND ENDWALLS														
PIPE I.D.	END SECTIONS						STRAIGHT ENDWALLS (COMMON DIM)					SKEWED ENDWALLS		
	'A'	'B'	'C'	'E'	'F'	'T'	'G'	'H'	'K'	'L'	YD^3	'G'	'L'	YD^3
12"	4"	2'–0"	4'–1"	2'–0"	6'–1"	1⅞"	1'–2"	1'–6"	0'–9"	4'–4"	0.1	1'–0"	6'–4"	0.2
15"	6"	2'–3"	3'–10"	2'–6"	6'–1"	1⅞"	1'–2"	1'–6"	0'–9"	4'–10"	0.1	1'–0"	6'–10"	0.2
18"	9"	2'–3"	3'–10"	3'–0"	6'–1"	2"	1'–5"	1'–9"	0'–11"	5'–10"	0.2	1'–3"	7'–7"	0.3
24"	10"	3'–8"	2'–6"	4'–0"	6'–2"	2½"	1'–8"	1'–10"	0'–11"	7'–4"	0.2	1'–5"	8'–9"	0.3
30"	1'–0"	4'–6"	1'–8"	5'–0"	6'–2"	2¾"	1'–11"	2'–1"	1'–1"	8'–10"	0.3	1'–8"	10'–0"	0.4
36"	1'–3"	5'–3"	2'–11"	6'–0"	8'–2"	3"	2'–3"	2'–5"	1'–3"	10'–6"	0.4	2'–0"	11'–4"	0.6
42"	1'–10"	5'–3"	2'–11"	6'–6"	8'–2"	3½"	2'–9"	2'–11"	1'–6"	12'–0"	0.7	2'–6"	12'–4"	0.9
48"	2'–1"	6'–0"	2'–2"	7'–0"	8'–2"	4"	3'–4"	3'–3"	1'–8"	13'–8"	1.0	3'–0"	13'–4"	1.2

FLARED END SECTION – REINFORCEMENT			
PIPE DIA.	QTY. & DIM OF RODS	STEEL #'S	FABRIC
12"	(2) #3x4'–0" SIDE RODS	3.0	18" 2x8 – w2.1 x w1.7
15"	(2) #3x4'–0" SIDE RODS	3.0	18" 2x8 – w2.1 x w1.7
18"	(2) #3x4'–0" SIDE RODS	3.0	18" 2x8 – w2.1 x w1.7
24"	(2) #3x6'–0" SIDE RODS	4.5	24" 2x8 – w2.9 x w2.9
30"	(2) #4x6'–0" SIDE RODS	8.0	30" 2x8 – w4.0 x w2.9
36"	(2) #4x8'–0" SIDE RODS	10.7	42" 2x8 – w4.0 x w2.9
42"	(2) #4x8'–0" SIDE RODS	10.7	48" 2x8 – w4.5 x w2.9
48"	(2) #4x8'–0" SIDE RODS	10.7	48" 2x8 – w4.5 x w2.9
36" – 48"	(2) #4x6'–0" BACK RODS	8.0	N/A

GENERAL NOTES:

1. CLASS 'B' CONCRETE TO BE USED IN ENDWALLS.
2. CHAMFER ALL EXTERIOR CORNERS 1".
3. FLARED END SECTIONS ARE NORMALLY USED ON PIPES WITH SKEW ANGLES FROM 75° TO 105°
4. FLARED END SECTION CONFIGURATION
   INLET LOCATION – TONGUE
   OUTLET LOCATION – GROVE



SECTION X–X

SEE STD. NO D–3.0A FOR PLAN, END, SKEWED AND INSTALLATION SECTION VIEW

STANDARD LANDSCAPE DETAILS:

TOWN OF MOORESVILLE

STANDARD DETAIL

LANDSCAPE STANDARDS

TREE PLANTING (FOR SINGLE AND MULTI-STEM TREES)

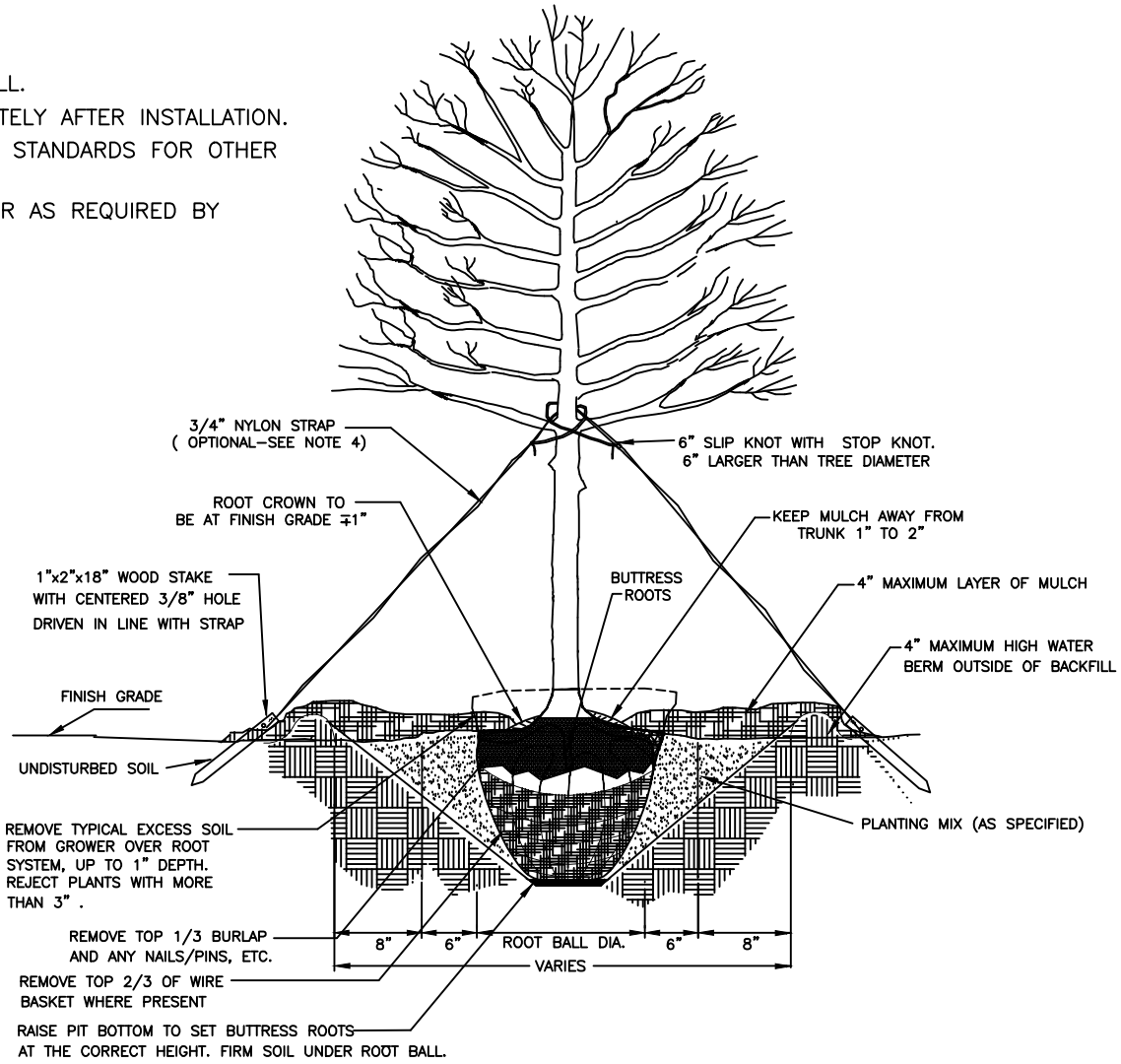
June 2018
Revision 2

NTS

L - 1.0

NOTES:

1. REMOVE WIRE OR NYLON TWINE FROM BALL.
2. SOAK ROOT BALL AND PLANT PIT IMMEDIATELY AFTER INSTALLATION.
3. SEE ATTACHED LANDSCAPE CONSTRUCTION STANDARDS FOR OTHER PLANTING REQUIREMENTS.
4. STAKING REQUIRED FOR LEANING TREES OR AS REQUIRED BY DIRECTOR OF ENGINEERING.



ALL TREES SHALL MEET AMERICAN STANDARD FOR NURSERY STOCK (AMSI, 1990, PART 1, "SHADE AND FLOWERING TREES")

FOR EXAMPLE:	CALIPER	HEIGHT (RANGE)	MAX. HEIGHT	MIN. ROOT BALL DIA.	MIN. ROOT BALL DEPTH
	2"	12–14'	16'	24"	16"
	3"	14–16'	18'	32"	21"

MINIMUM HEIGHT AT TIME OF PLANTING:

TREE TYPE	MIN. CALIPER	MIN. HEIGHT
CANOPY	2"	8'–0"
UNDERSTORY	1–1/4"	6'–0"
EVERGREEN	2"	6'–0"
MULTI–STEM	MIN. 3 STALKS	8'–0"

TOWN OF MOORESVILLE

STANDARD DETAIL

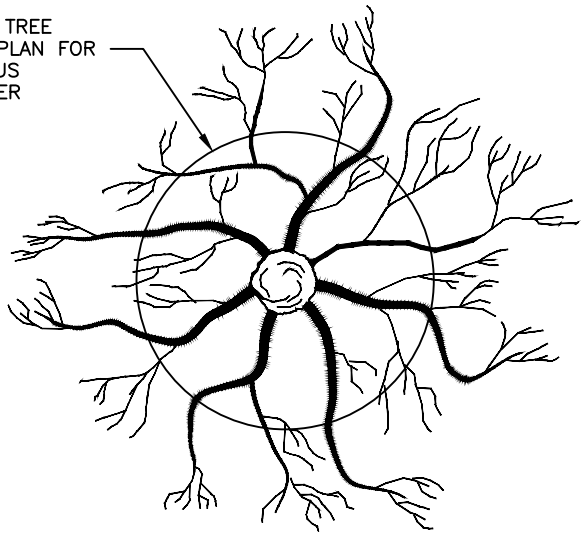
LANDSCAPE STANDARDS

TREE PROTECTION DETAIL

NTS

January 2009
Revision 1

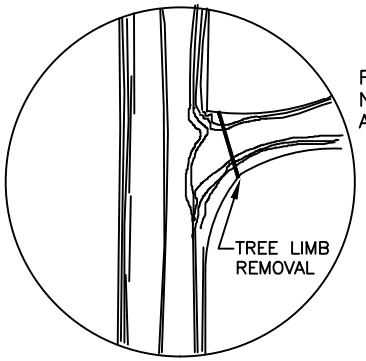
L - 2.0



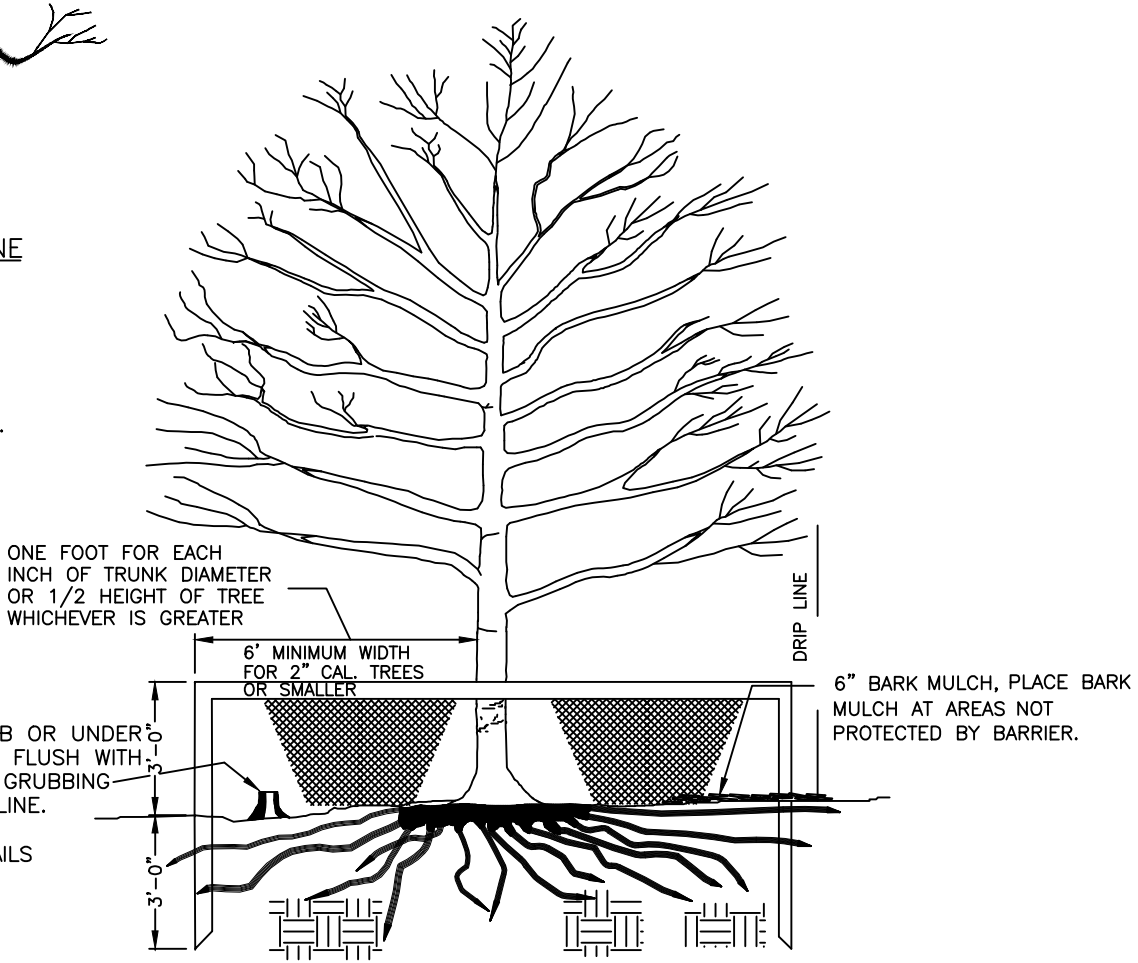
PLAN VIEW OF ROOT ZONE

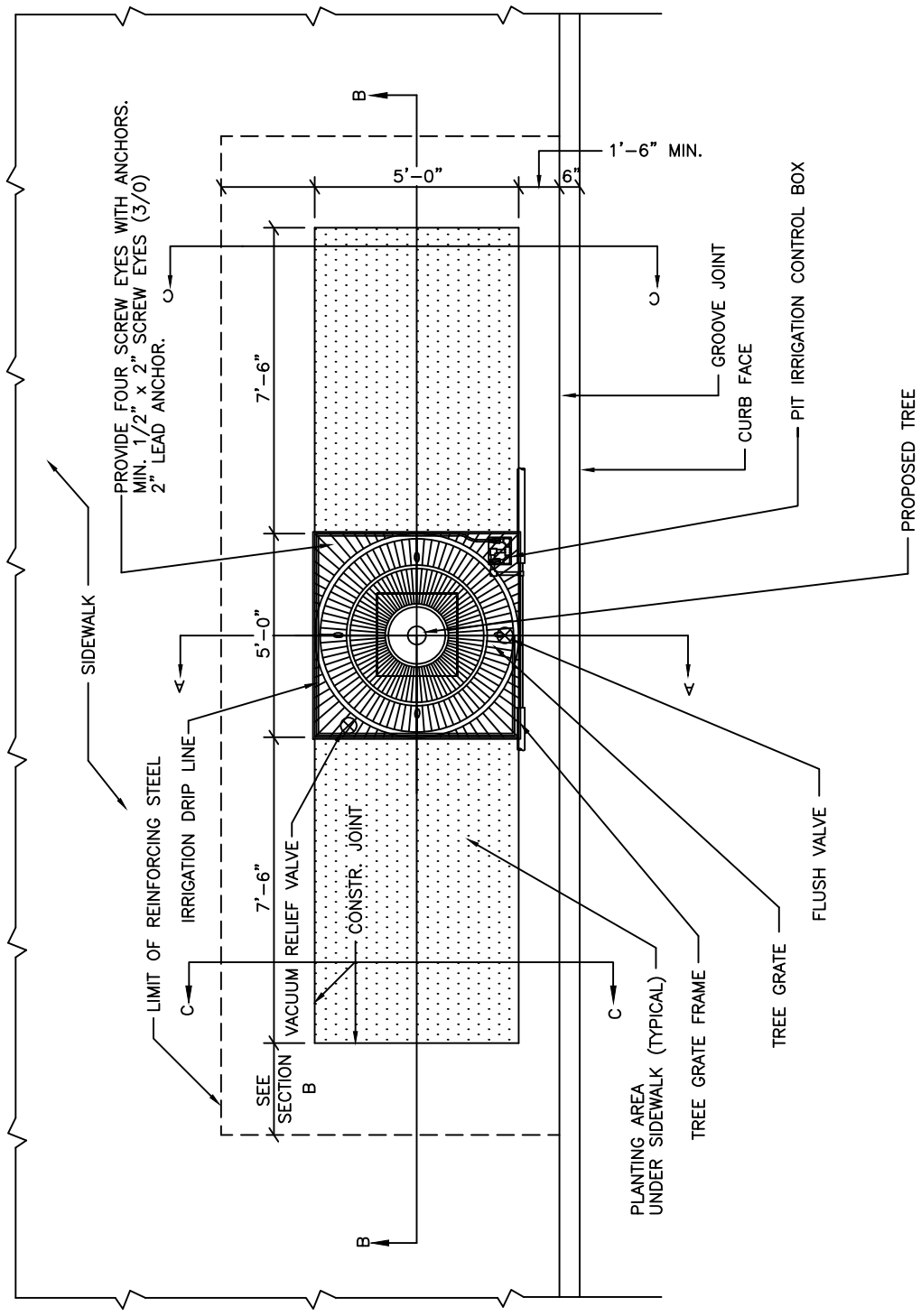
NOTES:

1. REMOVE ALL BARRIERS UPON COMPLETION OF PROJECT.
2. TREES SHOULD BE LIMBED UP TO 7' HIGH.
3. ALL UNDERBRUSH SHOULD BE NO TALLER THAN 3'.

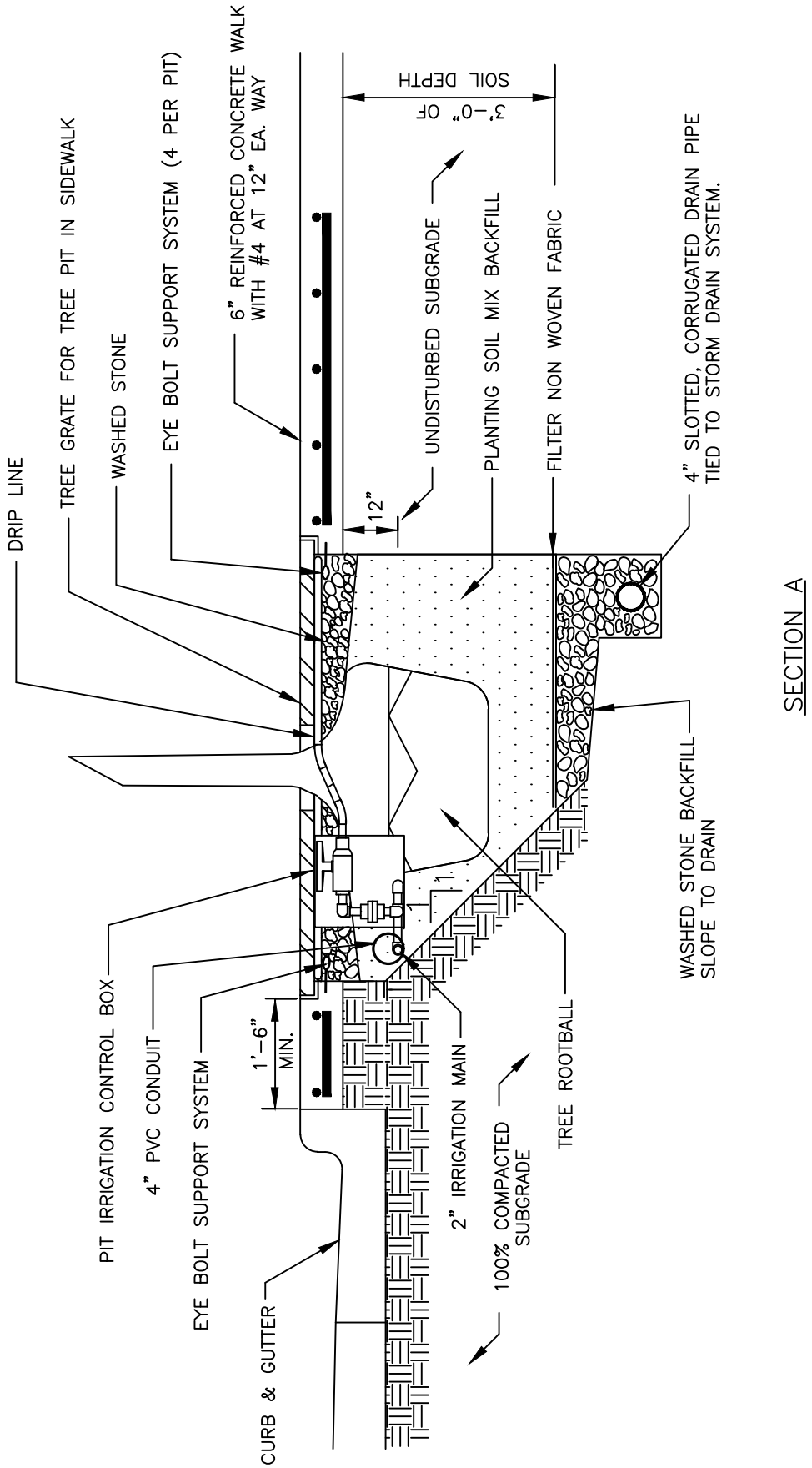


FOR PRUNING SEE NATIONAL ARBORIST ASSOCIATION SPECS.





TOWN OF MOORESVILLE STANDARD DETAIL	LANDSCAPE STANDARDS TREE PIT WITH GRATE IN SIDEWALK (PLAN)	January 2009 Revision 1	
		NTS	L - 3.0A



SECTION A

TOWN OF MOORESVILLE

STANDARD DETAIL

LANDSCAPE STANDARDS

TREE PIT WITH GRATE IN SIDEWALK (SECTION)

January 2009
Revision 1

NTS

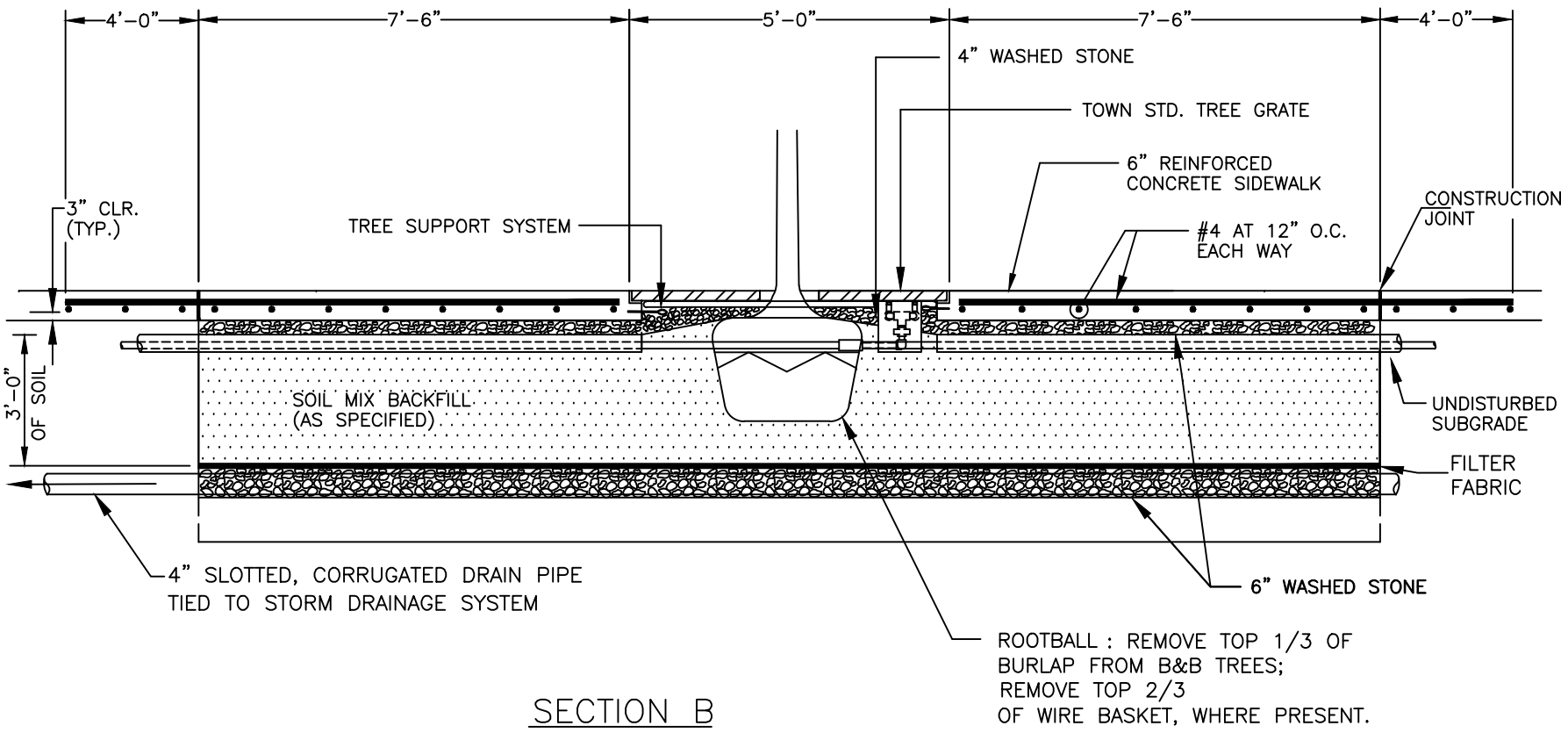
L - 3.0B

TOWN OF MOORESVILLE

STANDARD DETAIL

LANDSCAPE STANDARDS

TREE PIT WITH GRATE IN SIDEWALK (SECTION)



SECTION B

January 2009
Revision 1

NTS

L - 3.0C

TOWN OF MOORESVILLE

STANDARD DETAIL

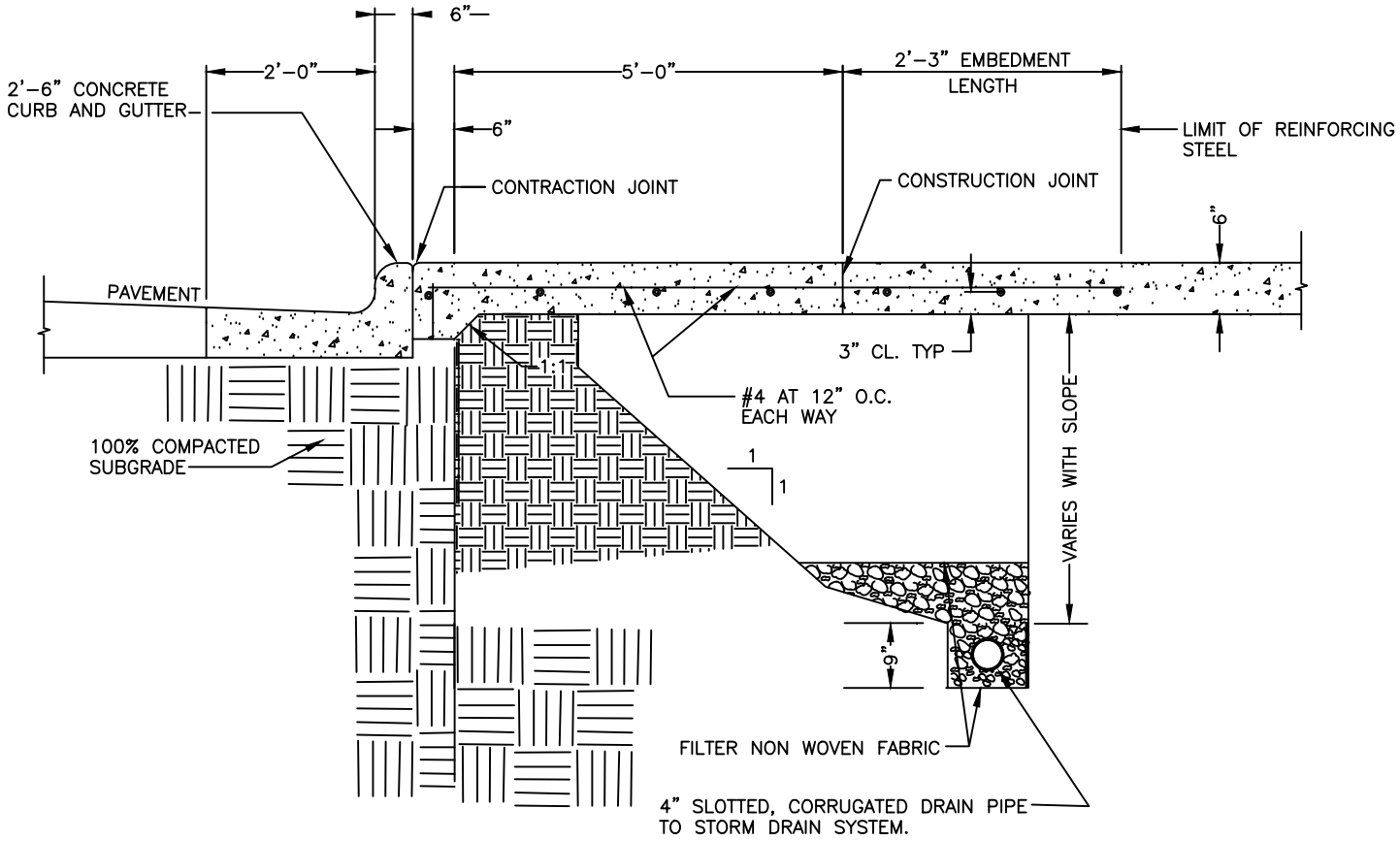
LANDSCAPE STANDARDS

TREE PIT WITH GRATE IN SIDEWALK (SECTION)

January 2009
Revision 1

NTS

L - 3.0D



SECTION C

GENERAL NOTES:

1. EXPANSION JOINTS ARE PERMITTED AT 45' MIN. SPACING AND NOT LESS THAN 12'-6" FROM CENTER OF TREE GRATE.
2. SEE STANDARD NUMBER R-9.0 FOR DETAIL OF CONTRACTION JOINT.
3. CONCRETE SHALL BE 3600 PSI. IN 28 DAYS.
4. ALL REINFORCING STEEL SHALL BE GRADE 60.
5. USE REINFORCED STEEL BAR SUPPORTS IN COMPLIANCE WITH N.C.D.O.T. STANDARD SPECIFICATION 970-4.

NOTE

A DRAINAGE SYSTEM IS REQUIRED AS SHOWN FOR ALL IRRIGATED PLANTING AREAS LOCATED ADJACENT TO STREET.

TOWN OF MOORESVILLE STANDARD DETAIL	LANDSCAPE STANDARDS DRIP IRRIGATION ASSEMBLY FOR TREE PIT WITH GRATE	January 2009 Revision 1	
		NTS	L - 4.0

TOWN OF MOORESVILLE

STANDARD DETAIL

LANDSCAPE STANDARDS

SHRUB PLANTING DETAIL

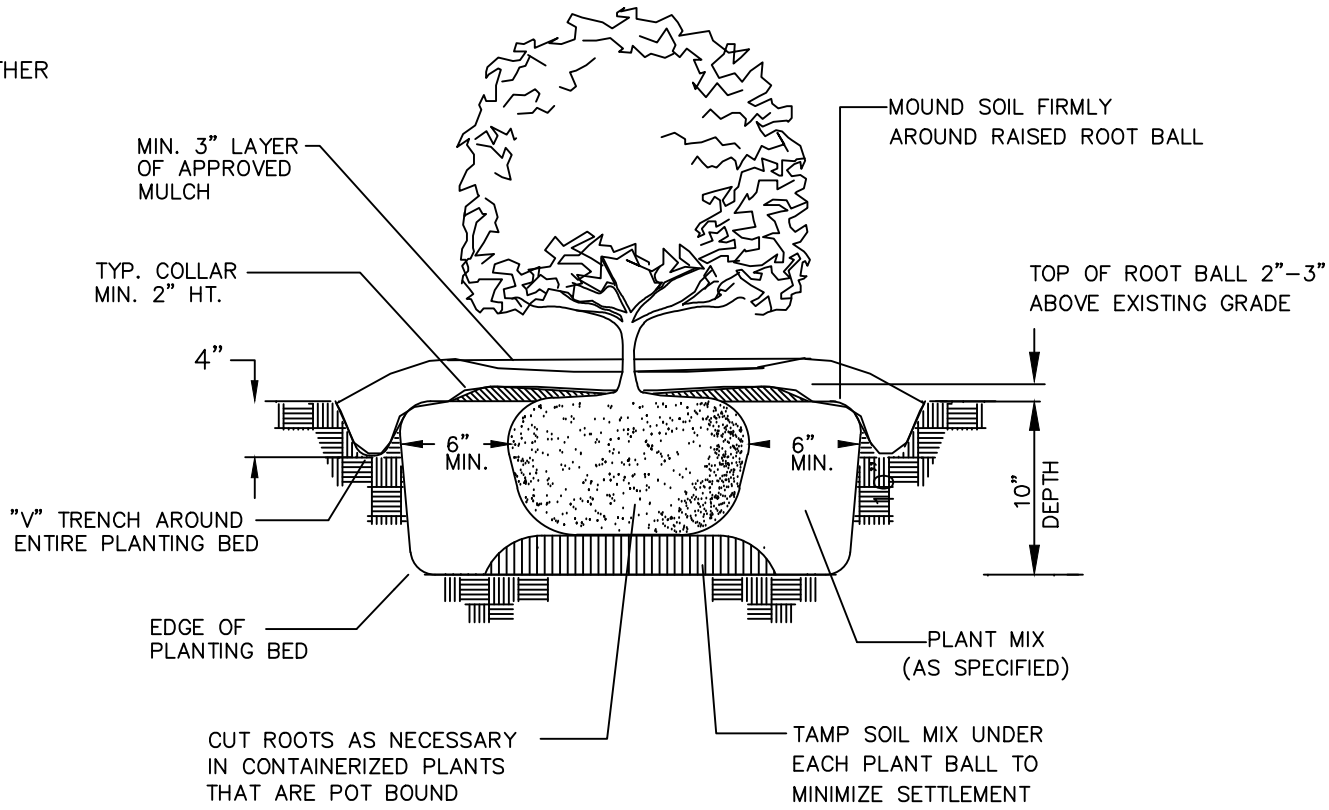
NTS

January 2009
Revision 1

L - 5.0A

NOTES:

1. INSTALL TOP OF PLANT BALL 2"–3" ABOVE ADJACENT GRADE.
2. TAMP PLANTING MIX FIRMLY AS PIT IS FILLED AROUND EACH PLANT BALL.
3. SOAK EACH PLANT BALL AND PIT IMMEDIATELY AFTER INSTALLATION.
4. SEE SPECIFICATIONS FOR OTHER PLANTING REQUIREMENTS.



TYPICAL PLANTING BED DETAIL

TOWN OF MOORESVILLE

STANDARD DETAIL

LANDSCAPE STANDARDS

SHRUB PLANTING BED

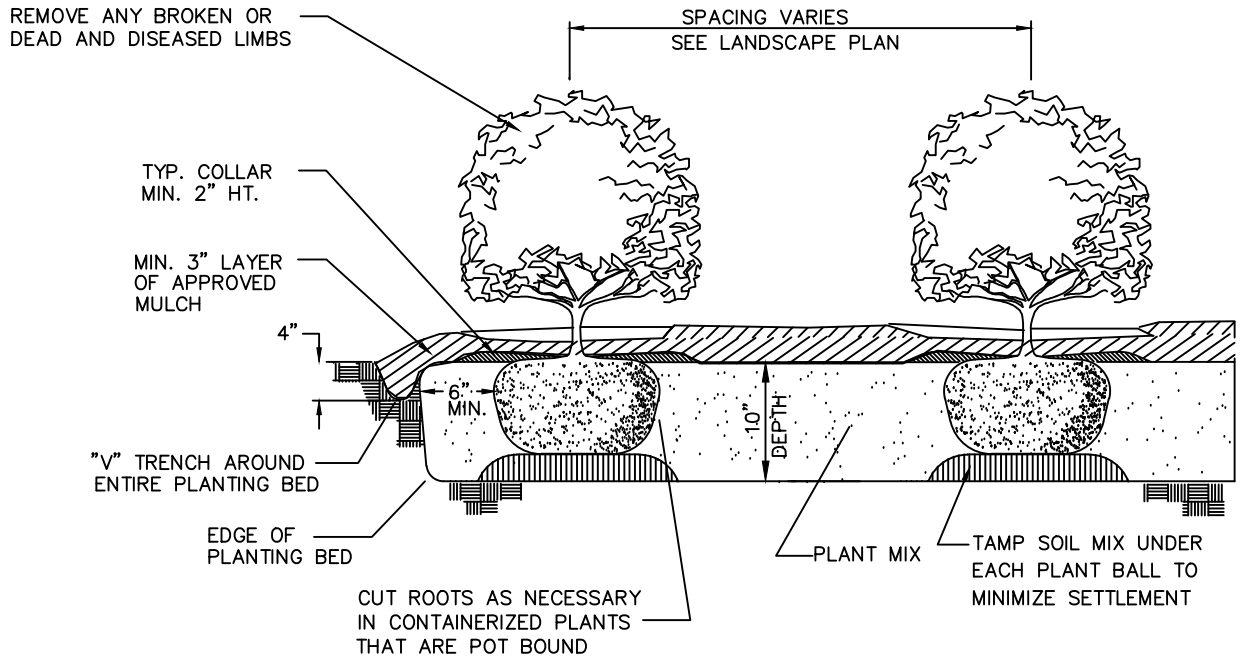
January 2009
Revision 1

NTS

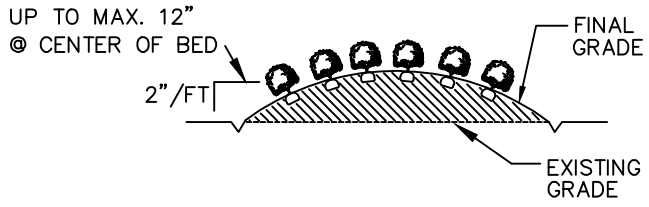
L - 5.0B

NOTES:

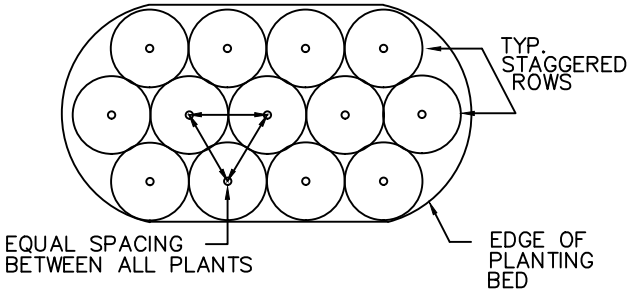
1. INSTALL TOP OF PLANT BALL 2" ABOVE ADJACENT GRADE.
2. TAMP PLANTING MIX FIRMLY AS PIT IS FILLED AROUND EACH PLANT BALL.
3. SOAK EACH PLANT BALL AND PIT IMMEDIATELY AFTER INSTALLATION.



TYPICAL PLANTING BED DETAIL



TYPICAL BED MOUNDING



TYPICAL PLANTING BED PLAN

(PAGE INTENTIONALLY LEFT BLANK)

TOWN OF MOORESVILLE

STANDARD DETAIL

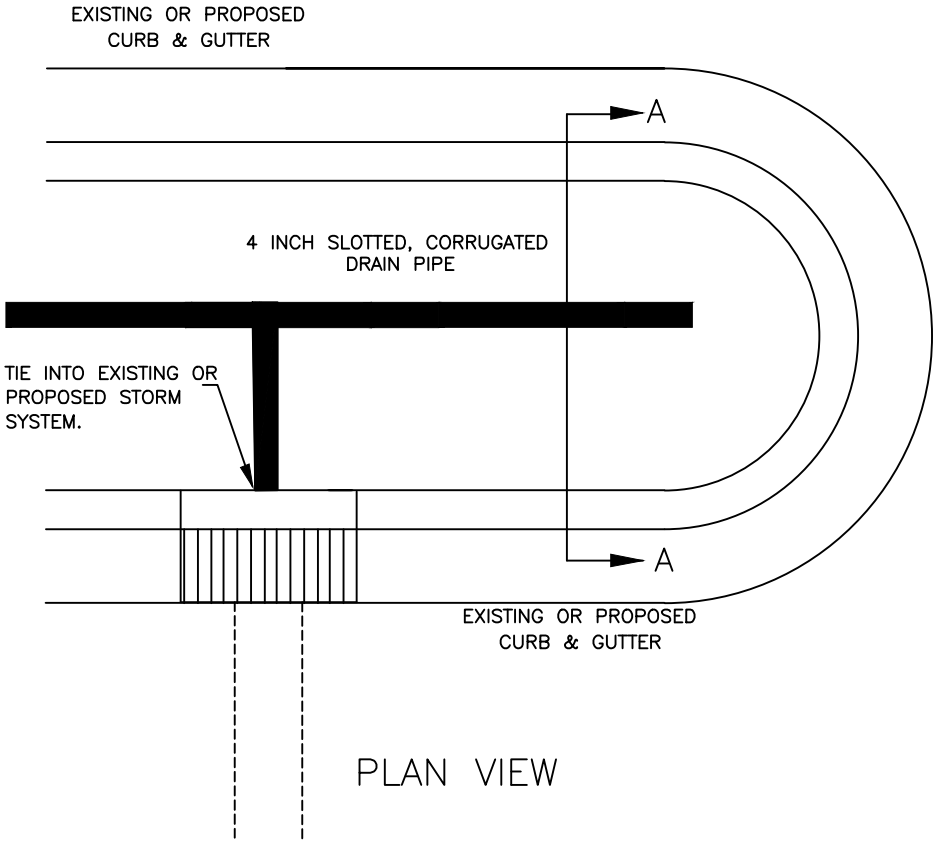
LANDSCAPE STANDARDS

STREET MEDIAN EXCAVATION, DRAINAGE AND BACKFILL

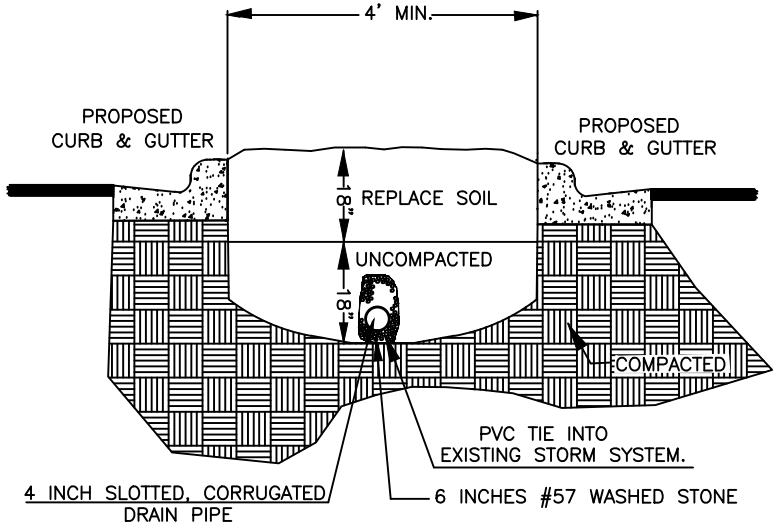
January 2012
Revision 2

NTS

L - 7.0



PLAN VIEW



TYPICAL SECTION A–A

NOTES:

1. FABRIC FOR WRAPPING THE DRAINS WITH PERFORATED PIPE AND WASHED STONE SHALL BE THE NON–WOVEN TYPE, MIRAFI 140NL OR EQUAL

2. SUBSURFACE DRAINAGE SHALL BE INSTALLED IN ALL MEDIANS WHERE DRAIN LINES CAN BE TIED INTO EXISTING STORM DRAIN SYSTEM. A 4 INCH PERFORATED, CORRUGATED PVC DRAIN SHALL BE INSTALLED IN EACH MEDIAN AT THE BOTTOM OF THE EXCAVATED AREA. DRAIN SHALL BE COVERED WITH A MINIMUM 6 INCHES OF #57 WASHED STONE, THEN WRAPPED WITH THE SPECIFIED NON–WOVEN GEOTEXTILE FABRIC. SPECIAL CARE SHALL BE EXERCISED WHEN FILLING MEDIANS WITH SOIL SO NOT TO CRUSH OR DAMAGE THE DRAINAGE SYSTEM OR RECOMPACT THE SOIL.

TOWN OF MOORESVILLE

STANDARD DETAIL

LANDSCAPE STANDARDS

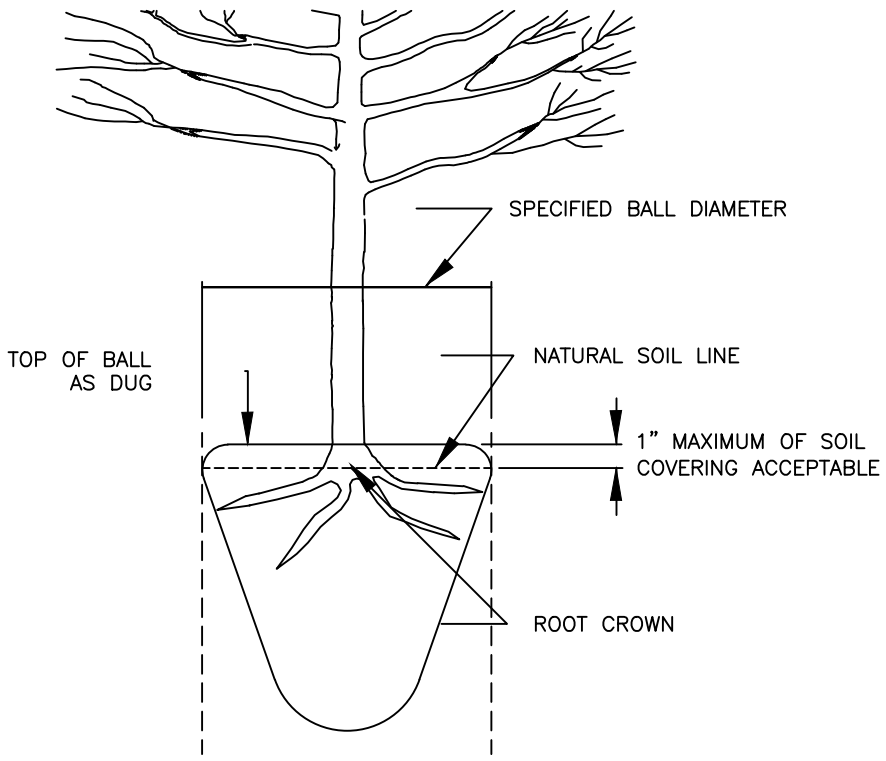
ROOT CROWN DEPTHS

(TREE ROOT BALL CONDITION ON TREES FROM SUPPLIERS)

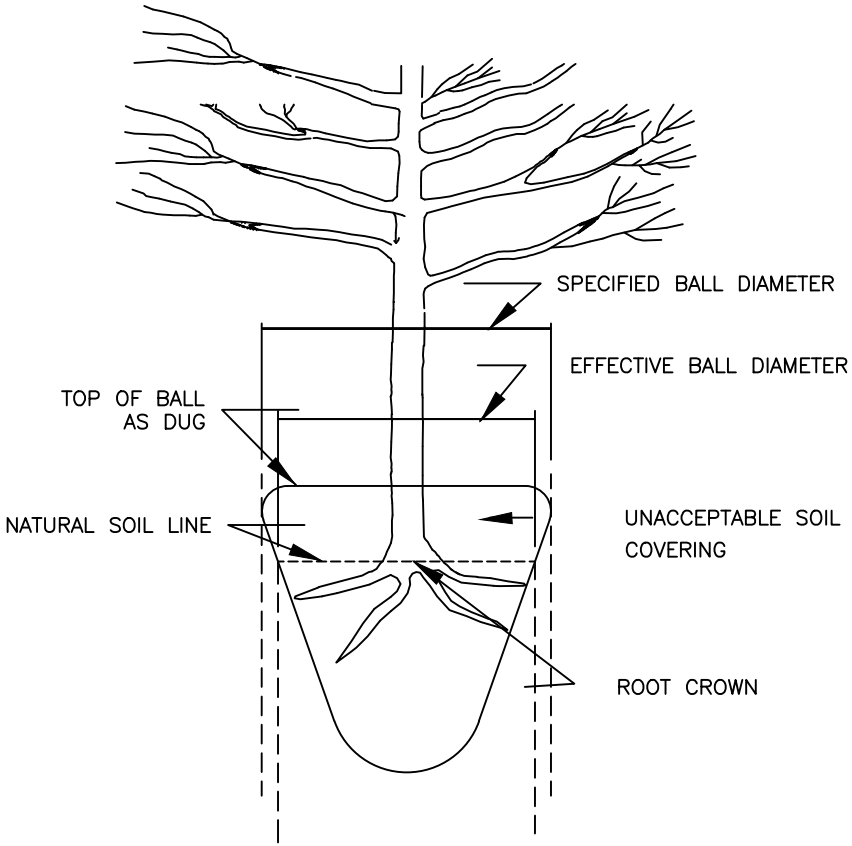
January 2009
Revision 1

NTS

L - 8.0



ACCEPTABLE CONDITION



UNACCEPTABLE CONDITION

NOTE:
A ROOT COLLAR EXCAVATION FOR ALL TREES SPECIFIED MAY BE DONE BY THE INSPECTOR TO ENSURE THAT TREES WERE NOT PLANTED/GROWN TOO DEEPLY AT SOURCE (NURSERY). LANDSCAPE CONTRACTOR SHALL HAVE SUPPLIER MARK GROUND LEVEL LINE ABOVE ROOT BALL. IF INSPECTOR DETERMINES THAT THERE IS EXCESSIVE SOIL OVER THE ROOT CROWN, THESE TREES WILL BE REJECTED.

TOWN OF MOORESVILLE

STANDARD DETAIL

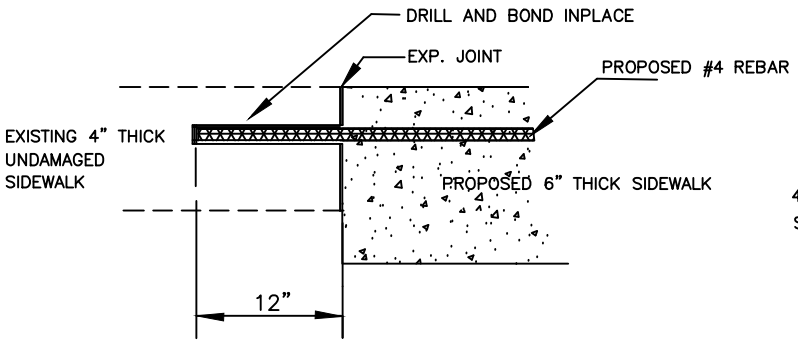
LANDSCAPE STANDARDS

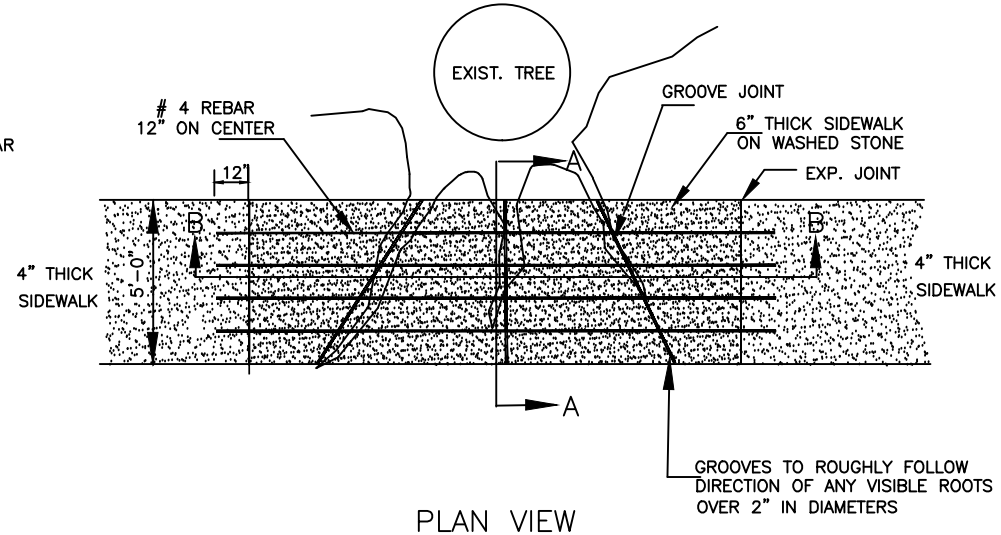
BRIDGING TREE ROOTS

January 2009
Revision 1

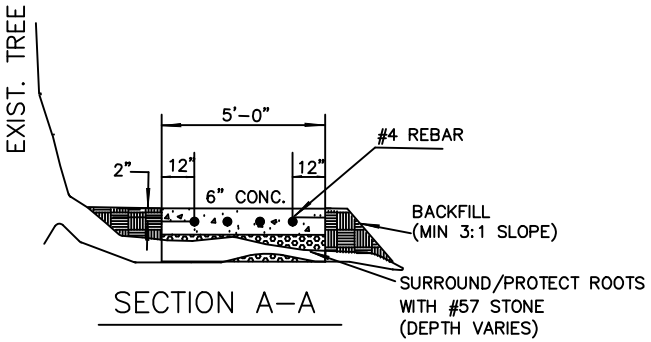
NTS

L - 9.0

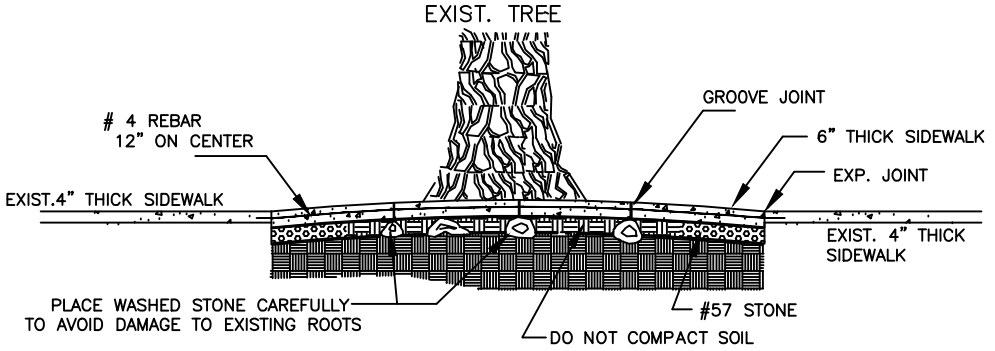




PLAN VIEW



SECTION A–A



SECTION B–B

TOWN OF MOORESVILLE

STANDARD DETAIL

LANDSCAPE STANDARDS

TEMPORARY TREE PROTECTION DETAIL

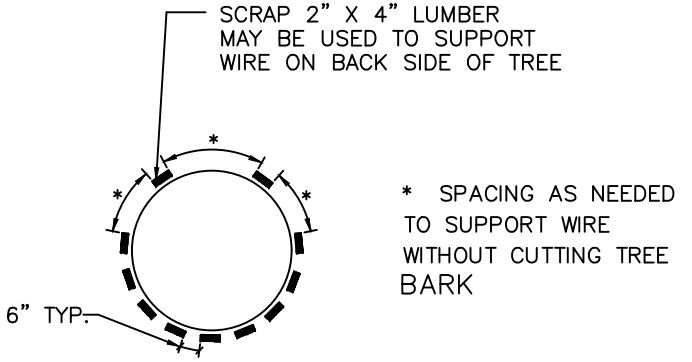
January 2009
Revision 1

NTS

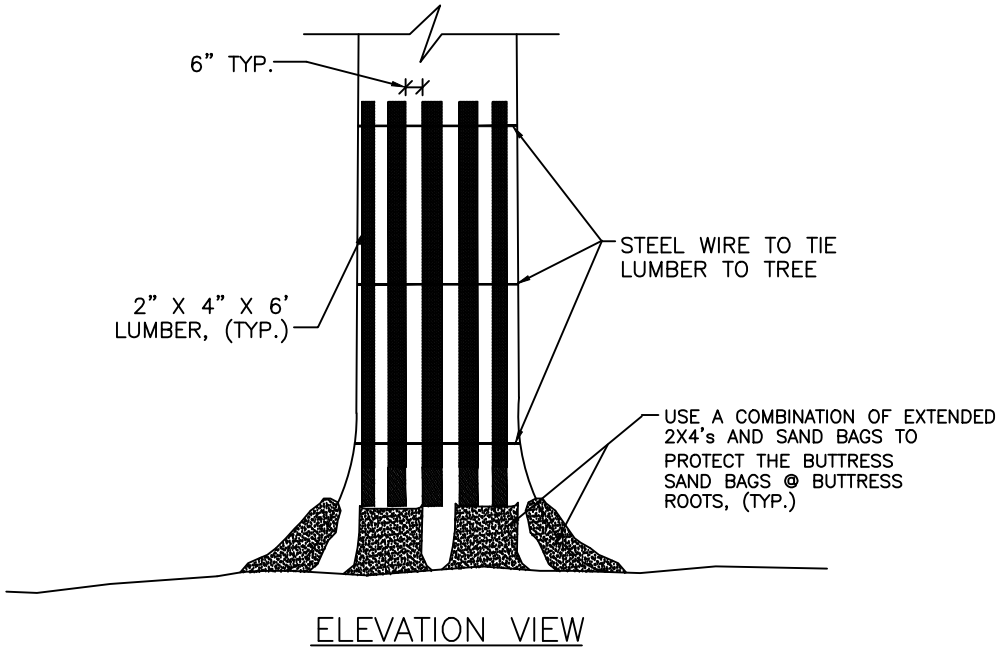
L - 10.0

NOTES:

1. THIS TREE BUMPER DETAIL SHALL BE USED WHEN WORKING WITHIN 10' OF AN EXISTING TREE TO BE PROTECTED.
2. ALL TREES SHALL BE SAVED UNLESS NOTED OTHERWISE ON THE PLANS OR DIRECTED BY THE ENGINEER.
3. LUMBER, WIRE, AND SANDBAGS MAY BE REUSED AT OTHER TREES.
4. THE INTENT OF THIS DETAIL IS TO PROTECT EXISTING TREES FROM DAMAGE DURING CONSTRUCTION ESPECIALLY FROM BACKHOE ARM SWING. AN ALTERNATE APPROACH MAY BE USED IF APPROVED IN WRITING BY THE DIRECTOR OF ENGINEERING.



PLAN VIEW



ELEVATION VIEW

TOWN OF MOORESVILLE

STANDARD DETAIL

LANDSCAPE STANDARDS

ASPHALT CURB PLACEMENT AT EXISTING TREE

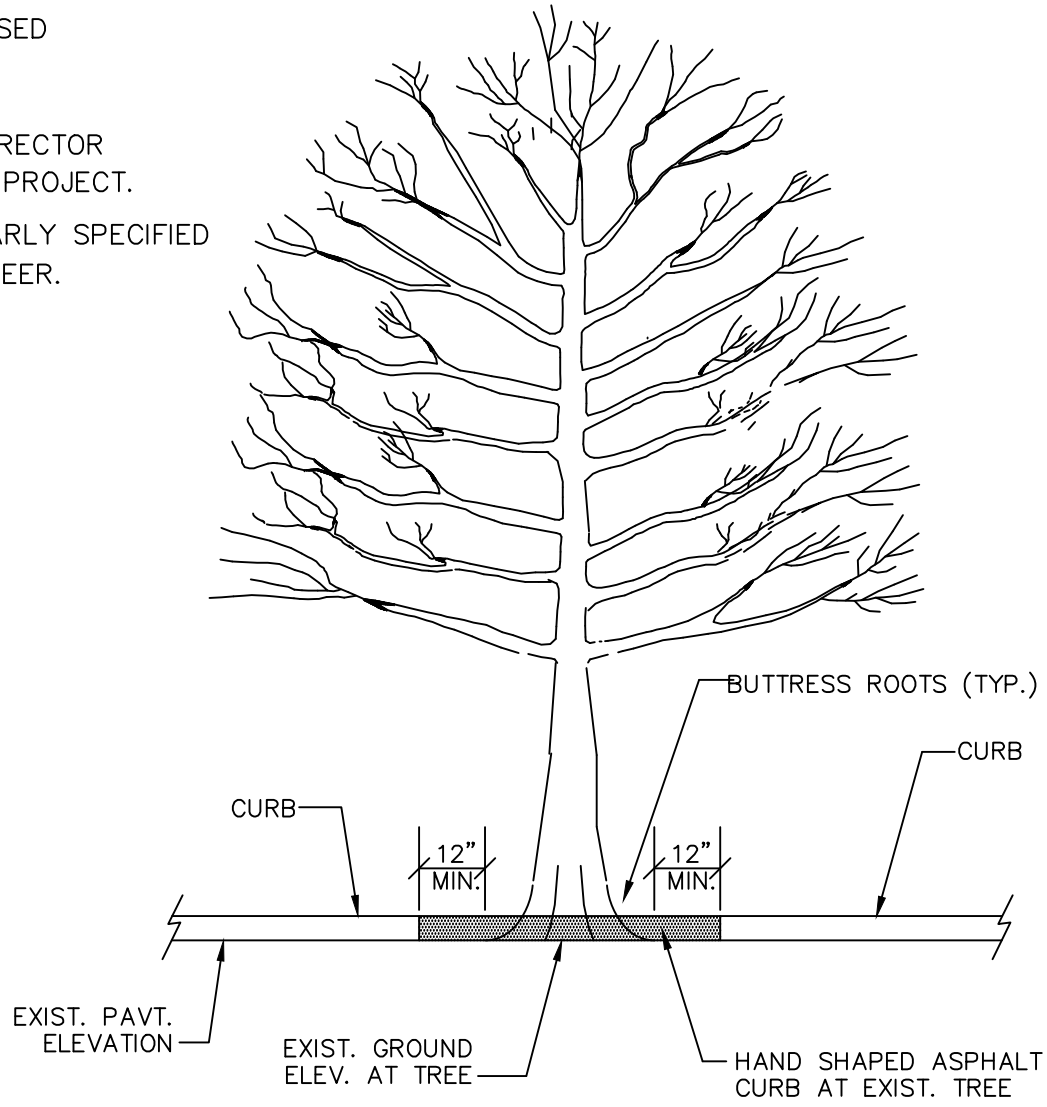
NTS

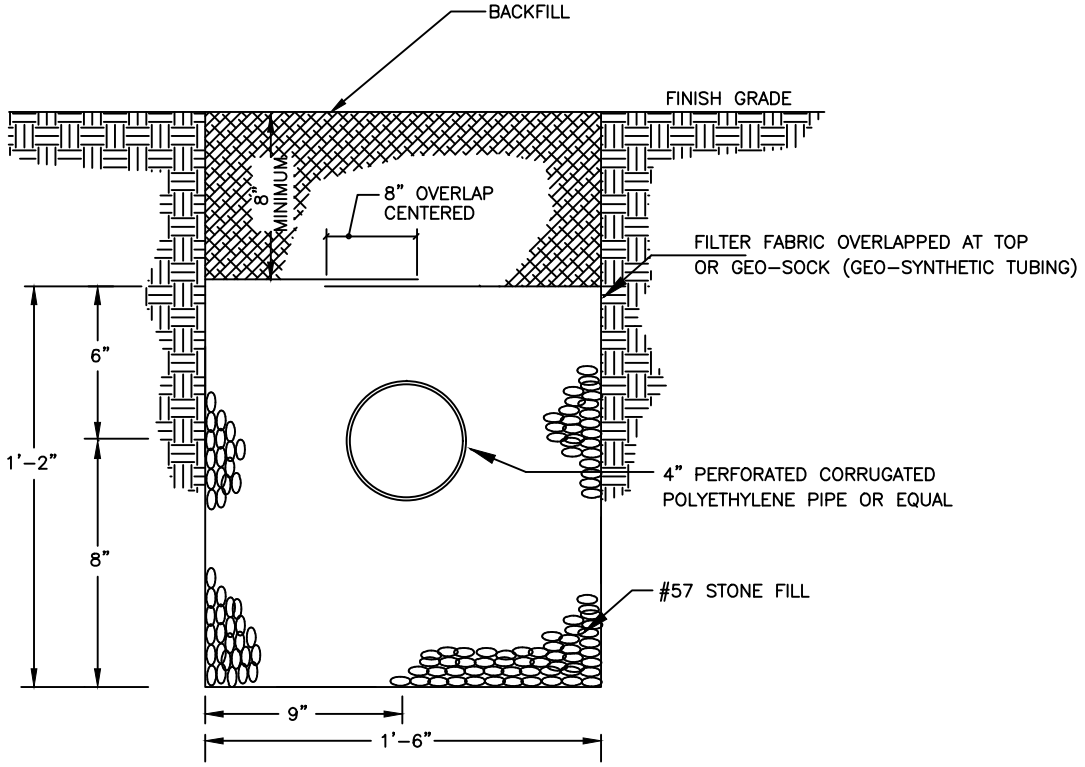
January 2009
Revision 1

L - 11.0

NOTES:

1. CONTRACTOR SHALL USE EXTREME CAUTION WHEN WORKING NEAR EXISTING TREES.
2. WHERE EXISTING TREES ARE WITHIN 4' OF THE PROPOSED BACK OF CURB, THE PROPOSED CURB SHALL END A MINIMUM OF 12" FROM THE TREE'S BUTTRESS ROOTS.
3. THIS DETAIL MUST BE APPROVED BY THE DIRECTOR OF ENGINEERING BEFORE BEING USED ON A PROJECT.
4. NO TREES SHALL BE REMOVED UNLESS CLEARLY SPECIFIED ON THE PLANS OR IDENTIFIED BY THE ENGINEER.
5. AVOID FILL PLACEMENT NEAR TREE.





NOTES:

1. SEE SITE PLAN FOR SLOPE OF SUBGRADE.
2. FILTER FABRIC SHALL BE WATER PERMEABLE, SYNTHETIC FABRIC.

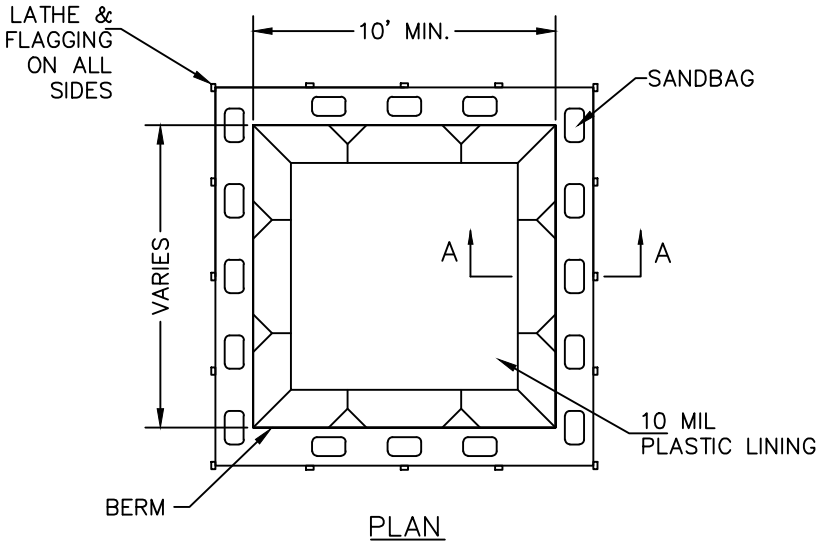
TOWN OF MOORESVILLE STANDARD DETAIL	LANDSCAPE STANDARDS FOUR - INCH SUBDRAIN	January 2009 Revision 1 NTS | L - 12.0

STANDARD MISCELLANEOUS DETAILS:

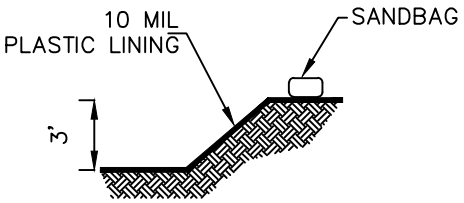
NOTES:

1. A STABILIZED ENTRANCE PAD OF RAIL ROAD BALLAST (2–3" MINIMUM) SHALL BE LOCATED WHERE TRAFFIC WILL ENTER OR LEAVE THE CONSTRUCTION SITE ONTO A PUBLIC STREET.
2. FILTER FABRIC OR COMPACTED NCDOT ABC STONE SHALL BE USED AS A BASE FOR THE CONSTRUCTION ENTRANCE.
3. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC STREETS OR EXISTING PAVEMENT. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS WARRANT AND REPAIR OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT.
4. ANY SEDIMENT SPILLED, DROPPED, WASHED, OR TRACKED ONTO STREETS MUST BE REMOVED IMMEDIATELY.
5. WHEN APPROPRIATE, WHEELS MUST BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTERING A PUBLIC STREET. WHEN WASHING IS REQUIRED, IT SHALL BE DONE IN AN AREA STABILIZED WITH CRUSHED STONE WHICH DRAINS INTO AN APPROVED SEDIMENT BASIN.

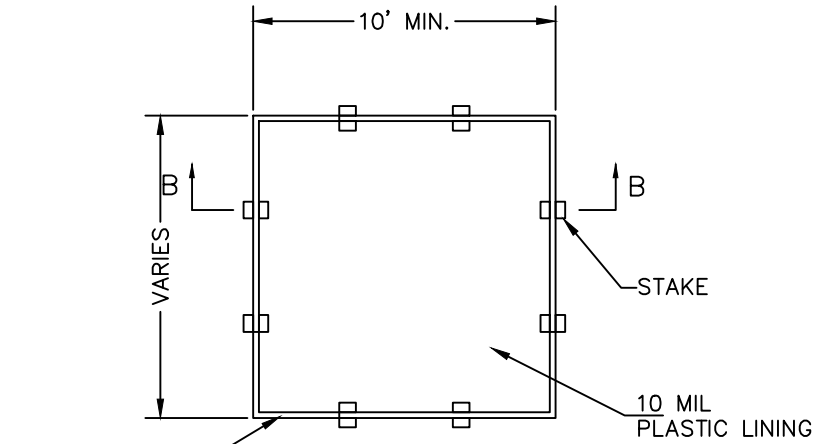
TOWN OF MOORESVILLE STANDARD DETAIL	MISCELLANEOUS DETAILS STABILIZED CONSTRUCTION ENTRANCE	January 2009 Revision 1	
		NTS	M-1.0



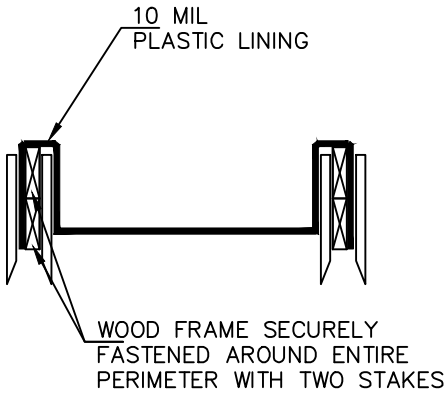
PLAN
NTS
TYPE "BELOW GRADE"



SECTION A–A
NTS



PLAN
NTS
TYPE "ABOVE GRADE"

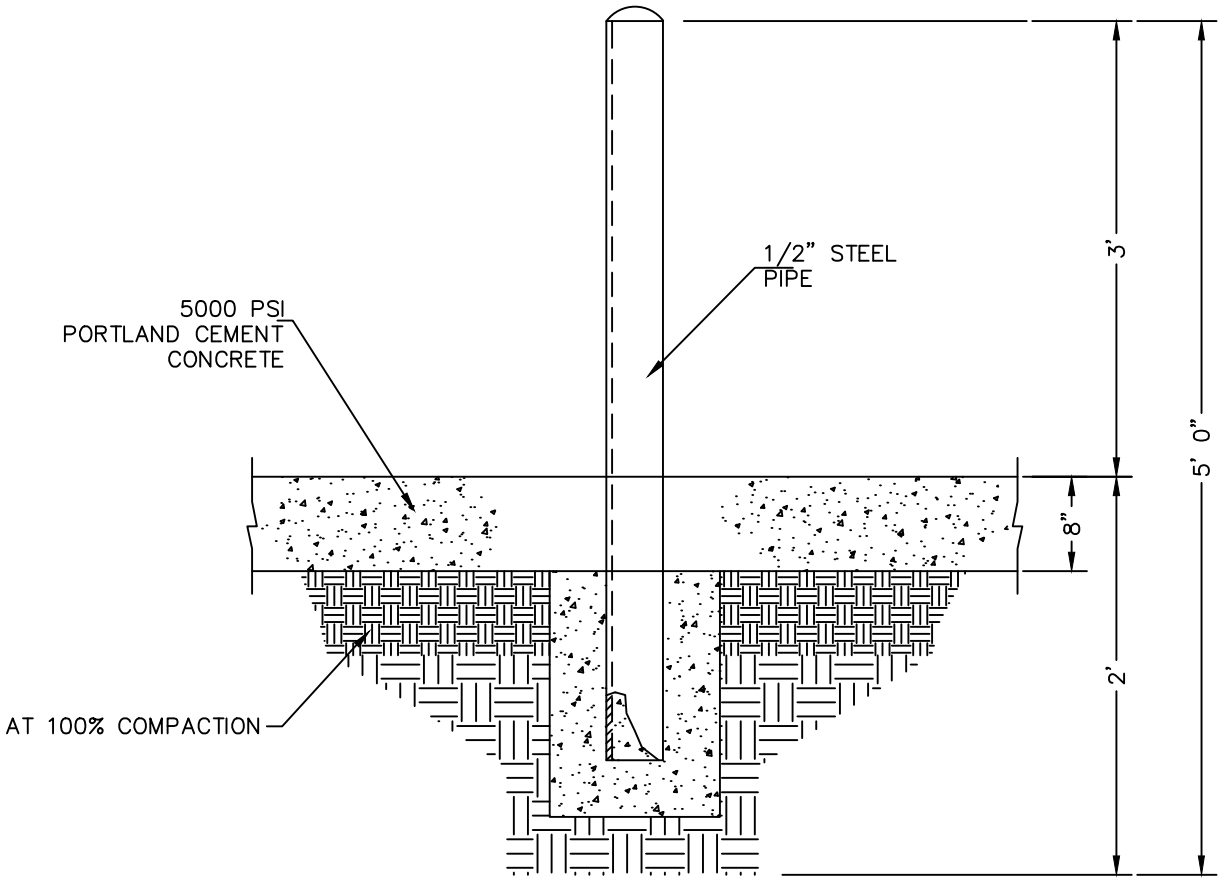


SECTION B–B
NTS

NOTES:

1. TEMPORARY CONCRETE WASHOUT FACILITIES SHOULD BE LOCATED A MINIMUM OF 50' FROM STORM DRAIN INLETS, OPEN DRAINAGE FACILITIES, AND WATER COURSES.
2. ACTUAL LAYOUT SHALL BE DETERMINED IN FIELD.
3. A SIGN SHOULD BE INSTALLED ADJACENT TO THE FACILITY TO INFORM CONCRETE EQUIPMENT OPERATORS TO USE THE PROPER FACILITIES.
4. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30' OF THE TEMPORARY WASHOUT FACILITY.
5. ONCE CONCRETE WASTES ARE WASHED INTO THE DESIGNATED AREA AND ALLOWED TO HARDEN, THE CONCRETE SHOULD BE BROKEN UP, REMOVED, AND DISPOSED OF.
6. WASHOUT FACILITIES MUST BE CLEANED, OR NEW FACILITIES CONSTRUCTED AND READY FOR USE ONCE THE WASHOUT IS 75% FULL.

TOWN OF MOORESVILLE STANDARD DETAIL	MISCELLANEOUS DETAILS TEMPORARY CONCRETE WASHOUT FACILITY	January 2009 Revision 1 NTS | M-2.0



NOTES:

1. DUMPSTER PADS SHOULD BE CONSTRUCTED OF CONCRETE WITH A MINIMUM COMPRESSIVE STRENGTH OF 5000 PSI.
2. THE PAD APRON SHOULD BE A MINIMUM OF 8" THICK.
3. TWO CONCRETE FILLED 6" I.D. STEEL PIPE BOLLARDS SHOULD BE INSTALLED 4' APART AND 1' FROM THE REAR EDGE OF THE PAD BEHIND EACH DUMPSTER TO PROTECT THE ADJACENT SCREENING MATERIALS.
4. THESE BOLLARDS SHALL BE SET IN CONCRETE FOOTINGS A MINIMUM OF 2 FEET IN DEPTH.
5. BOLLARDS SHALL BE PAINTED YELLOW.

TOWN OF MOORESVILLE STANDARD DETAIL	MISCELLANEOUS DETAILS DUMPSTER PAD BOLLARD	January 2009 Revision 1 NTS | M-3.0