



# **Land Development Standards Manual**

*October 2020*

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# CHAPTER 1 SPECIFICATIONS AND SPECIAL PROVISIONS

## A. GENERAL NOTES

1. The City of Kannapolis Land Development Standards Manual has been adopted by the City of Kannapolis for use to design and construct infrastructure within the city limits of Kannapolis and the ETJ. The Manual is intended to provide the minimum specifications and standards for development. Additional requirements may be deemed necessary by the Director of Engineering depending on the proposed improvement. There are supporting specifications from multiple agencies listed in Chapter 6 – REFERENCES. All specifications used and noted will be the most current revision for the respective specification and publication. The more restrictive specification shall be enforced.
2. No work associated with excavations, tie-ins to existing utilities, lane or road closures requiring observation by City personnel will be allowed on weekends and holidays unless written authorization is obtained from the Director of Engineering.
3. No work will be permitted outside of the hours of 7:00AM to 9:00PM on weekdays and 8:00AM to 9:00PM on weekends without authorization from the Director of Engineering.
4. Contractors performing work in the City of Kannapolis shall have a North Carolina Contractor License with the appropriate classification for the work being performed.
5. No land disturbing activities shall be allowed until an erosion control permit has been obtained from the NCDEQ. Land disturbing activities include, but are not limited to, grubbing, grading and utility installations.
6. Prior to grading operations, a grading permit shall be obtained from the City of Kannapolis Planning Department.
7. Prior to beginning construction in the City of Kannapolis, a preconstruction meeting with the City Inspector shall be held, and submittals (shop drawings) shall be approved. The submittals should include all materials (roadway, storm and utilities) to be used during construction. Please allow 2 weeks for the review. The review will be performed by the Director of Engineering.
8. Erosion control measures shall be installed as required by the erosion control and sediment permit. Maintenance and documentation as required by the erosion control and sediment permit is the responsibility of the contractor and erosion control measures shall not be removed without the permission of NCDEQ or the Director of Engineering. Sediment leaving a site, regardless of size of project, shall have corrective actions taken immediately by the financially responsible person to avoid further loss of sediment from the site. Methods of conveyance of sediment from the site include water, air, gravity or ice.
9. The use of City water to perform construction activities shall be metered. The City has 1 fire hydrant for obtaining non-potable water for construction located at the City's Operation Center, 1401 Bethpage Road. Prior to obtaining water from the hydrant, a permit application shall be submitted to the Water Resources Director. In lieu of using the fire hydrant at the City's OC, a fire hydrant meter may be obtained from the City for specific locations. For details to obtain a fire hydrant meter, contact City of Kannapolis Customer Service at 704-920-4385. The meter applicant is responsible for backflow prevention at the meter and payment for water used.

END OF SECTION

## B. ACRONYMS

**AASHTO** – American Association of State Highway and Transportation Officials

**ACI** – American Concrete Institute

**ANSI** – American National Standards Institute

**ASTM** – American Society for Testing and Materials

**CIP** – Capital Improvement Projects

**CRMPO** – Cabarrus-Rowan Metropolitan Planning Organization

**CTP** – Comprehensive Transportation Plan (Developed by the CRMPO)

**DIP** – Ductile Iron Pipe

**DWQ** – North Carolina Department of Environmental Quality, Division of Water Quality

**FHA** – Federal Highway Administration

**IFC** – International Fire Code

**MUTCD** – Manual for Uniform Traffic Control Devices

**NACTO** – National Association of City Transportation Officials

**NCAC** – North Carolina Administrative Code

**NCDEQ** – North Carolina Department of Environmental Quality

**NCDOT** – North Carolina Department of Transportation

**NPDES** – National Pollutant Discharge Elimination System

**PROWAG** – Public Right of Way Accessibility Guidelines

**PVC** – Polyvinyl Chloride

**RCP** – Reinforced Concrete Pipe

**SCM** – Stormwater Control Measure

**UDO** – Unified Development Ordinance

**USACE** – United States Army Corps of Engineers

**USGS** – United States Geological Survey

**WSACC** – Water and Sewer Authority of Cabarrus County

END OF SECTION

## CHAPTER 2 STREETS

### A. GENERAL NOTES

1. All work and materials shall conform to the latest edition of the NCDOT Standard Specifications for Roads and Structures unless otherwise specified in this manual.
2. Depending on the proposed construction activities, a bond may be required for possible damages to City streets and, shall be in an amount established by the City.
3. The contractor shall maintain two-way traffic at all times when working within existing streets in accordance with the latest edition Manual for Uniform Traffic Control Devices (MUTCD) and NCDOT.
4. Street cuts and sidewalks should be completely repaired in an expedient manner. Unless otherwise noted in construction documents, cuts must be filled per Standard Details, with flowable fill or suitable material (asphalt, concrete or approved equal) to within 1.5" of finished grade within 3 days of initial work. Finished roadway surfaces, sidewalks and curbs must be restored within 30 days of initial work.
5. Trench Backfill Requirements:
  - a. All backfill shall be non-plastic in nature, free from roots, vegetative matter, waste, construction material or other objectionable material. Materials deemed by the Inspector as unsuitable for backfill purposes shall be removed and replaced with select backfill material.
  - b. All trenches in the street right-of-way shall be backfilled immediately after the pipe is laid. No more trench shall be opened in advance of pipe laying than is necessary to expedite the work. One block or 200' (whichever is less) shall be the maximum length of open trench on any line under construction. All fill shall be placed and compacted in 6" layers.
  - c. All trench backfill, subgrade, and embankment fill, and ABC shall require density tests be performed at a frequency as referenced in each respective section of NCDOT Specifications. Test reports shall be conveyed to the City on a weekly basis.
6. All subgrade shall be compacted to a depth of 8" below the finished surface to a 100% density in accordance with AASHTO T 99 as modified by NCDOT. All embankment shall be compacted to 95% density in accordance with AASHTO T 99 as modified by NCDOT for depths greater than 8".
7. All manholes, junction boxes, water valve boxes and other appurtenances shall be covered at subgrade level with a steel plate until the first lift of surface course asphalt is placed. At that time, the utility may be raised to the finished grade.
8. A tolerance for grading the subgrade shall be +/- 1/2" from the established grade will be permitted after the subgrade has been graded to a uniform surface. A tolerance of +/- 1/4" will be permitted under concrete pavement mainline lanes. Perform the grading operation such that the maximum difference between the established grade and the graded subgrade within any 100' section is 1/2" for normal subgrade and 1/4" for subgrade for concrete pavement.
9. A proof roll<sup>(1)</sup> shall be required prior to placing curb and gutter<sup>(2)</sup>, ABC and asphalt. Equipment<sup>(3)</sup> to be used for the proof rolls includes a loaded tandem dump truck or a loaded water truck.
  - a. Proof rolls will not be performed on frozen subgrades and inclement weather will void any proof roll if the associated work has not been completed.

b. A motor grader may be used in some circumstances for a proof roll on curb and gutter only. Prior approval by the Director of Engineering is required for use of a motor grader.

c. Weight requirements for equipment:

Motor Grader	30,000 lbs
Water Truck	30,000 lbs
Tandem Truck	45,000 lbs

10. Concrete or asphalt shall not be placed in inclement weather. The contractor shall protect freshly placed concrete or asphalt in accordance with Section 420 (Concrete Structures), Division 6 (Asphalt Pavements), and Division 7 (Concrete Pavements and Shoulders) of NCDOT Standard Specifications. Prior to any concrete being placed, a pre-pour meeting shall be required. Schedule the pre-pour meeting with the inspector.
11. All concrete used for streets, curb and gutter, sidewalks and drainage structures, etc. shall be approved NCDOT mixes, unless otherwise directed by the Director of Engineering or project special provisions. Concrete testing shall follow requirements and frequency set forth by NCDOT and ACI.
12. The concrete temperature at the time of placement shall be between 50°F and 95°F except where other temperatures are required by NCDOT Specifications, Section 420. Do not place concrete without permission when the air temperature measured at the location of the concrete operation in the shade away from artificial heat is below 35°F. When such permission is granted, uniformly heat the aggregates and/or water to a temperature not higher than 150°F. Heated concrete shall be between 55°F and 80°F at the time of placement.
13. All excess concrete on the front edge (lip) of gutter shall be removed when curb and gutter is poured with a machine.
14. Straight forms shall not be used for forming curb and gutter in curves.
15. Contraction joints, expansion joints and joint sealer shall follow NCDOT Specifications and Kannapolis Standard Details.
16. All concrete shall be cured with curing compound. Use white pigmented curing compound which meets ASTM C 309, as required by NCDOT Section 825 and Section 1026, applied at a uniform rate per manufacturer's instructions. Apply the membrane curing compound after the surface finishing is complete and immediately after the free surface moisture disappears, but at no point, more than 24 hrs of after placement of the concrete.
17. All curb and gutter shall be backfilled with soil approved by the Director of Engineering within 7 days after construction, but not before 3 curing days has elapsed. Do not place ABC or pavement adjacent to the curb before the 3 curing days has elapsed.
18. Prior to any asphalt being placed, a pre-pave meeting shall be required. Schedule the pre-pave meeting with the inspector.
19. Asphalt shall not be placed unless the minimum temperatures are met in NCDOT Specifications, Section 610. Do not place surface course material that is to be the final layer of pavement between December 15 and March 16 of the next year if it is 1" or greater in thickness, or between November 15 and April 1 of the next year if it is less than 1" in thickness, unless otherwise approved. Do not place plant mix base course that will not be covered with surface or

intermediate course during the same calendar year or within 15 days of placement if the plant mix is placed in January or February.

20. Drainage shall be maintained on the streets between the first lift of S9.5C and the second lift of S9.5C when the street is accepted. Use Kannapolis Standard Details to accommodate drainage in low areas.
21. Surfaces shall be tacked when asphalt is being placed over existing asphalt streets or adjoining concrete, storm drain and sanitary sewer structures. In the event more than 1 lift of asphalt is placed in a single day, tack is still required between lifts.
22. All asphalt cuts shall be made with a saw when preparing street surfaces for patching or widening strips. Milling is an acceptable alternative to saw cuts when applicable.
23. Paper joints shall be used to seal the ends of an asphalt pour so that future extensions can be made without causing rough joints.
24. When placing asphalt against existing surfaces, a straight edge shall be used to provide a smooth and consistent transition between the two surfaces at that location.
25. Dead-end streets without cul-de-sacs shall be required to install object signs designating the dead-end.
26. Fire apparatus access road shall be capable of supporting the imposed load of fire apparatus weighing at least 75,000 lbs in any weather condition, including during development construction. Furthermore, the access road minimum unobstructed width shall be 20', exclusive of shoulders, with a 13'-6" unobstructed vertical height (IFC Section 503.2.1) and shall not exceed a 10% grade. In the event a fire hydrant is located on the access road, the minimum width of the road shall be 26', exclusive of shoulders (IFC Appendix D). Grades steeper than 10% as approved by the fire chief. See Appendix A for dead-end access road turnarounds.
27. During phasing of residential developments temporary turnarounds are required for fire apparatus access. The temporary turnaround is required for streets 150' + from the intersecting street without a designed cul-de-sac.
28. All permanent striping shall conform to NCDOT Specifications, and MUTCD standards and specifications. Temporary striping may be paint and conform to NCDOT specifications for the duration of time in which the striping can be installed prior to installing the permanent striping.
29. Traffic Calming Devices shall be prohibited unless approved by the fire code official (2018 NC Fire Code 5.3.4.1).

END OF SECTION

## B. STANDARDS OF STREET DESIGN

1. **Streets** (Public and Private): Refer to Appendix A for Street Classifications.

2. **Intersections:**

a. Maximum Street Grade at Intersections (See Appendix A):

- i. STOP or YIELD Condition: Vertical alignment is 2% maximum through the crosswalk areas (marked or unmarked). Outside of the crosswalk areas, the vertical alignment is 5% maximum within 100' of an intersection.
- ii. THROUGH MOVEMENT Condition: Vertical alignment is 5% maximum through the crosswalk areas. Where feasible, it is recommended that the vertical alignment for a through movement street also be set at 2% maximum through the crosswalk areas (marked or unmarked).
- iii. Insofar as practical, streets shall intersect at an angle of 90° for a minimum of 50' from the roadway intersection. In no case shall the angle be less than 75°. Intersections having more than 4 corners shall be prohibited. Proposed streets which intersect opposite sides of another street (either existing or proposed) shall be laid out to intersect directly opposite each other.
- iv. A roundabout may be constructed at any intersection location where it may be desired in order to enhance intersection capacity, reduce vehicle speeds along a corridor, or enhance intersection aesthetics. Roundabouts shall be designed in accordance with the criteria set forth in Roundabouts: An Informational Guide (Federal Highway Administration Publication No. FHWA-RD-00-067). Care should be taken in order to ensure roundabouts are not located in close proximity to adjacent stop or signal controlled intersections where long queues may back up into the roundabout.

3. **Intersection Sight Distance:**

- a. Minimum sight triangles will be provided at each intersection corner.
- b. Sight triangles shall contain no fence, structure, earth bank, hedge, planting, wall or other obstruction between a height greater than 2' above the property line grade as established by the Director of Engineering. The following are exempted from this provision:
  - i. Public utility poles.
  - ii. Trees trimmed (to the trunk) to a height at least 9' above the level of the intersection.
  - iii. Other plant species of open growth habit that are not planted in the form of a hedge and which are so planted and trimmed as to leave in all seasons a clear and unobstructed cross-view.
  - iv. A supporting member or appurtenance to a permanent building lawfully existing on the effective date of this ordinance.
  - v. Official warning signs or signals.
  - vi. Signs which conform to the Sign Ordinance (Article 12 Kannapolis UDO) mounted 10' or more above the ground with supports that do not encroach on the clear-vision area.

4. **Stopping Sight Distance:** May need to be included on the design plans. See Appendix A for minimum sight distances.
5. **Cul-de-sac Streets:**
  - a. A maximum of 20 equivalent residential units (ERUs) may take access from a cul-de-sac. ERUs are determined in Article 14 of the Kannapolis UDO. Temporary cul-de-sacs on stub streets are exempted from this limitation.
    - i. The preliminary and final site plan shall show a stub connecting the cul-de-sac to adjoining areas or parcels where future roadways are delineated on a recorded subdivision or site plan (provided reasonable connection can be achieved without the need for a bridge or other feature to negate substantial topography). The stub shall be improved as pedestrian walkway, trail or bikeway.
    - ii. The radius for the circular terminus, or turnaround, shall be not less than 48'.
6. **A Traffic Impact Analysis:** required for developments generating 1,000 or more trips per day or 100 trips per peak hours with the following criteria:
  - a. Application for Conditional Zoning Rezoning.
  - b. Application for Conditional Use Permit/Major Site Plan.
  - c. Application for Minor Site Plan.
    - i. Application for Preliminary Subdivision Plat.
    - ii. Developments with 40 or more dwelling units without direct primary access on a major or minor thoroughfare.
7. **Driveways**
  - a. Refer to Kannapolis Standard Details for driveway layout and separation requirements.
  - b. Driveway Permits and inspections are required per UDO.
8. **Design Vehicles**
  - a. Site designs and/or street designs shall evaluate the minimum turning radius for the vehicular traffic intended for use to support the proposed improvement. The evaluation of the vehicular turning radius shall include, but not be limited to, parcel delivery trucks, garbage trucks, semi-truck and trailers and current Kannapolis Fire Department fire apparatus vehicles. See Appendix A for appropriate design vehicles.
  - b. Regardless of the street classification or design vehicle, radii may need to be adjusted to meet the requirements of the proposed usage and vehicle. The Director of Engineering may request the additional requirements based on the proposed usage warrants.

**TABLE A-1 STANDARDS OF STREET DESIGN**

<b>Street Type</b> Average Daily Traffic (ADT)	<b>Alley</b> 100	<b>Local</b> 250	<b>Collector</b> 3000 Major 1000 Minor	<b>Thoroughfare</b> 8000 Major 4000 Minor
<b>Longitudinal Grade</b> Min Max: level/rolling hilly (stop/yield) at intersection (thru movement) at intersection Within 100' of an intersection	1%	1%	1%	See Thoroughfare Plan
	10 %	10 %	8 %	
	10 %	10 %	10 %	
	5 %	2 %	2 %	
	5 %	5 %	5 %	
5 %	5 %	5 %		
<b>Min Horizontal Centerline Curve Radius</b>		150'	230'	
<b>Min Tangent between Reverse Curves</b>		50'	100'	
<b>Street Intersection Radius<sup>(6)</sup></b>	20'	30'		
<b>Design Speed</b> Min Max	15 mph	25 mph	25 mph	
	15 mph	35 mph	35 mph	
<b>Design Vehicle</b> Residential Non-Residential	SU-30	SU-30		WB-62
			Bus-45 & SU-30 WB-62 or WB-40	
<b>Separation <sup>(1)(2)(3)</sup></b> driveway - driveway driveway - intersection driveway - residential prop. line driveway - non-residential prop. line intersection - intersection	40'	40'	120'	400'
	25'	60'	120'	250'
	5'	5'	5'	5'
	10'	10'	10'	10'
	N/A	200'	200'	600'-1000'
<b>Pavement Schedule <sup>(4)(5)</sup></b> surface course (S9.5C) intermediate course (I19.0C) base course (residential) base course (non-residential)	2"	2-1" Lifts	2-1" Lifts	See NCDOT Roadway Design Standards
	0"	2.5"	2.5"	
	8" ABC or 4" B25.0C			
	N/A	10" ABC or 5" B25.0C		
<b>Dead-End Fire Apparatus Access Roads</b> Length Width Vertical clearance Maximum grade Turnaround required	0-150'	150'-500'	500'-750'	750'+
	20'	20'	26'	Special Approval Required
	13.5'	13.5'	13.5'	
	10 %	10 %	10 %	
	None	60' "Y" 96' ø Cul-De-Sac 120' Hammerhead (Temporary)		
	<b>Max Cul-de-sac Lengths</b> Zoning	RM-1, RM-2, RV	AG, RE, RL	CD, I-1, I-2
800'		1000'	1500'	500'
RC, CC				
300'				

Notes:

1. Single-family dwellings and duplex dwellings on individual lots shall be exempt from the minimum separation between driveways as shown in the table above. However, such driveways shall maintain a minimum of 5' of side clearance from residential property lines and 10' for all others.
2. City streets: proposed streets which intersect opposite sides of another street (either existing or proposed) shall be laid out to intersect directly opposite each other. Intersections which cannot be aligned shall be separated by a minimum length of **200'** between survey centerlines.
3. For state-maintained streets, reference the NCDOT Policy on Street and Driveway Access to North Carolina Highways.
4. Non-residential street pavement design shall be evaluated on a case-by-case basis.
5. Prior to substituting B25.0C, approval shall be obtained from the Director of Engineering.
6. Radius measured from edge of pavement.

END OF SECTION

## C. GRADING

1. The maximum slope for cuts and fill embankments is 2:1. Fill embankment materials shall be placed and thoroughly compacted in successive layers  $\leq 10''$  in depth for the full width of the cross-section, including the width of the slope area. No stumps, trees, brush, rubbish or other unsuitable materials or substances shall be placed in the embankment.
2. Longitudinal grades shall have a minimum grade of 1% and a maximum grade of 10%.
3. Transverse grade or crown shall be  $\frac{1}{4}''/\text{ft}$ .

END OF SECTION

## D. ROADWAY BASE

1. Stone base course shall conform in all respects to Section 520 (Aggregate Base Course), Section 1006 (Aggregate Quality Control/Quality Assurance), Section 1010 (Aggregate for Non-Asphalt Type Bases) of the NCDOT Standard Specifications for Roads and Structures.
2. The stone base shall be compacted to 100% in accordance with AASHTOT180 as modified by NCDOT when conventional density test #3 is used. When nuclear density testing is performed, a nuclear target density of at least 98% shall be obtained. In addition, the nuclear density of any single test location shall be at least 95% of the nuclear target density.
4. ABC will not be allowed within widening strips less than 5' in width.

END OF SECTION

## E. ROADWAY INTERMEDIATE AND SURFACE COURSE

1. Plant mixed asphalt shall conform in all respects to Section 610 (Asphalt Concrete Plant Mix Pavements) of the NCDOT Specifications for Roads and Structures.
2. A pre-pave meeting shall be required prior to placing any asphalt.
3. An approved NCDOT Job Mix Formula shall be required to be submitted for each mix to be used prior to paving.
4. The contractor shall have a QMS Roadway Technician on-site during the paving operation.
5. The final 1" lift of asphalt surface course for residential subdivision streets shall be withheld until a minimum of 85% of the portion platted is occupied (occupied means a certificate of occupancy has been issued) and no conflicts exist between the water and sewer services and the proposed driveways.
6. Roadway Final Lift Inspection Procedures:
  - a. Contractor puts down 3.5" (2.5" of I19.0C, 1" of S9.5C) asphalt and raises structures to final grade (including concrete collars 1" below final grade). Asphalt is to be placed around structures to prevent damage.
  - b. Contractor submits Record Drawings to the Director of Engineering.
  - c. Upon approval by the Director of Engineering, Contractor may request final inspection for water and/or sanitary sewer. Owner, along with the City inspector, shall then verify the water services and/or sanitary sewer laterals are not in conflict with driveways and/or other proposed infrastructure.
  - d. The final asphalt must be placed before 2 yrs have lapsed since the approval of the 3.5" asphalt layer. Surety must be approved by the City to cover the 2-yr period.
  - e. After placement of the final asphalt, the Contractor may request final inspection for the roadway, and upon approval, the 1-yr warranty of the roadway begins.
7. In the event construction traffic must be routed on newly paved streets, a bond shall be provided to the City until construction activities are completed.
8. Prior to placing the final layer of surface course asphalt, the City inspector shall be given a 48 hr notification to inspect the roadway for deficiencies. All deficiency repairs are to be completed prior to application of final layer.
9. Cores or nuclear density may be used on base, intermediate and first lift of surface course mixes. Cores will not be permitted on the final lift of surface course. Only nuclear density testing shall be used on the final lift of surface course.
10. Access must be maintained during the paving operation. Residents, emergency vehicles, solid waste collection and mail delivery will need to be addressed during the pre-pave meeting.

END OF SECTION

## F. SIDEWALKS AND RAMPS

1. Where sidewalks and pedestrian routes within street crossings (including marked and unmarked crosswalks) are provided, they must be constructed so they are accessible to all potential users, including those with disabilities and conform to Americans Disability Act.
2. Sidewalks shall be constructed of not less than NCDOT, Class B concrete, and shall be 4" thick, constructed on an adequately graded base, except where a sidewalk crosses a driveway it shall be 6" thick. Subgrade shall be compacted to 95% of the maximum density obtainable in accordance with AASHTO T 99 as modified by NCDOT. The surface of the sidewalk shall be steel trowel and light broom finished and cured with an acceptable curing compound. Tooled joints shall be provided at intervals of not less than 5', and ½" expansion joints at intervals of not more than 50'. ½" expansion joints will be required where the sidewalk joins any rigid structure. The sidewalk shall have a maximum lateral slope of 2% toward the street.
3. All expansion joints shall be filled with joint sealer.
4. Planting strip adjacent to sidewalk shall be graded to ¼"/ft, except where excessive natural grades make this requirement impractical. In such cases, the Director of Engineering may authorize a suitable grade.
5. Sidewalk widths shall be a minimum of 5' unless otherwise specified.
6. Approval of sidewalk construction plans must be obtained as part of the plan review process. Except in unusual circumstances, the sidewalk must be located a minimum of 6' from the back of the curb or at the back of the right-of-way. A recorded public sidewalk easement is required for all sidewalk located outside public right-of-way; the width shall be equal to the distance from the right-of-way line to the back of the sidewalk plus two feet or to the face of building, whichever is less. The sidewalk easement must be recorded with the Cabarrus County or Rowan County Register of Deeds prior to issuance of a certificate of occupancy for the corresponding building(s).
7. Running slope of directional ramps shall be from 7.5% to 8.33% maximum. Ramp length is not required to exceed 15' regardless of the resulting slope, which shall be uniform for the length of the ramp. Curb ramps are required where sidewalks intersect curbing at any street intersection and at Type III driveway connections.
8. Truncated domes shall be Federal Standard Color Code number 20109, "Red Brown".
9. Refer to the MUTCD (latest edition) for construction zone pedestrian routes and signalization and controls for actuators. Curb ramps shall be designed and constructed in accordance with the American Disability Act.
10. Where pedestrian routes are contained within a street or right-of-way, the grade of pedestrian access routes shall not exceed the general grade established for the adjacent street or highway.

END OF SECTION

## G. DRIVEWAYS

1. A Driveway Permit from the City of Kannapolis is required prior to making connection to a City street. Refer to the Land Development details for driveway layout requirements.
2. Inspections of the street connections are required by the City. Provide a minimum notice of 48 hrs to schedule the inspection.
3. Depending on the type of connection to streets or roadways, additional right of way, dedicated to the City, may be required for improvements to the existing roadway. The cost of the right of way acquisition and street improvements is the responsibility of the Developer.
4. All driveway approaches shall be a concrete apron section, except that Type III driveway entrances may be required to public or private developments that have parking spaces for  $\geq 200$  vehicles or when determined by the Director of Engineering. The shall be installed to the right-of-way line or at least 10' from the edge of the roadway and/or back of curb.
5. Medians or islands may be permitted for street type driveways and private street entrances only, upon approval of the Director of Engineering and subject to the following conditions:
  - a. The raised median or island shall be constructed on private property to the rear of the right-of-way line.
  - b. The minimum width of the median or island as measured nearest the right-of-way line (excluding the nose) shall be 15', the minimum length shall be 50'.
  - c. For street type driveways with a median or island, the combined width of pavement of the separated driveway segments shall not exceed 48'.
6. Dedication and construction of turn lanes shall be required in any conditional use, special use, or driveway permit, or subdivision approval for a use or development which is adjacent to a two-lane public street with average daily traffic (ADT) exceeding 5000 vpd, or a four-lane or larger public street with ADT exceeding 10,000 vpd, if any one of the following conditions are also present:
  - a. The use of development requires 50 or more off-street parking spaces.
  - b. The use of development consists of at least 50 attached or detached residential dwelling units.
  - c. The use of development will generate more than 100 trips during the peak hours of 7:00am-9:00am, 11:00am-1:00pm, and 4:00pm-6:00pm. Data shall be based on ITE's "Trip Generation" and based upon the highest land use permitted by the zoning classification.
  - d. The use of development, as it may be affected by such restrictions, is reasonably expected to generate more than 25 truck (13,000 G.V.W.) trips per day through a single driveway.
  - e. The use or development, as it may be affected by such restrictions, creates special safety or traffic conditions due to limited sight distance and/or posted speeds in excess of 35 miles per hour along the adjacent public street. Such conditions shall be determined in writing by the Director of Engineering.

END OF SECTION

## H. PARKING

1. Off-street parking spaces shall be provided in accordance with the requirements in Article 8 of the Kannapolis UDO. The Planning Department reviews and approves the parking requirements and the Planning Director shall be authorized to approve any alternate parking plans for developments.
2. Parking spaces for handicapped or disabled persons shall comply with Chapter 4 of the North Carolina Accessibility Code and the following:
  - a. Single non-van: 14' x 18' (9' width + 5' access aisle).
  - b. Single van: 17' x 18' (9' width + 8' access aisle).
  - c. Double van, non-van, and van double: 26' x 18' (9' width for ea space + 8' access aisle).
3. Reference Standard Details for parking dimensions.
4. Bumper Overhang dimensions for parking spaces include the front/rear of the parking space.

END OF SECTION

## I. STREET LIGHTING

1. Requests for Street Lighting

Requests for street lighting may be submitted to the Director of Public Works. Each request will be considered in accordance with approved standards and any special conditions of merit such as pedestrian activity, traffic volumes, accident history, crime rate, vertical and horizontal street alignment and hazardous traffic conditions. Any extensions of the lighting system will be subject to the limitations of appropriation of funds by the City Council.

2. Standards for Street Lighting

- a. Street lighting for residential and collector streets will be in accordance with current lighting design standards and specifications mounted at height of approximately 25' on a wooden pole. Spacing of lighting fixtures shall be approximately 400' - 500' except where warranted by special conditions
- b. One fixture shall be placed at each street intersection or cul-de-sac.
- c. Street lighting for major thoroughfares and the central business district will be determined by an appropriate professional. Spacing of fixtures along major thoroughfares and commercial areas will be determined by current engineering standards.
- d. Light fixtures on public right of way for purpose of illuminating the roadway ordered by private citizens will not be permitted.
- e. Private lighting fixtures mounted on the back of poles located on the public right of way for the purpose of illuminating private property will be permitted with permission of the City of

Kannapolis. All costs will be borne by the applicant and contractual arrangements made directly with the utility company.

- f. The City of Kannapolis will not be responsible for any lighting fixtures installed for the purpose of illuminating private property.

### 3. Street Lighting Plan Required for all New Developments

Lighting plans shall be prepared by a qualified lighting designer. Lighting plans shall be submitted to the City for approval along with subdivision utility plans in accordance with applicable City ordinances, policy and regulations. The developer is responsible for bearing all costs associated with providing the minimum street lighting design and layout as approved by the City.

### 4. Special Lighting Fixtures

When developers of new subdivisions wish to provide an illumination level along public streets equal or greater than the City standard and to provide more decorative lighting fixtures, the City will consider accepting new fixtures for maintenance by the City. The City will assume responsibility for monthly electrical service and maintenance costs.

END OF SECTION

## J. NCDOT COORDINATION

1. Any connection or potential impact to a NCDOT roadway shall require approval by NCDOT. It is recommended coordination meetings take place early in the development process with the developer, NCDOT and City of Kannapolis discussing potential requirements for roadway improvements, access to the site and right of way dedications. NCDOT has the ultimate authority for any work in NCDOT right of way.
2. It is the sole responsibility of the requesting party to determine if a street is State maintained or not.
3. Plan submittals, review and approvals should be coordinated concurrently with both, NCDOT and the City of Kannapolis, to avoid conflicting requirements. The coordination should take into account the review process of the two agencies may not coincide and communication of submittals from the requesting party is essential in avoiding delays. In situations where an agency's regulation differs from that of the other agency, the more restrictive of the two shall govern.
4. NCDOT and the City of Kannapolis require approvals for connections to existing roadways. The City of Kannapolis will approve any connections to City streets. Prior to obtaining Construction Plan approval, the requesting party shall provide the City of Kannapolis an approved driveway permit from NCDOT allowing access to the site from a NCDOT street.
5. During construction of the project, both NCDOT and the City of Kannapolis have enforcement authority to ensure safety in the right of way is not being compromised. Both agencies have the ability to affect the project's progress if there is reason to believe proper construction practices are not being adhered to and/or if unsuitable materials are being used in the right of way. Failure to comply with permits and the approved plans may result in revocation of permits.
6. The City of Kannapolis has the authority to request that Cabarrus County or Rowan County Code Enforcement withhold the issuance of a Certificate of Occupancy until all work is completed and

in compliance with the approved permits. For additional information regarding the coordination between NCDOT and the City of Kannapolis, please see NCDOT – Policy on Street and Driveway Access to North Carolina Highways, Chapter 2, Section A.

END OF SECTION

## K. RETAINING WALLS

1. Retaining walls or retaining wall systems providing cumulative vertical relief greater than 5' in height within a horizontal separation distance of 50' or less shall be designed under the responsible charge of a registered design professional per the 2012 North Carolina Building Code, Section 1807.2 and NCDOT retaining wall design guidelines. Allowable systems include but are limited to: cast-in-place walls, soil nailing, modular retaining wall system, Mechanically Stabilized Earth (MSE) Retaining Walls, H-beam retaining wall system, boulder retaining walls and gabions. Design submittals shall include copies of foundation reports, design load assumptions, and retaining wall design calculations.
2. Building Permit approval and inspection of retaining walls shall be conducted by Cabarrus County or Rowan County Code Enforcement as applicable.
3. The developer is required to provide the approved wall designs to the City of Kannapolis prior to plan approval.
4. The developer shall be responsible for providing geotechnical testing, engineering oversight, and construction observation of the wall construction by a qualified individual. Copies of the inspection reports and the design engineer's wall certification shall be provided with the as-built drawings for the retaining wall.
5. For retaining walls impacting City of Kannapolis easements, utilities, and right of ways, County approval of proper construction of the completed walls and completion of the City's Retaining Wall Certification form is required prior to the issuance of a Final Plat or Certificate of Occupancy, as applicable. If the retaining walls are used to assist with ingress/egress of City easements, the City will also be included in the approval process.
6. Cast in place concrete retaining walls are the only wall type that may be considered within the theoretical 1:1 of the roadway on a case by case basis.
7. When geo-grid is approved in the right-of-way and conflicts with a utility trench, the wall design shall include design calculations to allow the geo-grid to be interrupted within the utility trench. Clearances shall be provided between the geo-grid and conflicting utility to allow for City personnel to maintain the utility without damage to the geo-grid or wall.

END OF SECTION

## L. BRIDGES

1. The use of a bridge for a publicly maintained project shall require prior approval by the Director of Engineering.
2. The layout and design of bridges shall follow the current applicable NCDOT policies and manuals and shall be designed under the responsible charge of a registered design professional.
3. The bridge shall be designed to include support for lighting, public water lines and other public utilities. Private utility lines are not allowed to be attached to the structure.
4. Design submittals shall include copies of foundation reports, design load assumptions, and bridge design calculations for structural components.
5. The developer shall be responsible for providing geotechnical testing, engineering oversight and construction observation of the bridge and associated structures by a qualified individual. Copies of the inspection reports and the design engineer's as-built certification shall be provided with the as-built drawings for the bridge.

END OF SECTION

## M. GREENWAYS

1. Greenways constructed in the jurisdiction of the City of Kannapolis shall follow current guidelines by NCDOT, NCDOT Greenway Specification Z-200, MUTCD, AASHTO, FHWA, ADA and this manual.
2. Construction of greenways and trails shall require permits be obtained from each agency having jurisdiction within the construction area. Potential agencies requiring permits for greenway construction are: NCDOT, FEMA Conditional Letter of Map Revision (CLOMR/LOMR), U. S. Army Corps of Engineers, DWQ and NCDEQ.
3. Minimum stopping sight distance for various design speeds, vertical and horizontal curves, and grades need to be considered to ensure safe braking distance on a shared use path. The AASHTO Guide for the Development of Bicycle Facilities provides methodologies, tables and graphs of stopping sight distance for various combinations of grade and design speed.
4. Horizontal radii shall be a minimum 90' centerline radius.
5. Radii at greenway intersections shall be a minimum 20' to accommodate maintenance vehicles.
6. Greenway intersections should be aligned at 90° angles when possible.
7. Shared-use trails shall be constructed to a minimum width of 10'. Trails to be used for pedestrians only shall be constructed to a minimum width of 5'.
8. Shoulders for all trails shall have a minimum 2' width on each side of the trail. 5' shoulders shall be required in fill areas and 3' shoulders in cut areas.
9. A clear, unobstructed, space from the edge of pavement of 10' shall be required. Trees greater than 15" in diameter may remain, provided they are at least 2' clear of the trail.

10. Greenways and trails shall not be constructed with a crown. All greenways and trails shall be constructed with cross-slopes between 1% - 2%.
11. Longitudinal slope shall be less than 5% unless existing contours prohibit. In the event grades are steeper than 5%, an 8.33% grade shall not be longer than 200', a 10% grade shall not exceed 30' and a 12.5% grade shall not exceed 10' without a rest area.
12. Rest areas shall be greater than 5' in length, have a width greater than the width of the trail segment to and from the rest area, have a grade less than 5%, have a cross-slope that exceeds 2%, have a minimal change of grade and cross-slope on the segment connecting the rest area with the main pathway and have accessible designs for amenities such as benches, where provided.
13. The typical section for greenways shall include:
  - a. Geotextile fabric for soil stabilization placed on subgrade compacted to a density of 92% in accordance with AASHTO T99 as modified by NCDOT.
  - b. ABC shall be placed at a 6" compacted depth with a density of 92% in accordance with AASHTO T180 as modified by NCDOT for both nuclear and ring test.
  - c. Asphalt option: place asphalt, 2" of S9.5B placed in one lift, in accordance with Section 610 of the Standard Specifications, compacted to at least 85%. Coring of the final surface course will not be allowed.
  - d. Concrete option: place 6" of Class AA concrete in accordance with NCDOT and ACI specifications. The concrete shall be reinforced with 6"x6"x1.4x1.4 WWF with non-structural fiber. The concrete will include ½" expansion joints at 40' spacing and control joints at 10' spacing.
14. Provide a 54" safety rail when the following is within 6' of the edge of pavement:
  - a. Slope  $\geq$  3:1 & drop of 6'.
  - b. Slope  $\geq$  2:1 & drop of 4'.
  - c. Slope  $\geq$  1:1 & drop of 1'.
15. Retaining walls should be avoided within the greenway corridor. In the event retaining walls are required to be constructed; the wall may require a building permit and inspection from the respective county and be designed by a licensed professional as outlined previously in this manual. All efforts shall be made to keep the wall to a height of 4' or less.
16. The current North Carolina Building Code requires handrails for instances where the distance from the top of a boardwalk deck to the bottom of the creek or top of ground is 30" or more. For instances where the distance is less than 30", a 6" toe board shall be used to prevent falls.
17. Bridges shall have at least 10' clear inside dimensions. For bridges 10' in width, a design load of H5 shall be required. For bridges 12' in width, a design load of H10 shall be required.
18. Overhead clearance shall be 8' minimum of vertical height for pedestrian trails and 10' of vertical height for multi-use trails.

19. During paving operations, dump truck loads shall be prohibited to 15 tons to prevent damage to the compacted ABC.

20. In environmentally sensitive areas, alternative seeding specifications may be required.

**END OF SECTION**

# CHAPTER 3 STORM DRAINAGE

## A. GENERAL NOTES

1. All work and materials shall conform to the latest edition of the NCDOT Standard Specifications for Roads and Structures, NCDOT Standard Drawings and the Kannapolis Land Development Standards.
2. Prior to beginning construction in the City of Kannapolis, a preconstruction meeting with the City Inspector shall be held, and submittals (shop drawings) shall be approved. The submittals should include all materials (roadway, storm and utilities) to be used during construction.

### 3. Stormwater Permit

Site Condition	Stormwater Detention	Water Quality
< 1.0 ac & < 20,000 sf impervious area	No	No
< 1.0 ac & > 20,000 sf impervious area	Yes	No
> 1.0 ac & < 20,000 sf impervious area	No	Yes (low density)
> 1.0 ac & > 20,000 sf impervious area	Yes	Yes (high density)

### 4. Storm Drainage Easements

- a. Minimum of 20' wide, pipe centered in easement preferably in common open space.
  - b. Width requirements based on pipe depth (see Appendix A) and must provide for 1:1 excavation, bottom width = outside pipe diameter + 2'.
  - c. Shall be dedicated to the City of Kannapolis.
  - d. Maximum slopes for maintenance vehicles: longitudinal = 15%, cross slopes of 5%.
  - e. If a storm drainage channel is also constructed in the easement, sufficient width shall be dedicated so that a minimum 12' travel area beyond the top of grade is provided.
5. All pipe shall be laid with the bell or groove upgrade and the joint entirely interlocking.
  6. All pipe shall be installed using NCDOT Specifications outlined in the NCDOT Standard Specifications for Roads and Structures, Section 300, unless otherwise noted in this manual.

### 7. Storm Drainage Pipe Cover

- a. Minimum cover is 2' measured from the final surface. Less than 2' requires prior approval by the Director of Engineering.
  - b. Maximum cover: reference NCDOT Highway Design Branch Roadway Design Manual.
8. In areas where downstream impoundments will create a tailwater that backs water up into the pipe system, culverts shall be constructed with O-ring seals in the joints, which may require testing of the system. Locations of the system testing will be determined by the Director of Engineering.

**9. Storm Drainage Pressure Testing**

When pipe testing is required, the storm structures shall also be tested as required. Vacuum testing may be used as outlined in ASTM C1244. Exfiltration tests may also be performed as follows:

- a. Plug the inlet and outlet and fill the manhole with water to within 6' of the top of the manhole.
  - b. Allow the water to stabilize for 1/2 hr and refill the manhole to the original elevation.
  - c. Mark the initial depth of water, and after 1 hr record the drop in the water level in the manhole.
  - d. The maximum allowable drop in vertical water height in the manhole shall be ¼" for all diameter sizes of manholes. If the water level in the manhole drops below the allowable drop amount, the Contractor shall repair the leak and retest.
10. Storm drainage piping shall be placed in a straight alignment at uniform grade. No changes in alignment shall be allowed except at catch basins, manholes, or other junctions that provide appropriate clean out access. The maximum length between access points is 400'.
11. The interior surfaces of all storm drainage structures shall be pointed up and smoothed to an acceptable standard using mortar mixed to manufacturer's specifications.
12. All pipes in storm drain structures shall be flush with the inside wall. The floor of all storm drain structures shall be filled with concrete to an elevation flush with the downstream invert.
13. All storm drain structures over 3'-6" in height must have steps in accordance with standard details set forth in NCDOT Standard Specifications for Roads and Structures.
14. Catch basins, junction boxes, and storm drainage manholes shall be sized for the number and angle of pipes entering the structure. The following structures require a PE's certification for the design of the structure and shop drawings for the structure dimensions and construction details:

<b>STRUCTURE</b>	<b>HEIGHT*</b>
Brick catch basins	> 12'
Precast catch basins	> 16'
Open throat catch basins	> 16'
Drop inlets	> 12'
Junction Box	> 12'
Precast waffle wall structures	> 10'
Traffic bearing precast structures	> 15'
Precast manholes	> 30'
Brick manholes	<b>Not Allowed</b>

Refer to the NCDOT Roadway Standard Drawings for the location of the measurement points to determine maximum height.

15. Catch basins with frame, grates and hoods installed in curb and gutter sections less than 2'-6" wide shall offset the frame, grate and hood to the back of the structure to maintain a consistent width of roadway.
16. Frames, grates and hoods shall not be offset from the catch basin more than 4", front to back.

17. Density tests shall be required on trench backfill at a frequency established in the NCDOT Specifications. Test reports shall be conveyed to the City on a weekly basis.
18. Precast waffle boxes may not be used in areas with traffic bearing loads. Pipe shall enter precast waffle boxes in the area provided for knock outs, the corner or supporting wall section of a waffle box shall not be cut.
19. All graded creek banks and slopes shall be at a maximum 2:1 and not to exceed 10' without terracing, otherwise the slopes shall be designed by a Professional Geotechnical Engineer and approved by the Director of Engineering on a case by case basis.
20. Acceptance of the storm requires: 2 videos (the 1<sup>st</sup> video is prior to the first proof roll, the 2<sup>nd</sup> video is after the installation of dry utilities, but prior to acceptance of the streets); as-built drawings; and certification by the design engineer using the Certification Form in Appendix A.

## END OF SECTION

### B. STANDARDS FOR STORM DRAINAGE & DETENTION DESIGN

1. All storm drainage design shall conform to the standards and specifications as provided in the Kannapolis Storm Water Design Manual or the more restrictive of any standards that conflict.
2. Site grading shall not increase the flow rate or velocity of runoff onto downstream properties.
3. **Storm Drainage Design**
  - a. Minimum pipe size is 15" to an inlet and 18" for open cross pipe culverts.
  - b. Storm system pipes shall be designed for non-pressure conditions using the 10-yr, 24-hr storm event.
  - c. Cross-drainage storm sewers shall be designed for a 25-yr, 24-hr storm event, 50-yr 24-hr storm event for thoroughfares.
  - d. Minimum pipe slope is 0.5% or that which produces a velocity of 2.5 fps when flowing full.
  - e. Maximum pipe velocities shall not exceed 20 fps.
  - f. Maximum discharge velocities at pipe outlets is 10 fps.
  - g. Inlets shall be located using a rainfall intensity of 4"/hr, maximum 400' spacing.
  - h. Double catch basins shall be provided at all sag points.
  - i. Maximum headwater HW/D  $\leq$  1.2.
  - j. Minimum freeboard:
    - i. 12" for pipes  $\leq$  3'.
    - ii. 18" for pipes  $>$  3'.
    - iii. 6" at yard inlets.

#### 4. Stormwater Detention Design

- a. All proposed site plans that require a NCDEQ Sediment & Erosion Control Plan, or that will exceed 20,000sf in new impervious area, shall be required to construct stormwater detention facilities to mitigate increased runoff.
  - b. Detention facilities shall be designed to maintain the pre-developed runoff rate for 1-yr & 10-yr, 24-hr storm events.
  - c. Emergency spillways shall accommodate the 50-yr, 24-hr storm event.
  - d. Provide 6" of freeboard for emergency spillway.
5. Downstream ponds, lakes or other man-made bodies of water shall be analyzed using the 50-yr storm event.
  6. The lowest finish floor elevations for residential structures must be a minimum of 2' above the downstream road crossing elevation or 2' above the calculated 100-yr flood elevation. Areas with the potential to flood during the 100-yr event shall have no basement finished floor elevation lower than the downstream catch basin rim elevation, plus 2'. Slab on grade residential structures must be a minimum of 1' above the highest point of the downstream catch basin or yard inlet.

END OF SECTION

#### C. WATER QUALITY STANDARDS FOR DESIGN

1. Both point and non-point source pollutants shall be managed to comply with the Phase II NPDES Storm Water Permit requirements for post-construction pollution control. Articles 4 and 9 in the Kannapolis UDO outlines requirements for post-construction compliance.
2. The City of Kannapolis utilizes the State of North Carolina Department of Environmental Quality Design Manual for standards of design to obtain compliance to these requirements within the city limits or ETJ.
3. Alternate SCM designs may be used, but the products to be used must be part of the NCDEQ Preliminary Evaluation Period Program and include specifications for monitoring and replacement with an approved SCM if the product does not perform as designed.

END OF SECTION

## D. FLOOD STUDIES

1. Flood studies documenting the impact of drainage structures to be constructed within a 100-yr floodplain are required. The culvert design capacity for these structures is the 100-yr storm event.
2. Flood Studies documenting the impact of fill placed in the 100-yr floodplain may be required for a project. See the City of Kannapolis UDO sections related to Flood Protection for additional guidance on when a flood study is required for fill placement.
3. Flood Studies submittals should include digital files of the HEC-RAS models used to evaluate the impacts and a copy of the work maps used to prepare the study.
4. Work Maps should clearly label the existing and proposed conditions, the existing FEMA data, and the proposed ineffective areas, floodway modifications, revised flood fringe areas, and the revised 100-yr flood fringe.
5. Guidance for the Preparation of Flood Studies can be found in the following documents:
  - a. NC Department of Floodplain Mapping – Riverine Hydrologic & Hydraulic Engineering Guidelines and Standards.
  - b. FEMA – Procedures For “No-Impact” Certification for Proposed Developments in Regulatory Floodways.
  - c. FEMA – MT-2 Application Forms and Instructions for Conditional Letters of Map Revision and Letters of Map Revision.
  - d. FEMA – MT-1 Application Forms & Instructions Conditional Letters of Map Amendment (CLOMAs), Final Letters of Map Amendment (LOMAs), Letters of Map Revision Based on Fill (LOMR-Fs) and Conditional Letters of Map Revisions Based on Fill (CLOMR-Fs).
  - e. NCDOT – Guidelines for Drainage Studies and Hydraulic Design.

END OF SECTION

## E. REINFORCED CONCRETE PIPE

1. All concrete shall meet the minimum specifications set forth in Section 1032 of the NCDOT Standard Specifications for Roads and Structures.
2. Concrete pipe used within the street right-of-way shall be a minimum of Class III Reinforced Concrete Pipe, with a minimum diameter of 15" (18" minimum on cross drain culverts within the ETJ and open-ended culverts under a road). Installation of Class IV or higher concrete pipe shall be identified on the As-Built Plan and the City inspector shall be given documentation and notification of this information prior to construction.
3. Use flexible plastic joint material except when material of another type is specified in the contract documents. Joint material of another type may be used when permitted.
4. RCP < 42" in diameter, NCDOT Section 300 shall be used for installation.
5. RCP ≥ 42" in diameter:
  - a. Wrap filtration geotextile fabric around all pipe joints. Extend geotextile at least 12" beyond each side of the joint. Secure geotextile against the outside of the pipe by methods approved by the Engineer.
  - b. #57 stone shall be used as bedding. Bedding shall consist of a minimum of 7" in depth under the pipe, continuing up to the spring line of the pipe.
6. ASTM C969 and ASTM C1103 are acceptable methods of testing concrete pipe when testing is required by the Director of Engineering.

END OF SECTION

## F. HIGH DENSITY POLYETHYLENE PIPE (HDPE)

1. The Director of Engineering may approve the use of Dual Wall High Density Polyethylene Pipe (HDPE) outside the right-of-way.
2. 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 meet the minimum specifications set forth in Section 1032 of the NCDOT Standard Specifications for Roads and Structures.
3. Bell and spigot joints shall be required on all pipes inside the right-of-way. Bells shall cover at least 2 full corrugations on each section of pipe. The bell and spigot joint shall have an O-ring rubber gasket meeting ASTM F477 with the gasket factory installed, placed on the spigot end of the pipe. Pipe joints shall meet all requirements of AASHTO M294.
4. All HDPE pipe installed must be inspected and approved by the City's Inspector prior to any backfill being placed. The City inspector must be present during the backfilling operation as well.
5. Bedding for HDPE pipe shall be Select Material Class III or Class II, Type 1, loosely placed to a depth as outlined in NCDOT Standard Drawing 300.01, Flexible Pipe.
6. Backfill material used to install HDPE pipe within the street right-of-way shall be Select Material, Class III or Class II, Type 1, as defined by Section 1016-3 of the NCDOT Standard Specifications for Roads and Structures. All backfill material shall be approved by the City inspector prior to placement of the material within the street right-of-way.
7. The minimum length of HDPE pipe permitted for use shall be 4'. HDPE flared end sections or fittings are not allowed.
8. All HDPE pipe installed shall be third party certified and shall bear the Plastic Pipe Institute's (PPI) certificate sticker.
9. All HDPE pipe shall be checked for deflection using a mandrel no sooner than 30 days after installation of the final backfill and prior to the final acceptance of the pipe. The mandrel size shall not be more than 5% of the inside diameter of the pipe, see Appendix A for dimensions of mandrel.
10. ASTM F1417 or ASTM 2487 shall be used when testing is required by the Director of Engineering.

END OF SECTION

## G. POLYPROPYLENE PROFILE WALL PIPE

1. The Director of Engineering may approve the use of Polypropylene Profile Wall Pipe for use both within and outside the right-of-way.
2. Polypropylene Profile Wall 12" – 60" dual pipe shall have a smooth interior and annular exterior corrugations; 30" – 60" triple wall pipe shall have smooth interior and exterior surfaces with the exterior having minor annular corrugations.
3. Polypropylene Profile Wall pipe of the sizes shown or specified shall conform to:
  - a. ASTM F2736 Standard Specification for 6" - 30" Polypropylene (PP) Corrugated Single Wall Pipe and Double Wall Pipe
  - b. ASTM F2764 Standard Specification for 30" - 60" Polypropylene (PP) Triple Wall Pipe and Fittings for Non-Pressure Sanitary Sewer Applications
4. Submittals shall include:
  - a. Manufacturer's product information including details of installation, joints and pipe/manhole connections; properties and strengths of pipes; and instructions on storage, handling, transporting and installation.
  - b. Pipe design load calculations (suggested if deep burial is an issue).
  - c. Factory test reports.
5. Pipe shall be joined with a gasketed integral bell and spigot joint meeting the requirements of ASTM F2736.
6. Pipe diameters 12" - 60" shall be watertight according to the requirements of ASTM D3212, with the addition of a 15-psi requirement. Spigot shall have 2 gaskets meeting the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gaskets are free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.
7. 12" - 60" diameters shall have a reinforced bell with a polymer composite band installed by the manufacturer.
8. Damaged pipe will be rejected and shall be replaced at the Contractor's expense. Pipe and specials stored prior to use shall be stored in such a manner as to keep the interior free from dirt and foreign matter.
9. Fittings shall not be allowed. Any change in direction and/or additional pipes shall have a catch basin, manhole or junction box installed at the necessary location.
10. Polypropylene pipe shall be installed within 6 months of delivery to project site unless written approval is granted from the manufacturer and approved by the Engineer. Approval of an extension in storage time must be requested in writing and accompanied by inspection within 2 weeks prior to installation by an authorized representative of the manufacturer.
11. Long-term above ground storage of polypropylene pipe and fittings shall conform to the following procedure:
  - a. Pipe shall be stored on flat timber supports to facilitate placement and removal of lifting slings around pipe. All pipes shall be chocked to prevent rolling in high winds.

- b. If stacked, minimum 3" wide timber supports shall be used and placed at the quarter points with chocks. Pipe shall not be stacked higher than 10' above the ground.
  - c. Pipe and Fitting laydown should be relatively flat and free of other potentially damaging debris. Laydown area should have proper drainage. At no time, shall any portion of pipe or fittings be stored in standing water for more than 24 hrs.
12. Pipe shall be handled using textile slings or other means recommended by manufacturer. Chains and cables in direct contact with pipe are not recommended.

**13. Installation**

- a. Shall be in accordance with NCDOT Specifications, Section 300, and ASTM D2321 and manufacturer recommended installation guidelines.
- b. Minimum cover in traffic areas for  $\leq 48"$  shall be 1'
- c. Minimum cover in traffic areas for  $\geq 60"$  shall be 2'.
- d. Backfill material for minimum cover situations shall consist of:
  - i. Class 1.
  - ii. Class 2 95-85% SPD.
  - iii. Class 3 95-90%.
  - iv. Class 4 95%.

**14. Jointing:**

- e. Clean ends of pipe and coupling components.
- f. Apply joint lubricant to pipe ends and elastomeric seals of coupling. Use only lubricants approved by the pipe manufacturer.
- g. Use suitable equipment and end protection to push or pull the pipes together.
- h. Do not exceed forces recommended by the manufacturer for coupling pipe.
- i. Join pipes in straight alignment. Do not allow any deflection angle or pipe misalignment to exceed the maximum permitted by the manufacturer.

**15. Backfill**

- a. Use non-cohesive materials include gravels, gravel-sand mixtures, sands, and gravelly sands.
- b. Accomplish immediately after the pipe is laid.
- c. The fill around the pipe shall be placed in layers not to exceed 8".
- d. Compacted to 95% of the maximum density with the AASHTO T 99 Modified Proctor Test.
- e. A density of 100% AASHTO T 99 Modified Proctor is required for the top 8".

#### 16. Testing Polypropylene Profile Wall Pipe

- a. Water tightness test (if required by the Director of Engineering) may be accomplished in accordance with ASTM F1417 or ASTM F2487.
  - b. Deflection shall be checked using a mandrel no sooner than 30 days after installation of the final backfill. The mandrel size shall not be more than 5% of the inside diameter of the pipe, see Appendix A for dimensions of mandrel.
17. Provide properly trained manufacturer's service technician employed by the manufacturer to ensure proper installation of Polypropylene Profile Wall Pipe.

END OF SECTION

#### H. CORRUGATED ALUMINIZED METAL PIPE (SPECIAL DESIGN)

1. Corrugated Aluminized Steel Type 2 pipe, Corrugated Aluminum Alloy Structural Plate pipe, or Corrugated Aluminum Alloy Structural pipe arches may be used in special locations for culverts  $\geq 60$ " in diameter. Type 1A Corrugated Metal Pipe shall not be allowed. The metal pipe shall be a minimum of 14-gauge metal. All pipe must be supplied by NCDOT approved manufacturers.
2. Bedding, installation and backfill of CAMP piping shall follow NCDOT specifications for flexible pipe in Section 300.
3. The minimum cover for CAMP piping shall follow NCDOT specifications and manufacturer recommended specifications, whichever is the more restrictive.
4. Corrugated aluminum alloy culvert pipe shall meet AASHTO M 196, except that Type IA pipe will not be permitted.
5. When a pipe is proposed to be installed in a stream with high velocity ( $>15$  fps) runoff and with heavy bed load (especially angular rocks with sharp corners), the design and pipe gage must be evaluated for abrasion.
6. The soil water environment shall have a pH range between 4.0 to 9.0 and a resistivity of 500 ohm-cm or greater.
7. Galvanized steel, asphalt coated, and polymer coated pipe shall not be permitted.

END OF SECTION

## I. SPECIAL STRUCTURES

1. Bridges, arch culverts, retaining walls, box culverts bottomless culverts, large headwalls, etc. shall be reviewed on a case by case basis depending on the intended use and environmental impacts associated with the project. The Director of Engineering shall set forth guidelines for the design of Special Structures.
2. All Special Structures shall be designed by a licensed professional with credentials to support the intended design and work.
3. All Special Structures shall follow the specifications, certifications and approval processes associated with Federal, State, and Local agencies, along with the requirements of this manual.

END OF SECTION

## Chapter 4 UTILITIES

### A. GENERAL NOTES

1. Specifications used in addition to this manual are City of Kannapolis Water and Sewer Extension Policy, Code of Ordinances Chapter 17 – Water and Sewer, NCAC, NCDEQ, NCDOT Standard Specifications for Roads and Structures and WSACC.
2. All water and sewer permits shall be obtained prior to beginning construction. Any piping installed prior to obtaining permits will not be accepted. Water and sewer permits are obtained through WSACC and NCDEQ.
3. Any size service related to a major subdivision plat or project, installation will be made by the developer. Reference the most recent fee schedule adopted by City Council.
4. Casing pipe for boring and jacking operations shall be steel pipe and have a minimum yield strength of 35,000 psi. The casing pipe shall be sized using the table in Appendix A.
5. No laterals shall cross back through a utility easement or within a R/W. Also, no bends will be permitted for lateral lines between the tap and the meter location.
6. Master meters for water are not permitted for use at multi-family facilities. Each structure is required to have the proper backflow prevention installed and be individually metered.
7. All RPZ's are to be located outdoors and within 5' of the water meter. Any deviation from this standard must be approved in writing by the City's Director of Water Resources.
8. Public water extensions shall be accepted into public service prior to any combustible materials being delivered or vertical construction beginning on new construction sites. Any deviation of this requirement shall need written permission from the Kannapolis Fire Chief.
9. Any utility cuts performed in City of Kannapolis streets shall be patched using City of Kannapolis Standard Details.
10. All utility structures installed in existing streets shall require excavatable flowable fill concrete be used as backfill to fill the voids between the structure and the walls of the excavation.
11. Density tests shall be required on trench backfill at a frequency established in the NCDOT Specifications. Test reports shall be conveyed to the City on a weekly basis.
12. A minimum notice of 2 business days is required to schedule testing or final inspections of utilities.
13. **Utility Easements**
  - a. Minimum of 20' wide, pipe centered in easement preferably in common open space.
  - b. Width requirements based on pipe depth (see Appendix A) and must provide for 1:1 excavation, bottom width = outside pipe diameter + 2'.
  - c. Shall be dedicated to the City of Kannapolis.
  - d. Maximum slopes for maintenance vehicles: longitudinal = 15%, cross slope = 5%.

END OF SECTION

## B. WATER DISTRIBUTION

### 1. Water Distribution Piping Materials

Shall be either PVC or DIP:

- a. 2" - 4" PVC SDR 13.5, Class 315, ASTM D 2241, ASTM D 1784 cell classification 12454-B, ASTM D 1869.
- b. 6" - 12" PVC C900, DR 14, Class 200. The bell of the pipe shall be an integral thickness wall made monolithically with the pipe.
- c. 3" - 12" DIP, Class 350, ANSI/AWWA C151/A21.51.
- d. 16" DIP +, Class 250, ANSI/AWWA C151/A21.51.
- e. Water service piping shall be Type K Copper tubing, per ASTM B-88.
- f. End connections shall be compression. Copper services shall conform to AWWA C-800. See Appendix A.

### 2. Fittings for Water Distribution Piping

Shall be:

- a. ≤ 2", push-on PVC, ASTM D-3139, SDR-13.5, Class 315.
  - b. 3" – 4", DIP Class 250.
  - c. 6" – 24" DIP Class 350.
  - d. 30" + DIP Class 250.
  - e. Mechanical joint fittings shall be CI or DIP and conform to ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53 for compact fittings.
  - f. Fittings for water services shall be red brass containing 85% copper, 5% lead, 5% tin, and 5% zinc in conformance with ASTM B-62. Fittings shall be compression in accordance with AWWA C-800 and shall utilize a compression and/or the split clamp with tightening screw. Stab type fittings are prohibited.
3. All materials shall be new, manufactured either in the year that construction begins or the previous year.
  4. PVC pipe shall be shipped, stored, and strung in a manner to limit its total accumulated exposure to sunlight and UV radiation to no more than 4 weeks.
  5. Tracer wire is required to be taped to all water piping, including mains and services. Tracer wire shall be #12 plastic coated solid copper wire. Non-metallic location tape is required 1' above the water piping.
  6. Water line installation requires staking for alignment, location and elevation.
  7. All mechanical joint fittings, gate valves and fire hydrants require restraining glands and appropriate thrust blocks unless otherwise noted.

8. Water mains shall be adequately anchored to resist thrusts that may develop at fittings and any other location where a change in flow direction occurs.

**9. Tapping Sleeve and Valves**

All connections to existing mains shall require tapping sleeve and valves:

- a. Valves 2" – 12", 200 psi working pressure, 400 psi testing pressure.
  - b. Valves 14" - 24", 150 psi working pressure, 300 psi testing pressure.
  - c. Tapping sleeves shall be cast iron or stainless steel 150 psi working pressure.
  - d. Split-type cast iron tapping sleeves shall be required for all taps where the new branch line is of equal diameter as the existing main being tapped. Stainless steel tapping sleeves shall be required on all existing asbestos concrete piping regardless of size.
10. Water services shall be installed 5' from the sewer lateral, on the up-hill side of the lateral. The service shall not to exceed the center of the lot, measured equidistance between proposed lot lines. Service lines shall not cross back over an easement for sewer or water mains.
  11. Water services shall not be permitted in sidewalks or driveways or other pavements. Any services in conflict shall be capped at the main and a new service connected at the main and installed to the property line. Lateral lines shall not cross back over an easement for sewer or water mains.
  12. All water services shall be installed uniformly on both sides of the street. No bends allowed in lateral line between tap and meter.
  13. Water meters shall read in gallons.
  14. Fire hydrants shall have integral Storz nozzles. Hydrants are to be painted Safety Red with industrial enamel paint.
  15. A minimum 3' of clear space shall be maintained around the circumference of fire hydrants, unless otherwise approved.
  16. The spacing and quantity of fire hydrants required can be found in the IFC 507 and City of Kannapolis UDO Appendix C for reference.
  17. Water mains installed in cul-de-sacs shall maintain a straight alignment to the back of the cul-de-sac with a blow off installed at the termination point, located behind the back of curb.
- 18. Water Main Pressure Testing**
- a. All new water mains shall be pressure tested for leakage and disinfected prior to acceptance by the City of Kannapolis.
  - b. Water mains shall be tested prior to placing ABC, curb and gutter or asphalt.
  - c. Testing of the water main cannot be performed until the water main has been backfilled and a minimum of 7 days after the last thrust block has been poured.
  - d. A representative of the City of Kannapolis shall be present for all testing.

- e. Pressure tests will be conducted without interruption for a period of 2-hr and no more than 5000' per section tested. The allowable leakage shall be in accordance with current AWWA C600 standards, as shown in the below modified formula:

$$Q = 0.0068 \text{ DLN}$$

Where

Q = allowable leakage in gal/hr

D = nominal diameter of pipe in inches

L = length of section tested in feet, divided by 1000'

N = square root of average test pressure in psi

- 19. Unless otherwise noted, fire hydrants shall be in the closed position during testing.
- 20. Disinfection of water mains shall conform to the requirements of ANSI/AWWA C651-92, WSACC and NCDEQ.
- 21. All frame and covers on manholes and valve boxes installed during construction of the water system shall be solid and state the use of system, "WATER" on the cover. Use NCDOT Standard Drawing 840.54.
- 22. Where corrosion is deemed to be a serious problem, DIP shall be provided with cathodic protection or an internal/external encasement, lining, or coating appropriate for the pipe material and situation. Such encasements, linings and coating shall be manufactured or applied in accordance with the appropriate ANSI and AWWA standards.
- 35. **Requirements for Acceptance of Water Main System**
  - a. As-built drawings (both paper & digital copies) adhering to the As-built Checklist in Chapter 5.
  - b. Engineer's Certification.
  - c. State approval.
  - d. Easements or Rights-of-Way dedicated to the City.

### 23. **Mi.Net System**

Water main extensions may require installation of infrastructure to support the Mi.Net system utilized by the City of Kannapolis. The type of equipment and locations of said equipment shall be coordinated with Kannapolis Public Works Department. The City of Kannapolis shall not be responsible for the cost of the additional equipment unless otherwise noted.

END OF SECTION

## C. SANITARY SEWER

### 1. Sanitary Sewer Piping

Shall be either PVC or DIP, see Appendix A:

- a. 4" - 15" PVC shall be Solid wall ASTM D3034, SDR 35, Cell Classification 12454 B.
  - b. 18" - 48" PVC shall be Profile wall ASTM F794 Stiffness PS46.
  - c. All sizes DIP shall be Class 50.
2. All sewers shall be designed and constructed to give mean velocities, when flowing full, of not less than 2 fps, based on Manning's formula using an "n" value of 0.013. Minimum slopes for piping are as follows:

Diameter of Pipe (inches)	Minimum Slope (feet per 100 feet)
6	0.60
8	0.40
10	0.28
12	0.22
14	0.17
15	0.15
16	0.14
18	0.12
21	0.10
24	0.08
27	0.07
30	0.06
36	0.05

3. PVC pipe shall be shipped, stored, and strung in a manner to limit its total accumulated exposure to sunlight and UV radiation to no more than 4 weeks.
4. All materials shall be new, manufactured either in the year that construction begins or the previous year.
5. Transitions between PVC and DIP shall be made with an Adaptor Coupling SWRxDIOD Harco PT #2834-080 or approved equal.

### 6. Sanitary Sewer Pipe Testing

- a. Sewer mains shall be tested prior to placing ABC, curb and gutter or asphalt.
- b. A representative of the City of Kannapolis shall be present for all testing.
- c. A mandrel test is required on PVC piping no sooner than 30 days after installation of the pipe.
- d. Pipe  $\leq 24"$ , low pressure air testing shall be used in lieu of exfiltration testing. Low pressure air testing shall comply with ASTM C828 for PVC pipe. See Appendix A for Air Test requirements.
- e. Continuity tests shall be performed on all tracer wire installed on all utility systems.

7. **Sanitary Sewer Pipe Bedding**

- a. PVC - #57 stone 6" under the pipe to 6" over the top of pipe.
  - b. DIP - #57 stone 6" under the pipe.
  - c. The bedding requirements are minimum depths and unsuitable soils may require additional stone be placed in the trench. In the event the undercut extends 2' or more below the bottom of pipe, the Director of Engineering shall determine the means and methods of remediation.
- 8. #57 stone is required on all sewer laterals; see Kannapolis Standard Details.
  - 9. Tracer wire is required to be taped to all sewer piping, including mains and laterals. Tracer wire shall be #12 plastic coated solid copper wire. Non-metallic location tape is required 1' above the sewer piping.
  - 10. Laterals shall have a No-Hub cast iron cap with a stainless-steel No-Hub coupling at the clean out at the property line.
  - 11. Laterals are to be installed uniformly on both sides of the street, and at an appropriate location to maximize the lowest elevation of the lot, but in no case, shall be installed in a location with an elevation higher than the elevation at the center of the lot. Lateral lines shall not cross back over an easement for sewer or water mains.
  - 12. Clean outs shall not be permitted in sidewalks or driveways or other pavements. Any clean outs in conflict shall be capped at the main and a new lateral connected at the main and installed to the property line.

END OF SECTION

D. **SANITARY SEWER MANHOLES**

- 1. Manholes shall be constructed with precast bases as indicated in the details.
- 2. Inside drops shall be used for 8" – 12" diameter sewer unless indicated otherwise on the drawings.
- 3. Manhole inside diameters\* shall be as follows, unless otherwise directed by the engineer or noted on the drawings, according to the largest sewer pipe connected to the manhole:

Pipe Diameter	Manhole Diameter
8" – 16"	4'
18" – 36"	5'
39" – 54"	6'
54" +	8'

\*The minimum diameter of all drop manholes (inside or outside) shall be 5'.

- 4. Minimum invert elevation entering manhole shall be 0.20' above exiting invert or top of invert out pipe minus diameter of the entering, whichever is greater.
- 5. Drop manholes shall be required on sewer entering a manhole at an elevation greater than 2' above the manhole invert. Where the difference in elevation is less than 2', the invert shall be filleted to prevent solids deposition.

6. The flow channel shall be made to conform as closely as possible in shape, and slope to that of the connecting sewers.
7. All connections to manholes shall require resilient connectors, conforming to ASTM C923, with stainless steel clamp, drawbolt and nut or "A" Lok. Connections to existing manholes shall be made by coring into the existing manhole wall and installation of a resilient connector.
8. The connecting pipe shall not protrude more than 2" inside the manhole wall.
9. All manhole components shall be designed to withstand an H-20 loading. All precast manholes installed in the NCDOT right of way shall be approved by NCDOT.
10. Concrete used in the manufacture of manholes shall be 4,000 psi minimum at 28 days, containing 4% minimum air content, cement at a rate of 564 #/cy minimum, and conform to ASTM C478, C890, C891, C923, C33, C494, and C260.
11. Manhole reinforcement shall conform to ASTM A615 grade 60 deformed bar, ASTM A82 or ASTM A185 welded wire fabric.
12. All joints between precast components shall be sealed with butyl rope no less than 14' long. The external joint shall be wrapped with a polyethylene backed flat butyl rubber sheet no less than 1/16" thick and 6" wide applied to the outside perimeter of the joint.
13. Manhole steps shall be provided in all sections of the manhole and be aligned vertically on 15" centers. The bottom step shall be no more than 26" from the top of the bench in the base section. The step pull-out strength shall be 1,000 lbs. minimum in accordance with ASTM C478.
14. Manholes shall have a maximum of 12" of grade rings placed on the structure. All joints, including grade rings, shall be sealed with butyl sealant, rope and sheet types.
15. All frames and covers on sewer manholes shall be solid and state the use of system, "SANITARY SEWER" on the cover. Use NCDOT Standard Drawing 840.54.
16. All frames shall be set on butyl sealant and wrapped with sheet butyl. All frames set outside of the roadway shall be bolted to the manhole with at least 2 bolts on opposing sides of the frame. Frames and covers located outside the roadway shall extend at least 2' above grade unless otherwise noted. Any frames and covers located in roadways or shoulders shall conform to the slopes surrounding the frame and covers.
17. Manholes shall be protected from the 100-yr flood by either setting the frame and cover 2' above the 100-yr flood elevation or installing a watertight frame and cover with a vent 2' above the 100-yr flood elevation. Manholes shall be vented every 1,000' or every other manhole, whichever is greater.
18. Vent pipes shall be Grade B, FY=35,000 psi, 3" diameter with a mesh stainless steel screen in the opening.
19. Manholes shall be installed at the end of each line, at all changes in grade, size, or alignment, at all intersections, and at distances not greater than 425'. Sewer mains greater than 425' may be allowed at the discretion of the Director of Engineering.
20. Where corrosive conditions are anticipated, consideration shall be given to providing corrosion protection on the interior of the manhole.

## 21. Sanitary Sewer Manhole Bedding

Manholes shall set on a minimum of 6" of #57 stone.

## 22. Sanitary Sewer Manhole Vacuum Pressure Testing

A vacuum of 10" of mercury shall be placed on the inside of the manhole. Vacuum testing shall be performed on 100% of the manholes installed. For a passing vacuum test on sanitary sewer manholes, the vacuum cannot drop from 10" – 9" under the following:

- a. 4' diameter manhole, < 60 seconds.
- b. 5' diameter manhole, < 75 seconds.
- c. 6' diameter manhole, < 90 seconds.
- d. 7' diameter manhole, < 105 seconds.
- e. 8' diameter manhole, < 120 seconds.
- f. 10' diameter manhole, < 150 seconds.

Sewer manholes shall be tested prior to placing ABC, curb and gutter or asphalt.

A representative of the City of Kannapolis shall be present for all testing.

## 24. Requirements for Acceptance of Sanitary Sewer System

- a. Video of the sewer system (after the installation of dry utilities, but prior to acceptance).
- b. As-built drawings (both paper & digital copies) adhering to the As-built Checklist in Chapter 5.
- c. Engineer's Certification.
- d. State approval.
- e. Easements or Rights-of-Way dedicated to the City.

END OF SECTION

## E. WASTEWATER PUMP STATIONS

1. The City of Kannapolis policy for wastewater pump stations is to minimize the need for pump stations. The additional expense of operation and maintenance, along with the environmental concerns associated with pump stations is the basis of the policy.
2. While the construction of pump stations is not viewed as the initial option for providing sewer service, there are situations that pump stations can be allowed. The following criteria will be utilized during the consideration of developer funded pump stations.

- a. The pump station can be eliminated by a project or combination of projects, all of which are included for funding in the approved 5-yr CIP. The pump station can be eliminated by a project being done under a reimbursable program and the funds have been made available to the City.
  - b. The proposed pump station is at an appropriate location and has adequate capacity or expansion capacity to serve as a permanent or long-term facility and gravity service is cost prohibitive or not possible due to other circumstances.
  - c. The construction of the proposed pump station would include elimination of one or more existing pump stations.
  - d. The construction of the proposed pump station would facilitate significant progress toward achievement of land use goals and strategies described by current, officially approved planning documents and no other reasonable options are available for service.
  - e. The receiving system must have available capacity to carry the proposed pump station discharge. Any upgrades required will be the responsibility of the Developer requesting the pump station.
3. All wastewater pump stations shall be designed by Professional Engineer licensed in the North Carolina, comply with the NCDEQ, Minimum Design Criteria for the Permitting of Pump Stations and Force Mains and be permitted through NCDEQ.
  4. Only non-clog pumps designed and manufactured for use in conveying raw, unscreened wastewater shall be permitted. The pumps shall be capable of handling a 3" solid and any trash or stringy material that can pass through a 4" hose. Pumps shall be designed for continuous duty.
  5. The impellers shall have blades that are generally forward rounded or otherwise configured to avoid catching solids, trash, and stringy material.
  6. Pumps shall have no less than a 4" diameter suction and discharge opening.
  7. Multiple pumps shall be used such that the pump station is capable of conveying the peak hourly wastewater flow to its desired outfall location with the largest single pump out of service.
    - a. In duplex pump stations, the pumps shall be of the same capacity.
    - b. If pumps in series are required to meet capacity or total dynamic head requirement, each set of pumps in series shall be viewed as a single pumping unit.
    - c. Priming pumps as well as any other auxiliary system that is required for pump functionality shall also be provided in multiple numbers.
  8. Determination of pump capacity shall be based on development build out. For regional pump stations, pump capacity shall be based on the entire service area over the life of the pump station.
  9. The minimum allowable design daily wastewater flow to the pump station shall be: historical potable water use, wastewater flow generation data; or established long-range wastewater planning criteria.
  10. The storage capacity for the pump station shall include 2-hr storage above the high-water alarm elevation at the peak flow rate.
  11. Pump capacity shall also be based upon the need to maintain a minimum velocity of 2 fps.

12. Pump selection shall be based on total dynamic head versus capacity; static head requirements; friction head requirements; minor losses; pressure head at the junction of the existing force main; no cavitating; and maximized operating efficiency.
13. System curves shall be generated and evaluated not only for present day conditions, but also for conditions that may exist over the expected lifetime of the pump station.
14. The Hazen-Williams friction coefficient, C, appropriate for the force main pipe material and age of the force main shall be used, see Appendix A.
15. Consideration shall be given to minimizing motor speed and the motor horsepower shall be at least 1.15 x what is required during the entire pump performance curve.
16. Constant speed pumps shall be cycled such that the number of starts is minimized, and resting times are maximized to avoid overheating and overstressing of the pump motor.
17. All pumps shall be UL or FM listed, hermetically sealed, air filled submersible type, electric motor for operation at 460V, 3ph, 60hz power. Pumps shall be designed for use in electrically hazardous locations, general use in pumping sewage, and be provided with thermal overload protection and moisture detection system.
18. A quick disconnect suction line shall be installed in the wet well, 1' above finished floor, extending above the finished grade of the wet well. The suction line shall be restrained joint DIP.
19. A quick disconnect pump connection shall be required at location designated by the Kannapolis Director of Water Resources.
20. If the pump station will be maintained by the City, the tract of land where the pump station will be located shall be deeded and recorded to the City of Kannapolis. The tract shall be large enough to accommodate the pump station, structures (including a 10' x10' outbuilding), emergency generator, parking, and maneuvering of maintenance vehicles, accommodate grading, ingress/egress to the site, and a security fence.
21. All ports of entry to the pump station, structures, vaults, panels, etc. shall be lockable.
22. The lift station shall be provided with adequate indoor and outdoor lighting to facilitate normal and emergency operation and maintenance activities during daylight and non-daylight hours. Outdoor/all-weather lighting (120V) with outdoor/all-weather switch shall be provided under the weather cover for electrical and/or SCADA panels installed outside.
23. The security fence shall be chain link, 8' high, around the entire perimeter and have double-swing gates with a minimum clear opening of 18'. The size, layout, and configuration of the fenced area for the lift station site shall be sufficient to allow multiple vehicles to be at the station at the same time. The site shall be able to accommodate at a minimum a 6,000-gallon tri-axle vactor.
24. Roads for ingress/egress of pump stations shall be a minimum of 16' wide but will be evaluated on a case by case basis to adequately serve the pump station in any weather condition. Refer to gravel road access typical section detail for minimum pavement schedule.
25. All structures shall be designed and constructed in complete compliance with all applicable state, local and federal codes as well as applicable Occupational Safety and Health Administration (OSHA) and National Fire Protection Association (NFPA) standards and display all applicable safety placards.

26. Piping and valves shall be designed and installed per the NCDEQ, Minimum Design Criteria for the Permitting of Pump Stations and Force Mains.
27. The site shall have a water supply. If municipal water is the source of potable water, a ¾" water service with a reduced pressure principle backflow prevention device is required inside the security fence and shall have 120V power provided for freeze protection. If municipal water is unavailable, a well shall be required to provide water. Wells shall be required to deliver 10 gpm at 40 psi and be marked as non-potable. A freeze-proof yard hydrant is required inside of the security fence.
28. All electrical systems and equipment shall be designed and installed meeting the standards of Underwriters Laboratories Incorporated (UL), National Electrical Manufacturer's Association (NEMA), National Fire Protection Association (NFPA), North Carolina State Building Code (NCSBC), National Electrical Code (NEC) and NCDEQ, Minimum Design Criteria for the Permitting of Pump Stations and Force Mains (MDCPPSFM).
29. Contact Kannapolis Director of Water Resources, (704) 920-4200, to obtain the current requirements for installation of telemetry and other instrumentation.
30. Stand-by power generation is required for pump stations. The stand-by power shall be fueled by natural gas, where available, or liquid propane, where natural gas is not available. The generator shall be sized to adequately supply the pump station with consistent power enough to operate the pumps and supporting accessories throughout a power outage. The generating unit shall be located in a building structure or otherwise protected from the weather elements and meet the minimum requirements per the NCDEQ, Minimum Design Criteria for the Permitting of Pump Stations and Force Mains.
31. Testing of all appurtenances associated with the pump station shall be performed per the NCDEQ, Minimum Design Criteria for the Permitting of Pump Stations and Force Mains and/or local specifications.
32. Three (3) hard copies and one (1) digital copy of the Operations and Maintenance (O&M) Manuals shall be provided to the City upon start-up of the pump station. The manual shall be prepared using the criteria in the NCDEQ, Minimum Design Criteria for the Permitting of Pump Stations and Force Mains.
33. If the pump station will be maintained by the City, one spare pump for each type/model shall be provided for each type/model of pump installed and four (4) spare floats.
34. If the pump station will be maintained by the City and the design capacity is greater than 15,000 gallons per day, a 10' by 10' storage outbuilding shall be provided on site within the security fenced area. The storage outbuilding shall meet all minimum respective county codes. The storage outbuilding shall have at least one standard door and one double door opening of at least 7' in height and 5' in width. The storage outbuilding shall be equipped with a vent ridge type vent in the roof line. The storage outbuilding shall be equipped with outdoor clasp type locks to accommodate a pad lock. The storage outbuilding shall be equipped with a fire extinguisher inside. The storage outbuilding shall have studs at least 24" on center for the walls and be constructed on slab for flooring. The storage outbuilding shall be installed as to protect against flooding and shall be out of the flood plain.
35. The 100-year floodplain elevation shall be noted on the applicant's drawings. All above ground equipment, electrical controls, and access hatches shall be located at least 2' above the 100-year floodplain.
36. Landscaping Requirements - The applicant shall provide landscaping for the lift station in accordance with the Kannapolis Development Ordinance. At a minimum, landscaping shall be

compatible with the surrounding neighborhood. However, Leyland cypress and poplar trees are not allowed for pumping station sites. Holly bushes are the preferred bushes for screening. Screening is required if there are existing or proposed dwellings within 200'. Within the lift station fence line, the entire area shall be provided with a 6" ABC base. City vehicles must be able to pull within 4' of the wet well without obstruction.

37. The site shall be graded to provide positive drainage away from the lift station wet well, mechanical and electrical equipment and appurtenances.
38. All check valves shall be installed in the horizontal position in an accessible location outside of the wet well inside an epoxy coated vault or manhole with adequate clearance for its removal.
39. Stations with a permitted design point of 0.5 MGD and larger, shall require additional solids removal. The additional removal can be achieved by using grinders or mechanical bar screen.
40. All hatches shall be of sufficient size that the largest piece of equipment may be removed with a minimum of 6" of clearance on all sides. Hatches shall be solid aluminum diamond plate with spring assist if more than 50 pounds of lifting weight is required. Hatches shall include recessed lifting handle, security lock pin, and factory installed safety slide bars to hold vertically open. All hatches shall be anti-slam.
41. The submersible pump wet well shall be equipped with an ultrasonic transmitter to provide depth measurements to the SCADA system.
42. Permanent flow metering shall be required at all lift stations. Flow monitoring and run time reporting software and hardware will be required at all proposed lift stations. All stations shall be provided with flow meters in accordance with the following requirements:
  - a. Flow meters shall be electromagnetic type with 316 stainless steel metering tube sized to maintain velocities within the recommended range provided by the manufacturer over the full range of anticipated flows.
  - b. Flow meters shall be installed in an accessible location in the lift station dry well or outside within the fenced area inside an epoxy coated vault or manhole with adequate clearance for its removal.
  - c. The piping installation shall provide 5 diameters of straight pipe runs upstream and 2 diameters downstream from the meter, or additional lengths if required by meter manufacturer. Bypass piping shall be provided of equal or greater size than the flow meter piping with sufficient valving to allow the flow meter to be removed for maintenance without taking the station out of service.
  - d. Flow meter shall be equipped with a microprocessor based "smart" transmitter that is capable of converting and transmitting a signal from the flow tube with a 4-20 mA DC signal.
  - e. The flow meter shall have an integrated LCD readout capable of displaying flow rate and totalized flow. The LCD screen shall not be installed inside the confined space vault.
43. All lift station structures other than the wet well shall be provided with a means to remove accumulated water and wastewater from the structure. All floor and walkway surfaces shall be sloped such that water and wastewater drains to a designated sump area under the influence of gravity.
44. All structures shall have means to remove accumulated water with an appropriately sized drainage pipe draining to the wet well. The discharge for the drainage pipe shall be higher than the high-

water level alarm and be equipped with a buck-bill/check valve. The drain pipe shall not allow backflow of wastewater and gasses from the wet well into the structure.

45. There shall be a spare check valve supplied for every model installed at the lift station.
46. Pump Piping Requirements - Each pump shall be provided with separate suction and discharge piping systems designed in accordance with the following minimum requirements:
  - a. Suction and discharge piping shall be a minimum of 4" diameter unless approved by the Director of Water Resources.
  - b. Suction and discharge piping shall be sized to maintain velocities between 2' and 8' per second. Suction piping shall provide a minimum 5 diameters of straight, unobstructed (ie no flow disturbing fittings) run upstream from the pump.
    - i. Suction piping for all wet well mounted suction lift stations shall be schedule 40 stainless steel at a minimum.
  - c. Reducers required for connection to the suction connection flange on the pump volute shall be long radius, concentric reducing elbows.
  - d. The pipe and fittings shall have a minimum of 12" of clearance from any wall or floor and there shall be a minimum 36" clearance between the piping of each pump or greater if required by the pump manufacturer.
  - e. All exposed fittings whether inside or outside the lift station shall be flanged joint ductile iron fittings. Applicants shall provide appropriate restraining joints for all piping.
  - f. Flexible couplings shall be provided on pump discharge piping and common headers to facilitate construction as well as routine maintenance and replacement of valves, etc.
  - g. With the exception of submersible pumps, restrained couplings shall be provided at the suction and discharge nozzles for all pumps that can accommodate both angular and parallel misalignment to prevent the transmission of pipe strain to the pump volute and limit nozzle loading in accordance with the pump manufacturer's requirements.
47. Valve Requirements - All lift stations shall be provided with sufficient valves to allow for proper operation and maintenance of the lift station during normal, peak, and emergency bypass conditions. Valves shall be suitable for use with raw, unscreened wastewater and shall be of a design suitable for its function, its installation location, as well as the normal and maximum operating pressures expected at the lift station.
  - a. A full-closing eccentric plug shut-off valve shall be provided on the suction (for wet/dry pit stations) and discharge piping of each pump.
  - b. An outside-lever, swing check valve shall be provided on the discharge piping of each pump, between the pump and the shut-off valve. Check valves shall be installed in the horizontal position in order to prevent the accumulation of debris on the back side of the flap that may prevent the valve from opening. Check valves shall be located so that all working parts are readily accessible including the top cover that is removed periodically for maintenance.
  - c. Discharge piping shall be connected to check valves using a meg-a-flange connector in the valve vault.

- d. Valves shall not be placed inside the wet well.
  - e. All valves should be individually supported from below wherever possible. The use of flange supports that bolt directly to the valve flange are discouraged unless other means of thrust restraint are provided that limit the movement of the valve and potential damage to both the valve and support.
  - f. Valving shall be adequate to provide for all operating conditions, pump removal and replacement, bypassing, and equipment maintenance (i.e. flow meters, electrical components, phased construction, mechanical maintenance, etc.)
  - g. All valves shall open left, counter-clockwise.
48. Discharge Valve Vault Requirements for Submersible Lift Stations - Submersible lift stations shall be provided with a concrete valve vault located directly adjacent to the wet well. Valve vaults shall be provided with the following design features:
- a. Valve vaults shall be constructed of epoxy coated precast concrete. All precast structures shall comply with ASTM C-478 at a minimum.
  - b. The minimum allowable interior size for valve vaults shall be 6' x 6' for lift stations with 4"-6" force mains and 8' x 8' for larger force mains.
  - c. Valve vaults shall be provided with a minimum 4' x 4' double leaf aluminum access hatch.
  - d. Manhole steps shall not be installed in valve vaults. An OSHA approved aluminum access ladder shall be installed from the access hatches to 1' above the floor inside the vault and extend 2' above the hatch when fully extended.
  - e. Provide at least 12" of clearance between valves and the wall.
  - f. Provide at least 36" of clearance between the valves for each pump discharge.
  - g. When vertical clearance is required, it shall be adequate for safe worker entry and exit without crouching.
  - h. All penetrations to be cast with watertight flexible boots meeting ASTM C-923.
  - i. The floor shall be tapered to a 18" x 18" x 12" sump pit.
49. Lift stations shall be provided with a system that allows for the removal and installation of the pumps and grinders without requiring entry into the wet well or manhole and with clear vertical access.
- a. Each pump and grinder shall be provided with a dual-guide rail system and lift-out chain section with guide cable.
  - b. Removal systems shall guide the pump or grinder system into its fully seated, operating position.
  - c. Both the guide rail and the lift-out chain shall be capable of withstanding the forces required to disengage the pump or grinder from the wet well or structure.
  - d. Both the guide rail and the lift-out chain shall be manufactured of type 304 stainless steel.

## END OF SECTION

### F. FORCE MAINS

1. Force mains shall be designed per NCDEQ, Minimum Design Criteria for the Permitting of Pump Stations and Force Mains, Section 4.0.
2. Pipe materials and specifications shall be selected based on the installation and operating conditions of the system and shall consider the following criteria:
  - a. Installation depth and overburden pressure.
  - b. Soil conditions and groundwater pressure.
  - c. Corrosion resistance from both external and internal sources.
  - d. Strength required withstanding internal pressures expected during normal operation as well as those resulting from hydraulic surges and water hammer.
3. Force mains shall be constructed of the following pipe:
  - a. Ductile iron pipe – DIP shall conform to ANSI/AWWA C151/A21.51 “Ductile Iron Pipe, Centrifugally Cast in Metal Molds for Water or Other Liquids.”
    - i. The thickness and pressure class of DIP pipe shall be determined in accordance with ANSI/AWWA C150/A21.50 “Thickness Design of Ductile Iron Pipe.”
    - ii. Fittings for DIP shall conform to ANSI/AWWA C110/A21.10 “Ductile-Iron and Gray-Iron Fittings, 3” - 48” for Water and Other Liquids” or ANSI/AWWA C153/A21.53 “Ductile Iron Compact Fittings, 3” - 24” and 54” - 60” for Water Service.”
    - iii. DIP force mains shall have mechanical, gasketed push-on type joints. or flanged if exposed. Restrained joint DIP may be used for anchoring purposes. Gaskets shall be in accordance with ANSI/AWWA C111/A21.11 Flanged DIP shall conform to ANSI/AWWA C115/A21.15
    - iv. Where corrosion is deemed to be a serious problem, DIP shall be provided with cathodic protection applied in accordance with the appropriate ANSI and AWWA standards.
  - b. Polyvinyl Chloride (PVC) materials used in the manufacturing shall conform to ASTM D1784.
    - i. PVC pipe shall conform to AWWA C900 or C905. The thickness and pressure class of PVC shall be determined in accordance with AWWA C900 or AWWA C905 but shall be a minimum or Pressure Class 200, SDR 14 or less.
    - ii. Force mains of PVC pipe shall have elastomeric gasketed push-on type joints in accordance with ASTM F477 “Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.”
    - iii. Mechanical joint DIP fittings conforming to ANSI/AWWA C110/A21.10 and C116/A21.16-98 shall be used for force mains 4” in diameter and larger.
    - iv. PVC pipe shall be shipped, stored, and strung in a manner to limit its total accumulated exposure to sunlight and UV radiation to no more than 4 weeks.

4. All force mains shall be identified with green plastic locator tape & black lettering identifying the pipeline as sanitary sewer. The tape shall be placed approximately 1' above the pipe.
5. Tracer wire is required to be taped to the force main. Tracer wire shall be #12 plastic coated solid copper wire.
6. Force mains shall be adequately anchored to resist thrusts that may develop at fittings and any other location where a change in flow direction occurs.
7. Testing of the force main cannot be performed until the force main has been backfilled and a minimum of 7 days after the last thrust block has been poured.
8. The hydro-static test pressure shall be 1.5 x the maximum pump operating head range, but not less than 100 psi. The test pressure shall be held a minimum of 2 consecutive hrs.
9. All valve boxes shall be labeled "Sewer".
10. All force mains shall be installed with a corrosion resistant internal lining. Lining shall be Protecto 401 ceramic epoxy or approved equal, unless otherwise approved by the Director of Water Resources. When the Director waives the force main internal lining requirement, pipes shall have a standard cement mortar lining except at the locations specified below where the corrosion resistant lining shall always be provided:
  - a. At all high points for a minimum distance of 100' in each direction.
  - b. At all locations where partially full conditions may exist or where the force main may be exposed to air during static or operating conditions as determined by a hydraulic model of force main, plus an additional 40' in each direction.
    - i. Provide hydraulic model for review if requesting variance.
11. **Requirements for Acceptance of Sanitary Sewer Force Main System**
  - a. Video of the sewer force main system (after the installation of dry utilities, but prior to acceptance).
  - b. As-built drawings (both paper & digital copies) adhering to the As-built Checklist in Chapter 5.
  - c. Engineer's Certification.
  - d. State approval.
  - e. Easements or Rights-of-Way dedicated to the City.

END OF SECTION

# CHAPTER 5 PLAN REQUIREMENTS

## A. PLAN SUBMITTAL REQUIREMENTS

This list should be considered as a guideline for technical and engineering requirements and should not be considered as a comprehensive list for all the requirements of a submittal.

### 1. Construction Plan Submittal Requirements:

Design according to the “Public Infrastructure Plan Review Checklist” as provided by the Director of Engineering and/or the City of Kannapolis website. Ensure the following are included:

- a. A north arrow.
- b. Scale between 1”=10’ to 1”=40’, preferably 1”=20’ horizontal, & appropriate vertical scale.
- c. Location of the property, including street name and address.
- d. The character of the present and future property uses and the current zoning.
- e. Location of existing property lines, rights-of-way, easements, turn lanes, tapers, utilities, retaining walls, storm drainage facilities, utility poles and guy wires, and other physical features which affect the driveway location.
- f. Location of all proposed property lines, rights-of-way, easements, buildings, driveways, sidewalks, off-street loading facilities, interior parking arrangements, traffic circulation patterns, & number of spacing required, median openings with storage lanes and tapers.

### 2. Roadways:

- a. Per City of Kannapolis Land Development Standards Manual, NCDOT and UDO Standards.
- b. Include the “Site Plan Sheet Notes” as shown on the City of Kannapolis website.
- c. Minimum road grade to be 1%, maximum is 10%.
- d. Existing curb and gutter and pavement to be replaced or repaired as required to tie to sound material.
- e. Tack coat to be applied to all existing asphalt surfaces prior to placing new asphalt.
- f. Show locations of curb cut for curb ramps and provide curb ramp detail.
- g. Provide a driveway plan sheet showing each lot and designating driveway locations and service locations.
- h. Provide driveway details and driveway profiles.

### 3. Water & Sewer:

All Water and Sewer Extensions to the City of Kannapolis systems shall be permitted through the North Carolina Department of Environmental Quality (NCDEQ) and shall be in accordance with The Standard Specifications for Wastewater Collection and Water Distribution for the Water and Sewer Authority of Cabarrus County (WSACC) and The City of Kannapolis Water & Sewer Standards and Policies.

- a. NCDEQ & City forms to be completed after initial City Review.
- b. Permitted through NCDEQ (City to review prior to NCDEQ Submittal).
- c. An electronic CAD file copy of the drawings is required for WSACC flow acceptance and verification of the water model.
- d. Water Meters, Fire Hydrants, and Backflow devices per City Standards. Details in CAD and PDF files are provided on the City of Kannapolis website.
- e. Include, the "Utility Plan Sheet Notes" as shown in this chapter and under the Water and Sewer Standards on the City of Kannapolis website.
- f. All Fire Hydrants shall be connected to public mains owned and operated by the City of Kannapolis.
- g. All Irrigation Lines shall be metered separately.

**4. Stormwater Systems:**

- a. Per City of Kannapolis and NCDOT Standards. See chapter 3.B.3 for storm drain design criteria.
- b. Public maintained structures shall be traffic rated.
- c. All culverts shall be RCP (minimum class III and use class rated for cover/loads) unless approved by the Director of Engineering.
- d. Provide details for all types of catch basins to be used. Ensure that culverts will fit in the proposed catch basin.
- e. If an alternate drainage box design is requested, structural calculations and construction details must be provided to review the request.
- f. Provide piping system profiles which include Hydraulic Grade Line (HGL).
- g. O-ring culverts are required for pressurized systems.
- h. Show that water is not being backed up on upstream properties or diverted onto lower properties.

**5. Stormwater Calculations:**

Provide a report documenting Pre & Post development conditions, offsite impacts, and the method of treatment. Ensure that the following items are included:

- a. Pre & Post development drainage basin maps & hydrographs.
- b. Rainfall runoff intensities and depths for Cabarrus County.
- c. Documentation for curve number, C values, time of concentration, and the equations used to generate the stage/storage/discharge tables.
- d. Buoyancy calculations for the riser and uplift anchor.
- e. Inlet capacity analysis.

- f. Stormwater conveyance (pipes, ditches, channels).
- g. Detention provided for the 1-yr and 10-yr storm events.
- h. Stormwater SCM Supplements.

**6. Stormwater Structures:**

- a. Provide a cross-section of the embankment showing fill slope angles, top width, barrel size & type, riser size & type, orifices (including size, location, type, & inverts), top of dam elevation, and spillway elevation.
- b. Make sure that the structures, orifices, and pipes and the associated inverts match in the design calculations and dimension details.
- c. Provide a construction detail for the trash rack.
- d. Show how the joints and connections will be made watertight.
- e. Show uplift anchor dimensions.
- f. If the structure is to be a regional or shared system, show the location of access easements and provide a copy of the proposed maintenance agreement.
- g. It is recommended that storage areas be fenced to prevent inadvertent entry.
- h. Provide a minimum 6" of freeboard in the system.
- i. If an emergency spillway is not provided, the system must pass the runoff from a 100-yr storm event.
- j. Provide forebay construction details.

**7. FEMA Flood Hazards:**

- a. Show the location of FEMA floodway, 100-yr flood fringe, cross-sections and flood elevations as determined by FIRM maps on the drawings.
- b. Show the location of the flood fringe area based on the FEMA flood elevation and the actual site topography.
- c. Show the minimum finish floor elevation for sites adjacent to a flood hazard (2' above flood elevation).
- d. Provide material specifications and compaction notes for fill to be placed in a floodplain. Certification of fill compaction is required for material placed in a floodplain.
- e. Provide the note listing the datum used for the topo and flood elevations.

**8. Easements:**

- a. Minimum of 20' wide, pipe centered in easement preferably in common open space.
- b. Width requirements based on pipe depth (see Appendix A) and must provide for 1:1 excavation, bottom width = outside pipe diameter + 2'.

- c. Shall be dedicated to the City of Kannapolis.
- d. Maximum slopes for maintenance vehicles: longitudinal = 15%, cross slopes of 5%.
- e. Water mains that serve more than one structure shall be considered public and will be provided with an adequate easement to maintain the line. All multi-family developments shall be provided with a separate meter for each structure. Waterlines feeding these meters will be considered public.
- f. See LDSM for overlapping easements.

**9. Other:**

- a. Stream Buffers shall be clearly delineated or provide letter from a Qualified Individual stating that there are no streams on the site.
- b. Erosion Control Permit:
  - i. If land disturbance > 1 ac provide copy of NCDEQ permit to City.
  - ii. If land disturbance < 1 ac obtain permit from City. Provide sufficient plan information (details/notes) to demonstrate intention to control erosion and prevent sedimentation from leaving the site.
- c. Provide copies of all necessary environmental permits.
- d. Encroachments will be needed for work in public rights-of-way and easements.
- e. Provide copies of land owner agreements for any offsite grading.
- f. Provide an AutoCAD file for AutoTurn and review of the site design.

END OF SECTION

**B. INFRASTRUCTURE PLAN REVIEW CHECKLIST**

THE FOLLOWING INFORMATION IS REQUIRED FOR ALL CONSTRUCTION DRAWINGS

1 paper & 1 digital copy of plans and calculations. Provide Autocad file upon plan approval.

**Initial Review Submittal**     **Revised Review Submittal**     **Final Approval Submittal**

- Construction plans: submitted on 24" x 36" sheets and include: an overall sheet for each section; sheet and page numbers; a legend showing line types and symbols; locations of all benchmarks and datums; appropriate sheet match lines; all referenced details; cross sections and pavement designs; separate sheets showing all easements, common spaces, and greenways; a separate storm drainage pipe schedule,
- Utility plans: all water, sewer, stormwater, and roadways shall be shown in plan and profile at a preferred scale of 1" = 20' horizontal with appropriate vertical scale; where feasible water and sewer is stationed along sanitary sewer, otherwise provide separate plan/profile, and stationing; label length of water mains and storm drainage pipes, label length and bearing of all sanitary sewer pipe; stormwater is referenced in the plan and profile with structures labeled; all utility clearances are labeled.

- RPZ's are to be located outdoors within 5' of the meter unless otherwise approved in advance in writing by the City's Director of Water Resources.

## END OF SECTION

### C. PUBLIC WATER AND SEWER MAIN EXTENSION REQUIREMENTS

All Water and Sewer Extensions to the City of Kannapolis systems shall be permitted through the North Carolina Department of Environmental Quality (NCDEQ) and shall be in accordance with The Standard Specifications for Wastewater Collection and Water Distribution for the Water and Sewer Authority of Cabarrus County (WSACC) and The City of Kannapolis Water & Sewer Standards and Policies.

- a. The below list should be considered as a guideline and should not be considered as a comprehensive list for all requirements of plan submittal.
  - i. NCDEQ & City forms to be completed after initial City Review.
  - ii. Permitted through NCDEQ (City to review prior to NCDEQ Submittal).
  - iii. Electronic Copy of plans will be required for WSACC flow acceptance.
  - iv. Design per City of Kannapolis Land Development Standards Manual and WSACC Standards—Standard Details can be obtained at [www.wsacc.org](http://www.wsacc.org) and [www.kannapolisnc.gov](http://www.kannapolisnc.gov).
  - v. Water Meters, Fire Hydrants, and Backflow devices per City Standards.
  - vi. All Fire Hydrants shall be public and connected to mains owned and operated by the City of Kannapolis.
  - vii. All Irrigation Lines shall be metered separately.
  - viii. All water mains that serve more than one structure shall be considered public and will be provided with an adequate easement to maintain the line. All multi-family developments shall be provided with a separate meter for each structure. Waterlines feeding these meters will be considered public.
  - ix. All water & sewer mains shall be required within the pavement section of all roads, regardless of public or private maintenance of the roads.
2. Water models shall be required for permitting and to verify sufficient flows and pressures for the proposed extension.
  - a. The following items shall be included as part of proposed water system model:
    - i. Summary of the flow test data used to create model.
    - ii. A schematic of the proposed system with all nodes and pipes clearly labeled.
    - iii. Model should show that average daily use plus minimum fire flow requirements will not drop the pressure below 20 psi anywhere in the system.

- iv. To simulate the existing system, the connection to the existing system should be modeled using a reservoir and pump. Pump curve should be based on fire hydrant flow data. Pump Report should be provided.
- v. Pipe summary table should be provided that includes the following:
  1. Pipe label, length and diameter.
  2. "C" factor (maximum allowable "C" factor = 120).
  3. Flow under average daily conditions.
  4. Hydraulic grade (upstream and downstream).
  5. Head loss per 1,000' of pipe.
- vi. Junction summary table should be provided that includes the following:
  1. Junction label, elevation and demand under average daily conditions.
  2. Static head and pressure.
  3. Residual head and pressure under average daily conditions.
- vii. Fire flow summary table should be provided that includes the following:
  1. Junction label.
  2. Available fire flow.
  3. Available total flow.
  4. Residual pressure at the fire flow node.
  5. Minimum system pressure junction.
  6. Minimum system pressure.

END OF SECTION

## D. PLAN NOTES

### Site Plan Sheet Notes:

1. The City of Kannapolis Land Development Standards Manual and NCDOT Standard Specifications are used for construction of the roadways, including the NCDOT SuperPave Manual.
2. Section 1018 of the NCDOT Standard Specifications will be used for the acceptance of borrow material being used for embankments backfill or other intended uses.
3. A 48-hr notice for scheduling is required for the proof roll. Please allow adequate time for the inspector to perform grade checks on the subgrade and ABC.
  - a. A proof roll will be performed prior to:

- i. Placement of curb and gutter.
  - ii. Placement of ABC.
  - iii. Placement of asphalt.
4. Aggregate Base Course shall be provided from approved sources as outlined in Section 1010 of the NCDOT Standard Specifications.
5. A Pre-Paving meeting will be required prior to any paving.
6. A NCDOT approved Job Mix Formula must be submitted for approval prior to paving.
7. Asphalt mixes and depths will adhere to the typical section for roadways approved in the construction drawings. Minimum depths unless otherwise noted will be 2 ½" of I 19.0C placed in one lift and 2" of S9.5C placed in two lifts. The first lift of S9.5C will be placed immediately on the I19.0C, and the second lift will be placed prior to acceptance of the road. Drainage will be required on the roadway during the transition of the two lifts of S9.5C.
8. A Pre-Pour meeting will be required prior to any concrete pours.
9. A NCDOT approved Mix Design must be submitted on a NCDOT form 312U prior to placing any concrete.
10. Refer to detail sheets for the proper installation requirements for storm piping using NCDOT Standard Drawing 300.01.
11. The contractor shall be required to submit a video of the storm system prior to acceptance of the system. In new subdivisions, 2 videos of the storm system shall be required. The first video is required to be performed prior to the first proof roll. The second video is required after the installation of dry utilities, but prior to acceptance of the streets by the City of Kannapolis.
12. Erosion Control Permit is required on-site during construction. NCDEQ will be inspecting the project for compliance with the erosion control plan if disturbing more than 1 ac City of Kannapolis Erosion Control Permit required for all construction disturbing less than 1 ac City will be inspecting the project for compliance with the erosion control plan.
13. The approved typical section includes a shoulder behind the curb and gutter on both sides of the roadway. The shoulder must be preserved during grading of adjacent properties.
14. Only street legal vehicles, legally loaded appropriately for the hauling vehicle, shall be used to transport construction materials on City streets.
15. Notify the City of any work being performed on the weekends. No work requiring testing or observation by the City will be permitted without written permission.
16. Noise Ordinance: 7:00am to 9:00pm – weekdays, 8:00am to 9:00pm weekends.

**Utility Plan Sheet Notes:**

1. All water main and sanitary sewer work shall be in accordance with the City of Kannapolis Land Development Standards Manual and standard specifications for wastewater collection and distribution for the Water and Sewer Authority of Cabarrus County (WSACC). Contractor shall have a copy of these specifications on-site at all times.

2. All existing water and sewer mains are owned and operated by the City of Kannapolis. The site inspector must be contacted at least 48 hrs prior to making any connection to the existing system.
3. Sanitary sewer laterals and water meter locations are approximate and are subject to relocation due to field locations. Under no circumstance will cleanouts and meters be located in driveways, sidewalks or under pavement of any type.
4. Water meters shall meet City of Kannapolis standards. Contractor is responsible for installing meter boxes and purchasing meters. Contractor shall coordinate with site inspector to have water meters delivered to the City of Kannapolis.
5. The developer will be responsible for paying applicable water and sewer connection fees before Zoning Clearance Permits are issued.
6. Contractor is fully responsible for contacting all appropriate parties assuring that utilities are located prior to commencement of construction. Call North Carolina 811 (1-800-632-4949) for utility locating services as required by law prior to commencement of any work. Contractor shall verify location and depth of all utilities prior to construction.
7. Contractor shall be responsible for sewer overflows that occur due to activities initiated by them and shall be responsible for, but not limited to, the costs associated with performing remedial work of/for environmental impacts and/or the paying of fines assessed by regulatory agencies and/or third-party claims.
8. Water & Sewer mains shall have a minimum cover of 36".
9. Bedding for PVC sewer mains and laterals should be WSACC Class B Bedding.
10. Unless otherwise noted, waterlines shall be PVC C900 for 6" - 12" diameter and PVC SDR 13.5 for 2" - 4" diameter per WSACC standards.
11. Unless otherwise noted, Sewer mains shall be PVC SDR 35 per WSACC standards.
12. Laterals shall have a No-Hub cap and stainless-steel No-Hub band at the clean out.
13. Ductile iron pipe shall be required for both water and sanitary sewer if the following clearances are not met:
  - a. Waterline crossing under sanitary sewer (for any clearance).
  - b. 18" vertical clearance for waterline installed above sewer line.
  - c. 10' horizontal separation for waterline parallel to sewer line (or 18" vertical separation in separate ditches).
  - d. For waterline, 18" clearance with storm drains.
  - e. For waterline, 12" clearance with gas mains, telephone ducts and underground cables.
  - f. For sanitary sewer, 18" clearance with storm drains.
  - g. Regardless of pipe material, a minimum 12" separation shall be required for water and sewer between other piping.
14. Initial connection to the existing water main shall be in accordance with the City of Kannapolis detail for a temporary by-pass connection for filling new water mains. The temporary jumper connection shall be removed and the waterline connected to the existing system only after the proposed

system has been pressure tested, chlorinated and accepted by the City of Kannapolis. No other connections will be allowed to the system until the proposed system has been accepted.

15. Notify the city of any work being performed on the weekends. No work requiring testing or observation by the city will be permitted without written permission.

16. Noise Ordinance: 7:00am to 9:00pm – Weekdays, 8:00am to 9:00pm Weekends.

## END OF SECTION

### E. ENCROACHMENT AGREEMENTS

1. Encroachment of any structures or landscaping, including, but not limited to, driveways, pools, fences, trees, wells, reservoirs, or other obstructions, which would interfere with free, easy, and clear access to utilities on any easement, are prohibited. However, certain structures, filling, or grading may be permitted upon execution of an express Encroachment Agreement. The City of Kannapolis may authorize an Encroachment Agreement, but only after review and approval of detailed plans.
2. In the event the City authorizes an Encroachment Agreement, obtaining the encroachment shall require the following:
  - a. A list of appurtenances being requested to encroach into the easement.
  - b. Provide a map of the encroachments with:
    - i. Site plan/map showing location of easements with the encroaching items (buildings, parking, utilities, etc.).
    - ii. Plat or deed book and page number that has the property and/or easement.
3. The Director of Engineering may impose additional and reasonable conditions upon the granting of any encroachment.
4. For Right-of-Way Extension/Service Permit, see Appendix A.

## END OF SECTION

### F. AS-BUILT REQUIREMENTS

Prior to Final Acceptance of the improvements, the Project Engineer shall submit to the Director of Engineering 1 certified copy of the “As-Built Record Drawings”, 1 digital pdf file, and 1 AutoCad file. “As Built Drawings” shall be tied to NAD 83 horizontal datum and to the NAVD 88 vertical datum. The Project Engineer shall provide all certifications that are required by the state for water and sewer improvements.

As-Built Drawings shall include the following:

1. **Site Impervious Area**
  - a. Verify and label the total impervious area of the site.
2. **Sanitary Sewer**
  - a. Elevations: Rim, Invert In (including inside drop), Invert Out.

- b. Linear Footage and type of pipe installed.
- c. Changes need to be reflected in plan and profile sheets.
- d. Permanent Easements shown (if applicable).
- e. Lateral Cleanouts shown in plan view.

### 3. **Water**

- a. Valve and Fitting locations.
- b. Fire Hydrant locations.
- c. Verify minimum cover over pipe in profile view.
- d. Verify type of pipe installed.
- e. Show restrained joint pipe (if applicable).
- f. Distances need to be shown in linear footage in plan view.
- g. Meters shown in plan view.

### 4. **Storm Drainage Conveyance Systems**

- a. Invert elevations (invert in and out).
- b. Rim elevations (junction boxes).
- c. Grate elevations (gutter line).
- d. Invert elevations on culverts (box and pipe).
- e. Flared End Sections elevation.
- f. Rip rap energy dissipation apron dimensions
- g. Linear footage of piping and type of pipe installed.
- h. Topographic survey of ditches.
- i. All dimensions shall be shown in plan and profile views.
- j. Update the pipe schedule.
- k. Revised calculations of as-built storm drainage conveyance systems with a statement from the Engineer of either in compliance or not in compliance with the approved design.
- l. Storm Drainage Conveyance System Certification.

### 5. **Stormwater Control Measures (SCM's)**

- a. Trash rack info.

- b. Method used to seal joints in pipes and wall openings.
- c. Type of sand (sand filters).
- d. Biomix material composition and infiltration rate (Bioretention).
- e. Channel Liner materials.
- f. Riser dimensions and elevations.
- g. Anti-floatation block dimensions.
- h. Stage storage chart for storage basins, forebays, detention areas, chambers, etc.
- i. Calculations verifying that the as-built design complies with design guidelines for the SCM and that the system provides the required detention storage and reduced runoff discharge rates.
- j. As-built topo verifying:
  - i. Location and Storage capacity of SCM.
  - ii. Access easement locations and grades.
  - iii. Basin side slopes (interior and exterior), top of embankment widths.
  - iv. Riser/Spillway elevations and widths.
  - v. Location of drainage features.
  - vi. Location/outline of underground filter systems.
  - vii. Pipe inverts, pipe size, and pipe materials.
  - viii. Underdrain inverts, cleanout inverts, underdrain pipe size and materials.
  - ix. Thickness of energy dissipation aprons and filters.
  - x. Filter fabric materials used.
  - xi. Orifice/weir inverts and dimensions.
  - xii. Bottom drain gate size/type and critical elevations (invert and top of valve stem).
- k. Planted Material Certifications.
- l. Any data needed to document the compliance with the NCDEQ Minimum Design Criteria for the SCM.
- m. Revised calculations of as-built facilities.
- n. SCM Certification.

**6. Streets**

- a. Road profile.

- b. Radius points.
- c. Curb elevations.

END OF SECTION

### G. Certifications

Certification forms for Stormwater As-Builts, Retaining Walls, Bridges, and Stormwater Control Measures can be found in Appendix A.

END OF SECTION

## CHAPTER 6 REFERENCES

1. American Association of State Highway and Transportation Officials most recent edition, A Policy on Geometric Design of Highways and Streets
2. Charlotte-Mecklenburg SCM Design Manual
3. Charlotte-Mecklenburg Wastewater Pump Stations
4. City of Charlotte Storm Water Services-Mecklenburg County Storm Water Services, Charlotte-Mecklenburg Storm Water Design Manual
5. City of Charlotte – Charlotte Water’s Design Manual
6. Contech – CMP Design Guide, 2017
7. Federal Highway Administration, Manual on Uniform Traffic Control Devices (MUTCD)
8. International Fire Code
9. Massachusetts Highways – Shared Use Paths and Greenways
10. Mecklenburg County Greenways – General Planning and Design Guidelines
11. National Association of City Transportation Officials, Urban Bikeway Design Guide
12. National Bridge Inspection Standards – Code of Federal Regulations
13. North Carolina Building Code
14. North Carolina Department of Environmental Quality, Minimum Design Criteria for the Permitting of Pump Stations and Force Mains
15. North Carolina Department of Environmental Quality, Stormwater Control Measures
16. North Carolina Department of Environment and Natural Resources, Erosion and Sediment Control Planning and Design Manual
17. North Carolina Department of Transportation, Asphalt Quality Management System Manual
18. North Carolina Department of Transportation, Complete Streets Planning and Design Guidelines
19. North Carolina Department of Transportation, Greenway Design Guidelines
20. North Carolina Department of Transportation, Policy on Street and Driveway Access
21. North Carolina Department of Transportation, Roadway Design Manual
22. North Carolina Department of Transportation, Roadway Standards Drawings

23. North Carolina Department of Transportation, Standard Specifications for Roads and Structures
24. Raleigh – Capital Area Greenway Planning and Design Guide
25. Raleigh Street Design Manual
26. Roundabouts: An Informational Guide (FHWA Publication No. RD-00-067)
27. Water and Sewer Authority of Cabarrus County (WSACC)

END OF SECTION

## Chapter 7 STANDARD DRAWINGS

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409	ACCESSIBLE PARKING & SIGNAGE STANDARDS
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414	DUMPSTER ENCLOSURE
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## B. DRAWINGS

The Kannapolis Standard Drawings shown are to be used for design and construction for projects in the City of Kannapolis. For construction activities not shown by Kannapolis Standard Drawings, NCDOT Standard Drawings shall be used.

## APPENDIX A

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TABLE A1 – STANDARDS OF STREET DESIGN

Street Type Average Daily Traffic (ADT)	Alley 100	Local 250	Collector 3000 Major 1000 Minor	Thoroughfare 8000 Major 4000 Minor
<b>Longitudinal Grade</b> Min Max: level/rolling hilly (stop/yield) at intersection (thru movement) at intersection Within 100' of an intersection	1%	1%	1%	See Thoroughfare Plan
	10 %	10 %	8 %	
	10 %	10 %	10 %	
	5 %	2 %	2 %	
	5 %	5 %	5 %	
<b>Min Horizontal Centerline Curve Radius</b>		150'	230'	
<b>Min Tangent between Reverse Curves</b>		50'	100'	
<b>Street Intersection Radius<sup>(6)</sup></b>	20'	30'		
<b>Design Speed</b> Min Max	15 mph	25 mph	25 mph	
	15 mph	35 mph	35 mph	
<b>Design Vehicle</b>  Residential Non-Residential	SU-30	SU-30		WB-62
			Bus-45 & SU-30	
			WB-62 or WB-40	
<b>Separation <sup>(1)(2)(3)</sup></b> driveway - driveway driveway - intersection driveway - residential prop. line driveway - non-residential prop. line intersection - intersection	40'	40'	120'	400'
	25'	60'	120'	250'
	5'	5'	5'	5'
	10'	10'	10'	10'
	N/A	200'	200'	600'-1000'
<b>Pavement Schedule <sup>(4)(5)</sup></b>  surface course (S9.5C) intermediate course (I19.0C) base course (residential) base course (non-residential)	2"	2-1" Lifts	2-1" Lifts	See NCDOT Roadway Design Standards
	0"	2.5"	2.5"	
	8" ABC or 4" B25.0C			
	N/A	10" ABC or 5" B25.0C		
<b>Dead-End Fire Apparatus Access Roads</b>  Length Width Vertical clearance Maximum grade  Turnaround required	0-150'	150'-500'	500'-750'	750'+
	20'	20'	26'	Special Approval Required
	13.5'	13.5'	13.5'	
	10 %	10 %	10 %	
	None	60' "Y" 96' ø Cul-De-Sac 120' Hammerhead (Temporary)		
<b>Max Cul-de-sac Lengths</b>  Zoning	RM-1, RM-2, RV	AG, RE, RL	CD, I-1, I-2	B-1, O-1, C-1, C-2, PUD
	800'	1000'	1500'	500'
	RC, CC			
	300'			

Notes:

1. Single-family dwellings and duplex dwellings on individual lots shall be exempt from the minimum separation between driveways as shown in the table above. However, such driveways shall maintain a minimum of 5' of side clearance from residential property lines and 10' for all others.
2. City streets: proposed streets which intersect opposite sides of another street (either existing or proposed) shall be laid out to intersect directly opposite each other. Intersections which cannot be aligned shall be separated by a minimum length of **200'** between survey centerlines.
3. For state-maintained streets, reference the NCDOT Policy on Street and Driveway Access to North Carolina Highways.
4. Non-residential street pavement design shall be evaluated on a case-by-case basis.
5. Prior to substituting B25.0C, approval shall be obtained from the Public Works Director.
6. Radius measured from edge of pavement.

**TABLE A2 – STOPPING SIGHT DISTANCE**

<b>MINIMUM STOPPING SIGHT DISTANCE (ft)</b>							
<b>Vehicle Speed (mph)</b>	<b>UPGRADES</b>			<b>FLAT</b>	<b>DOWNGRADES</b>		
	9 %	6 %	3 %	0 %	-3 %	-6 %	-9 %
25	140	145	150	155	160	165	175
30	180	185	200	200	205	215	230
35	225	230	240	250	260	275	290
40	270	280	290	305	315	335	355
45	320	330	345	360	380	400	430
50	375	390	405	425	450	475	510

**TABLE A3 – DESIGN INTERSECTION SIGHT DISTANCE, LEFT TURN FROM STOP**

<b>Design Speed (mph)</b>	<b>Stopping Sight Distance (ft)</b>	<b>Intersection Sight Distance for Passenger Cars</b>	
		Calculated (ft)	Design (ft)
15	80	165.4	170
20	110	220.5	225
25	155	275.6	280
30	200	330.8	335
35	250	385.9	390
40	305	441.0	445
45	360	496.1	500
50	425	551.3	555

TABLE A4 – GREENWAY MINIMUM STOPPING SIGHT DISTANCE

A	English Units - Minimum Length of Crest Vertical Curve (L) Based on Stopping Sight Distance														
	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300
2												30	70	110	150
3								20	60	110	140	180	220	260	300
4						15	55	95	135	175	215	256	300	348	400
5					20	60	100	140	180	222	269	320	376	436	500
6				10	50	90	130	171	216	267	323	384	451	523	600
7				31	71	111	152	199	252	311	376	448	526	610	700
8			8	48	88	128	174	228	288	356	430	512	601	697	800
9			20	60	100	144	196	256	324	400	484	576	676	784	900
10			30	70	111	160	218	284	360	444	539	640	751	871	1000
11			38	78	122	176	240	313	396	489	592	704	826	958	1100
12		5	45	85	133	192	261	341	432	533	645	768	901	1045	1200

1. When  $S > L = 2S - 900/A$       Shaded area represents  $S = L$

2. When  $S < L = AS^2/900$

L = Minimum Length of Vertical Curve (ft)

A = Algebraic Grade Difference (%)

S = Stopping Sight Distance (ft)

Height of Cyclist's Eye = 4.5'

Height of Object = 0'

Minimum Length of Vertical Curve = 3'

Source: AASHTO, Guide for the Development of Bicycle Facilities

TABLE A5 – SANITARY SEWER PIPE SIZING & MATERIAL

Material	Pipe Diameter (in)
Solid wall ASTM D3034, SDR 35, Cell Classification 12454	4 - 15
Profile wall ASTM F794 Stiffness PS46	18 - 48
Ductile Iron Pipe (DIP) Class 50	All Sizes

TABLE A6 – WATER DISTRIBUTION PIPE SIZING & MATERIAL

Material	Pipe Diameter (in)
PVC SDR 13.5	2 - 4
PVC C900	6 - 12
Ductile Iron Pipe (DIP) Class 350	3 - 12
Ductile Iron Pipe (DIP) Class 250	16 +

TABLE A7 – MANDREL DIMENSIONS

Pipe Type	Pipe Diameter	Minimum Inside Diameter	Inside Diameter with 5% Deflection
Dual Wall	15"	14.85	14.11
	18"	17.93	17.03
	24"	23.90	22.71
	30"	29.89	28.30
Triple Wall	30"	29.62	28.14
	36"	35.40	33.63
	42"	41.31	39.24
	48"	47.31	44.94
	60"	59.30	56.34

TABLE A8 – MAXIMUM COVER FOR POLYPROPYLENE PIPE

Diameter	Class 1	Class 2			Class 3		Class 4
	Compacted	95%	90%	85%	95%	90%	95%
12"	39	27	20	9	21	12	11
15"	42	29	21	10	22	12	11
18"	36	25	18	9	19	12	11
24"	31	22	16	7	16	11	10
30"	33	23	17	9	17	11	10
36"	32	22	16	7	16	11	10
42"	32	22	15	7	16	11	10
48"	31	21	15	6	15	10	9
60"	34	23	16	6	16	11	10

TABLE A9 CASING PIPE SIZES

Pipe Diameter	HIGHWAY		RAILROAD	
	Casing O.D.	Min. Wall Thickness	Casing O.D.	Min. Wall Thickness
6"	12.75"	0.188"	12.75"	0.250"
8"	18"	0.250"	18"	0.312"
12"	24"	0.250"	24"	0.406"
16"	30"	0.312"	30"	0.500"
24"	36"	0.375"	36"	0.5625"

**TABLE A10 – AIR TEST TABLE**

<b>Length of Line (ft)</b>	<b>4</b>	<b>6</b>	<b>8</b>	<b>10</b>	<b>12</b>	<b>15</b>	<b>18</b>	<b>21</b>	<b>24</b>
<b>25</b>	0:04	0:10	0:18	0:28	0:40	1:02	1:29	2:01	2:38
<b>50</b>	0:09	0:20	0:35	0:55	1:19	2:04	2:58	4:03	5:17
<b>75</b>	0:13	0:30	0:53	1:23	1:59	3:06	4:27	6:04	7:55
<b>100</b>	0:18	0:40	1:10	1:50	2:38	4:08	5:56	8:05	10:34
<b>125</b>	0:22	0:50	1:28	2:18	3:18	5:09	7:26	9:55	11:20
<b>150</b>	0:26	0:59	1:46	2:45	3:58	6:11	8:30	9:55	11:20
<b>175</b>	0:31	1:09	2:03	3:13	4:37	7:05	8:30	9:55	11:20
<b>200</b>	0:35	1:19	2:21	3:40	5:17	7:05	8:30	9:55	11:20
<b>225</b>	0:40	1:29	2:38	4:08	5:40	7:05	8:30	10:25	13:36
<b>250</b>	0:44	1:39	2:56	4:35	5:40	7:05	8:31	11:35	15:07
<b>275</b>	0:48	1:49	3:14	4:43	5:40	7:05	9:21	12:44	16:38
<b>300</b>	0:53	1:59	3:31	4:43	5:40	7:05	10:12	13:53	18:09
<b>350</b>	1:02	2:19	3:47	4:43	5:40	8:16	11:54	16:12	21:10
<b>400</b>	1:10	2:38	3:47	4:43	6:03	9:27	13:36	18:31	24:12
<b>450</b>	1:19	2:50	3:47	4:43	6:48	10:38	15:19	20:50	27:13
<b>500</b>	1:28	2:50	3:47	5:15	7:34	11:49	17:01	23:09	30:14

Note: If the length of sewer to be tested is submerged or partially submerged in groundwater, the test pressure shall be increased as required to overcome the actual static pressure exerted by the groundwater. If a test pressure greater than 8 psi results, air testing shall not be used and exfiltration testing will be required.

TABLE A11 – UTILITY EASEMENT WIDTH CHART

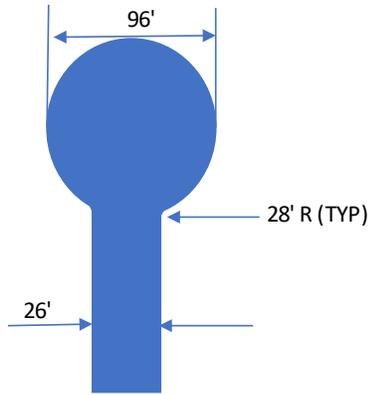
SEWER MAIN PIPE								
Diameter (in)	Diameter (ft)	Min. Bottom Width (ft)	Max. depth to bottom of pipe @ Esmt Width (ft)					
			20'	25'	30'	35'	40'	45'
8	0.67	2.67	8.67	11.17	13.67	16.17	18.67	21.17
12	1.00	3.00	8.50	11.00	13.50	16.00	18.50	21.00
16	1.33	3.33	8.33	10.83	13.33	15.83	18.33	20.83
24	2.00	4.00	8.00	10.50	13.00	15.50	18.00	20.50

\* - Depth beyond those shown on this chart shall require additional easement width to the nearest 5' increment.

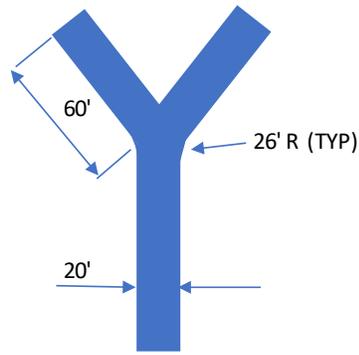
STORM PIPE									
Pipe Inner Diameter (in)	Wall Thickness (in)	Pipe Outer Diameter (ft)	Min. Bottom Width (ft)	Max. depth to bottom of pipe @ Esmt Width (ft.)					
				20'	25'	30'	35'	40'	50'
15	2.25	1.63	3.63	8.19	10.69	13.19	15.69	18.19	20.91
18	2.50	1.92	3.92	8.04	10.54	13.04	15.54	18.04	20.98
24	3.00	2.50	4.50	7.75	10.25	12.75	15.25	17.75	21.13
30	3.50	3.08	5.08	7.46	9.96	12.46	14.96	17.46	21.27
36	4.00	3.67	5.67	7.17	9.67	12.17	14.67	17.17	21.42
42	4.50	4.25	6.25	6.88	9.38	11.88	14.38	16.88	21.56
48	5.00	4.83	6.83	6.58	9.08	11.58	14.08	16.58	21.71
54	6.25	5.54	7.54	6.23	8.73	11.23	13.73	16.23	21.89
60	6.75	6.13	8.13	5.94	8.44	10.94	13.44	15.94	22.03
66	7.25	6.71	8.71	5.65	8.15	10.65	13.15	15.65	22.18
72	7.00	7.17	9.17	5.42	7.92	10.42	12.92	15.42	22.29

\* - Depth beyond those shown on this chart shall require additional easement width to the nearest 5' increment.

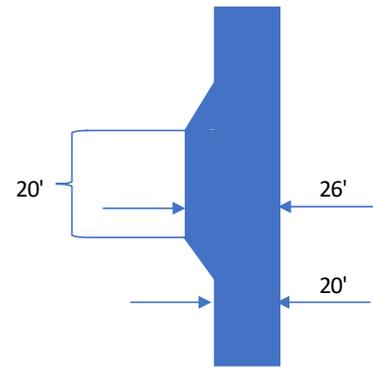
DIAGRAM A20 – DEAD-END FIRE APPARATUS ACCESS ROAD TURNAROUND



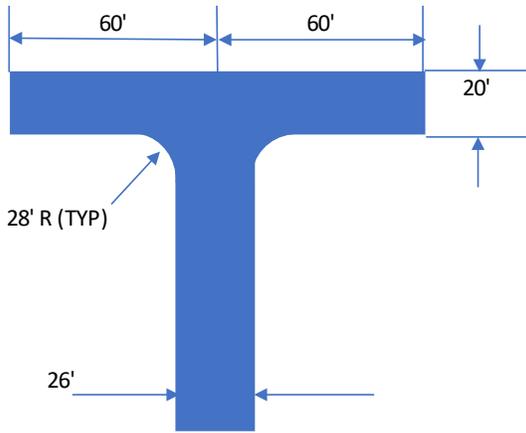
96' Diameter  
Cul-De-Sac



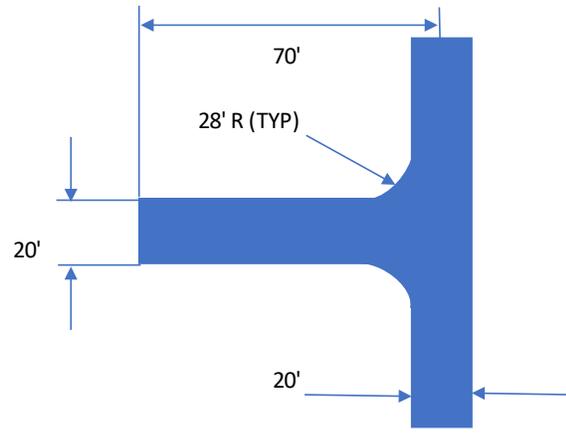
60' "Y"



Minimum Clearance  
Around a Fire Hyd.

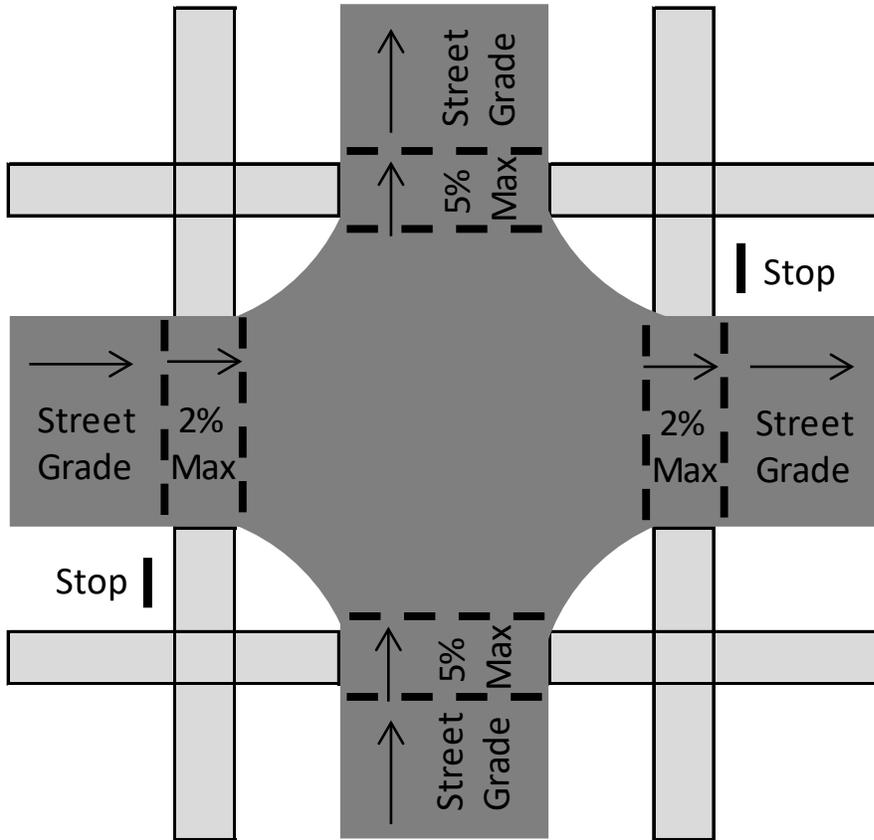


120' Hammerhead

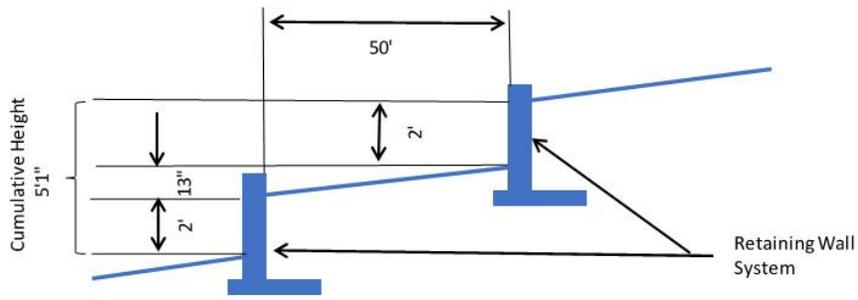


Acceptable Alternative  
to 120' Hammerhead

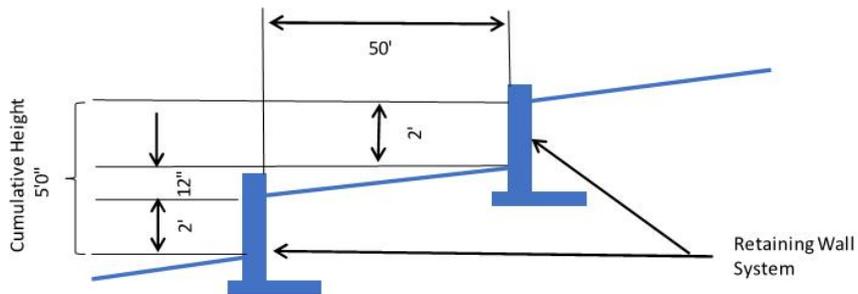
DIAGRAM A21 – INTERSECTION GRADES



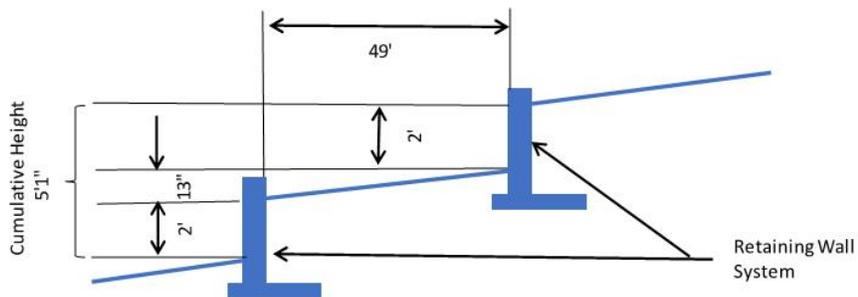
# DIAGRAM A22 – RETAINING WALLS



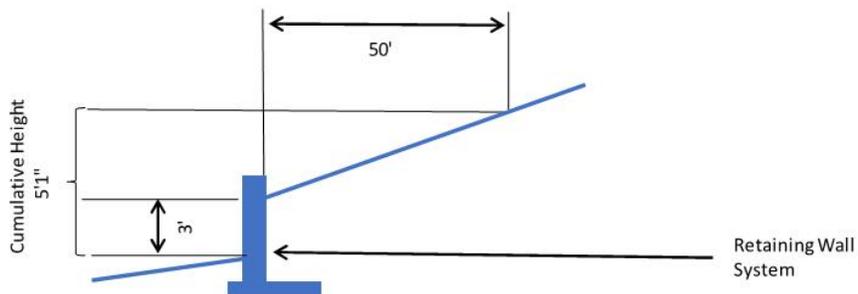
Example - A  
Design Professional Required



Example - B  
Design Professional Not Required



Example - C  
Design Professional Required



Example - D  
Design Professional Required

# STORM DRAINAGE CONVEYANCE SYSTEM CERTIFICATION

## As-Built Certification

I, \_\_\_\_\_, attest that this certification, for the \_\_\_\_\_ Project, has been reviewed by me and is accurate, complete and consistent with the information supplied in the plans, specifications, engineering calculations, and all other supporting documentation to the best of my knowledge. I further attest that to the best of my knowledge the Storm Drainage As-Built Plans have been prepared based on an accurate account of the stormwater piping and appurtenances installed during construction and any deviations from the approved construction plans shall not adversely impact the drainage system, discharge points, and/or adjacent properties analyzed during the approval process of the construction plans. Although other professionals may have developed certain portions of this submittal package, inclusion of these materials under my signature and seal signifies that I have reviewed this material and have judged it to be consistent with the proposed design.

SEAL:

\_\_\_\_\_  
(Date)

\_\_\_\_\_  
(Signature)

Engineer:  
Firm:  
Firm License #:  
Address:

## STORMWATER CONTROL MEASURE (SCM) CERTIFICATION

### As-Built Certification

I, \_\_\_\_\_, attest that this certification, for the \_\_\_\_\_ Project, has been reviewed by me and is accurate, complete and consistent with the information supplied in the plans, specifications, engineering calculations, and all other supporting documentation to the best of my knowledge. I further attest that to the best of my knowledge the As-Built Plans have been prepared based on an accurate account of the SCM and appurtenances installed during construction and any deviations from the approved construction plans were analyzed and verified to not adversely impact the performance of the SCM during the approval process of the construction plans. Although other professionals may have developed certain portions of this submittal package, inclusion of these materials under my signature and seal signifies that I have reviewed this material and have judged it to be consistent with the proposed design.

SEAL:

\_\_\_\_\_  
(Date)

\_\_\_\_\_  
(Signature)

Engineer:  
Firm:  
Firm License #:  
Address:

## RETAINING WALL CERTIFICATION

### As-Built Certification

I, \_\_\_\_\_, attest that this certification, for the \_\_\_\_\_ Project, has been reviewed by me and is accurate, complete and consistent with the information supplied in the plans, specifications, engineering calculations, and all other supporting documentation to the best of my knowledge. I further attest that to the best of my knowledge the As-Built Plans have been prepared based on an accurate account of the retaining wall system and appurtenances installed during construction and any deviations from the approved construction plans were analyzed and verified to not adversely impact the performance of the wall system analyzed during the approval process of the construction plans. Although other professionals may have developed certain portions of this submittal package, inclusion of these materials under my signature and seal signifies that I have reviewed this material and have judged it to be consistent with the proposed design.

SEAL:

\_\_\_\_\_  
(Date)

\_\_\_\_\_  
(Signature)

Engineer:  
Firm:  
Firm License #:  
Address:

## BRIDGE CERTIFICATION

### As-Built Certification

I, \_\_\_\_\_, attest that this certification, for the \_\_\_\_\_ Project, has been reviewed by me and is accurate, complete and consistent with the information supplied in the plans, specifications, engineering calculations, and all other supporting documentation to the best of my knowledge. I further attest that to the best of my knowledge the As-Built Plans have been prepared based on an accurate account of the bridge and appurtenances installed during construction and any deviations from the approved construction plans were analyzed and verified to not adversely impact the performance of the bridge analyzed during the approval process of the construction plans. Although other professionals may have developed certain portions of this submittal package, inclusion of these materials under my signature and seal signifies that I have reviewed this material and have judged it to be consistent with the proposed design.

SEAL:

\_\_\_\_\_  
(Date)

\_\_\_\_\_  
(Signature)

Engineer:  
Firm:  
Firm License #:  
Address:

# EROSION CONTROL PERMIT APPLICATION

## Applicant Contact Information

Name: \_\_\_\_\_

Phone: \_\_\_\_\_

## Project Information

Type of Construction: (Residential/Commercial): \_\_\_\_\_

Address: \_\_\_\_\_

Parcel & Lot #: \_\_\_\_\_

Disturbed Area (ac): \_\_\_\_\_

Date of land disturbing activity: \_\_\_\_\_

## Applicant agrees to the following items:

1. Call One-Call before digging 811 or 1-800-351-1111 and allow 3 business days before digging.
2. Install and maintain in proper working order, erosion control measures as needed to prevent sedimentation from leaving the construction site.
3. Remove any sediment and or aggregate discharged onto streets immediately.

\_\_\_\_\_  
Applicant Signature Date

# RESIDENTIAL DRIVEWAY ACCESS PERMIT APPLICATION

## Applicant Contact Information

Name: \_\_\_\_\_

Phone: \_\_\_\_\_

## Project Information

Address: \_\_\_\_\_

Contractor Name: \_\_\_\_\_

### Applicant agrees to the following items:

1. Notify the Engineering Department 2 business days in advance of when the work is to begin at 704-920-4221. Pipe and subgrade to be inspected prior to backfill & material placement.
2. Construct and maintain driveway(s) in absolute conformance with the current "Policy on Street and Driveway Access" as adopted by the City of Kannapolis.
3. Provide proper signs, traffic control and other warning devices for the protection of traffic in conformance with the current "Manual on Uniform Traffic Control Devices for Streets and Highways" .
4. Indemnify and save harmless the City of Kannapolis from all damages and claims for damage that may arise by reason of this construction.
5. Contact the City of Kannapolis to find out the required size of RCP pipe that must be installed.
6. Construct a 6" thick driveway between 12' - 20' in width within the right-of-way.

\_\_\_\_\_  
Applicant Signature

\_\_\_\_\_  
Date



**Right-of-Way Extension/Service  
Permit Application**

Provide the following information for the construction of facilities in the right-of-way:

Owner/Operator of Proposed Line: \_\_\_\_\_

Contact Representative & Position: \_\_\_\_\_

Address: \_\_\_\_\_

Phone: \_\_\_\_\_ Email: \_\_\_\_\_

Contractor of Proposed Line: \_\_\_\_\_

Address: \_\_\_\_\_

Phone: \_\_\_\_\_ Email: \_\_\_\_\_

Representative & Position: \_\_\_\_\_

Sub-Contractor of Proposed Line: \_\_\_\_\_

Address: \_\_\_\_\_

Phone: \_\_\_\_\_ Email: \_\_\_\_\_

Representative & Position: \_\_\_\_\_

List Additional Sub-Contractors and Their Information on Back of Page.

List All Road Rights-of-Way (City and NCDOT) and/or City Easements Where Installation/Construction is Proposed:

\_\_\_\_\_  
\_\_\_\_\_

Type of Utility/Extension Service: \_\_\_\_\_

Diameters	Materials	Length of Pipe



## APPENDIX B

### APPROVED PRODUCTS LIST FOR WATER MAIN MATERIALS

#### Pipe

2" – 4" PVC, SDR 13.5, Class 315

6" – 12" PVC, C-900, DR 14, Class 200

3" – 12" DIP, Class 350

16" DIP +, Class 250

¾" – 2" Water Service, Type K Copper

#### Saddles

2" pipe

- Dresser #194
- Ford S-70 Hinged
- McDonald 3891
- Mueller 13000 series

6" pipe and larger

- Mueller DR2S
- Ford FCD202
- Smith Blair 317
- Romac 202NS
- McDonald 4855A

#### Tapping Sleeves

New Branch line equal diameter as existing main

- Mueller H-615
- American Flow Control Series 2800

New Branch line smaller than existing main.

- Mueller H-304
- Romac SST

#### Corporation Stop

- Mueller B-25008N
- Ford FB1000-XX-Q-NL
- McDonald 74701BQ

## 1" Tee

- Mueller H-15381N
- Ford T444-XXX-Q-NL
- McDonald 74760Q

## 1" Ball Valve

- Mueller B-25209N
- Ford B44-XXXW-Q-NL
- McDonald 76100WQ

## Reducer

- Mueller H-15403N
- Ford C44-XX-Q-NL
- McDonald 74758Q

## Meter Stop

- Mueller B-24273N
- Ford BA94-XXXW-Q-NL
- McDonald 74642BYQWW

## Expansion Handwheel

- Mueller H-14234
- McDonald 714-2EHG
- McDonald 714-4EHG
- Ford ECL-XX-NL

## Yoke

- Mueller H-5020
- Ford Y502
- McDonald 14-2
- Mueller H-5040
- Ford Y504

## Straight Check Valve

- Mueller H-14247N
- Ford HS91-XXX-NL
- McDonald 711-3

## 1.5"- 2" Coppersetter

- Ford 70 Series
- Mueller B-2423-2N

## Valve Boxes

- Star Pipe Products — VB-0003
- Pro Select — PSVB461AW
- Sigma Corporation — VB-461

## Water Meter Box

TriCast 1118 Kannapolis with locking lid

- 3/4" – 1" meters

2'x3'x31" concrete meter box & lid

- 1-1/2" — 2" meters

84"x72"x72" concrete meter box

- 3" - 4" meter
- Bilco JD-AL H-20 aluminum Double Leaf Access Door
- Halliday Products Series H2C

84"x96"x72" concrete meter box

- 6" meter
- Bilco JD-AL H20 - aluminum Double Leaf Access Door
- Halliday Products Series H2C

## Irrigation Box

Southeastern MB-9 with #106 Lid

## Meters

All meter sizes should supply the V4 TTL.

- 3/4" - Hersey Bronze Body RDM Meter 5/8" x 3/4" with NICOR connector and MI. Node 4 AMI module with NICOR Connector
- 1" - Hersey 452 PD meter with NICOR connector and MI. Node 4 AMI module with NICOR Connector
- 1-1/2" - Hersey 562 Bronze body meter with NICOR connector and MI. Node 4 AMI module with NICOR Connector
- 2" - Hersey 572 Bronze body meter with NICOR connector and MI. Node 4 AMI module with NICOR Connector
- 3" - Hersey MVR350 Magnetic Vertical Turbine Meter with NICOR connector and MI Node 4 AMI module with NICOR connector
- 4" - Hersey MVR650 Magnetic Vertical Turbine Meter with NICOR connector and MI Node 4 AMI module with NICOR connector
- 6" - Hersey MVR1300 Magnetic Vertical Turbine Meter with NICOR connector and MI Node 4 AMI module with NICOR connector

## Fire Hydrants

- Mueller — Super Centurion 200
- American Darling — 5-1/4" B-84-B-5
- American AVK — Series 2780
- Clow — Medallion F-2545
- American Darling — 6' B-84-B-5

## Resilient Seated Gate Valves

- Mueller — A-2362 RWGV
- Clow — C-509
- Kennedy — C-509
- American Flow Control — Series 2500

## 3/4"- 2" Reduced Pressure Principle Assembly (RP)

- Zurn Wilkins 975XL2
- Zurn Wilkins 375XL
- Annes LF4000B
- Conbraco 4ALF-200
- Febco LF860
- Hersey FRP 2
- Watts LF009

## 3"-10" Reduced Pressure Detector Assembly (RPDA)

- Zurn Wilkins 375DA / 375AST
- Zurn Wilkins 475DA
- Annes SOOOSS
- Conbraco 4ANLF-700LBF
- Febco LF866
- Febco LF866V
- Hersey 6CM
- Watts 909RPDA

## 3/4"-2" Double Check Valve Assembly (DCVA)

- Zurn Wilkins 950XL
- Ames LF2000B
- Conbraco 4ALF-100
- Febco LF850
- Hersey FDC
- Watts LF007

### 3"-10" Double Check Detector Assembly (DCDA)

- Zurn Wilkins 450DA / 450STDA
- Zurn Wilkins 350DA / 350ASTDA
- Ames 3000SS
- Conbraco 4ALF-600 LBF (3"-8")
- Conbraco 4S-600 (10")
- Febco LF856
- Febco LF876V
- Hersey DDC2
- Watts 709DCDA

### Hot Boxes

- BF Products 232-APD
- BF Products 322-APD
- BF Products 56N-APD
- BF Products 65-APD
- BF Products 78 APD
- BF Products 98 APD

### Air Release Valves

- APCO 200A
- GA Industries Series 920
- Miltiplex Crispin PL series

### Combination Air and Vacuum Valve

- APCO 140C
- Multiplex Crispin Universal Air Release Valves UL series

### Wedge Action Retainer Glands

Approved for 350-psi through 12" and 250-psi through 48". UL/FM approved through 12". All retainer glands shall be epoxy coated or polyester powder coated.

- EBAA – Mega-Lug
- Romac – RomaGrip
- Sigma – One Lok Model SLDE
- SIP – EZ-Grip
- Star – Stargrip
- Tyler Union – TUF Grip TLD

### Wide Range Restrained Fitting

Approved for 350-psi through 12". Coupling/End Cap/Flanged Coupling

- Romac - ALPHA

Approved for 350-psi through 16". Coupling/End Cap/Flanged Coupling

- Krausz USA – Hymax Grip

## Sampling Stations

Approved for 200 psi. All piping shall be stainless steel.

- Kupferle – Eclipse #88-SS

## Transition Coupling

Approved for 250 psi. AWWA C219 NSF 61  
Utilize stainless steel fasteners.

Connections between AC and PVC or DIP shall use:

- Romac – Macro HP
- Ford – FC2W
- Krausz – Hymax Coupling 2
- Smith Blair – Quantum or 421/422

Connections between PVC or DIP shall use:

- Romac – Macro HP
- Krausz – Hymax or Hymax Grip (rest.) 890
- Smith Blair – Quantum
- JCM – Model 242, Optimum Range
- Ford – FC2W

Approved for 250 psi. AWWA C219 NSF 61  
Utilize stainless steel fasteners.

- Romac – XR-501 or Macro HP or ALPHA (ALPHA connections between Cast Iron, PVC or DIP only)
- Ford – FC2W
- Krausz – Hymax or Hymax Grip
- Smith Blair – Quantum or 421/422

\* - Or approved equals per the Director of Engineering or his/her designee.

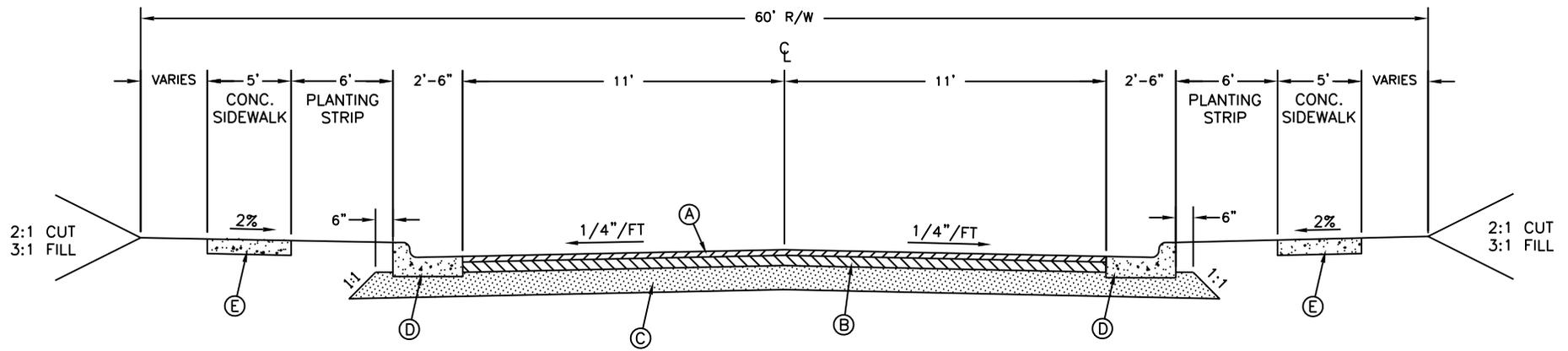
END OF SECTION

# ERRATTA

A. October 13, 2020

1. Throughout LDSM: changed “Public Works Director” to “Director of Engineering”.
2. p. 2-6, Table A-1, p. 2-7 note C.3, p. 5-1 note 2.c, and Appendix A Table A-1: changed maximum longitudinal roadway grade from 12% to 10% to concur with NC Fire Code.
3. p. 2-11, Section I Street Lighting: updated section to reflect new approval procedure and incorporate LED technology.
4. p. 3-1, Stormwater Permit Table: added “Low Density” and “High Density” to Water Quality column for clarification.
5. p. 4-1, note 7: deleted “Public Works Director”.
6. p. 4-4, changed leakage equation to  $Q = 0.0068 \text{ DLN}$  to meet current AWWA standards.
7. p. 5-2, added “Inlet capacity analysis”.
8. p. 5-2, added “Stormwater conveyance (pipes, ditches, channels)”
9. p. 5-4, note 9.b.ii: added “Provide sufficient plan information (details/notes) to demonstrate intention to control erosion and prevent sedimentation from leaving the site”.
10. p. 5-11, changed to “Storm Drainage Conveyance Systems”
11. p. 5-11, note F.3.c: changed to “Verify minimum cover over pipe in profile view”.
12. p. 5-11, added note F.4.f: “Rip rap energy dissipation apron dimensions.”
13. P. 5-12, added note F.4.l: “Storm Drainage Conveyance System Certification.
14. p. 5-12, changed to “Topographic survey of ditches”.
15. p. 5-12, added “Revised calculations of as-built facilities with a statement from the Engineer of either in compliance or not in compliance with the approved design.
16. Added details 345A and 345B “Water Quality Sampling Station”
17. Revised detail 304 “Relation of Water and Sewer Mains”
18. pp. 4-8 – 4-16, added notes to “Wastewater Pump Stations” and “Force Mains”.
19. p. 5-5, added RPZ note to “Infrastructure Plan Review Checklist”.
20. Throughout Appendix B: added approved products
21. Added detail 104A “Residential Hammerhead”
22. Added detail 107A “Typical Section Gravel Road Access”

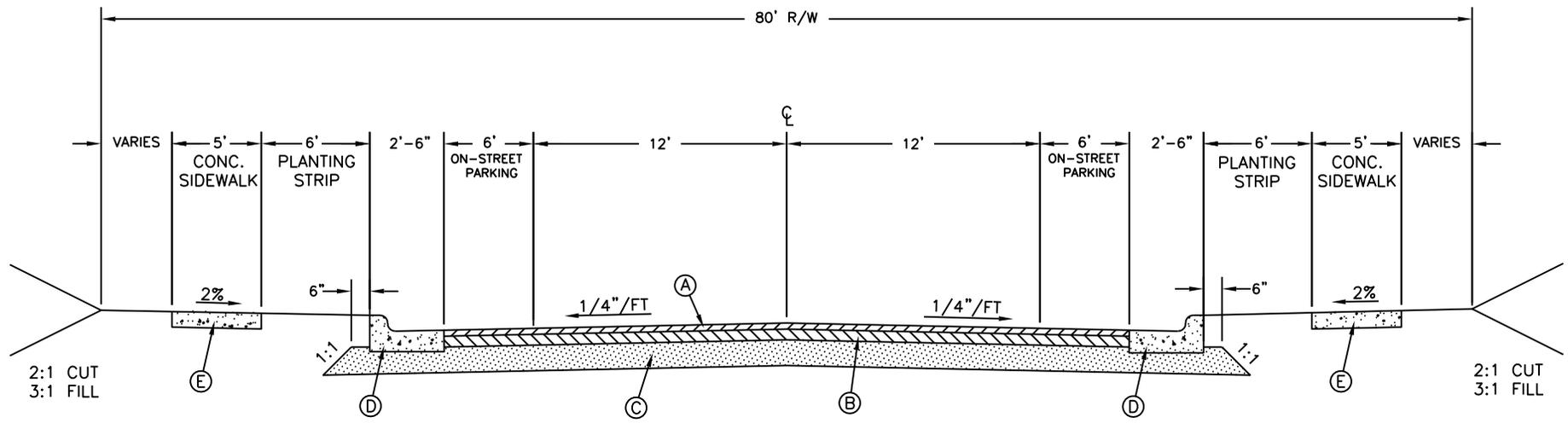
23. Added detail 415 "Typical CK Rider Bus Stop Detail"
24. Added detail 416 "Stub Street Sign Detail"
25. Updated Chapter 7 detail index



PAVEMENT SCHEDULE

- A. 2" S9.5B SURFACE COURSE (PLACED IN 2 - 1" LIFTS)
- B. 2.5" I19.0C INTERMEDIATE COURSE
- C. 8" AGGREGATE BASE COURSE (w/5.5" UNDER CURB)  
OR 4" B25.0C BASE COURSE (w/4" UNDER CURB)
- D. 2'-6" CURB & GUTTER (2'-0" VALLEY GUTTER MAY BE USED WITH PRIOR APPROVAL)
- E. 4" CONCRETE SIDEWALK

NOT TO SCALE



PAVEMENT SCHEDULE

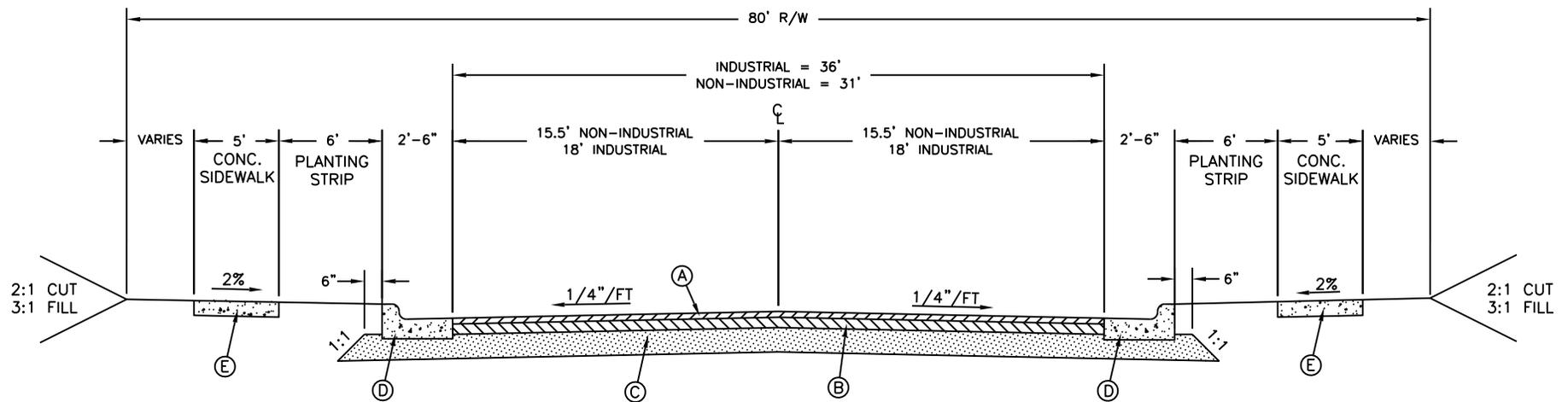
- A. 2" S9.5B SURFACE COURSE (PLACED IN 2 - 1" LIFTS)
- B. 2.5" I19.0C INTERMEDIATE COURSE
- C. 8" AGGREGATE BASE COURSE (w/5.5" UNDER CURB)  
OR 4" B25.0C BASE COURSE (w/4" UNDER CURB)
- D. 2'-6" CURB & GUTTER
- E. 4" CONCRETE SIDEWALK

NOT TO SCALE



**TYPICAL SECTION**  
**RESIDENTIAL COLLECTOR STREET**

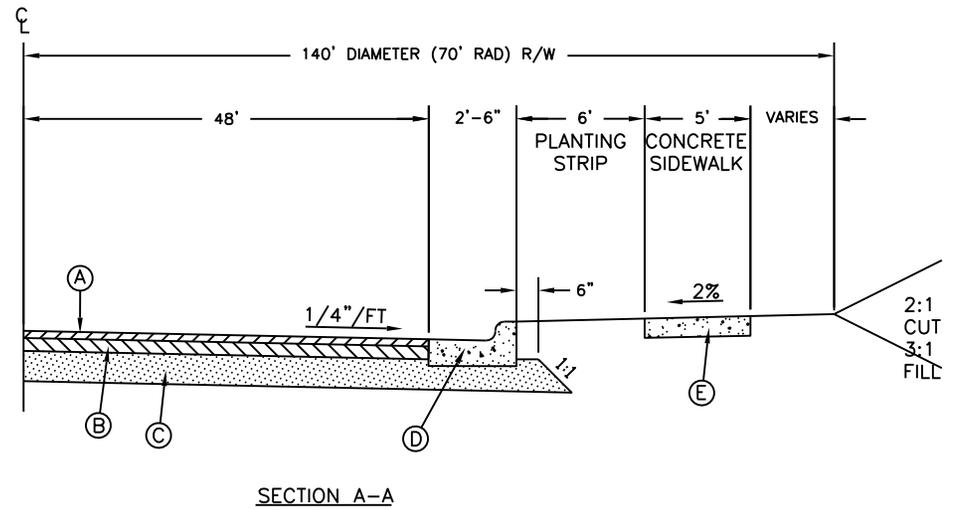
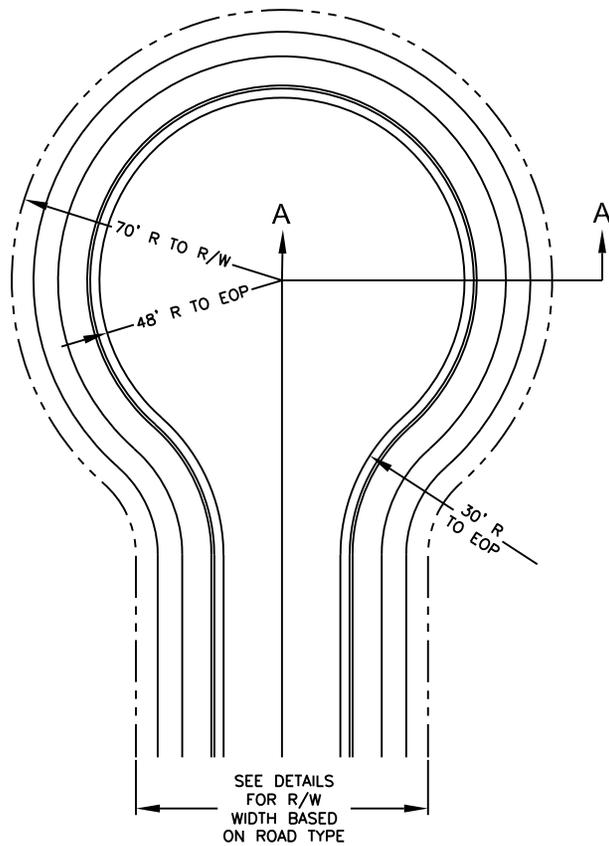
DECEMBER 2019
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**PAVEMENT SCHEDULE**

- A. 2" S9.5B SURFACE COURSE (PLACED IN 2 - 1" LIFTS)
- B. 2.5" I19.0C INTERMEDIATE COURSE
- C. 10" AGGREGATE BASE COURSE (w/7.5" UNDER CURB)  
OR 5" B25.0C BASE COURSE (w/4" UNDER CURB)
- D. 2'-6" CURB & GUTTER
- E. 4" CONCRETE SIDEWALK

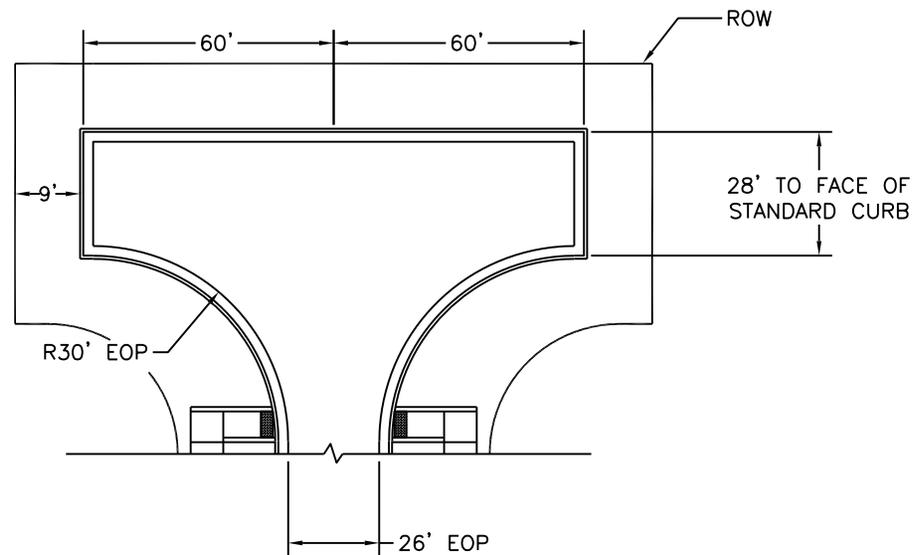
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PAVEMENT SCHEDULE

- A. 2" S9.5B SURFACE COURSE (PLACED IN 2 - 1" LIFTS)
- B. 2.5" I19.0C INTERMEDIATE COURSE
- C. 10" AGGREGATE BASE COURSE (w/7.5" UNDER CURB)  
OR 5" B25.0C BASE COURSE (w/4" UNDER CURB)
- D. 2'-6" CURB & GUTTER
- E. 4" CONCRETE SIDEWALK

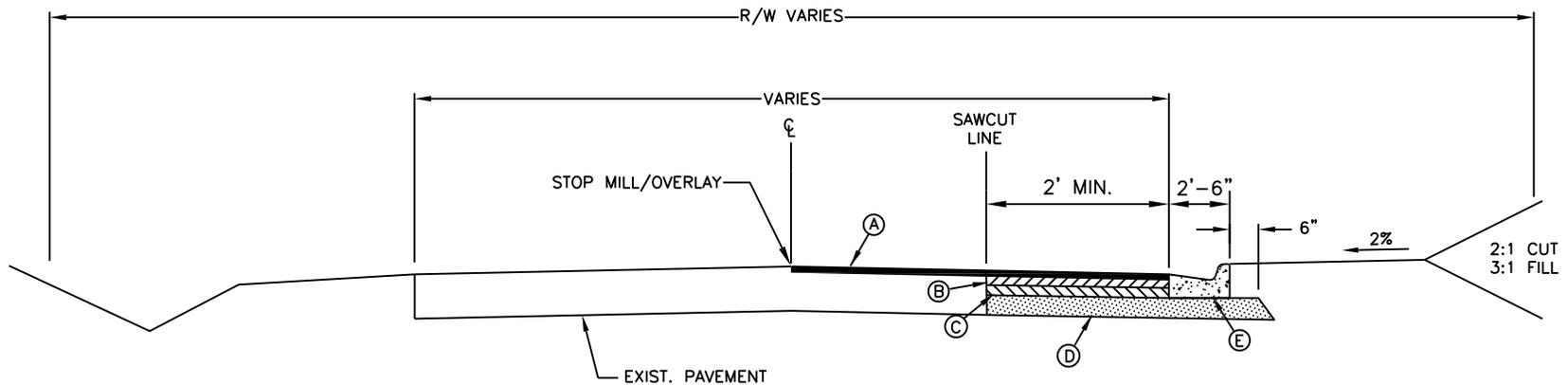
NOT TO SCALE



NOTES

1. VARIATIONS ON THIS DESIGN (E.G., WYES, TURNAROUNDS IN THE STEM, ROTATION OF ENTRY POINT, ETC.) CAN BE SUBMITTED TO THE ENGINEERING DEPARTMENT FOR REVIEW AND APPROVAL ON A CASE-BY-CASE BASIS.
2. SIDEWALK MAY BE REQUIRED TO EXTEND AROUND THE HAMMERHEAD WHERE PARKS OR SCHOOLS HAVE FRONTAGE TO THE END OF THE HAMMERHEAD.
3. FOR USE ON STREETS ONLY
4. SEE STREET TYPICAL SECTION FOR CROSS SECTION REQUIREMENTS

NOT TO SCALE



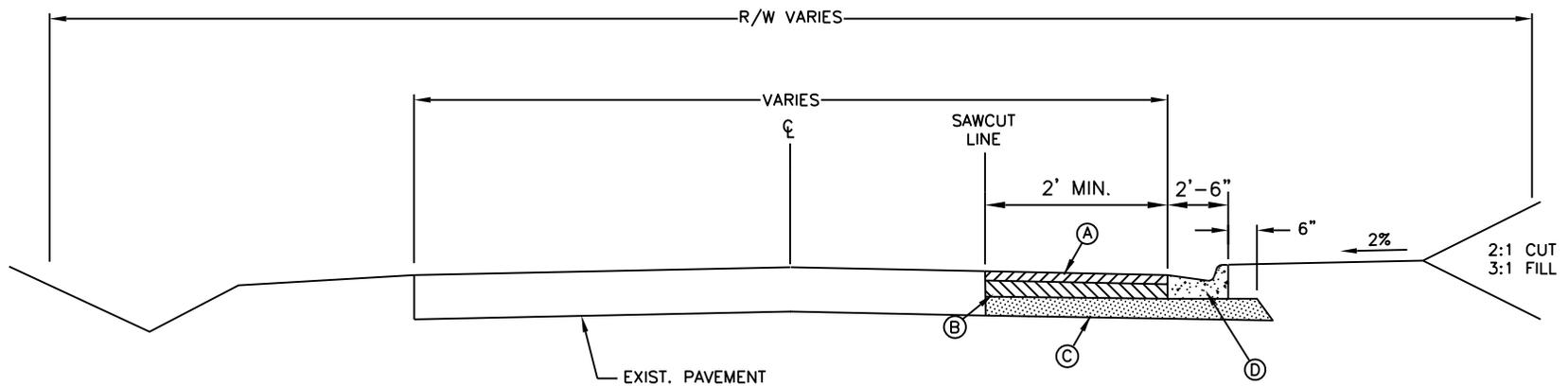
**NOTES:**

1. SIDEWALK, PLANTING STRIP AND CURB & GUTTER LOCATIONS SHALL BE DETERMINED BY THE APPLICABLE CROSS-SECTION DETAIL
2. ALL WORK TO BE DONE ON EXISTING NCDOT MAINTAINED STREETS SHALL REQUIRE NCDOT ENCROACHMENT/ACCESS APPLICATIONS, SUBMITTED TO THE CITY ENGINEER.
3. SAW CUT LOCATION TO BE DETERMINED IN FIELD.

**PAVEMENT SCHEDULE**

- A. 1.5" S9.5B OR S9.5C SURFACE COURSE
- B. 1.5" S9.5B OR S9.5C SURFACE COURSE
- C. 4" I19.0C INTERMEDIATE COURSE
- D. 4" B25.0C BASE COURSE
- E. 2'-6" CURB & GUTTER

NOT TO SCALE



**NOTES:**

1. SIDEWALK, PLANTING STRIP AND CURB & GUTTER LOCATIONS SHALL BE DETERMINED BY THE APPLICABLE CROSS-SECTION DETAIL
2. ALL WORK TO BE DONE ON EXISTING NCDOT MAINTAINED STREETS SHALL REQUIRE NCDOT ENCROACHMENT/ACCESS APPLICATIONS, SUBMITTED TO THE CITY ENGINEER.
3. SAW CUT LOCATION TO BE DETERMINED IN FIELD.

**PAVEMENT SCHEDULE**

- A. 3" S9.5B OR S9.5C SURFACE COURSE (PLACED IN 2-1.5" LIFTS)
- B. 4" I19.0C INTERMEDIATE COURSE
- C. 4" B25.0C BASE COURSE
- D. 2'-6" CURB & GUTTER

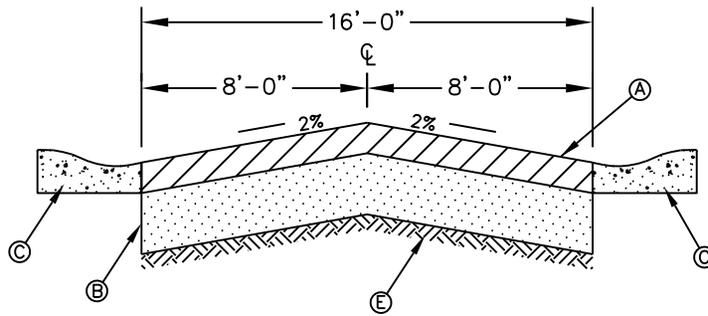
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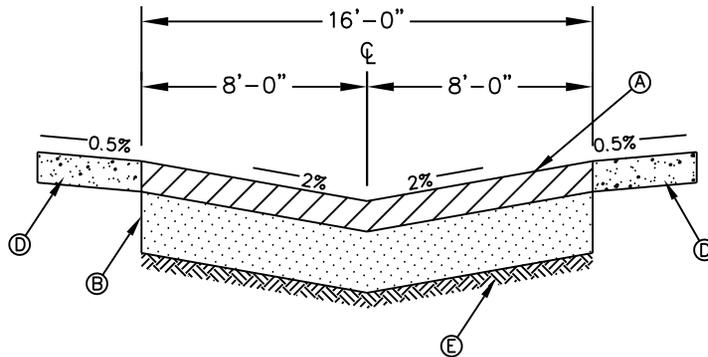
**TYPICAL SECTION  
CURB & GUTTER INSTALLATION  
ALONG EXISTING ROADWAY**

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ALLEY WITH NORMAL CROWN



ALLEY WITH INVERSE CROWN

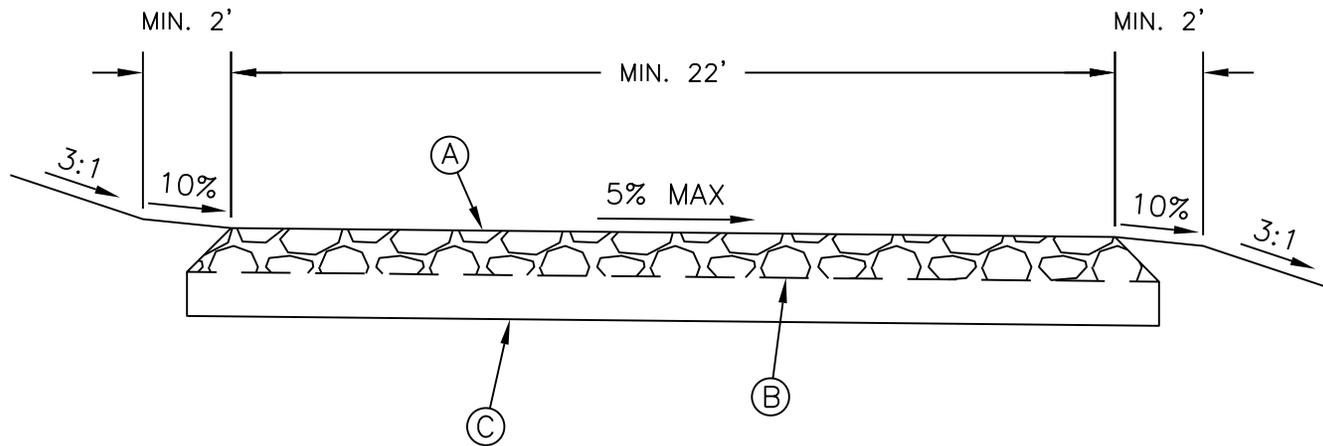
PAVEMENT SCHEDULE

- A. 2" S9.5C SURFACE COURSE
- B. 8" AGGREGATE BASE COURSE OR 4" B25.0C BASE COURSE
- C. 2'-0" VALLEY GUTTER
- D. 1'-0" CONCRETE STRIP
- E. SUBGRADE COMPACTED TO PUBLIC STREET STANDARDS

NOTES:

1. ALLEYS SHALL BE CONSIDERED PRIVATE EASEMENTS AND WILL NOT BE ACCEPTED FOR MAINTENANCE BY THE CITY OF KANNAPOLIS.
2. TYPICAL SECTION APPLIES TO SINGLE- OR DOUBLE-LOADED ALLEYS. FOR SINGLE-LOADED ALLEYS, THERE SHALL BE A 20-FOOT CLEAR ZONE FREE OF CUT SLOPES, OBSTRUCTIONS, HEDGES, ETC. FROM THE LOADED SIDE EDGE OF PAVEMENT.

NOT TO SCALE

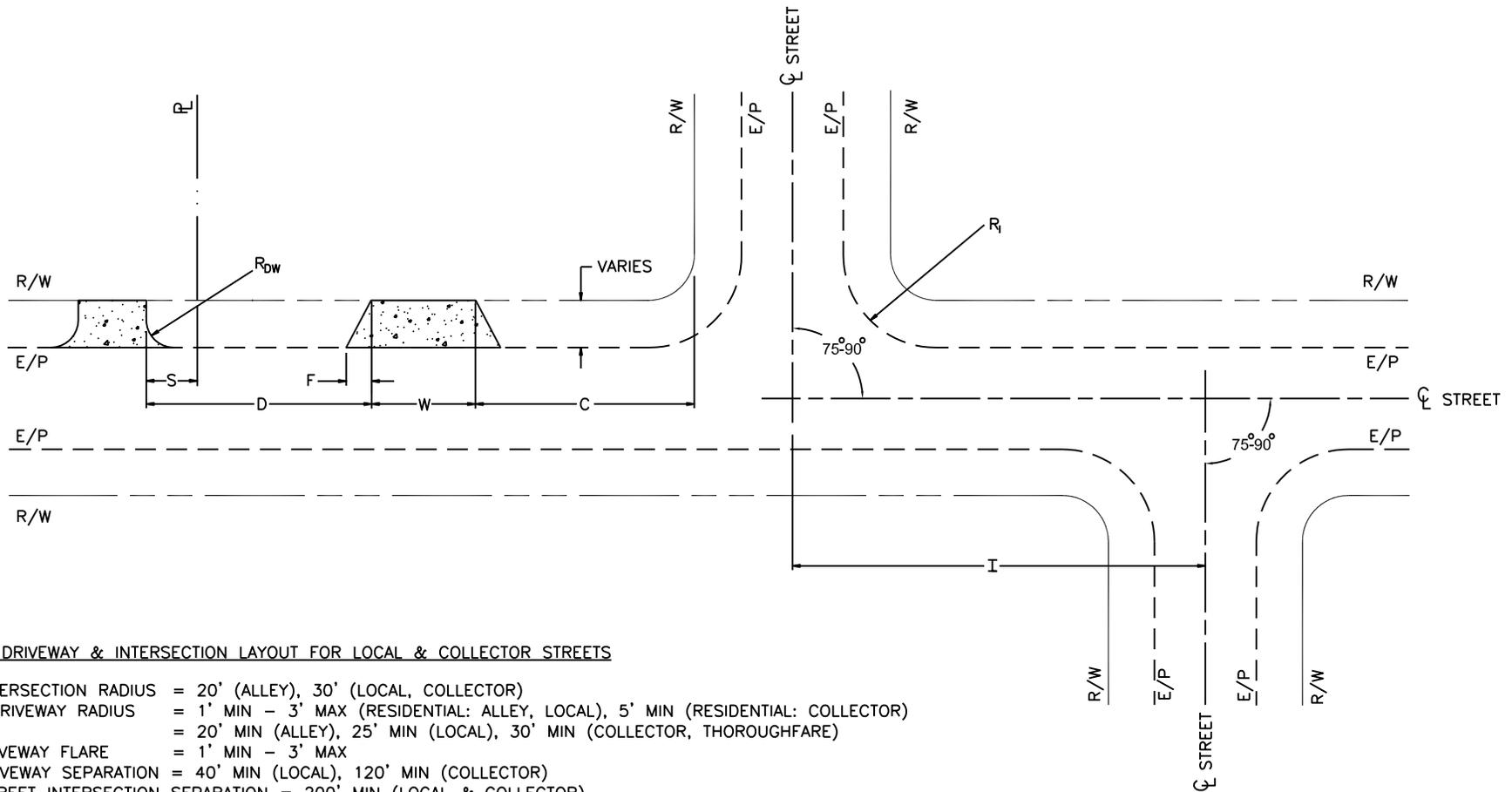


PAVEMENT SCHEDULE

- A. 6" AGGREGATE BASE COURSE
- B. GEOTEXTILE
- C. 12" MIN. COMPACTED SUBGRADE

NOTE: INGRESS/EGRESS ROADS AT PUMP STATIONS SHALL BE A MINIMUM OF 16' WIDE.

NOT TO SCALE



TYPICAL DRIVEWAY & INTERSECTION LAYOUT FOR LOCAL & COLLECTOR STREETS

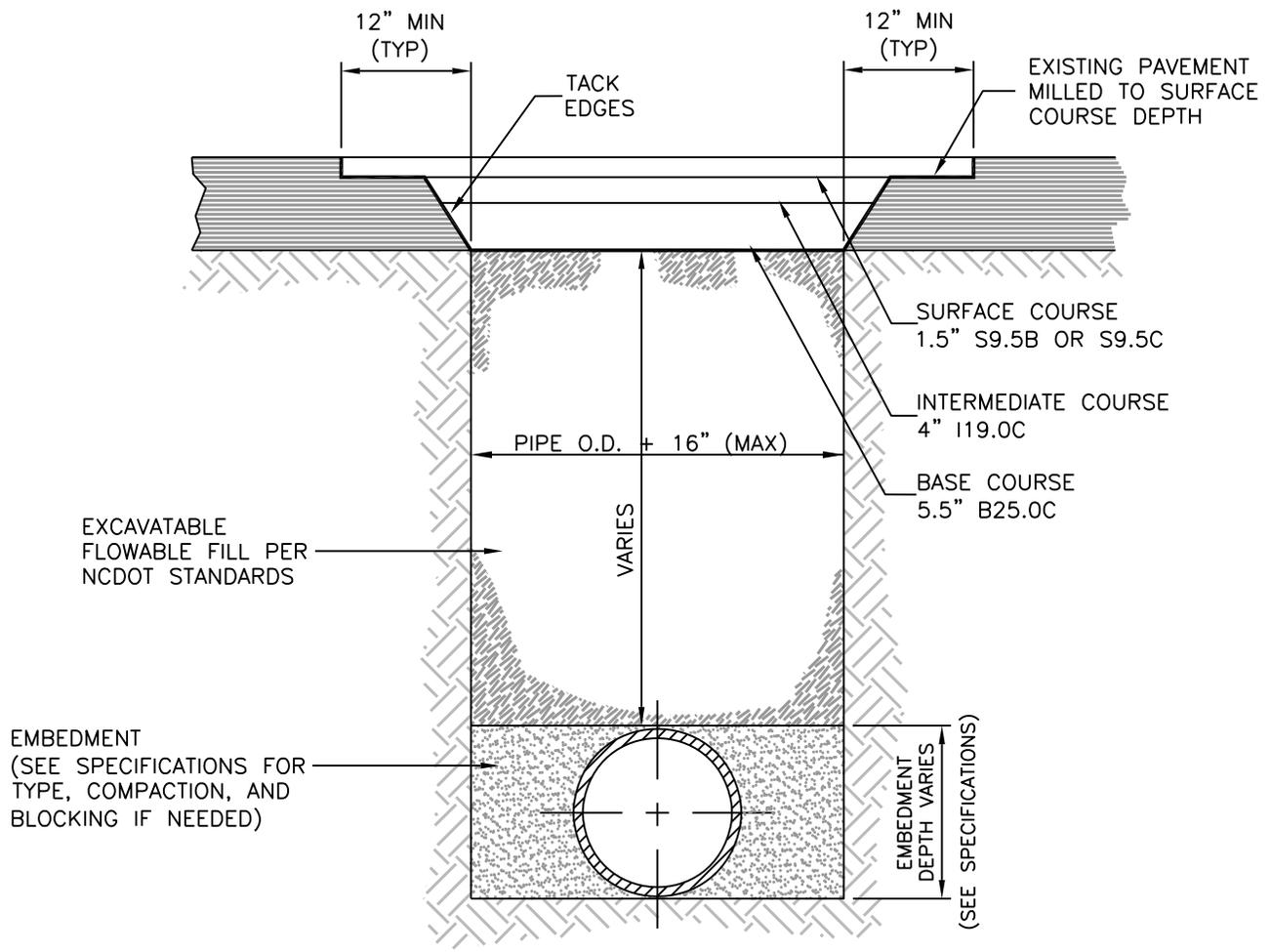
- $R_i$  = INTERSECTION RADIUS = 20' (ALLEY), 30' (LOCAL, COLLECTOR)
- $R_{dw}$  = DRIVEWAY RADIUS = 1' MIN - 3' MAX (RESIDENTIAL: ALLEY, LOCAL), 5' MIN (RESIDENTIAL: COLLECTOR)  
= 20' MIN (ALLEY), 25' MIN (LOCAL), 30' MIN (COLLECTOR, THOROUGHFARE)
- F = DRIVEWAY FLARE = 1' MIN - 3' MAX
- D = DRIVEWAY SEPARATION = 40' MIN (LOCAL), 120' MIN (COLLECTOR)
- I = STREET INTERSECTION SEPARATION = 200' MIN (LOCAL & COLLECTOR)
- C = CORNER CLEARANCE = SEE SIGHT DISTANCE REQUIREMENTS
- S = SIDE CLEARANCE = 5' MIN (RESIDENTIAL), 10' MIN (NON-RESIDENTIAL)
- W = DRIVEWAY WIDTH = 12' MIN - 20' MAX (RESIDENTIAL)  
= 15' MIN - 20' MAX (NON-RESIDENTIAL ONE-WAY)  
= 24' MIN - 36' MAX (NON-RESIDENTIAL TWO-WAY)

NOT TO SCALE



**TYPICAL DRIVEWAY & INTERSECTION LAYOUT**  
**FOR**  
**LOCAL & COLLECTOR STREETS**

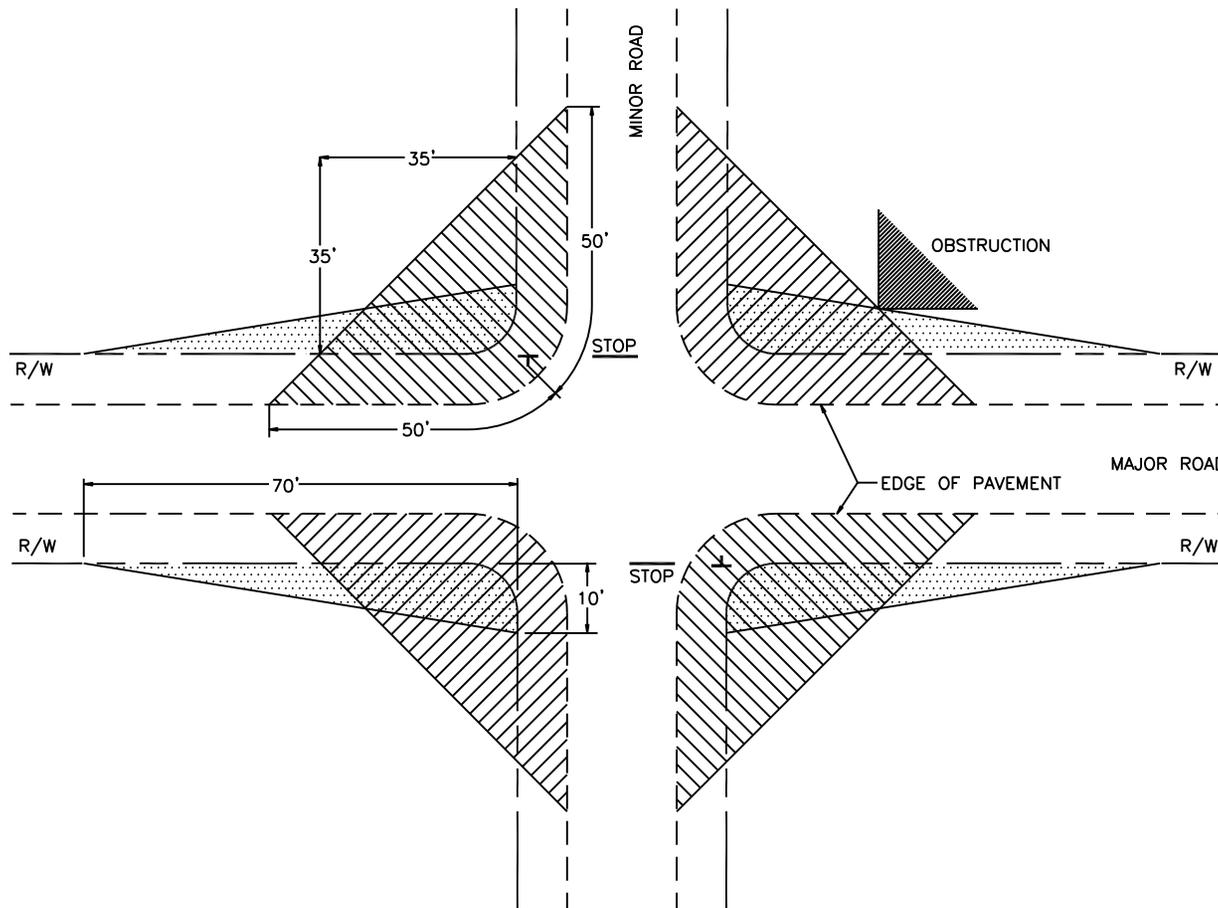
DECEMBER 2019



NOT TO SCALE



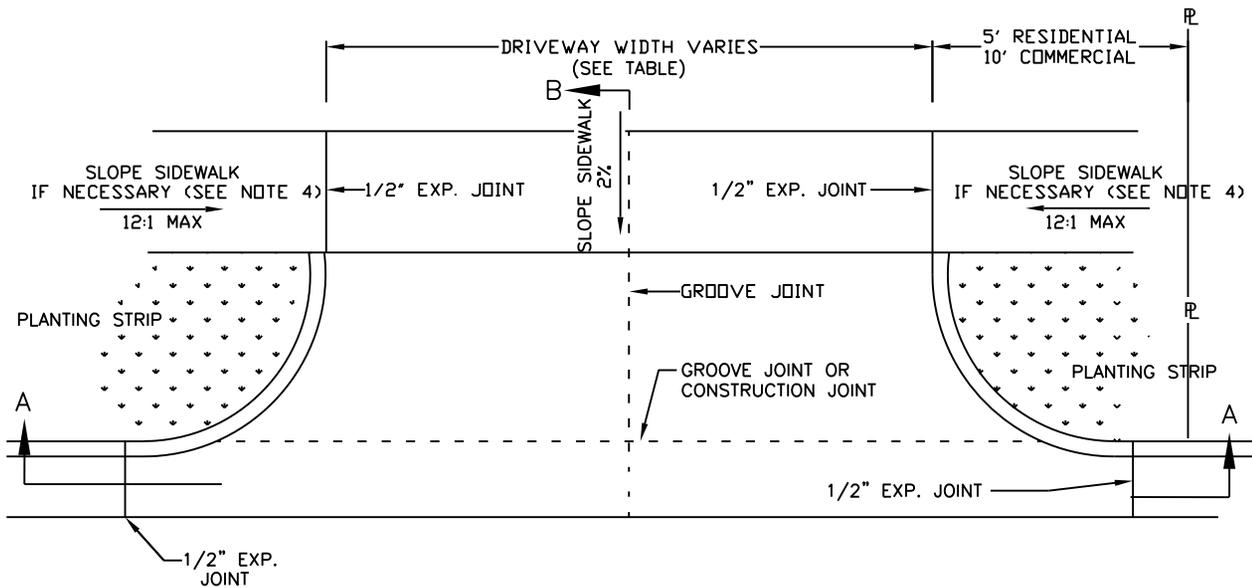
**UTILITY CUT PAVEMENT REPAIR DETAIL**



**NOTES:**

1. SIGHT TRIANGLES SHALL BE PROVIDED AT ALL STREET INTERSECTIONS AND SHALL CONTAIN NO OBSTRUCTION GREATER THAN 2' ABOVE THE GROUND.
2. REFERENCE THE LATEST EDITION OF AASHTO "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS" FOR ADDITIONAL REQUIREMENTS/RECOMMENDATIONS.

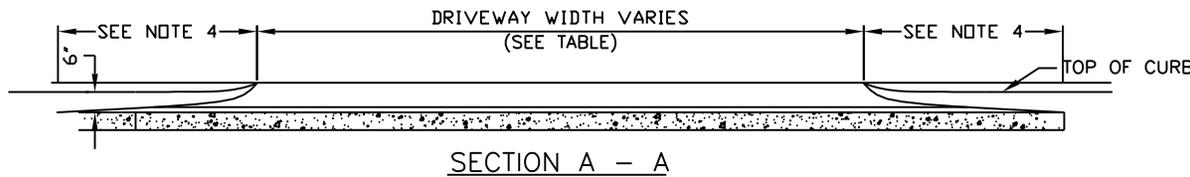
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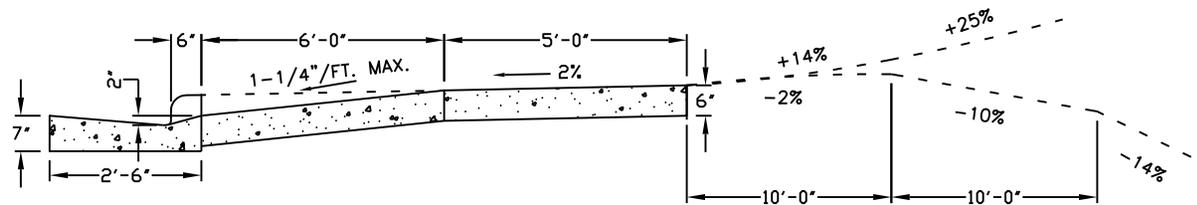
**NOTES:**

1. ALL CONCRETE TO BE MINIMUM NCDOT CLASS B, 6" MIN. THICKNESS.
2. ALL DRIVEWAYS MUST MEET THE CURRENT CITY DRIVEWAY REGULATIONS AND NCDOT REQUIREMENTS FOR SPACING, SIGHT DISTANCE AND OFFSETS FROM PROPERTY LINES AND INTERSECTIONS.
3. 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.
4. FOR PLANTING STRIP LESS THAN 6- FEET, SLOPE SIDEWALK TO MEET GRADE OF ENTRANCE. SIDEWALK GRADE SHALL BE 12:1 MAX.
5. RADIUS REQUIREMENTS: SEE TABLE 2A IN CHAPTER 2 OF LDSM
6. NO UTILITIES PERMITTED IN DRIVEWAYS.
7. NO DRIVEWAY SHALL BE WITHIN 5' (AS MEASURED ALONG STREET CURB STARTING AT THE DRIVEWAY RADIUS) OF ANY MUNICIPAL OR STATE OWNED FEATURE (I.E. CURB INLETS, FIRE HYDRANTS, UTILITY POLES OR SIMILAR STRUCTURES)

**PLAN VIEW**



**SECTION A - A**



**SECTION B - B**

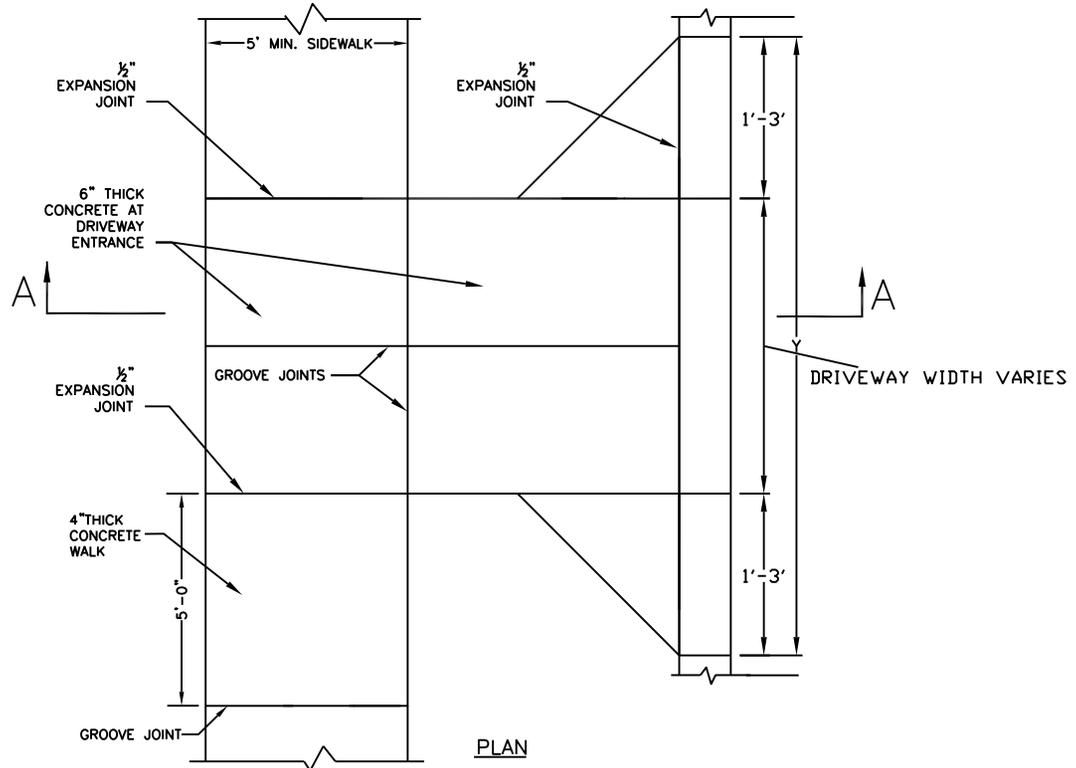
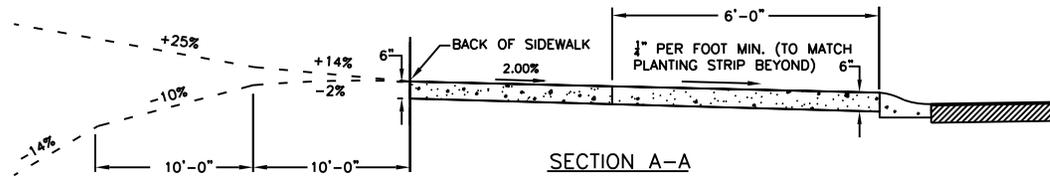
DRIVEWAY CLASSIFICATION		
TYPE DRIVEWAY	MINIMUM	MAXIMUM
RESIDENTIAL	12'	20'
COMMERCIAL/INDUSTRIAL MULTI-FAMILY	24'	36'
COMMERCIAL/INDUSTRIAL ONE-WAY	15'	20'

NOT TO SCALE



**DRIVEWAY ENTRANCE RADIUS**





**NOTES:**

1. ALL CONCRETE TO BE MINIMUM NCDOT CLASS B, 6" MIN. THICKNESS.
2. ALL DRIVEWAYS MUST MEET THE CURRENT CITY DRIVEWAY REGULATIONS AND NCDOT REQUIREMENTS FOR SPACING, SIGHT DISTANCE AND OFFSETS FROM PROPERTY LINES AND INTERSECTIONS.
3. 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.
4. FOR PLANTING STRIP LESS THAN 6', SLOPE SIDEWALK TO MEET GRADE OF ENTRANCE. SIDEWALK GRADE SHALL BE 12:1 MAX.
5. NO UTILITIES PERMITTED IN DRIVEWAYS.
6. NO DRIVEWAY SHALL BE WITHIN 5' (AS MEASURED ALONG STREET CURB STARTING AT THE DRIVEWAY RADIUS) OF ANY MUNICIPAL OR STATE OWNED FEATURE (I.E. CURB INLETS, FIRE HYDRANTS, UTILITY POLES OR SIMILAR STRUCTURES)

NOT TO SCALE

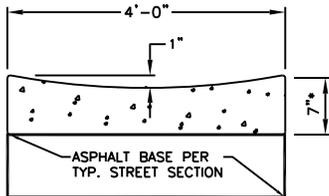


**DRIVEWAY ENTRANCE  
2'-0" VALLEY GUTTER**

DECEMBER 2019

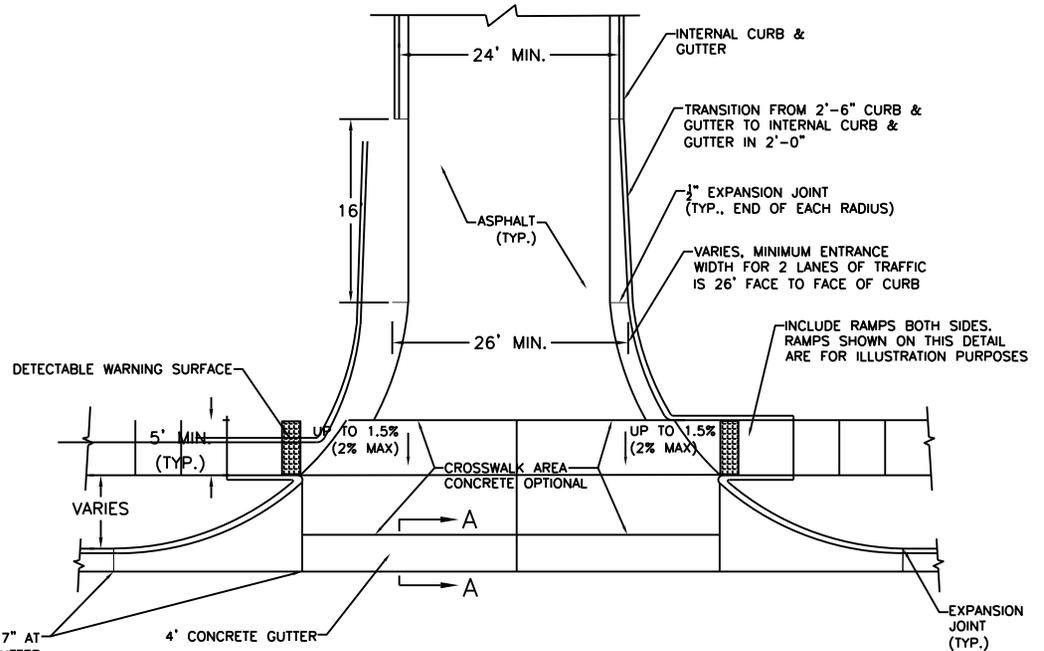
**NOTES:**

1. WHERE A TYPE III DRIVEWAY IS APPROVED BY THE KANNAPOLIS PUBLIC WORKS THAT CONNECTS TO AN EXISTING SIGNALIZED INTERSECTION, OR AT A LOCATION WHERE A TRAFFIC SIGNAL INSTALLATION IS PROPOSED BASED ON A TRAFFIC IMPACT/SIGNAL WARRANT STUDY, A FULL DEPTH ASPHALT PAVEMENT IS REQUIRED. THIS PAVEMENT DESIGN IS REQUIRED IN THE DRIVEWAY EASEMENT (100-FOOT MINIMUM) TO MAINTAIN DETECTOR LOOPS AND PAVEMENT MARKINGS. A TRAFFIC SIGNAL WILL BE INSTALLED ONLY IF KANNAPOLIS PUBLIC WORKS DETERMINES THAT ONE IS NECESSARY BASED ON A TRAFFIC STUDY OF CURRENT CONDITIONS.
2. MAY BE REQUIRED FOR PUBLIC OR PRIVATE DEVELOPMENTS WITH 200 OR MORE PARKING SPACES.
3. A CONCRETE GUTTER IS TO BE USED EXCEPT AT EXISTING OR PROPOSED TRAFFIC SIGNAL LOCATIONS. AT THESE LOCATIONS ADDITIONAL DRAINAGE REQUIREMENTS WILL BE NECESSARY TO ELIMINATE THE NEED FOR GUTTER ACROSS THE DRIVEWAY CONNECTIONS.
4. THE DRIVEWAY MUST RISE 6" FROM THE GUTTER LINE TO PREVENT RUNOFF FROM ENTERING DRIVEWAY. ALL DRIVEWAYS MUST MEET THE CURRENT CITY DRIVEWAY REGULATIONS AND NCDOT REQUIREMENTS FOR SPACING, SIGHT DISTANCE, AND OFFSETS FROM PROPERTY LINES AND INTERSECTIONS.
5. TWO (2) CURB RAMPS PER CURB RETURN REQUIRED AT SIGNALIZED INTERSECTIONS.
6. FOUR (4) FOOT GUTTER AND WINGS ARE REQUIRED TO DIRECT WATER ACROSS DRIVE. GUTTER AND WINGS MAY NOT BE REQUIRED IF THE DRIVEWAY GUTTER SLOPE IS GREATER THAN 2%.
7. MAINTAIN UP TO 1.5% (MAX. 2%) CROSS-SLOPE ON THE PEDESTRIAN ACCESS ROUTE BETWEEN CURB RAMPS. CONCRETE IS OPTIONAL FOR THE CROSSWALK AREA IN THE DRIVEWAY.
8. ALL CONCRETE TO BE MINIMUM NCDOT CLASS B, 6" MIN. THICKNESS.
9. ALL DRIVEWAYS MUST MEET THE CURRENT CITY DRIVEWAY REGULATIONS AND NCDOT REQUIREMENTS FOR SPACING, SIGHT DISTANCE AND OFFSETS FROM PROPERTY LINES AND INTERSECTIONS.
10. 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.
11. FOR PLANTING STRIP LESS THAN 6', SLOPE SIDEWALK TO MEET GRADE OF ENTRANCE. SIDEWALK GRADE SHALL BE 12:1 MAX.
12. NO UTILITIES PERMITTED IN DRIVEWAYS.
13. NO DRIVEWAY SHALL BE WITHIN 5' (AS MEASURED ALONG STREET CURB STARTING AT THE DRIVEWAY RADIUS) OF ANY MUNICIPAL OR STATE OWNED FEATURE (I.E. CURB INLETS, FIRE HYDRANTS, UTILITY POLES OR SIMILAR STRUCTURES).

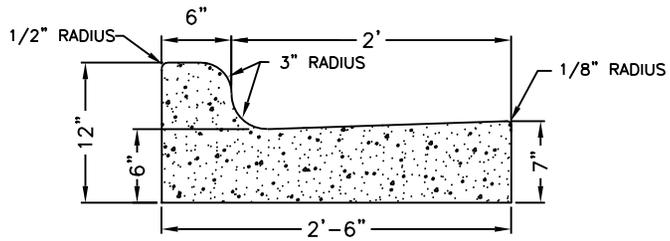


SECTION A-A

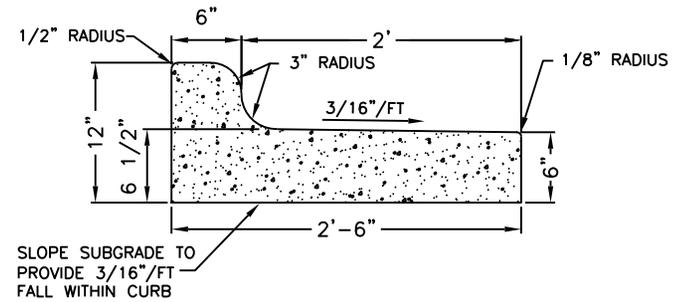
\* TRANSITION CONCRETE DEPTH FROM 7" AT LIP TO 10" AT 4' CONCRETE GUTTER CONSTRUCTION JOINT IF NO ASPHALT BASE INSTALLED. IF ASPHALT BASE IS USED, 7" CONCRETE DEPTH CAN BE CARRIED THROUGH THE 4' CONCRETE GUTTER.



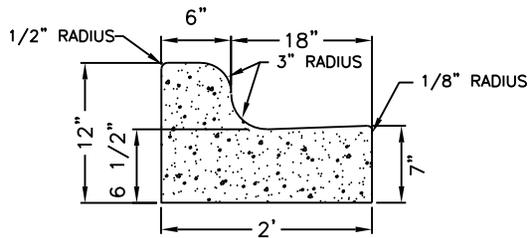
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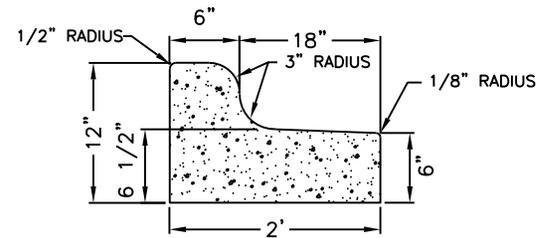
STANDARD 2'-6" CURB & GUTTER



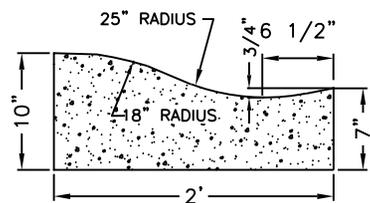
STANDARD 2'-6" SPILL CURB & GUTTER



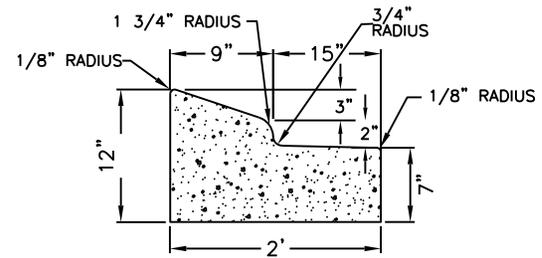
2'-0" CURB & GUTTER



2'-0" SPILL CURB & GUTTER



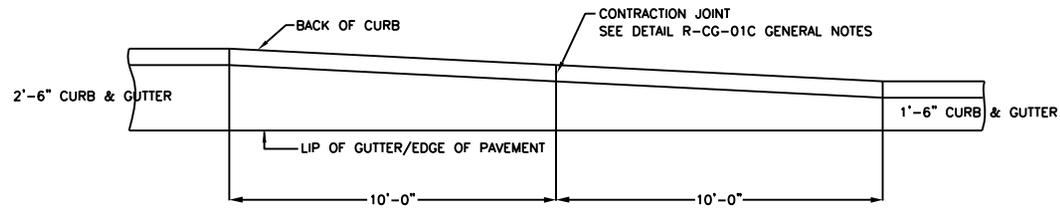
2'-0" VALLEY GUTTER



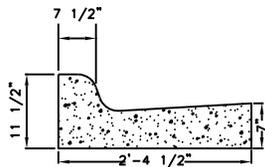
2'-0" MOUNTABLE CURB & GUTTER

NOT TO SCALE

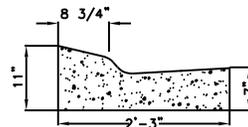
## CURB & GUTTER



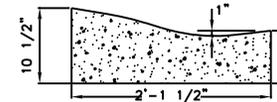
PLAN VIEW  
CURB TRANSITION  
2'-6" CURB & GUTTER TO 1'-6" CURB & GUTTER



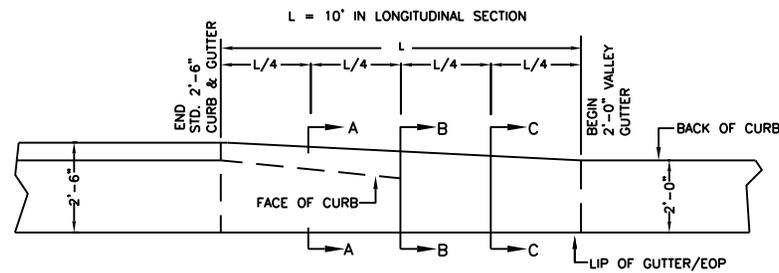
SECTION A-A



SECTION B-B

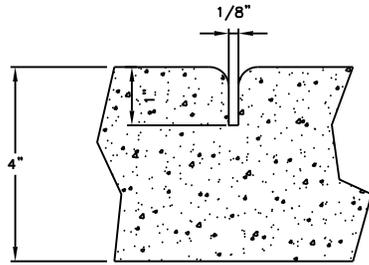


SECTION C-C

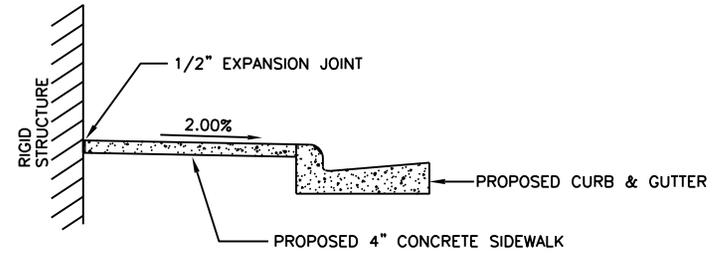


PLAN VIEW  
CURB TRANSITION  
2'-6" CURB & GUTTER TO 2'-0" VALLEY GUTTER

NOT TO SCALE



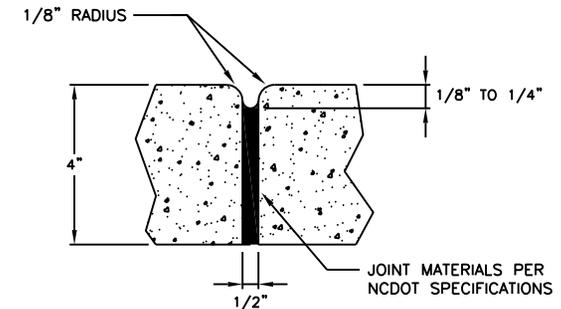
GROOVE JOINT IN SIDEWALK



DETAILS SHOWING EXPANSION JOINTS  
IN CONCRETE SIDEWALK

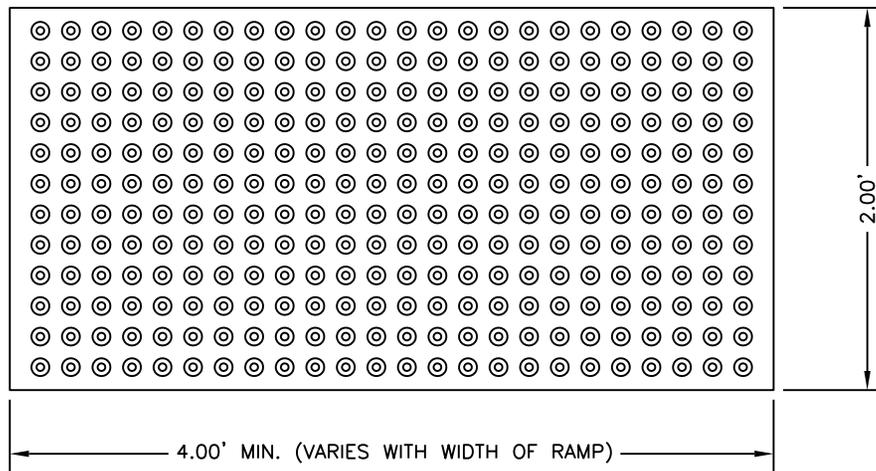
NOTES:

1. CONSTRUCT STANDARD SIDEWALK 5' WIDE AND 4" THICK UNLESS OTHERWISE DENOTED ON PLANS.
2. CONSTRUCT SIDEWALK 5' WIDE AND 6" THICK AT DRIVEWAY ENTRANCES.
3. CONSTRUCT SIDEWALK WITH A 2.00% CROSS SLOPE.
4. PLACE A GROOVE JOINT 1" DEEP WITH 1/8" RADII IN THE CONCRETE SIDEWALK AT 5' INTERVALS. ONE 1/2" EXPANSION JOINT WILL BE REQUIRED AT 50' INTERVALS. A 1/2" EXPANSION JOINT WILL BE REQUIRED WHERE THE SIDEWALK JOINS ANY RIGID STRUCTURE. ALL EXPANSION JOINTS SHALL BE FILLED WITH JOINT SEALER.
5. ZONING CONDITIONS MAY REQUIRE ADDITIONAL WIDTH SIDEWALKS WHICH SHALL SUPERSEDE THESE STANDARD DIMENSIONS SHOWN.

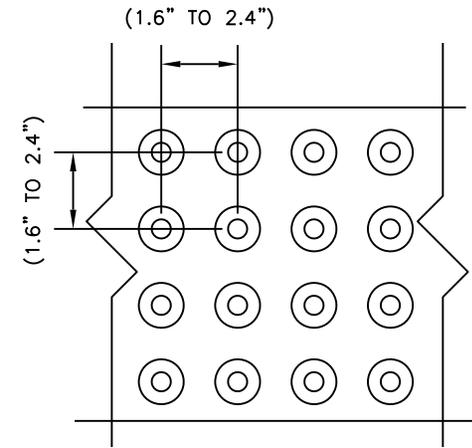


TRANSVERSE EXPANSION  
JOINT IN SIDEWALK

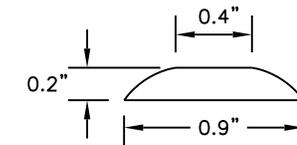
NOT TO SCALE



PLAN VIEW



TRUNCATED DOME SPACING



TRUNCATED DOME SECTION

NOTES:

1. ALL DETECTABLE WARNING DEVICES USED IN NEW CONSTRUCTION SHALL BE OF A RIGID PRECAST OR EMBEDDED PRODUCT APPROVED BY THE CITY ENGINEER. RETRO FIT MATS WILL ONLY BE ALLOWED ON EXISTING RAMPS WITH PRIOR APPROVAL OF THE CITY ENGINEER FOR MATERIAL TYPE AND INSTALLATION (IE. RESURFACING).
2. WIDTH OF DETECTABLE WARNING AREA SHALL BE A MINIMUM OF 4 FEET AND VARY WITH WIDTH OF RAMP.
3. LENGTH OF DETECTABLE WARNING AREA SHALL BE 2 FEET REGARDLESS OF SECTION WIDTH.
4. DETECTABLE WARNING DOMES SHALL BE ALIGNED ON A SQUARE GRID IN THE PREDOMINANT DIRECTION OF TRAVEL TO PERMIT WHEELS TO ROLL BETWEEN DOMES.
5. DETECTABLE WARNING AREA SHALL BE COLORED FS 20109 IN ALL LOCATIONS.
6. MATS ARE TO BE RIGID WITH TURN DOWN EDGES EMBEDDED IN CONCRETE TO ELIMINATE TRIP HAZARD.

NOT TO SCALE



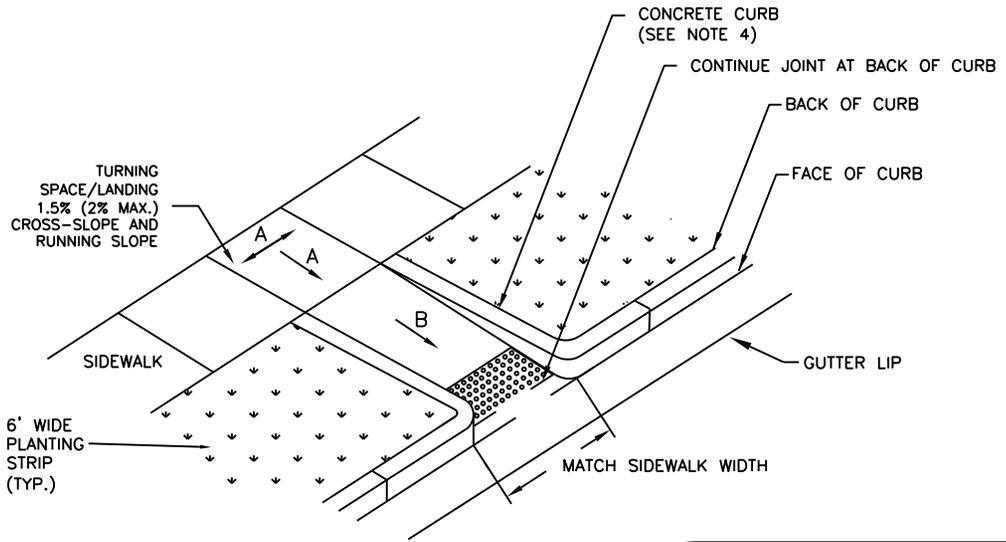
**TRUNCATED DOME DETAILS**

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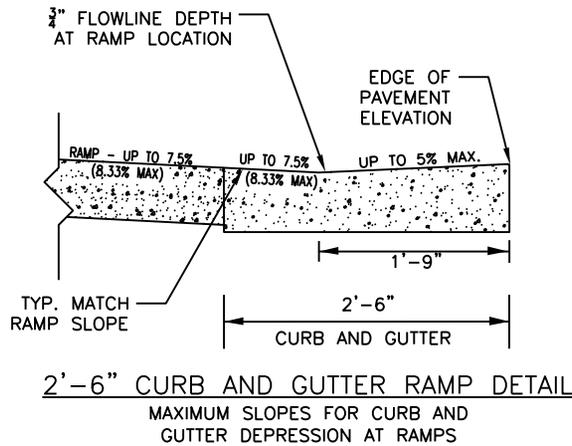
**NOTES:**

1. ENSURE FLUSH CONDITIONS AT CURB RAMP TO GUTTER TRANSITION.
2. TYPICALLY, THE SIDEWALK RUNNING SLOPE SHALL NOT EXCEED THE GENERAL GRADE ESTABLISHED FOR THE ADJACENT STREET.
3. IF THE SLOPE FROM FLOWLINE TO BACK OF CURB AT RAMP IS LESS THAN 8.33%, THEN THE SLOPE FROM LIP TO FLOWLINE AT RAMP MAY EXCEED 5% AS LONG AS THE ALGEBRAIC DIFFERENCE BETWEEN THESE TWO SLOPES IS LESS THAN 13.33%.
4. CURB RAMPS WITH RETURNED CURBS MAY BE USED ONLY WHERE PEDESTRIANS WOULD NOT TYPICALLY WALK ACROSS THE RAMP. THE ADJACENT SURFACE IS PLANTING OR OTHER NON-WALKING SURFACE.

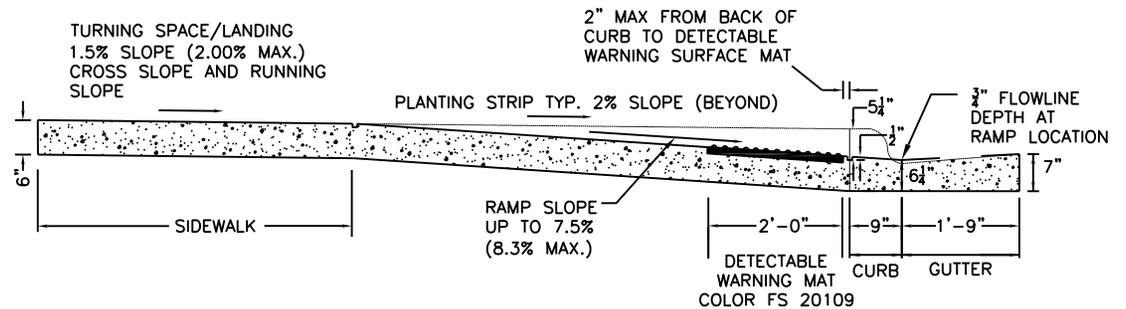


SLOPE "A" = UP TO 1.5% (2.00% MAX)  
 SLOPE "B" = UP TO 7.5% (8.33% MAX)

**PLAN VIEW**



**2'-6" CURB AND GUTTER RAMP DETAIL**  
 MAXIMUM SLOPES FOR CURB AND GUTTER DEPRESSION AT RAMPS



**TYPICAL RAMP SECTION AT CENTERLINE**

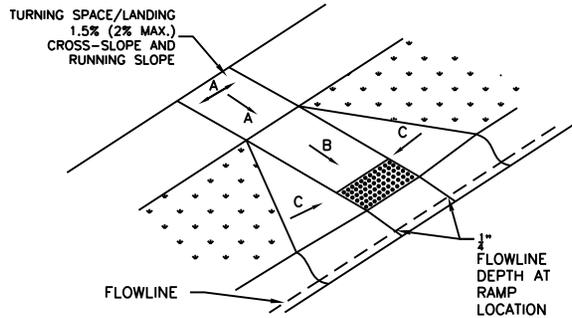
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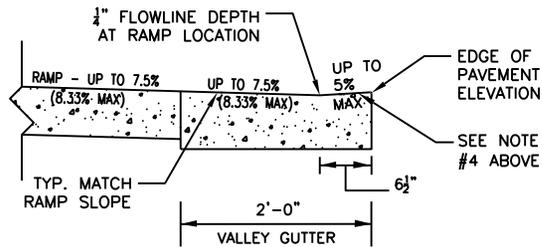
**PERPENDICULAR CURB RAMP  
 WITH 2'-6" CURB & GUTTER**

**NOTES:**

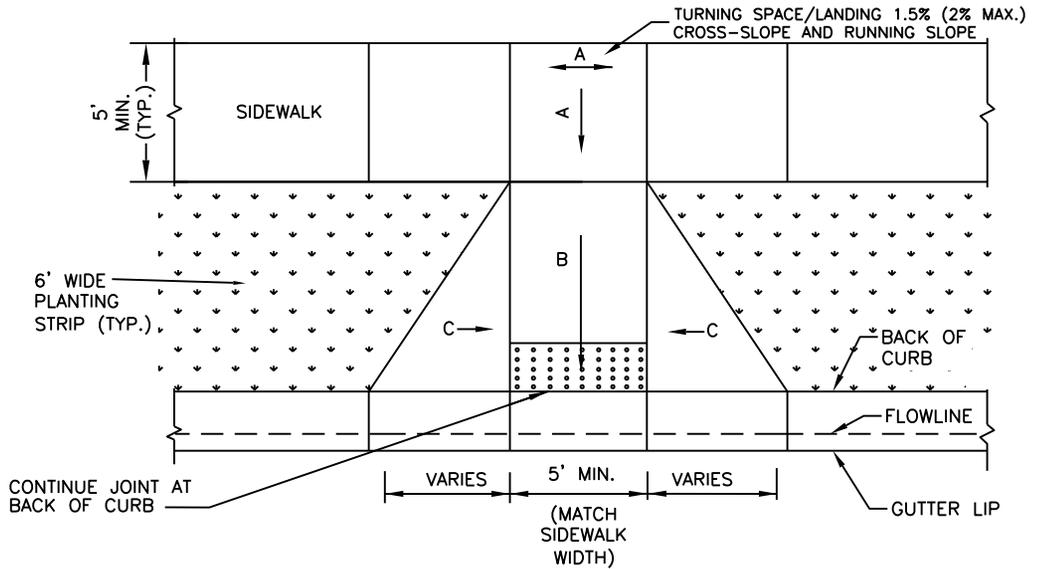
1. ENSURE FLUSH CONDITIONS AT CURB RAMP TO GUTTER TRANSITION.
2. TYPICALLY, THE SIDEWALK RUNNING SLOPE SHALL NOT EXCEED THE GENERAL GRADE ESTABLISHED FOR THE ADJACENT STREET.
3. MAINTAIN POSITIVE DRAINAGE ALONG THE LIP OF GUTTER IN RAMP. IN FLAT AREAS, ADDITIONAL CATCH BASINS MAY BE REQUIRED ON THE SIDES OF THE RAMP TO MINIMIZE STANDING WATER AT THE RAMP LOCATION.
4. IF THE SLOPE FROM FLOWLINE TO BACK OF CURB AT RAMP IS LESS THAN 8.3%, THEN THE SLOPE FROM LIP TO FLOWLINE AT RAMP MAY EXCEED 5% AS LONG AS THE DIFFERENCE BETWEEN THESE TWO SLOPES IS LESS THAN 13.3%.



**ISOMETRIC VIEW**

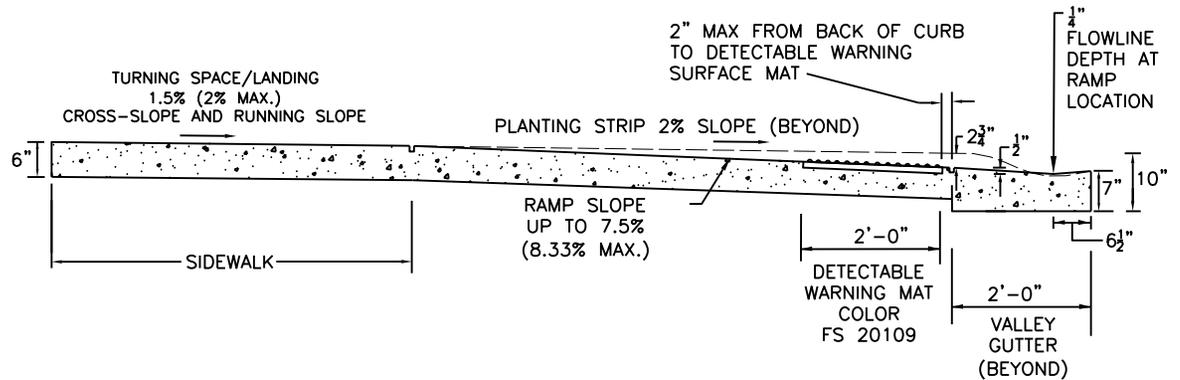


**2'-0" VALLEY GUTTER RAMP DETAIL**  
 MAXIMUM SLOPES FOR VALLEY GUTTER DEPRESSION AT RAMPS



**PLAN VIEW**

SLOPE "A" = UP TO 1.5% (2.00% MAX)
SLOPE "B" = UP TO 7.5% (8.33% MAX)
SLOPE "C" = UP TO 10% MAX



**TYPICAL RAMP SECTION AT CENTERLINE**

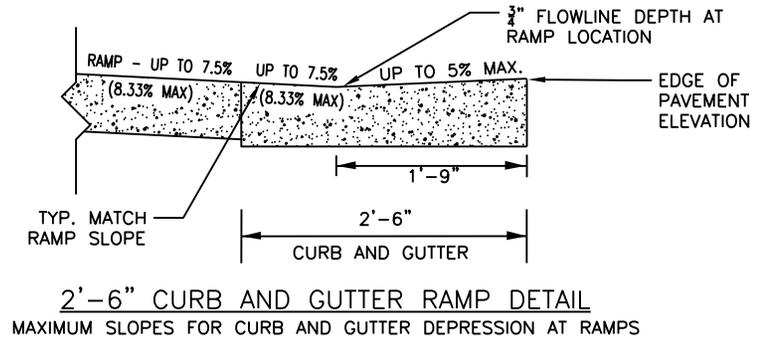
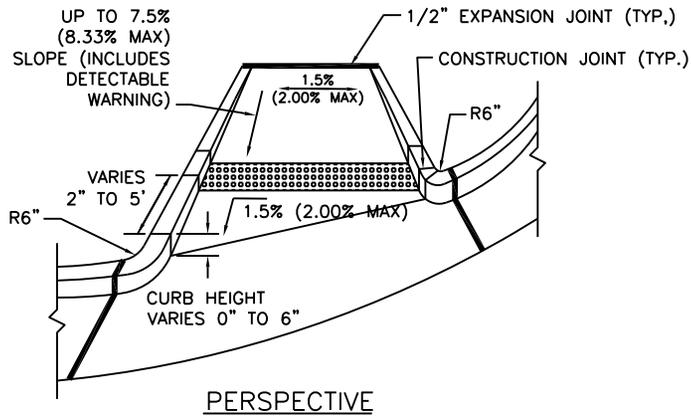
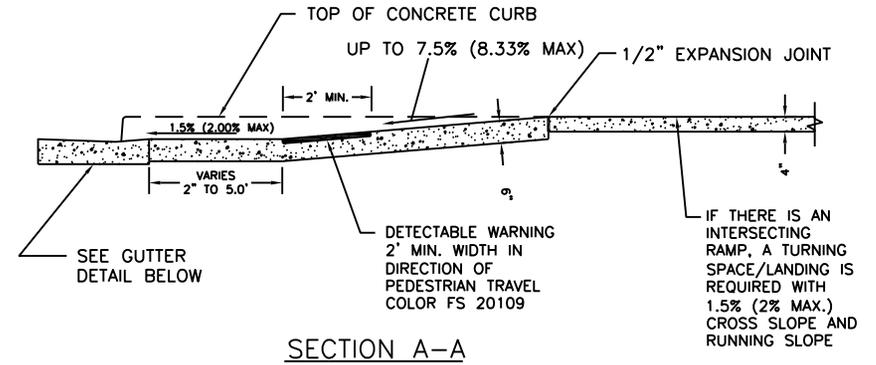
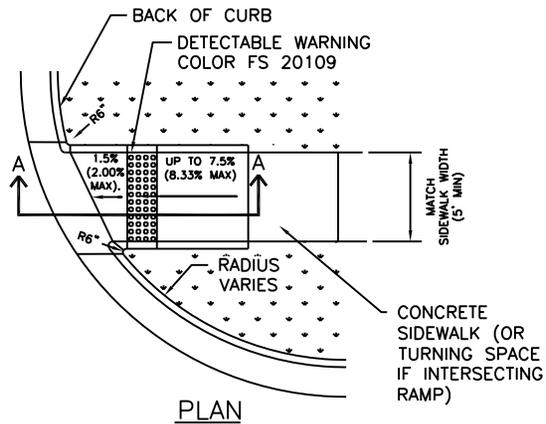
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**PERPENDICULAR CURB RAMP  
 WITH 2'-0" VALLEY GUTTER**

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**NOTES:**

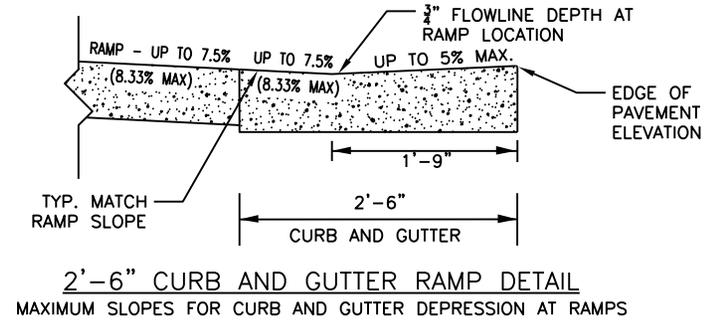
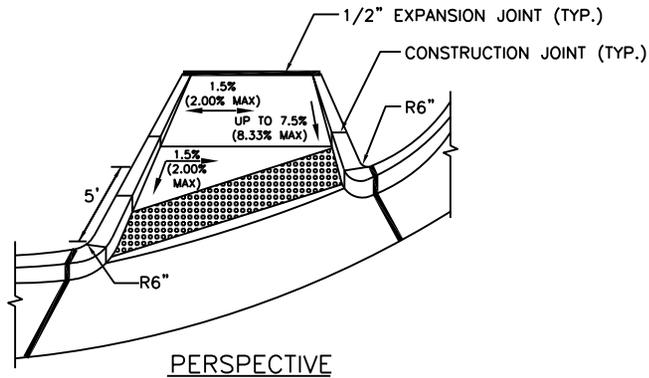
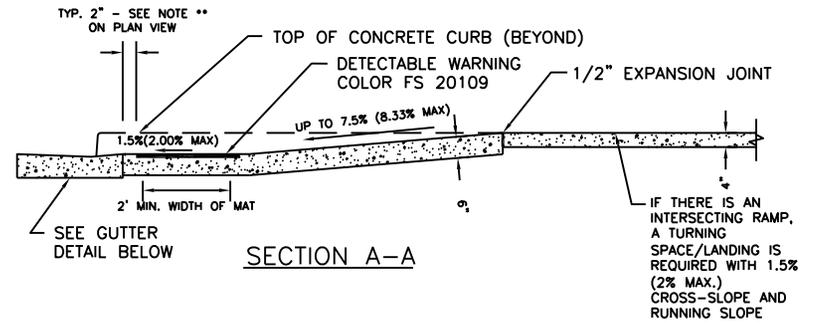
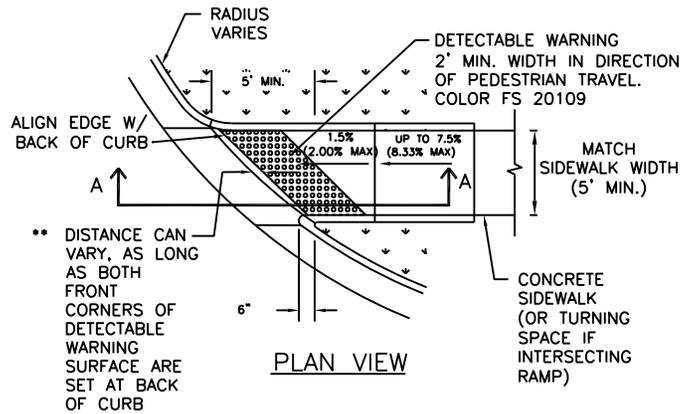
1. USE THIS DETAIL ONLY UNDER THE FOLLOWING CIRCUMSTANCES:
  - 5-FOOT SIDEWALKS WITH CURB RADII OF 35 FEET OR LESS
  - 6-FOOT SIDEWALKS WITH CURB RADII OF 30 FEET OR LESS
  - 8-FOOT SIDEWALKS WITH CURB RADII OF 25 FEET OR LESS
2. DIRECTIONAL RAMPS MAY BE USED WHEN AN 6-FOOT PLANTING STRIP IS PROVIDED. DO NOT USE THIS DETAIL IF THERE IS HARDSCAPE INSTEAD OF A PLANTING STRIP.
3. ALL CONCRETE SHALL BE AT LEAST NCDOT CLASS B.
4. ENSURE FLUSH CONDITIONS AT RAMP TO GUTTER TRANSITION.

NOT TO SCALE



**DIRECTIONAL CURB RAMP**  
**WITH SMALL/MEDIUM CURB RADIUS**

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**NOTES:**

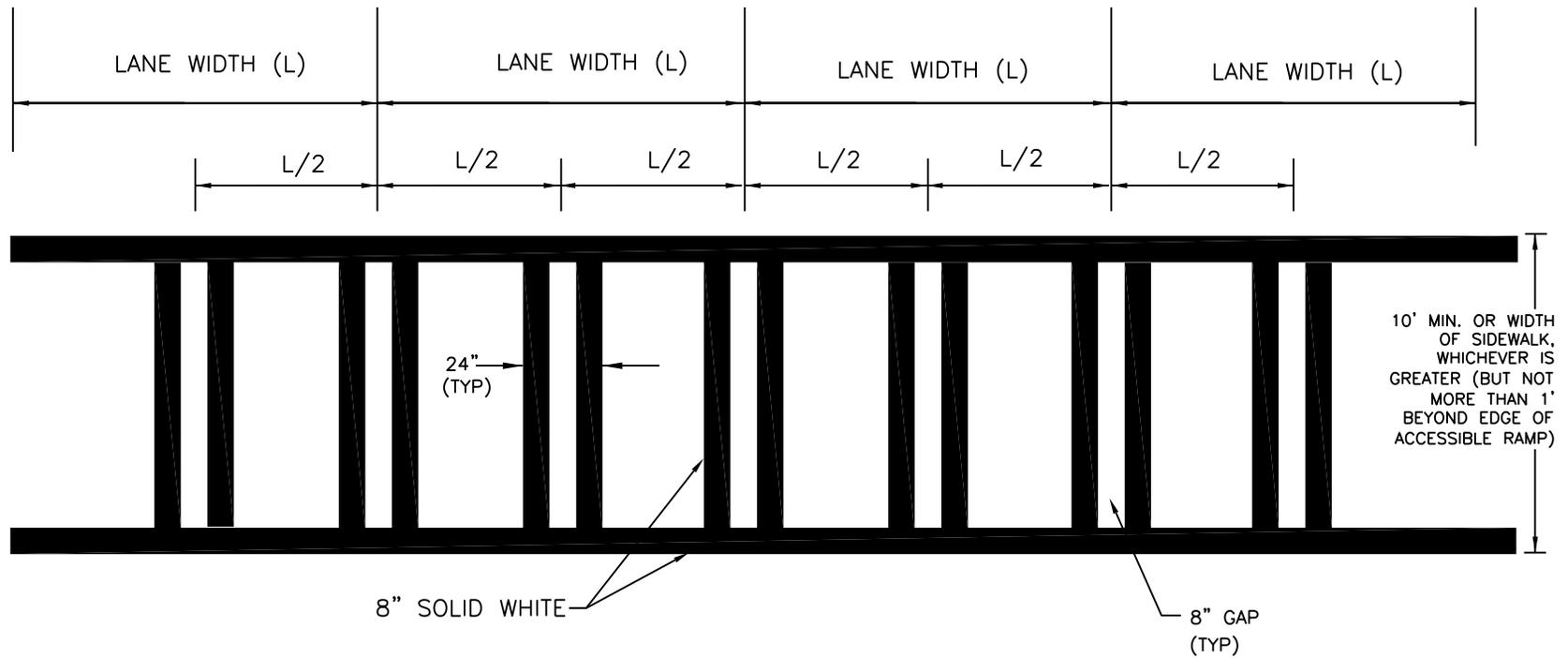
1. USE THIS DETAIL ONLY UNDER THE FOLLOWING CIRCUMSTANCES:
  - 5-FOOT SIDEWALKS WITH CURB RADII GREATER THAN 35 FEET
  - 6-FOOT SIDEWALKS WITH CURB RADII GREATER THAN 30 FEET
  - 8-FOOT SIDEWALKS WITH CURB RADII GREATER THAN 25 FEET
2. DIRECTIONAL RAMPS MAY BE USED WHEN A MIN. 6-FOOT PLANTING STRIP IS PROVIDED. DO NOT USE THIS DETAIL IF THERE IS HARDSCAPE INSTEAD OF A PLANTING STRIP.
3. ALL CONCRETE SHALL BE AT LEAST NCDOT CLASS B.
4. ENSURE FLUSH CONDITIONS AT CURB RAMP TO GUTTER TRANSITION.

NOT TO SCALE



**DIRECTIONAL CURB RAMP WITH LARGE CURB RADIUS**

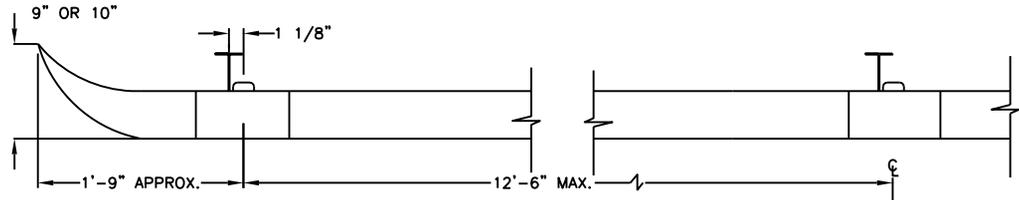
DECEMBER 2019



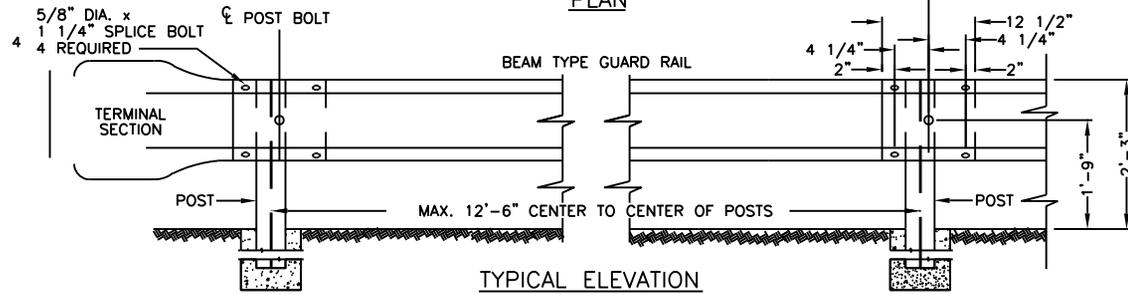
**NOTES:**

1. PER MUTCD STANDARDS, WHEN CROSSWALK LINES ARE USED THEY SHALL CONSIST OF SOLID WHITE LINES THAT MARK THE CROSSWALK. THEY SHALL BE NOT LESS THAN 150 MM (6 IN) NOR GREATER THAN 600 MM (24 IN) IN WIDTH.
2. IF TRANSVERSE LINES ARE USED TO MARK A CROSSWALK, THE GAP BETWEEN THE LINES SHOULD NOT BE LESS THAN 1.8 M (6 FT). IF DIAGONAL OR LONGITUDINAL LINES ARE USED WITHOUT TRANSVERSE LINES TO MARK A CROSSWALK, THE CROSSWALK SHOULD NOT BE LESS THAN 1.8 M (6 FT) WIDE.
3. IF USED, THE DIAGONAL OR LONGITUDINAL LINES SHOULD BE 300 TO 600 MM (12 TO 24 IN) WIDE AND SPACED 300 TO 1500 MM (12 TO 60 IN) APART. THE MARKING DESIGN SHOULD AVOID THE WHEEL PATHS, AND THE SPACING SHOULD NOT EXCEED 2.5 TIMES THE LINE WIDTH.

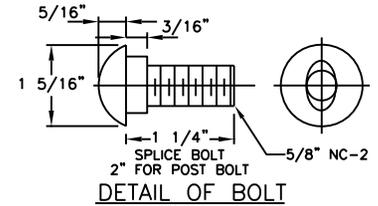
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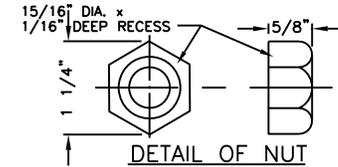
PLAN



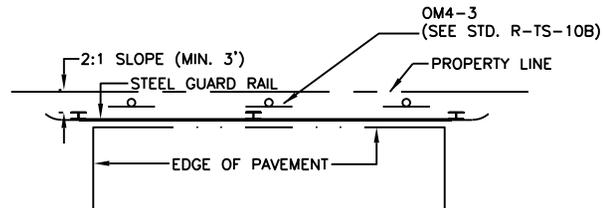
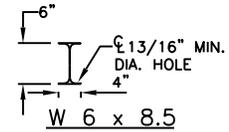
TYPICAL ELEVATION



DETAIL OF BOLT



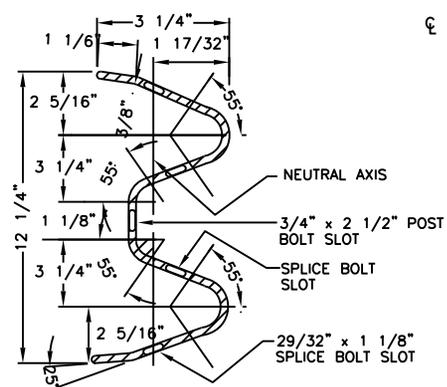
DETAIL OF NUT



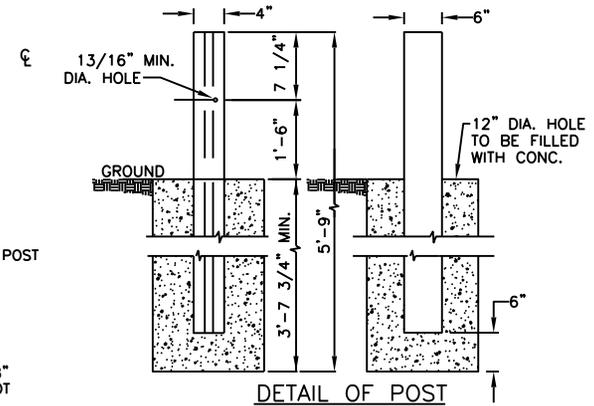
DEAD-END STREET BARRICADE

**NOTE:**

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



SECTION THRU RAIL ELEMENT

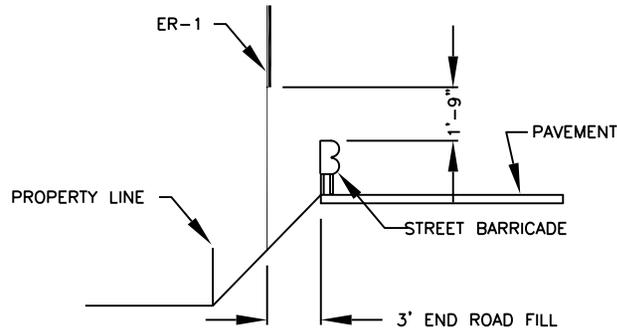


DETAIL OF POST

NOT TO SCALE

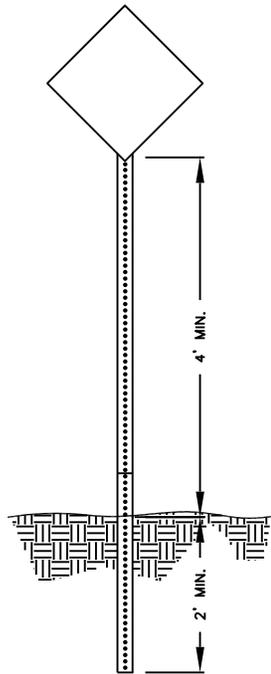
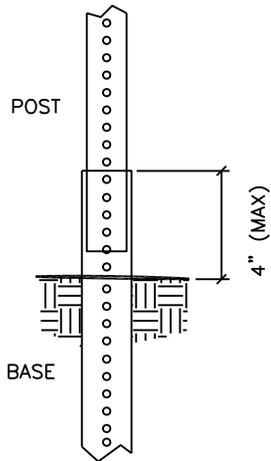
**NOTES:**

1. WHERE A DEAD-END STREET REQUIRES A GUARDRAIL SECTION, END OF ROADWAY MARKER (24"X24" RED) SIGNS ARE REQUIRED.
2. SIGNS ARE TO BE PLACED BEHIND GUARDRAIL 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).

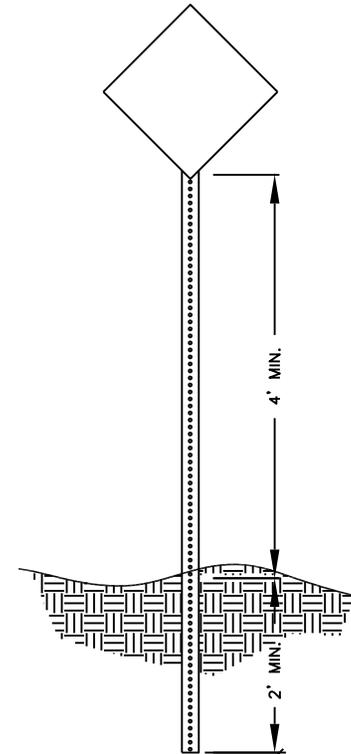
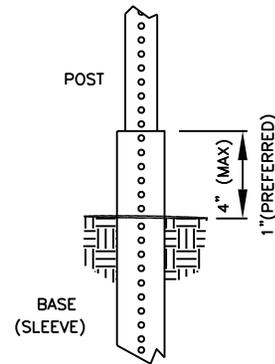


**SIGN LOCATION DETAIL**

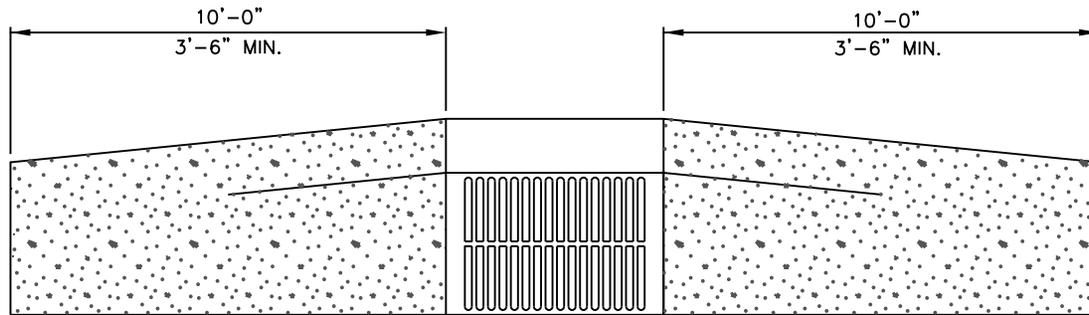
CROSS SECTION OF POST (2 #/FT.)



CROSS SECTION OF POST (14 GAUGE)



NOT TO SCALE

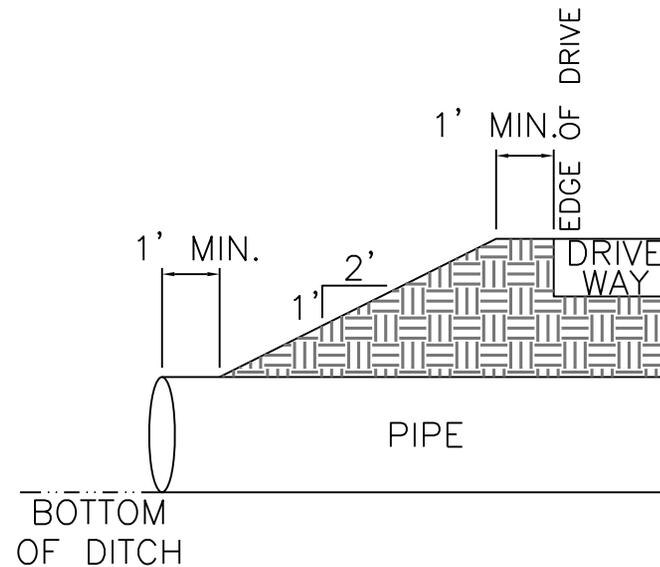


PLAN

NOTE:

1. TRANSITION FROM 2'-6" STANDARD CURB TO VALLEY CURB AT A DRAINAGE INLET ONLY.
2. TRANSITIONS SHORTER THAN 10' SHALL BE APPROVED BY THE CITY ENGINEER. UNDER NO CIRCUMSTANCE SHALL A TRANSITION BE SHORTER THAN 3'-6".

NOT TO SCALE



## RESIDENTIAL DRIVEWAY PIPE DETAIL

### NOTES:

1. THE PIPE SHALL BE A MINIMUM DIAMETER OF 15" REINFORCED CONCRETE OR APPROVED BY KANNAPOLIS AND A MINIMUM LENGTH OF 20'.
2. A LARGER PIPE SIZE MAY BE REQUIRED IF DETERMINED BY A PROFESSIONAL ENGINEER.
3. THE LENGTH OF PIPE REQUIRED SHALL BE THE AMOUNT NEEDED TO EXTEND (1') BEYOND THE TOE OF A 2:1 SLOPE. SEE SECTION DETAIL.
4. NO UTILITIES IN DRIVEWAY, MUST BE MIN. 3' FROM DRIVEWAY.
5. DITCH SHALL BE INSPECTED BY PUBLIC WORKS BEFORE PIPE IS INSTALLED.

NOT TO SCALE

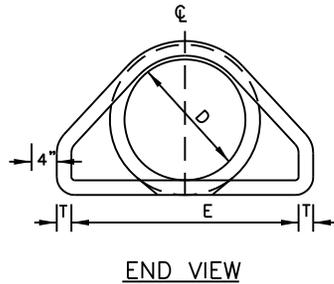
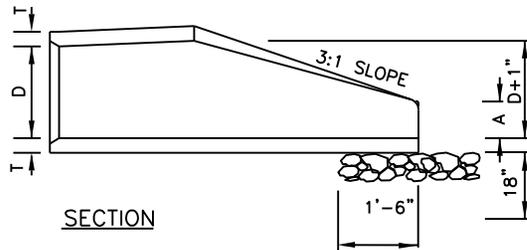
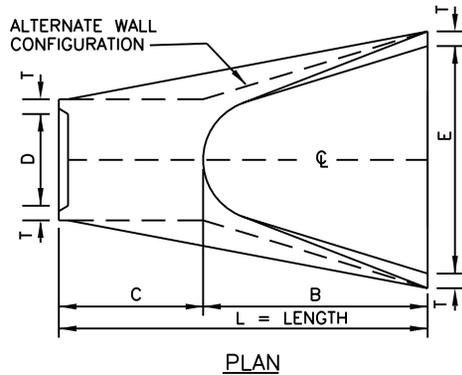


TABLE OF DIMENSIONS							
D	T	A	B	C	E	L	WT.
12"	2-1/4"	4"	2'-0"	4'-1"	2'-0"	6'-1"	730
15"	2-1/4"	6"	2'-3"	3'-10"	2'-0"	6'-1"	730
18"	2-1/2"	9"	2'-3"	3'-10"	3'-0"	6'-1"	1190
24"	3"	10"	3'-8"	2'-6"	4'-0"	6'-2"	1770
30"	3-1/2"	1'-0"	4'-6"	1'-8"	5'-0"	6'-2"	2380
36"	4"	1'-3"	5'-3"	2'-11"	6'-0"	8'-2"	5320
42"	4-1/2"	1'-9"	5'-3"	2'-11"	6'-6"	8'-2"	5920
48"	5"	2'-0"	6'-0"	2'-2"	7'-0"	8'-2"	7470
54"	5-1/2"	2'-3"	5'-6"	2'-10"	7'-6"	8'-4"	8810
60"	6"	2'-6"	5'-0"	3'-3"	8'-0"	8'-3"	11180
66"	6-1/2"	3'-0"	6'-0"	2'-3"	8'-6"	8'-3"	12530
72"	7"	3'-0"	6'-6"	1'-9"	9'-0"	8'-3"	13980

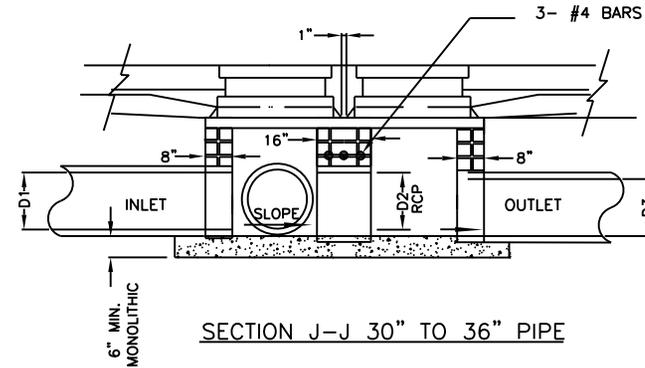
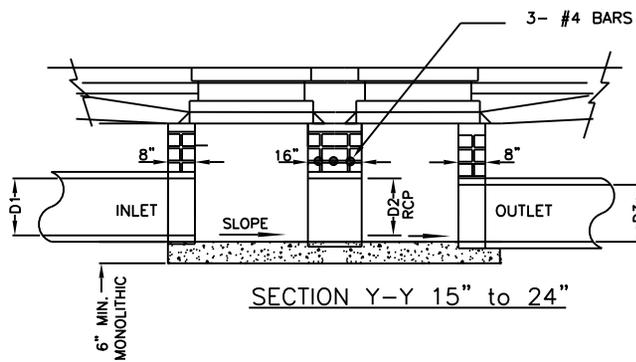
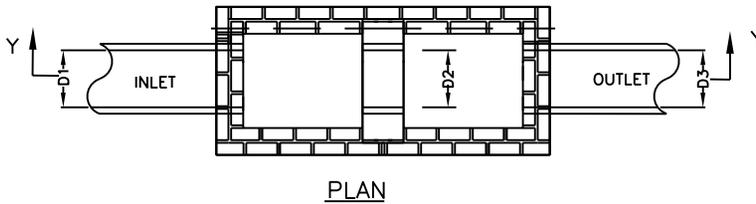
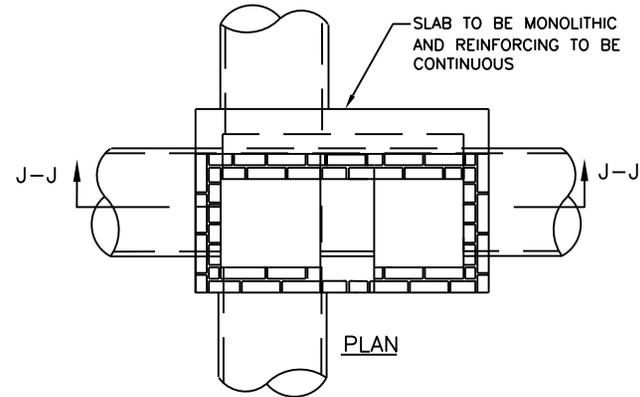
**NOTES:**

1. SEE FORMER NCDOT STANDARD 310.01 FOR DETAILS.
2. REINFORCEMENT SHALL CONFORM TO THE REQUIREMENTS OF REINFORCED CONCRETE PIPE OF LIKE DIAMETER PER AASHTO M170, TABLE 2, WALL B.
3. ALL CONCRETE TO BE 3600 P.S.I. COMPRESSIVE STRENGTH.
4. PROVIDE TONGUE OR SPIGOT JOINT AT INLET END SECTION.
5. PROVIDE GROOVE OR BELL JOINT AT OUTLET END SECTION.
6. THE DIMENSIONS FOR END SECTIONS SHALL SUBSTANTIALLY AGREE WITH THE TABLE. MINOR VARIATIONS WILL BE PERMITTED BASED ON THE MANUFACTURER'S STANDARD FORMS AND TEMPLATES.
7. NOT TO BE USED IN NCDOT MAINTAINED RIGHT OF WAY.

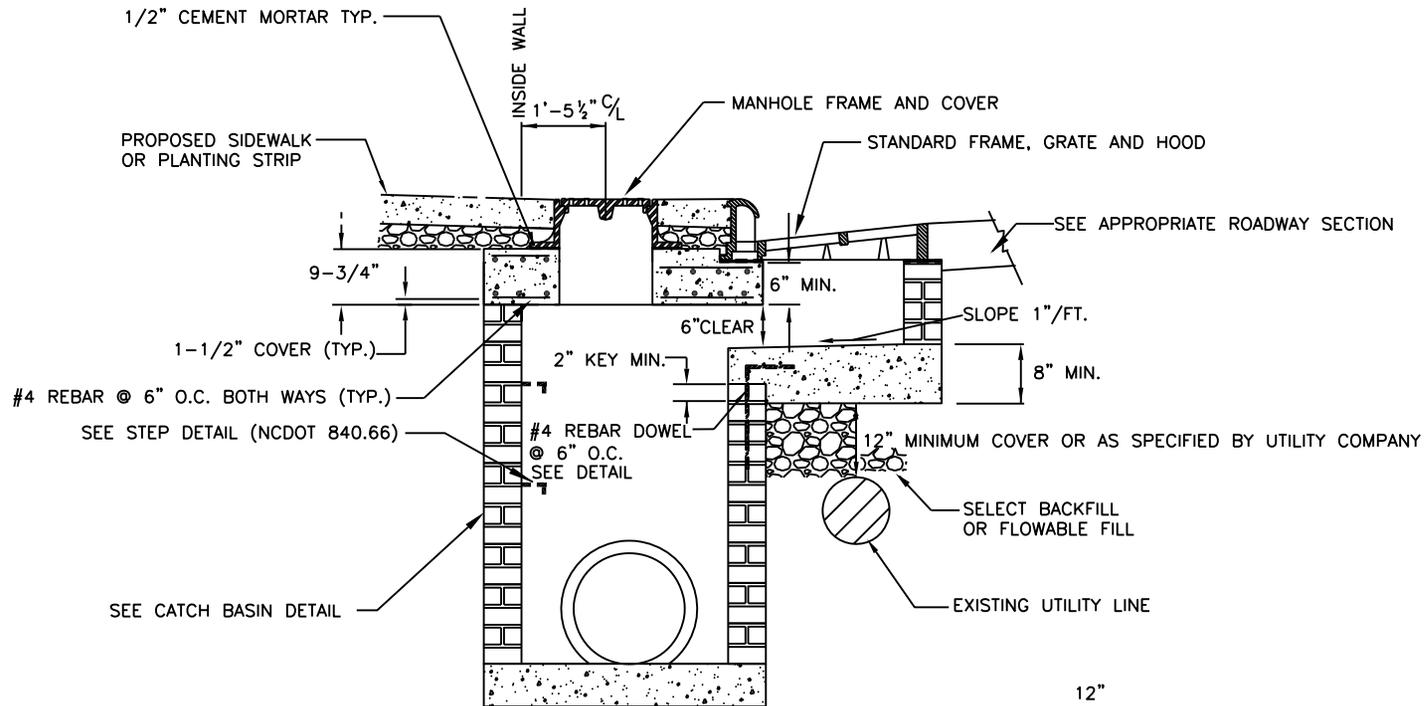
NOT TO SCALE

**NOTES:**

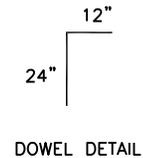
1. SEE NCDOT STANDARD 840.01 FOR DETAILS BASED ON PIPE SIZE PER CROSS SECTION.
2. CONSTRUCT TWO SINGLE BASINS PER NCDOT STANDARD WITH DOUBLE INTERIOR WALL.
3. ALL CONCRETE TO BE NCDOT CLASS B CONCRETE.
4. BASE SLAB SHALL BE MONOLITHIC.
5. PIPE SECTION D2 CONNECTING CATCH BASINS SHALL HAVE A MINIMUM DIAMETER SAME AS OF OUTLET PIPE D3.
6. ALL REINFORCING STEEL SHOWN ON NCDOT STANDARDS IS TO BE PROVIDED AS CONTINUOUS MEMBERS. (NO LAPS, USED AS A SINGLE CONTINUOUS BAR IN THE SLAB)
7. WEEP HOLES SHALL BE PLACED IN BACK WALL WITH FILTER FABRIC OR STONE ON BACK SIDE



NOT TO SCALE



OFFSET CATCH BASIN  
EXISTING UTILITY CONFLICT



DOWEL DETAIL

**NOTES:**

1. PRIOR APPROVAL FROM THE CITY ENGINEER IS REQUIRED.
2. THIS STRUCTURE IS TO ONLY BE USED ON CITY MAINTAINED STREETS AND NOT ON NCDOT STREETS WITHOUT THEIR PERMISSION.
3. SEE NCDOT DETAIL 840.01 FOR MAXIMUM PIPE SIZE ALLOWABLE.

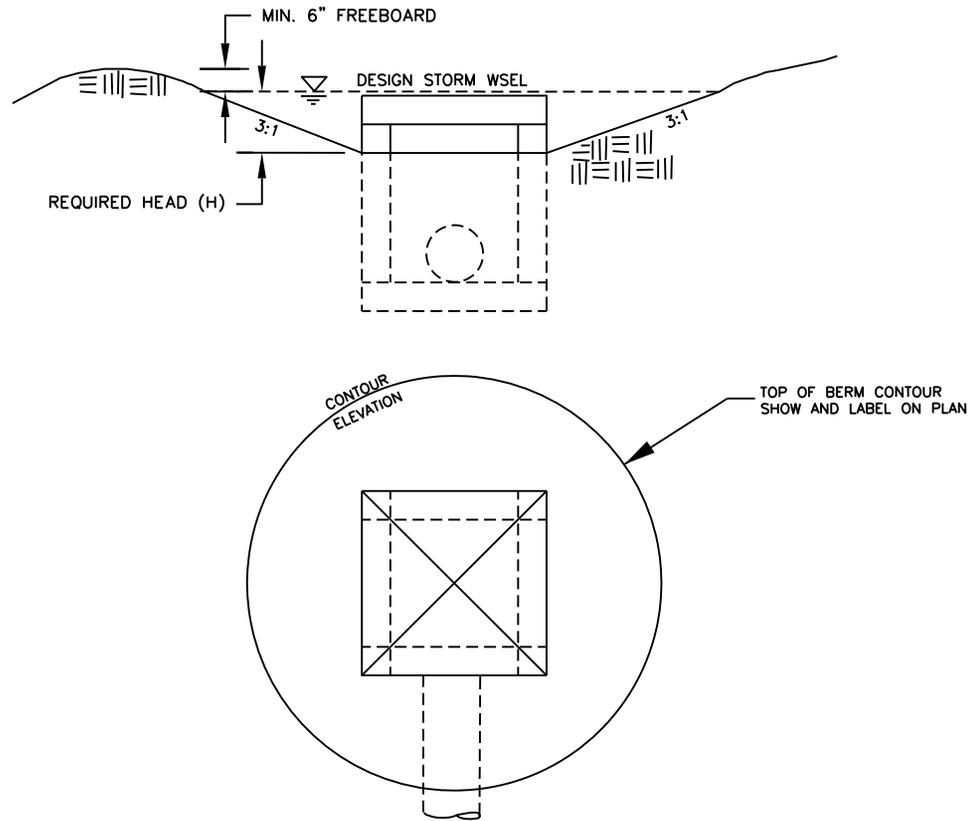
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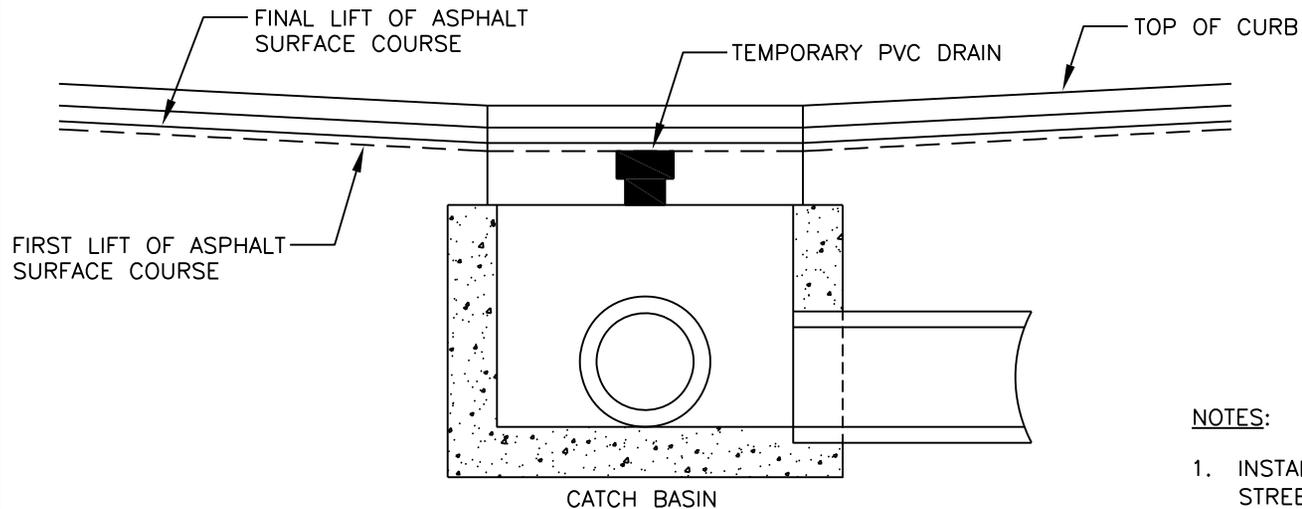
**OFFSET CATCH BASIN**

DECEMBER 2019

130

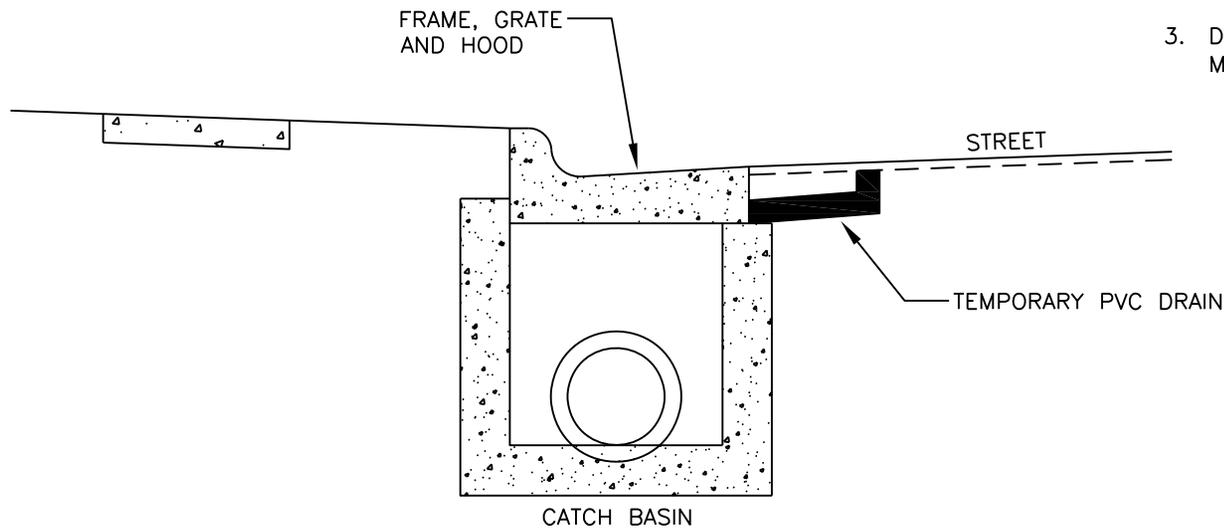


NOT TO SCALE



**NOTES:**

1. INSTALL AND MAINTAIN DRAINS IN LOW POINTS OF STREETS UNTIL FINAL 1" LIFT OF ASPHALT SURFACE COURSE IS PLACED.
2. FILL DRAINS WITH CONCRETE PRIOR TO PLACING FINAL 1" LIFT OF ASPHALT SURFACE COURSE.
3. DRAINS MAY BE CONSTRUCTED OF SCHEDULE 40 PVC, MINIMUM 3" DIAMETER.



NOT TO SCALE

**DEFINITION:** GRAVELED AREA TO BE LOCATED AT POINTS WHERE VEHICLES ENTER AND LEAVE A CONSTRUCTION SITE.

**PURPOSE:** TO PROVIDE A BUFFER AREA WHERE VEHICLES CAN DROP THEIR MUD AND SEDIMENT TO AVOID TRANSPORTING IT ONTO PUBLIC ROADS, TO CONTROL EROSION FROM SURFACE RUNOFF, AND TO HELP CONTROL DUST.

**CONDITIONS:** TO BE USED WHEREVER TRAFFIC WILL BE LEAVING A CONSTRUCTION SITE AND MOVING DIRECTLY ONTO A PUBLIC ROAD OR OTHER PAVED OFF-SITE AREA. CONSTRUCTION PLANS SHOULD LIMIT TRAFFIC TO PROPERLY CONSTRUCTED ENTRANCES.

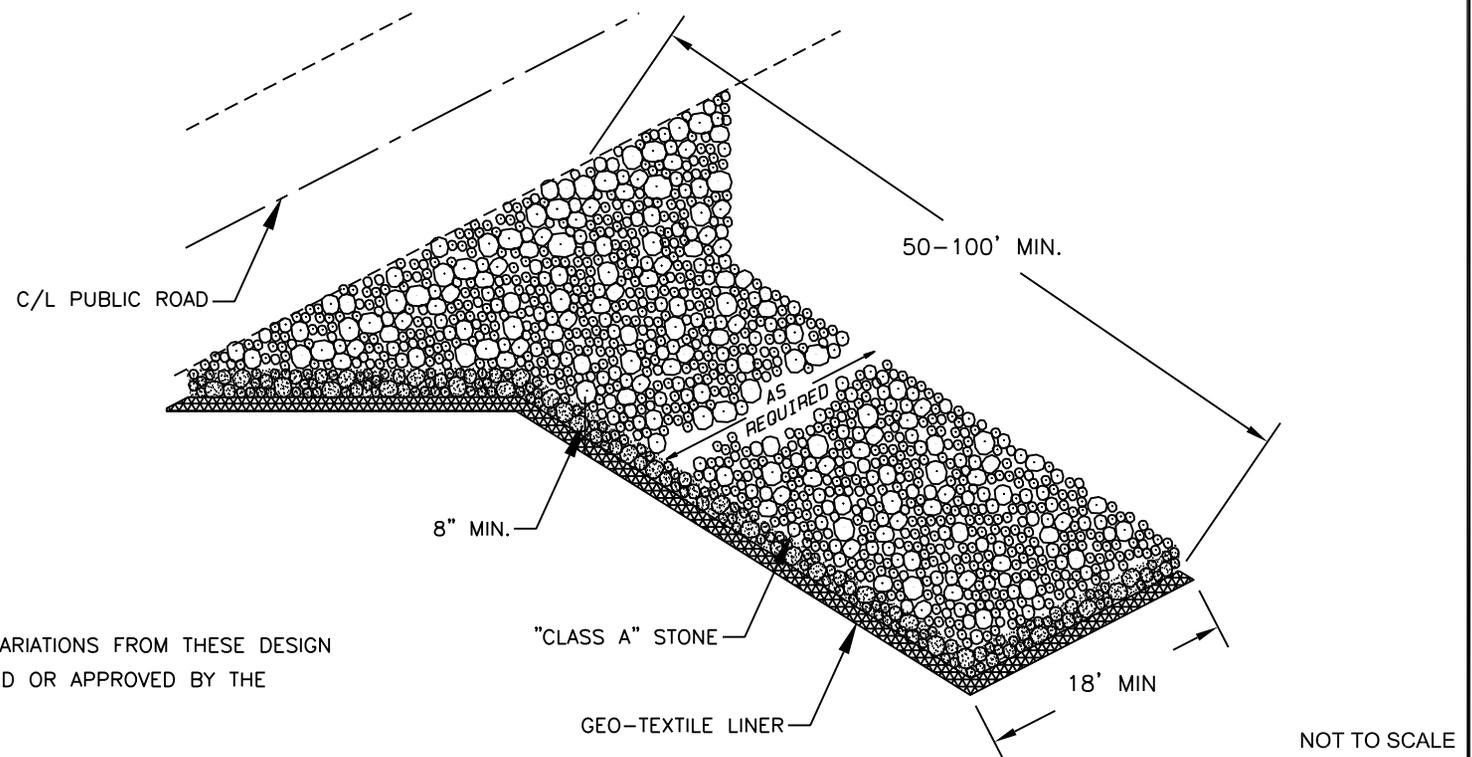
**DESIGN CRITERIA:** AGGREGATE SIZE – USE "CLASS A" STONE WITH GEO-TEXTILE LINER.

DIMENSIONS OF GRAVEL PAD – THICKNESS = 8" MINIMUM

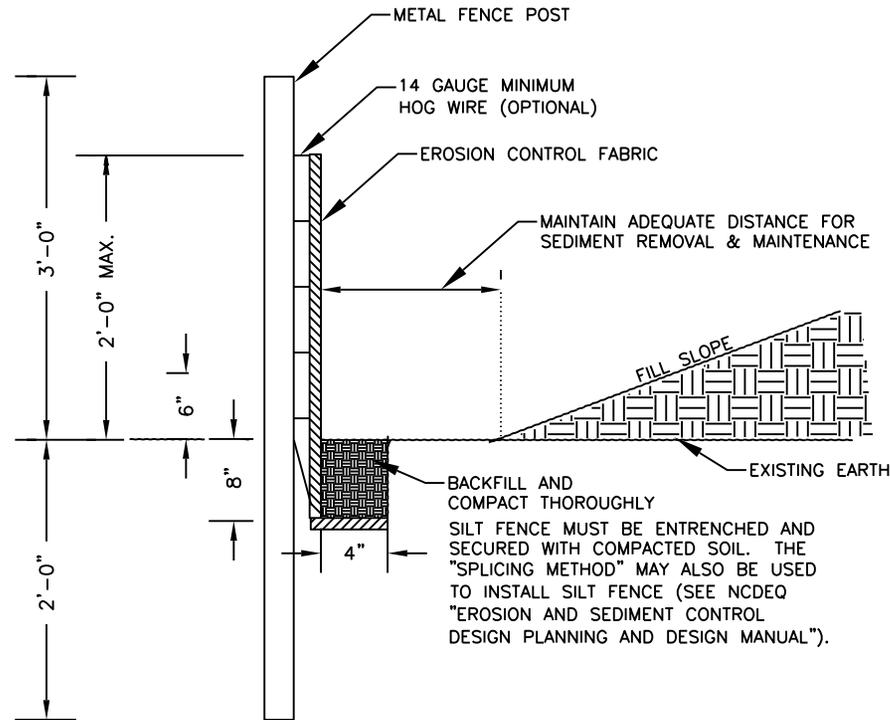
WIDTH = 18' MINIMUM

LENGTH = 50-100' MINIMUM, AS DETERMINED BY CITY STAFF

LOCATION = LOCATE CONSTRUCTION ENTRANCES TO LIMIT SEDIMENT FROM LEAVING THE SITE AND TO PROVIDE FOR MAXIMUM UTILITY BY ALL CONSTRUCTION VEHICLES. AVOID STEEP GRADES AND ENTRANCES AT CURVES IN PUBLIC ROADS.



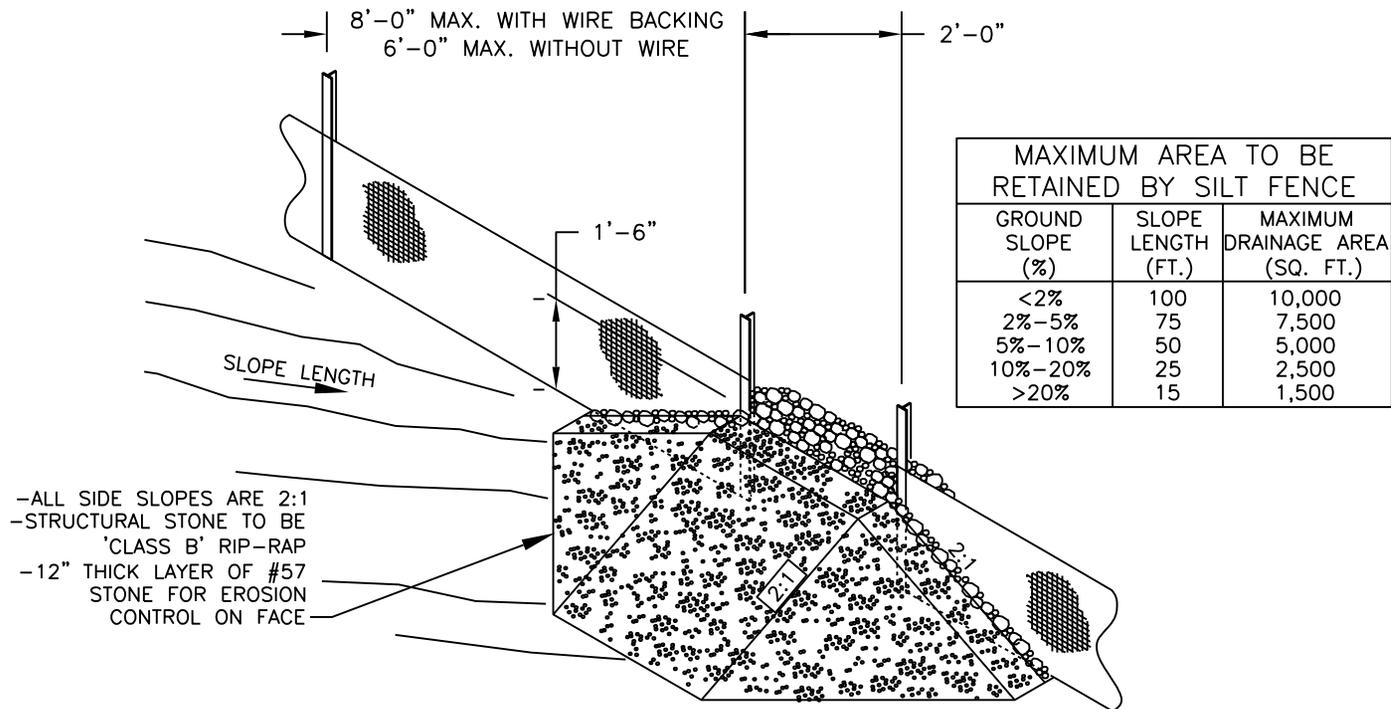
**NOTE:** SITE CONDITIONS MAY REQUIRE VARIATIONS FROM THESE DESIGN CRITERIA. VARIATIONS WILL BE DETERMINED OR APPROVED BY THE APPROPRIATE CITY STAFF.



**NOTES:**

1. SPACING OF POSTS USING HOG WIRE WITH APPROVED EROSION CONTROL FABRICS TO BE 8'-0" ON CENTER.
  2. SPACING OF POSTS WITHOUT HOG WIRE USING APPROVED EROSION CONTROL FABRICS TO BE 6'-0" ON CENTER.
- POST: METAL T-POST 5'-0" OR 6'-0" IN HEIGHT DEPENDING ON FILL SLOPE (MIN 1.33 LB/LF STEEL CONSTRUCTION).
- FABRIC: 3'-0" IN WIDTH (MUST BE STANDARD SPECIFICATIONS FOR SILT FENCE - ASTM D) WITH 12" BURIED IN TRENCH.
- STONE: (IF USED) #4 WASHED STONE PLACED 1'-0" DEEP AT SILT FENCE.
1. SPLICES IN FABRIC SHOULD BE OVERLAPPED A MIN. OF 4 FT.
  2. MAXIMUM DRAINAGE AREA = 1/4 ACRE PER 100 FT OF FENCE FOR 2% OR LESS SLOPE.
  3. SILT FENCE TO BE REMOVED AFTER CONSTRUCTION IS COMPLETE AS DIRECTED BY THE CONSTRUCTION INSPECTOR.

NOT TO SCALE



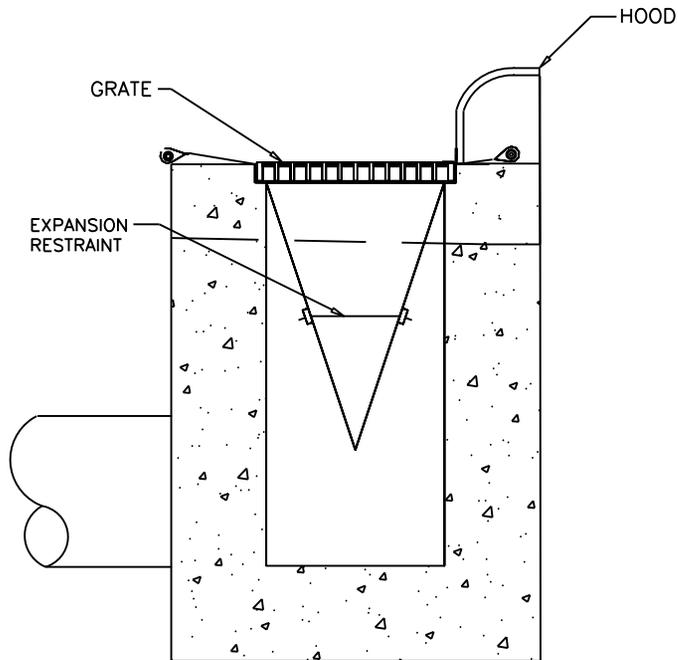
**NOTES:**

1. NON-EROSIVE OUTLETS ARE TO BE PLACED IN THE SILT FENCE AS SHOWN ON THE PROJECT PLANS AS DIRECTED BY THE CONSTRUCTION INSPECTOR.
2. NON-EROSIVE OUTLETS ARE TO BE LOCATED AT ALL NATURAL DRAINAGE AREAS AND DEPRESSIONS, WITH THE EXCEPTION OF PERENNIAL STREAMS.
3. THE MAXIMUM DRAINAGE AREA IMPOUNDED AT EACH OUTLET MUST NOT EXCEED 1/4 ACRE.

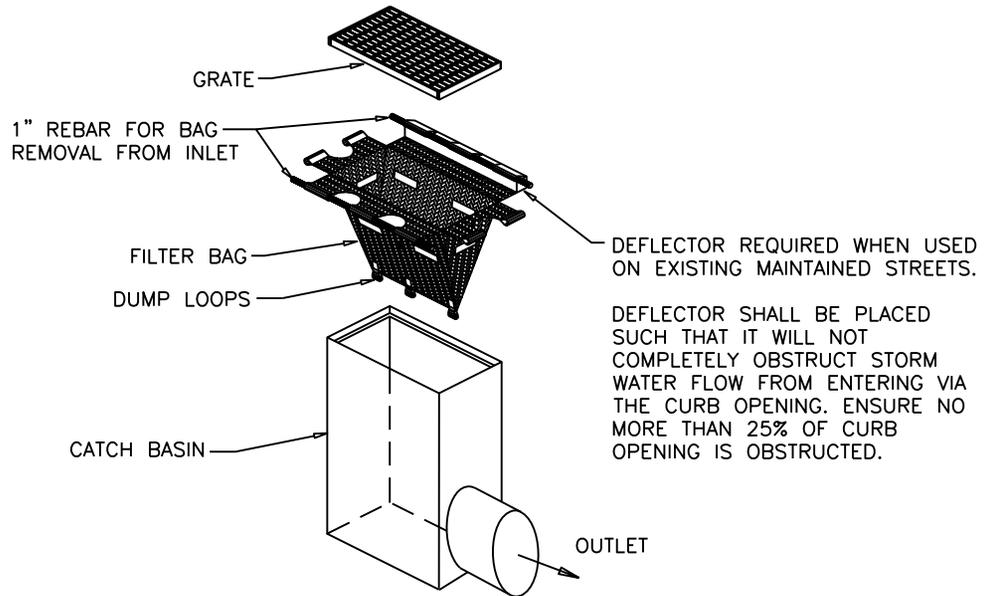
NOT TO SCALE

**NOTES:**

1. INLET MAINTENANCE SHALL BE DOCUMENTED IN PROJECT LOG BOOK.
2. FILTER TYPES SHALL BE APPROVED BY THE CITY INSPECTOR PRIOR TO INSTALLATION.
3. FILTER BAGS MAY BE REMOVED WHEN SITE IS STABILIZED AT THE DIRECTION OF THE ENGINEER.
4. FILTER BAGS SHALL BE REMOVED PRIOR TO STREET ACCEPTANCE AND/OR CLOSE OUT OF GRADING PERMIT.
5. FILTER BAGS SHALL BE CLEANED OR REPLACED ON A REGULAR BASIS (NOT BE MORE THAN HALF FULL AT ANY TIME).
6. FILTER BAGS MAY BE INSTALLED IN EXISTING CITY OR NCDOT ROADS AS LONG AS STORM DRAINAGE IS NOT IMPEDED.



SECTION

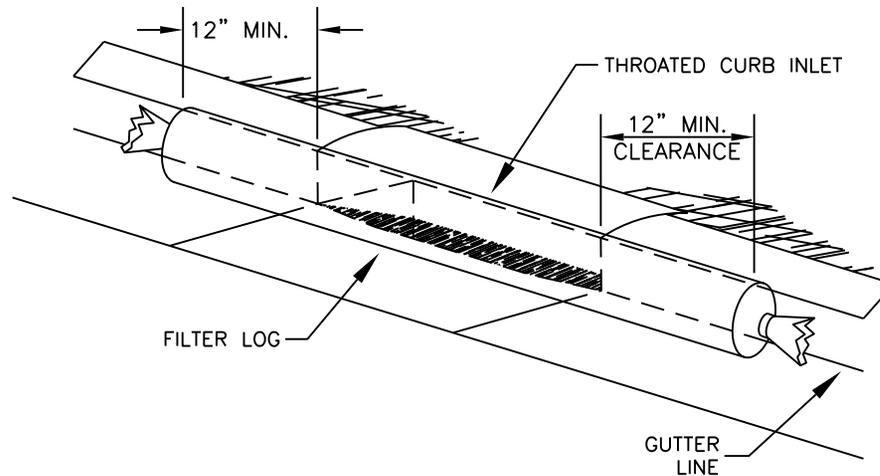


INSTALLATION

DEFLECTOR REQUIRED WHEN USED ON EXISTING MAINTAINED STREETS.

DEFLECTOR SHALL BE PLACED SUCH THAT IT WILL NOT COMPLETELY OBSTRUCT STORM WATER FLOW FROM ENTERING VIA THE CURB OPENING. ENSURE NO MORE THAN 25% OF CURB OPENING IS OBSTRUCTED.

NOT TO SCALE



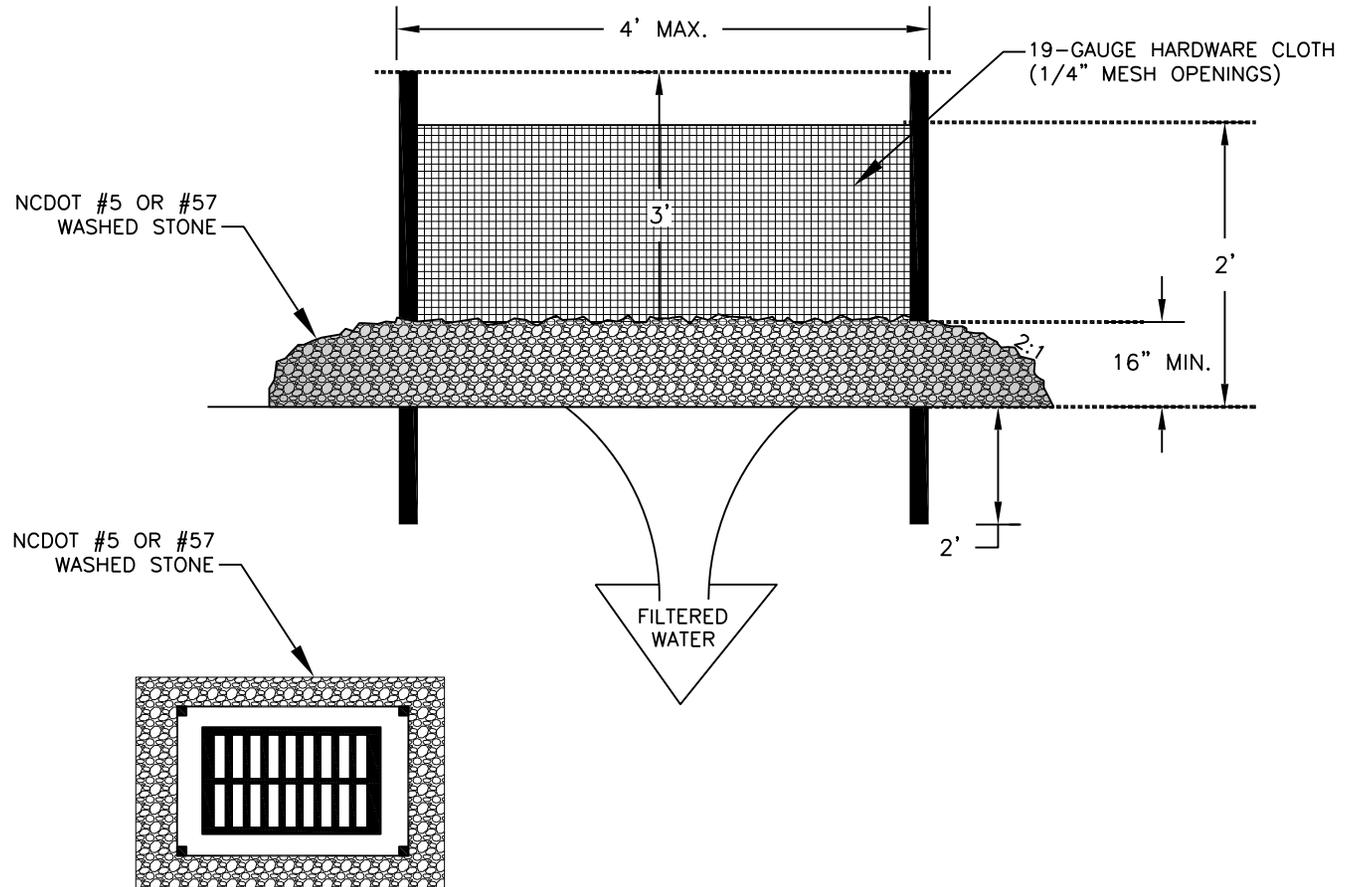
**NOTES:**

1. INSTALL THE FILTER LOG IN FRONT OF THE CURB INLET OPENING. EACH END OF THE FILTER LOG SHOULD OVERLAP THE CURB INLET APPROXIMATELY 12".
2. THE FILTER LOG SHALL BE A PRE-MANUFACTURED SYNTHETIC FILTER OR A SYNTHETIC SOCK MATERIAL FILLED WITH AN ACCEPTABLE FILTERING MATERIAL SUCH AS COMPOST, #57 CRUSHED STONE OR 100% SHREDDED RUBBER (TYPICALLY FROM TIRES).
3. THE FILTER LOG SOCK FABRIC SHALL BE HIGH DURABILITY NETTING MATERIAL TO RESIST PUNCTURE AND WEAR IN THE TRAFFIC AREAS.
4. SAND BAGS SHALL BE USED TO AID IN THE LOG SHAPE AND PREVENT IT FROM ENTERING INTO THE THROAT. THEY SHOULD BE PLACED BETWEEN THE LOG AND THE THROAT OPENING, AND USED TO SECURE THE ENDS OF THE LOG AGAINST THE CURB IF NEEDED. THE END OF THE LOG SHALL EXTEND A MINIMUM OF 1 FOOT PAST THE END OF THE THROAT OPENING.
5. IN ALL CASES, THE LOG SHALL PROVIDE A PHYSICAL BARRIER TO THE CATCH BASIN TO ALLOW FOR PONDING AND SEDIMENTATION ALONG THE UPSTREAM SIDE OF THE LOG. THE LOGS SHALL BE PLACED ON FLAT SURFACES AND MAINTAIN CONSTANT CONTACT WITH THE PAVED SURFACE. ANY DAYLIGHT WILL ALLOW FOR UNTREATED DISCHARGE AND IS NOT PERMITTED.
6. ALL FILTER LOGS MUST BE INSPECTED FREQUENTLY (24 HOURS AFTER A STORM EVENT AND WEEKLY) FOR PROPER FUNCTION. ACCUMULATED SEDIMENT AND DEBRIS SHALL BE REMOVED TO AVOID FUTURE FAILURE, AND MUST NOT EXCEED HALF OF THE EFFECTIVE HEIGHT OF THE LOG. REFERENCE MANUFACTURER'S RECOMMENDATIONS FOR ADDITIONAL MAINTENANCE.
7. REMOVE FILTER LOGS WHEN THE SITE HAS BEEN STABILIZED.

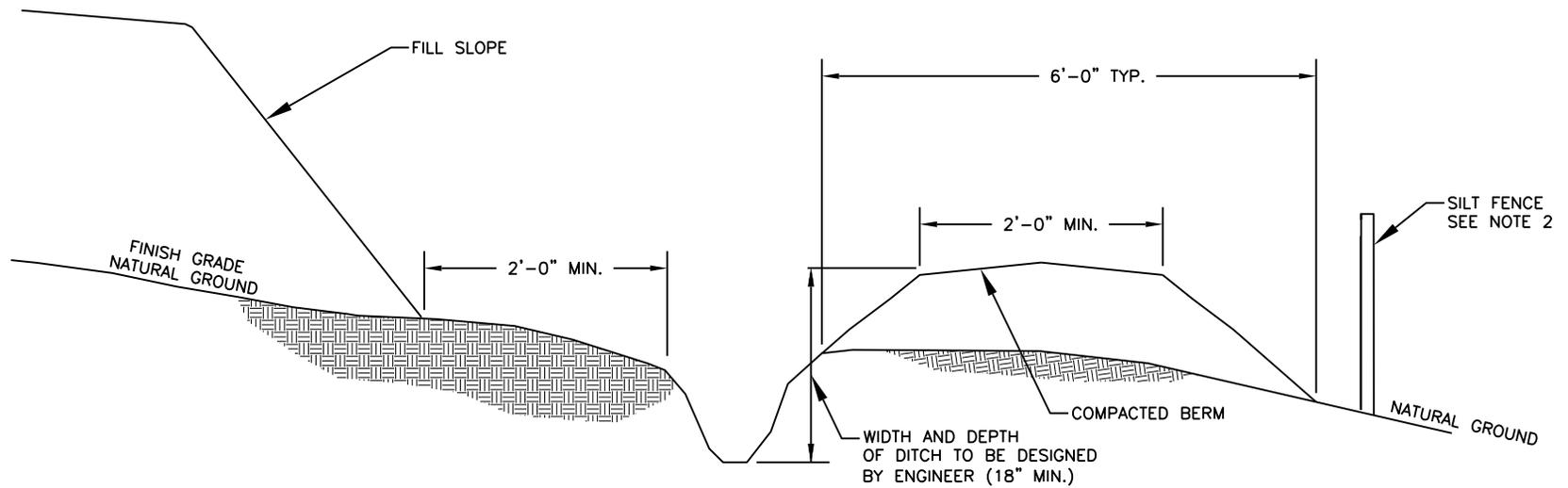
NOT TO SCALE

**NOTES:**

1. UNIFORMLY GRADE A SHALLOW DEPRESSION APPROACHING THE INLET.
2. DRIVE 5-FOOT STEEL POSTS 2 FEET INTO THE GROUND SURROUNDING THE INLET. SPACE POSTS EVENLY AROUND THE PERIMETER OF THE INLET, A MAXIMUM OF 4 FEET APART.
3. SURROUND THE POSTS WITH WIRE MESH HARDWARE CLOTH. SECURE THE WIRE MESH TO THE STEEL POSTS AT THE TOP, MIDDLE, AND BOTTOM. PLACING A 2-FOOT FLAP OF THE WIRE MESH UNDER THE GRAVEL FOR ANCHORING IS RECOMMENDED.
4. PLACE CLEAN GRAVEL (NC DOT #5 OR #57 STONE) ON A 2:1 SLOPE WITH A HEIGHT OF 16 INCHES AROUND THE WIRE, AND SMOOTH TO AN EVEN GRADE.
5. ONCE THE CONTRIBUTING DRAINAGE AREA HAS BEEN STABILIZED, REMOVE ACCUMULATED SEDIMENT, AND ESTABLISH FINAL GRADING ELEVATIONS.
6. COMPACT THE AREA PROPERLY AND STABILIZED IT WITH GROUND COVER.



NOT TO SCALE



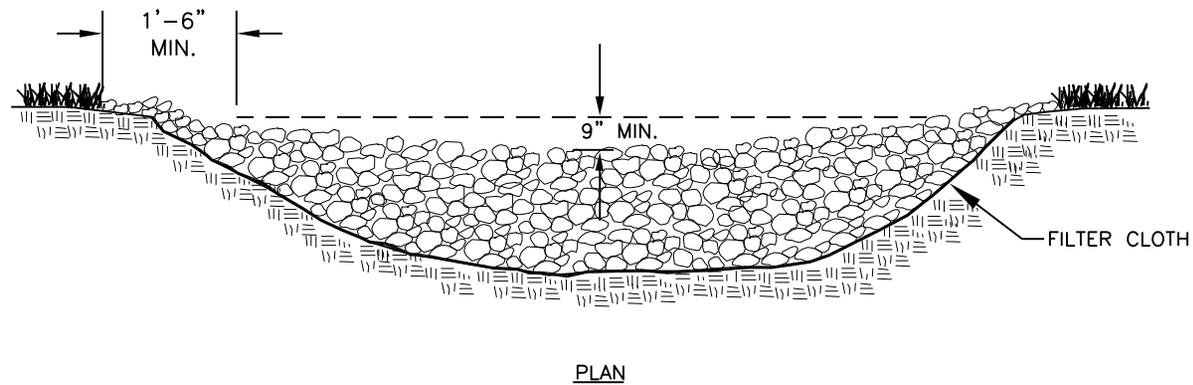
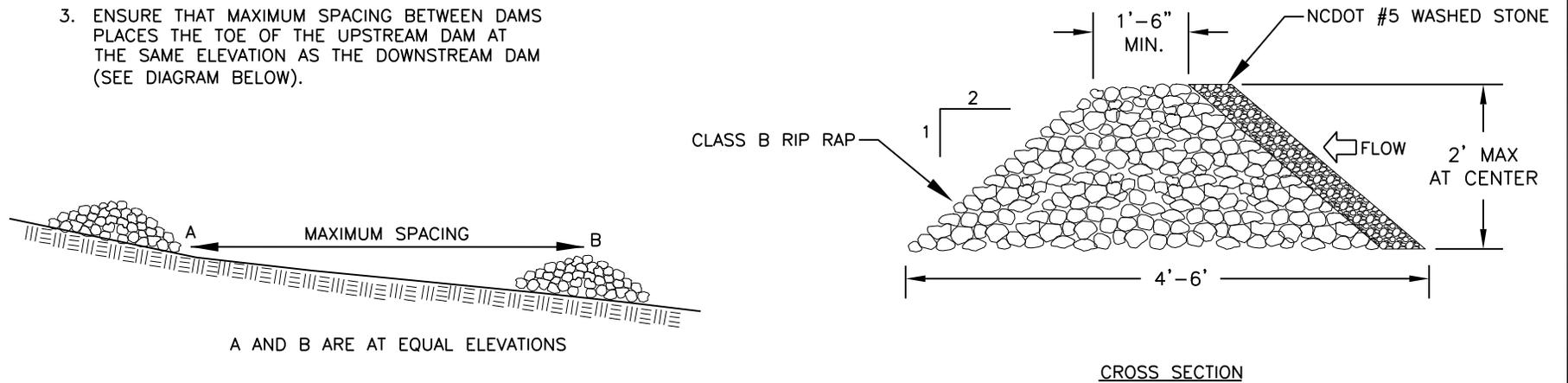
NOTES:

1. DITCH SHALL HAVE LONGITUDINAL SLOPE OF 1%.
2. SILT FENCE MAY BE REQUIRED BEHIND BERM.

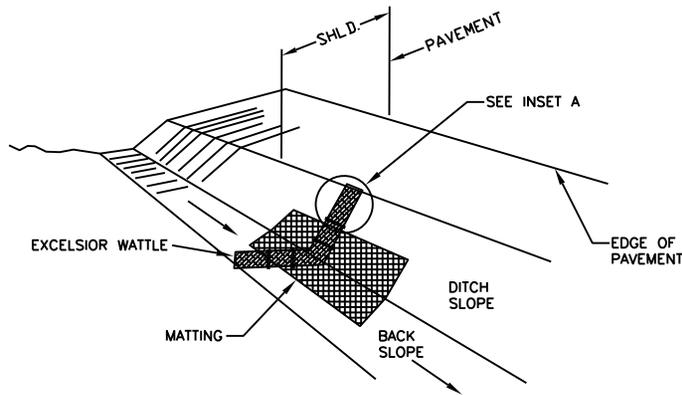
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**NOTES:**

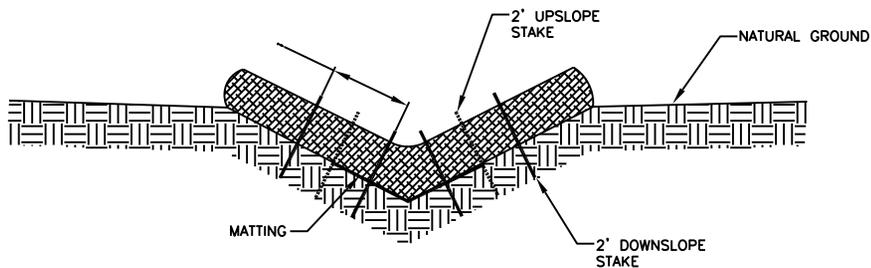
1. RIPRAP SIZE TO BE DESIGNED BY ENGINEER.
2. CHECK DAMS MAY BE USED IN SLOPING DITCHES OR CHANNELS TO SLOW VELOCITY OR TO CREATE SEDIMENT TRAPS.
3. ENSURE THAT MAXIMUM SPACING BETWEEN DAMS PLACES THE TOE OF THE UPSTREAM DAM AT THE SAME ELEVATION AS THE DOWNSTREAM DAM (SEE DIAGRAM BELOW).



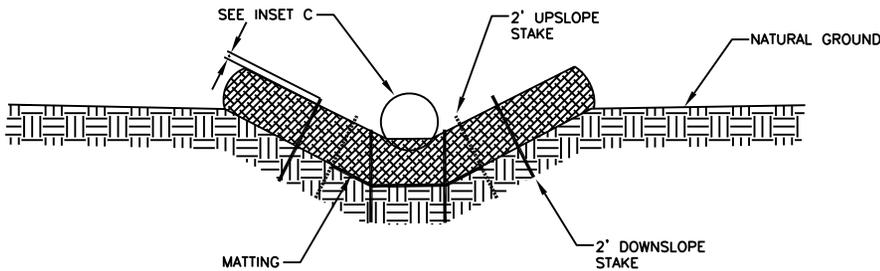
NOT TO SCALE



ISOMETRIC VIEW



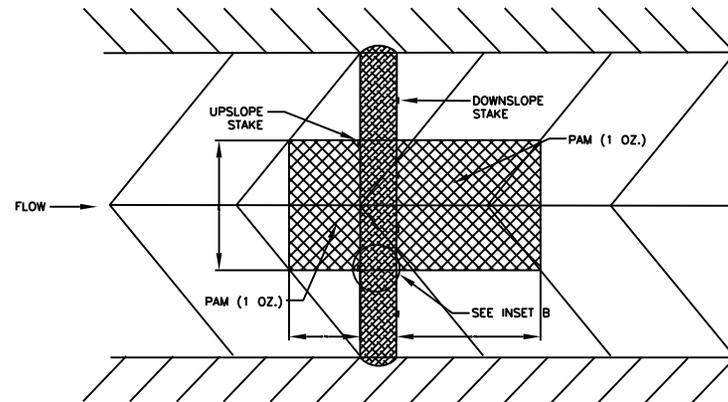
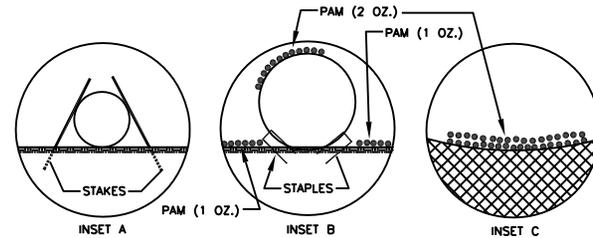
CROSS SECTION  
VEE DITCH



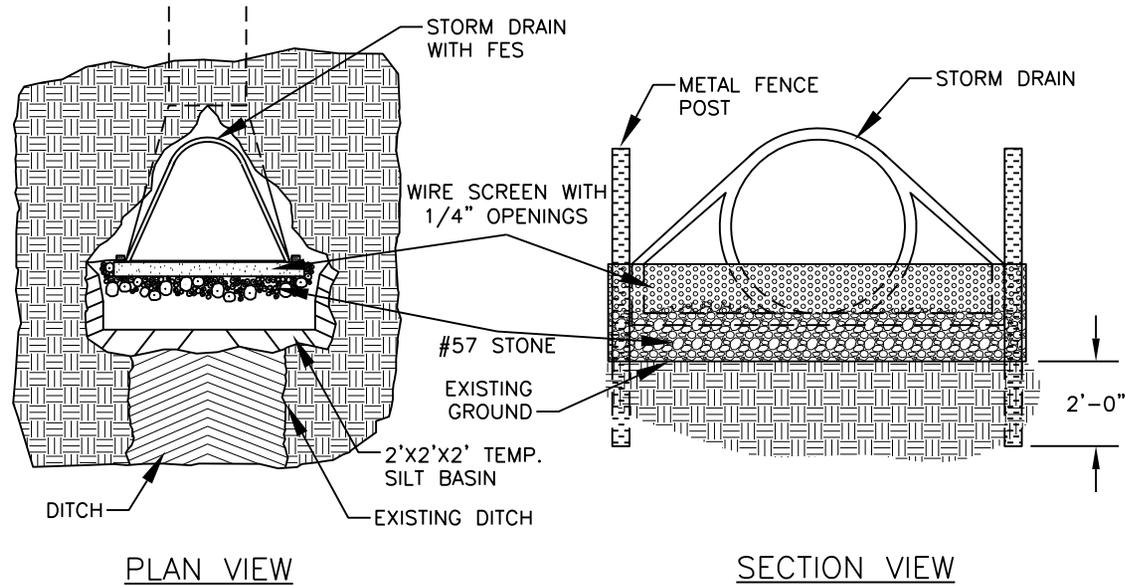
CROSS SECTION  
TRAPEZOIDAL DITCH

**NOTES:**

1. USE MINIMUM 12" DIAMETER FIBER WATTLE.
2. USE 2' WOODEN STAKES WITH A 2" X 2" NOMINAL CROSS SECTION.
3. ONLY INSTALL WATTLE(S) TO A HEIGHT IN DITCH SO FLOW WILL NOT WASH AROUND WATTLE AND SCOUR DITCH SLOPES AND AS DIRECTED.
4. INSTALL A MINIMUM OF 2 UPSLOPE STAKES AND 4 DOWNSLOPE STAKES AT AN ANGLE TO WEDGE WATTLE TO BOTTOM OF DITCH.
5. PROVIDE STAPLES MADE OF 0.125" DIAMETER STEEL WIRE FORMED INTO A U SHAPE NOT LESS THAN 12" IN LENGTH.
6. INSTALL STAPLES APPROXIMATELY EVERY 1 LINEAR FOOT ON BOTH SIDES OF WATTLE AND AT EACH END TO SECURE IT TO THE SOIL.
7. INSTALL MATTING IN ACCORDANCE WITH SECTION 1631 OF THE NCDOT STANDARD SPECIFICATIONS.

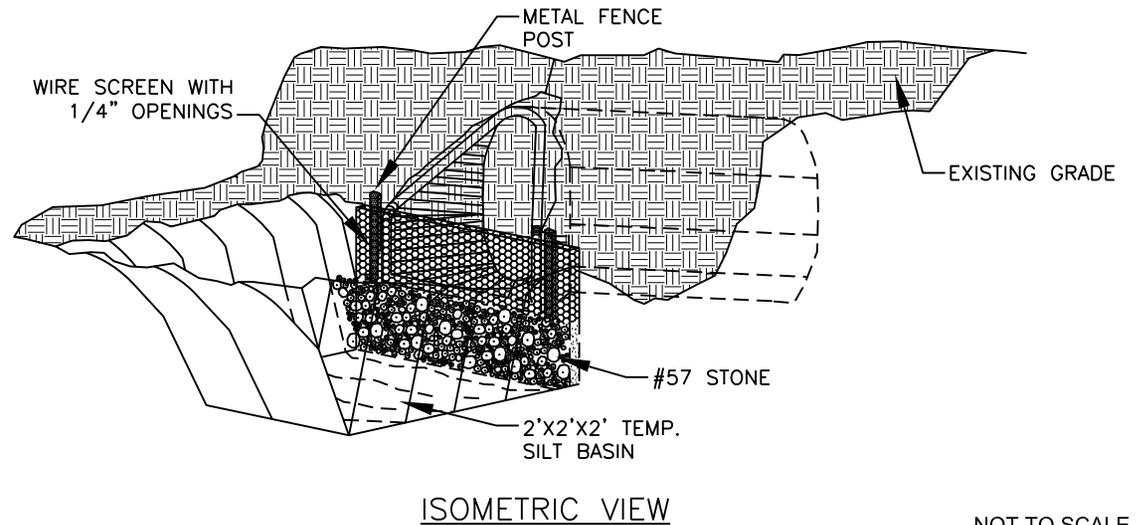


NOT TO SCALE



**NOTES:**

1. THIS MEASURE IS USED WHERE A DISTURBED DITCH FLOWS INTO A PROPOSED FES.
2. WIRE SCREEN SHALL BE 3/4" AND THE BOTTOM SHALL BE TRENCHED A MINIMUM OF 6" INTO THE GROUND AND HELD IN PLACE WITH #57 STONE.
3. ONCE DITCH IS STABILIZED, REMOVE WIRE SCREEN AND FILL BASIN WITH SUITABLE MATERIAL. INSTALL EXCELSIOR MATTING OVER BASIN TO STABILIZE FILL.

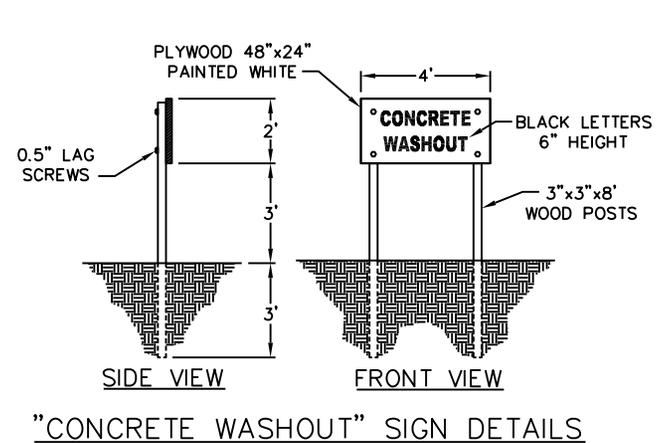
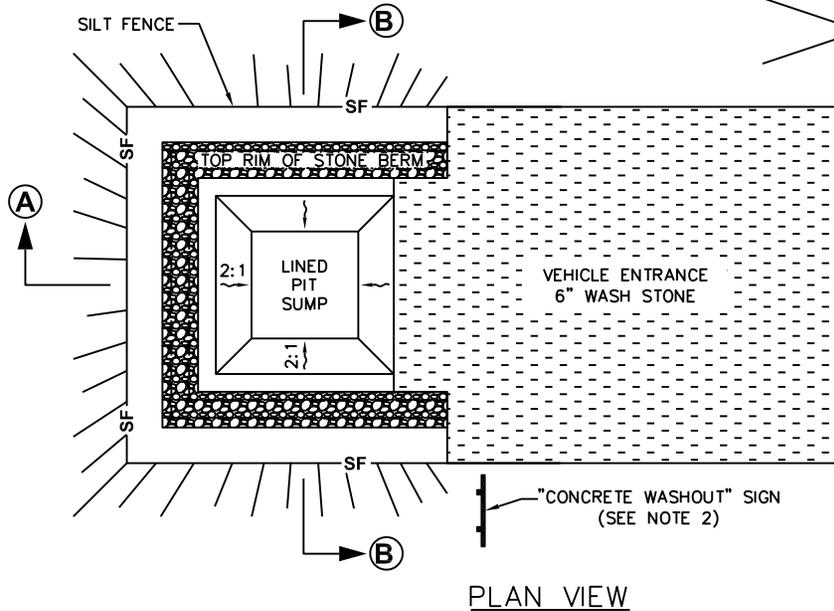
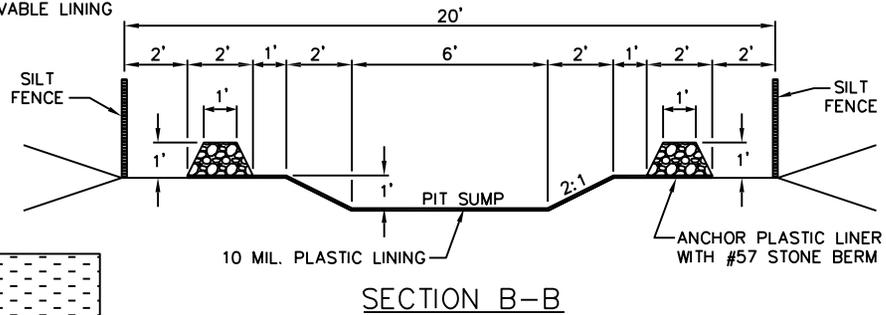
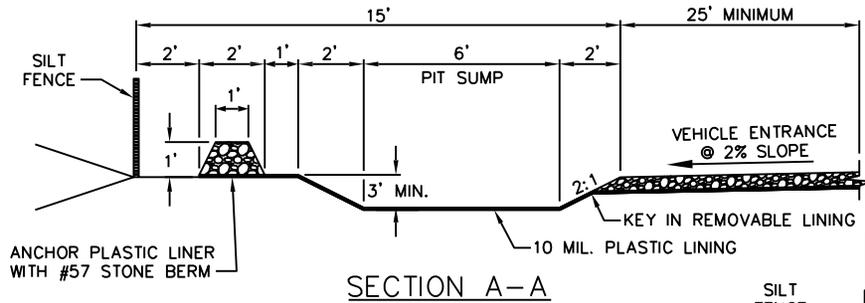


NOT TO SCALE

**FLARED END SECTION**  
**INLET PROTECTION**

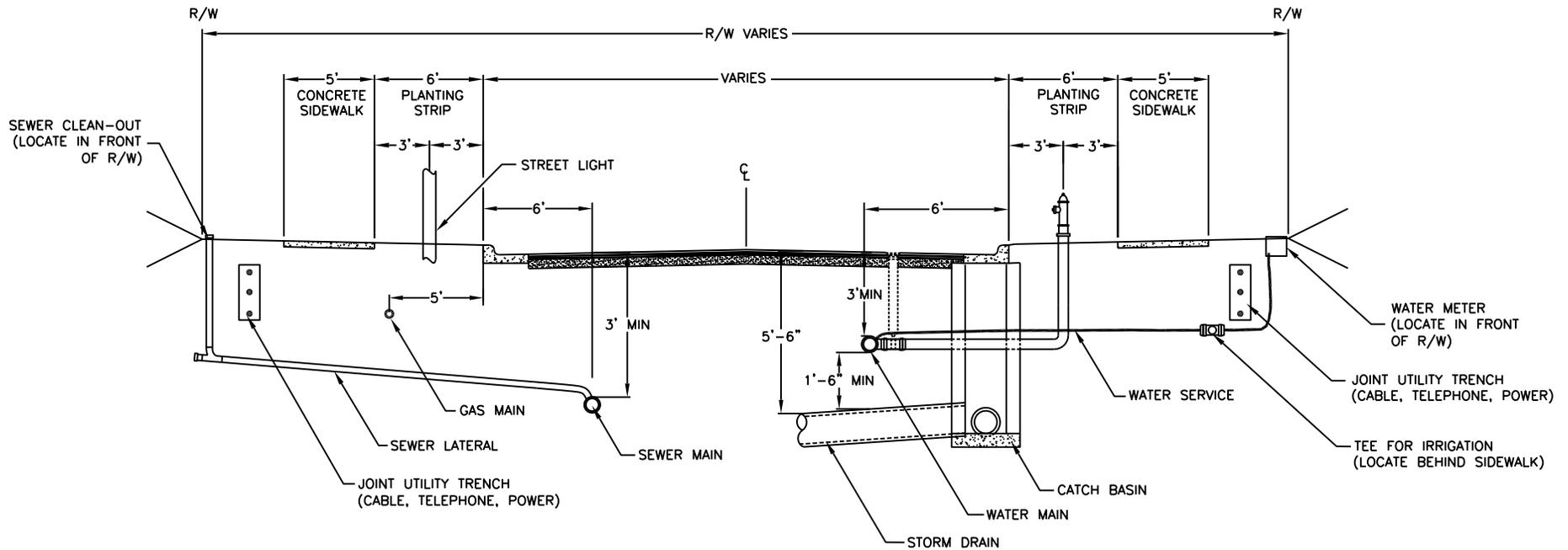
**NOTES:**

1. ACTUAL LOCATION DETERMINED IN FIELD.
2. THE CONCRETE WASHOUT FACILITY SHALL BE MAINTAINED WHEN THE LIQUID AND/OR SOLID REACHES 75% OF THE STRUCTURES CAPACITY.
3. CONCRETE WASHOUT FACILITY SHALL BE CLEARLY MARKED WITH SIGN INSTALLED WITHIN 30 FEET OF THE CONCRETE WASHOUT FACILITY.



NOT TO SCALE

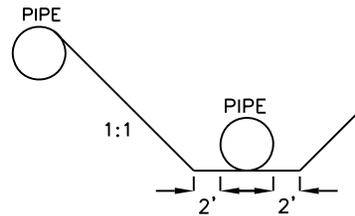
**CONCRETE WASHOUT PIT**



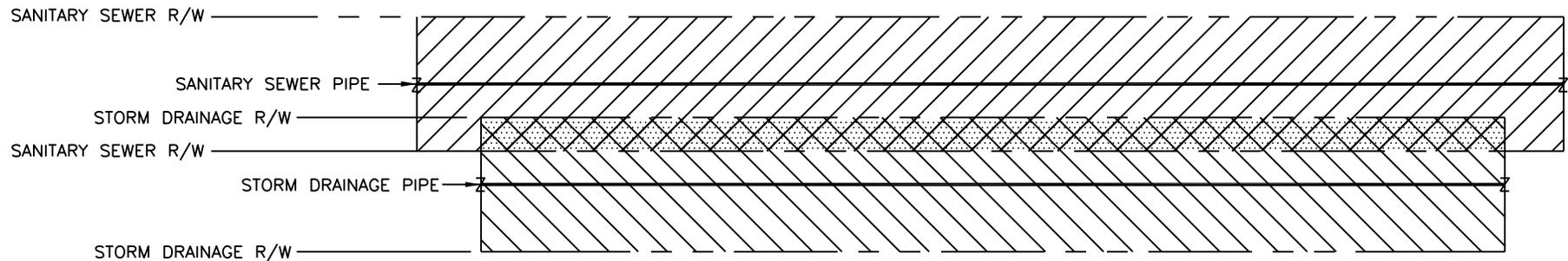
**NOTES:**

1. REFER TO STREET TYPICAL SECTIONS FOR DIMENSIONS & PAVEMENT SCHEDULE
2. WATER AND SEWER LOCATIONS MAY BE REVERSED FROM ABOVE

NOT TO SCALE



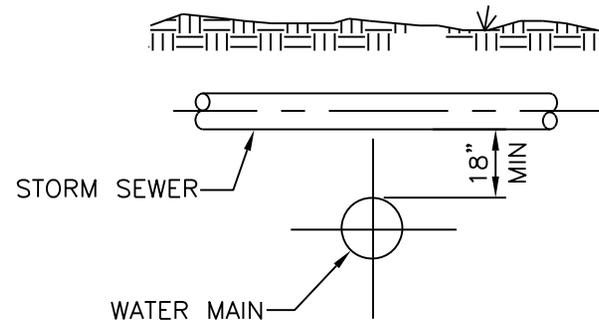
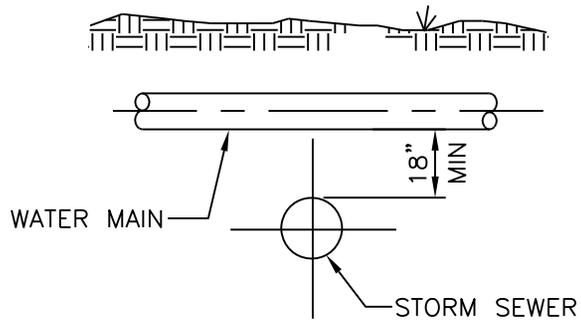
SECTION VIEW



THE SANITARY SEWER AND STORM DRAINAGE EASEMENTS MAY OVERLAP, HOWEVER THE PIPE & STRUCTURES MUST NOT BE IN THE OTHER UTILITY'S EASEMENT. THE SANITARY SEWER EASEMENT WIDTHS SHALL BE AS OUTLINED IN CITY'S LAND DEVELOPMENT STANDARDS MANUAL.

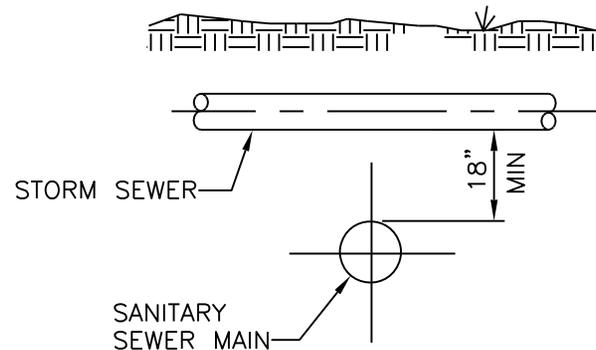
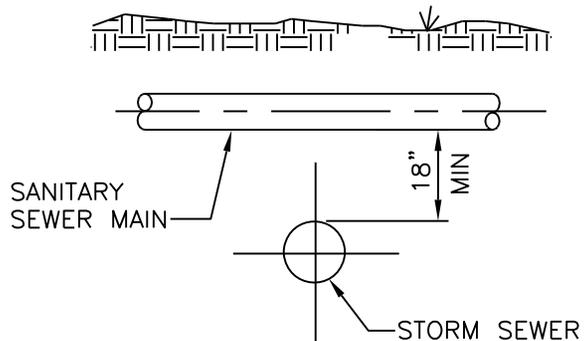
PLAN VIEW

NOT TO SCALE



**NOTE:**

WHEN A WATER MAIN CROSSES OVER OR UNDER A STORM SEWER AND CONDITIONS PREVENT THE REQUIRED 18" MIN VERTICAL SEPARATION, THE WATER MAIN SHALL BE CONSTRUCTED OF DUCTILE IRON PIPE WITH JOINTS EQUIVALENT TO WATER MAIN STANDARDS FOR A MINIMUM DISTANCE OF 10 FEET ON EACH SIDE OF THE POINT OF CROSSING. THE MINIMUM VERTICAL SEPARATION FOR DUCTILE IRON PIPE SHALL BE 12".

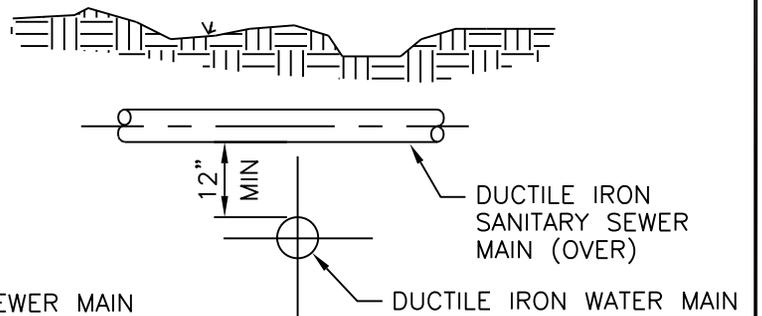
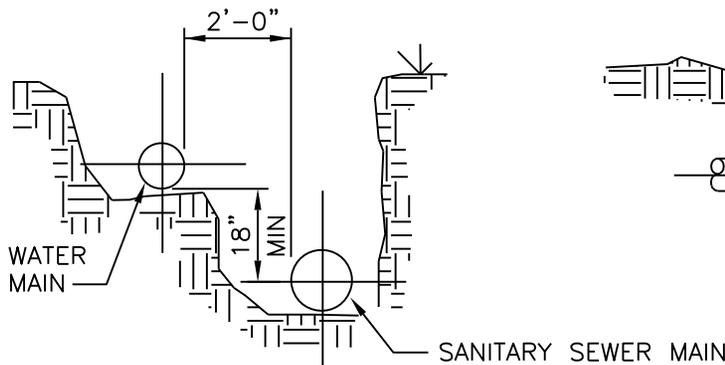
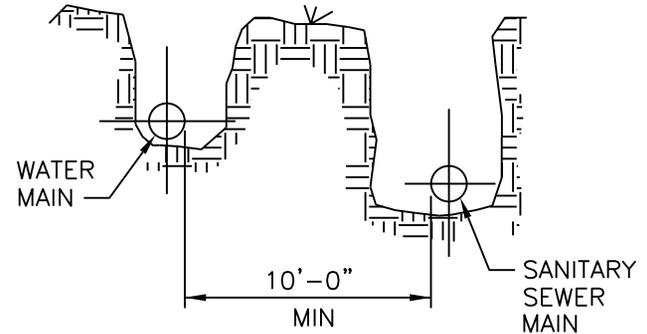
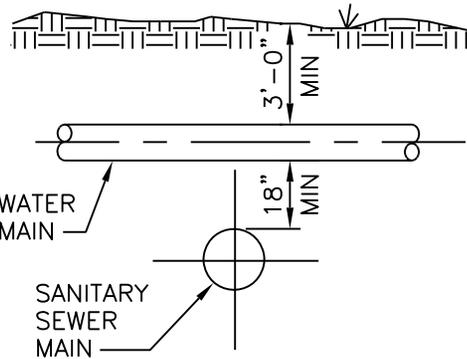
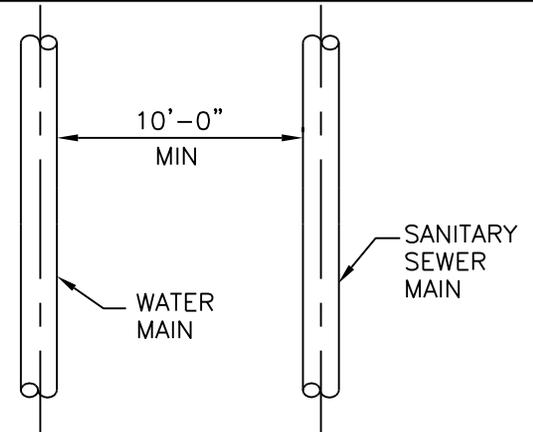
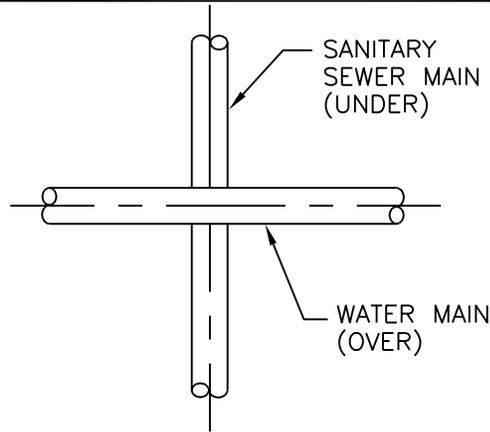


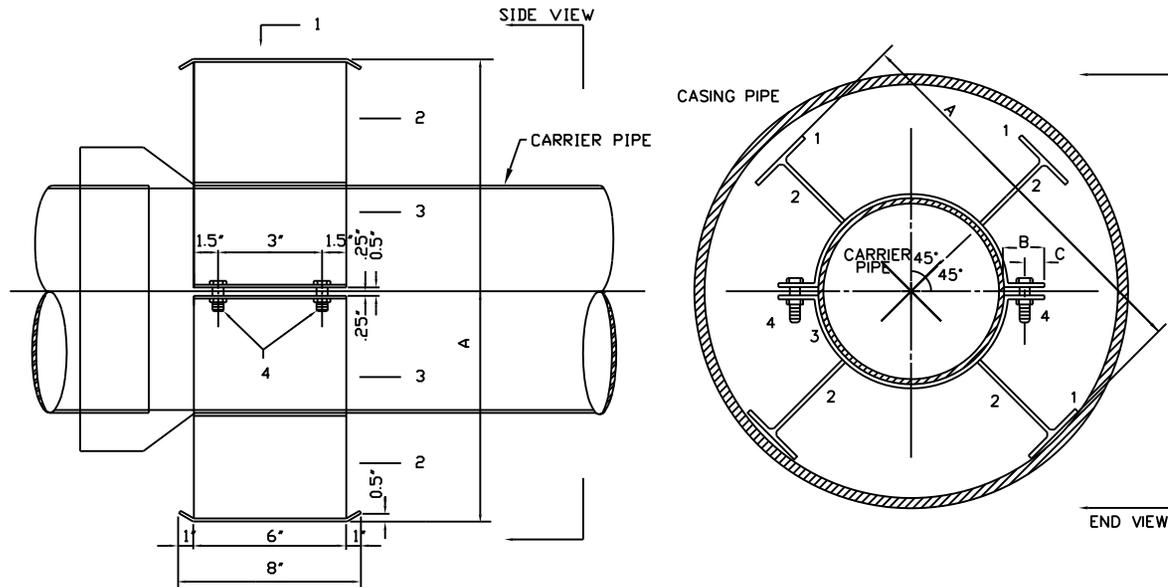
**NOTE:**

WHEN A SANITARY SEWER MAIN CROSSES OVER OR UNDER A STORM SEWER AND CONDITIONS PREVENT THE REQUIRED 18" MIN VERTICAL SEPARATION, THE SANITARY SEWER MAIN SHALL BE CONSTRUCTED OF DUCTILE IRON PIPE WITH JOINTS EQUIVALENT TO WATER MAIN STANDARDS FOR A MINIMUM DISTANCE OF 10 FEET ON EACH SIDE OF THE POINT OF CROSSING. THE MINIMUM VERTICAL SEPARATION FOR DUCTILE IRON PIPE SHALL BE 12".

**NOTE:**

WHEN THE WATER MAIN IS ABOVE THE SANITARY SEWER MAIN, BUT WITH LESS THAN 18" CLEARANCE, OR WHEN THE SANITARY SEWER MAIN IS ABOVE THE WATER MAIN, BOTH THE WATER MAIN AND THE SANITARY SEWER MAIN SHALL BE CONSTRUCTED OF DUCTILE IRON PIPE WITH JOINTS EQUIVALENT TO WATER MAIN STANDARDS FOR A MINIMUM LATERAL DISTANCE, MEASURED AT RIGHT ANGLES TO THE SEWER, OF 10 FEET ON EACH SIDE OF THE CROSSING. THE MINIMUM VERTICAL DISTANCE SEPARATION FOR DUCTILE IRON PIPE SHALL BE 12".





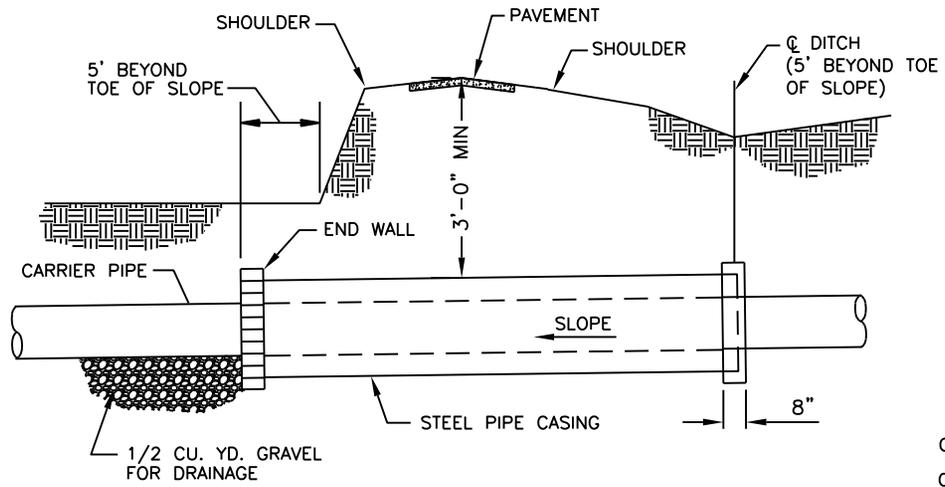
LEGS ROTATED OUT OF POSITION FOR CLARITY

**NOTES:**

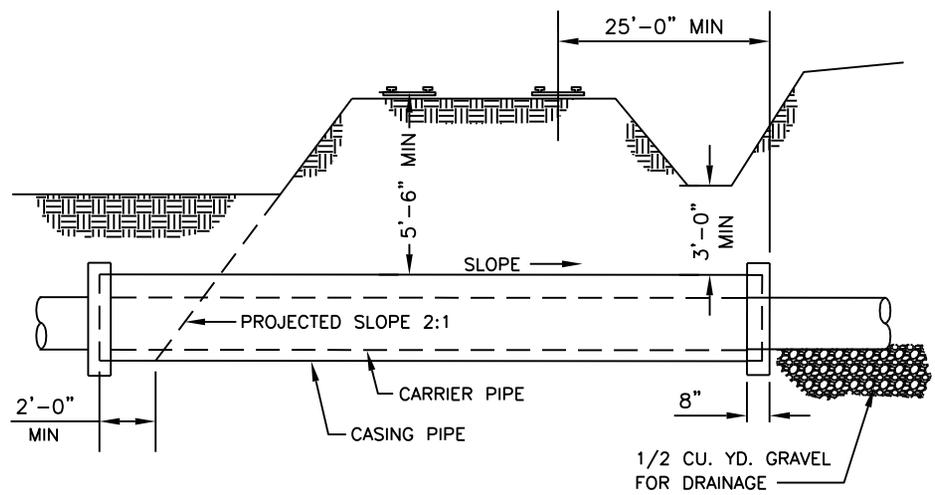
1. SEE WSACC SPEC 02240 FOR REQUIRED CASING DIAMETER AND MINIMUM THICKNESS.
2. CARRIER PIPE IS RESTRAINED PUSH-ON JOINT DIP, PROVIDE TWO SPIDERS PER JOINT OF CARRIER PIPE.
3. SPIDERS, NUTS, BOLTS & WASHERS SHALL BE STAINLESS STEEL.
4. ADJUST HEIGHT OF SPIDERS AS NECESSARY TO MAINTAIN SPECIFIED SLOPE.
5. CASING PIPE MATERIAL IS STEEL.

CARRIER PIPE		SPIDER 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

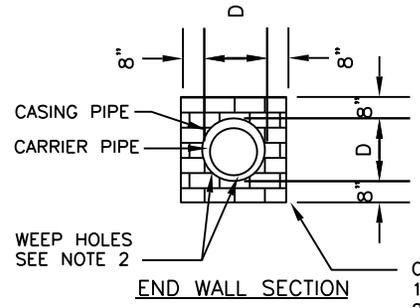
NOT TO SCALE



TYPICAL PIPE CROSSING UNDER HIGHWAYS



TYPICAL PIPE CROSSING UNDER RAILROADS



END WALL SECTION

COMMON BRICK MORTAR:  
 1 PART PORTLAND CEMENT  
 2 PARTS SAND  
 D = DIAMETER OF CASING PIPE

**NOTES:**

1. SEE DESIGN DRAWINGS FOR LOCATION, SIZE, AND LENGTH OF STEEL PIPE CASINGS
2. INSTALL TWO (2) 1" DRAINS EACH SIDE OF CARRIER PIPE IN DOWNHIL ENDWALL

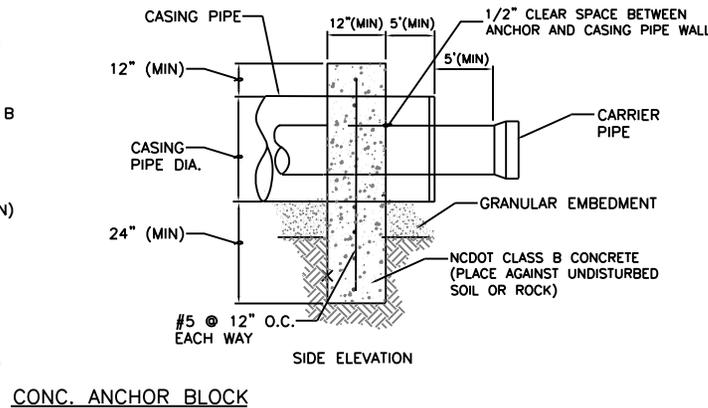
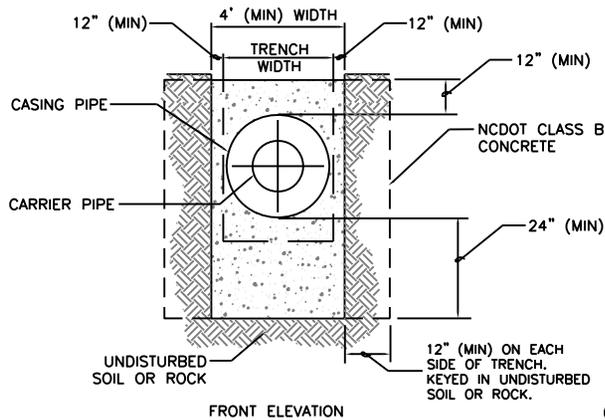
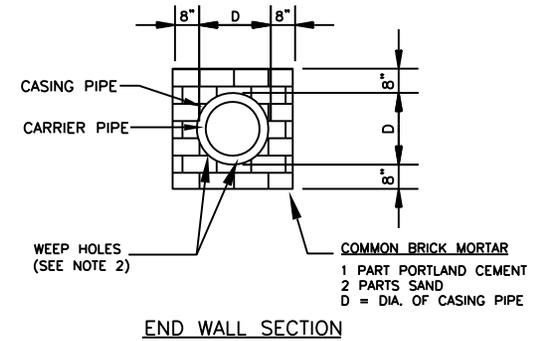
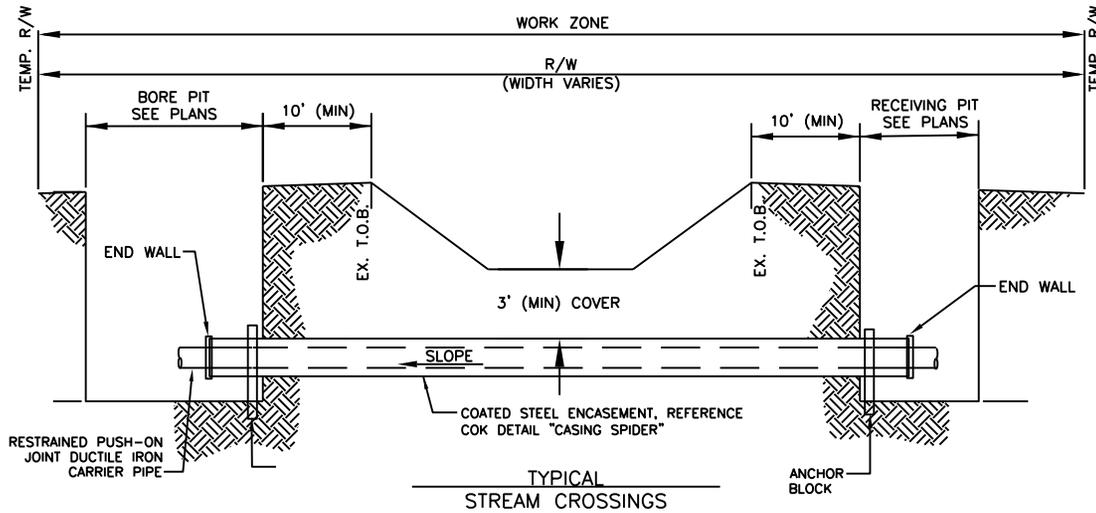
NOT TO SCALE



**ENCASEMENT PIPES  
 UNDER HIGHWAYS & RAILROADS**

DECEMBER 2019

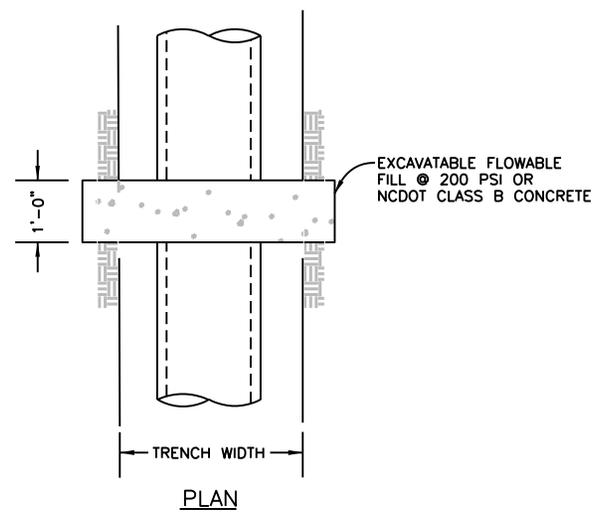
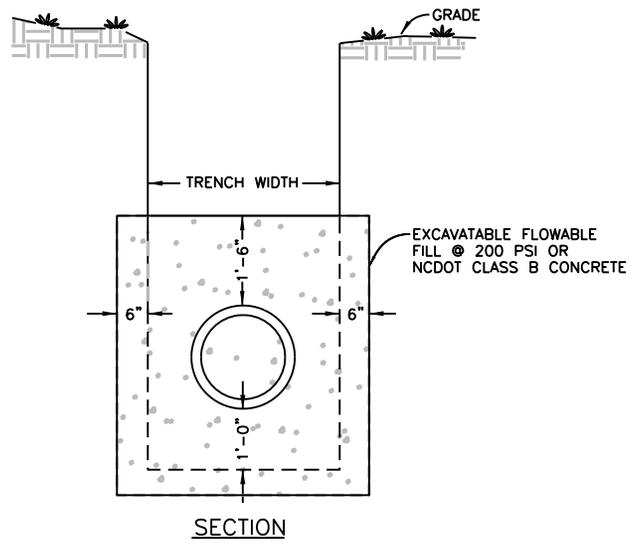
306



**NOTES:**

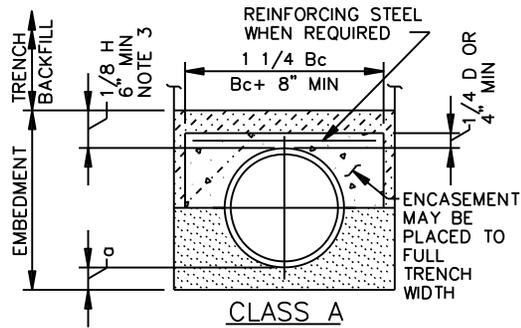
1. SEE DRAWINGS FOR LOCATION, SIZE AND LENGTH OF STEEL PIPE CASINGS.
2. INSTALL TWO (2) 1-INCH DRAINS EACH SIDE OF CARRIER PIPE IN DOWNHILL END WALL.
3. THE PIT/TRENCH EXCAVATION SHALL IN NO CASE BE CLOSER THAN 10- FEET FROM THE TOP OF STREAM AND/OR CREEK BANK.
4. RESTRAINED PUSH-ON JOINT DUCTILE IRON CARRIER PIPE SHALL EXTEND THROUGH CASING PIPE ASSEMBLY.
5. SEE COK DETAIL 305 "CASING SPIDER" FOR CASING PIPE AND SPIDER REQUIREMENTS.
6. INSTALL GATE VALVES ON WATER MAINS ON EACH SIDE OF THE STREAM ON THE HORIZONTAL PIPING PRIOR TO 45° ELBOWS.

NOT TO SCALE

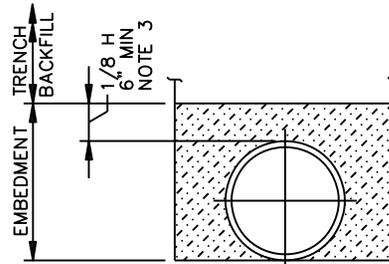


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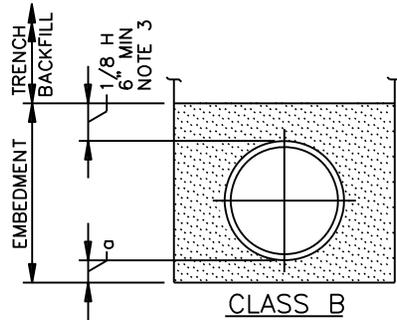
**ANTI-SEEP COLLAR**



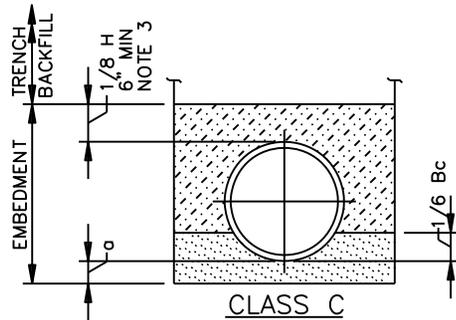
**CLASS A**  
ARCH ENCASEMENT



**CLASS D**



**CLASS B**



**CLASS C**

**LEGEND**

Bc OUTSIDE DIAMETER OF PIPE  
 H COVER ABOVE TOP OF PIPE  
 D NOMINAL PIPE SIZE  
 o EMBEDMENT BELOW PIPE (SEE TABLE)

- HAND PLACED EMBEDMENT
- GRANULAR EMBEDMENT
- CONCRETE

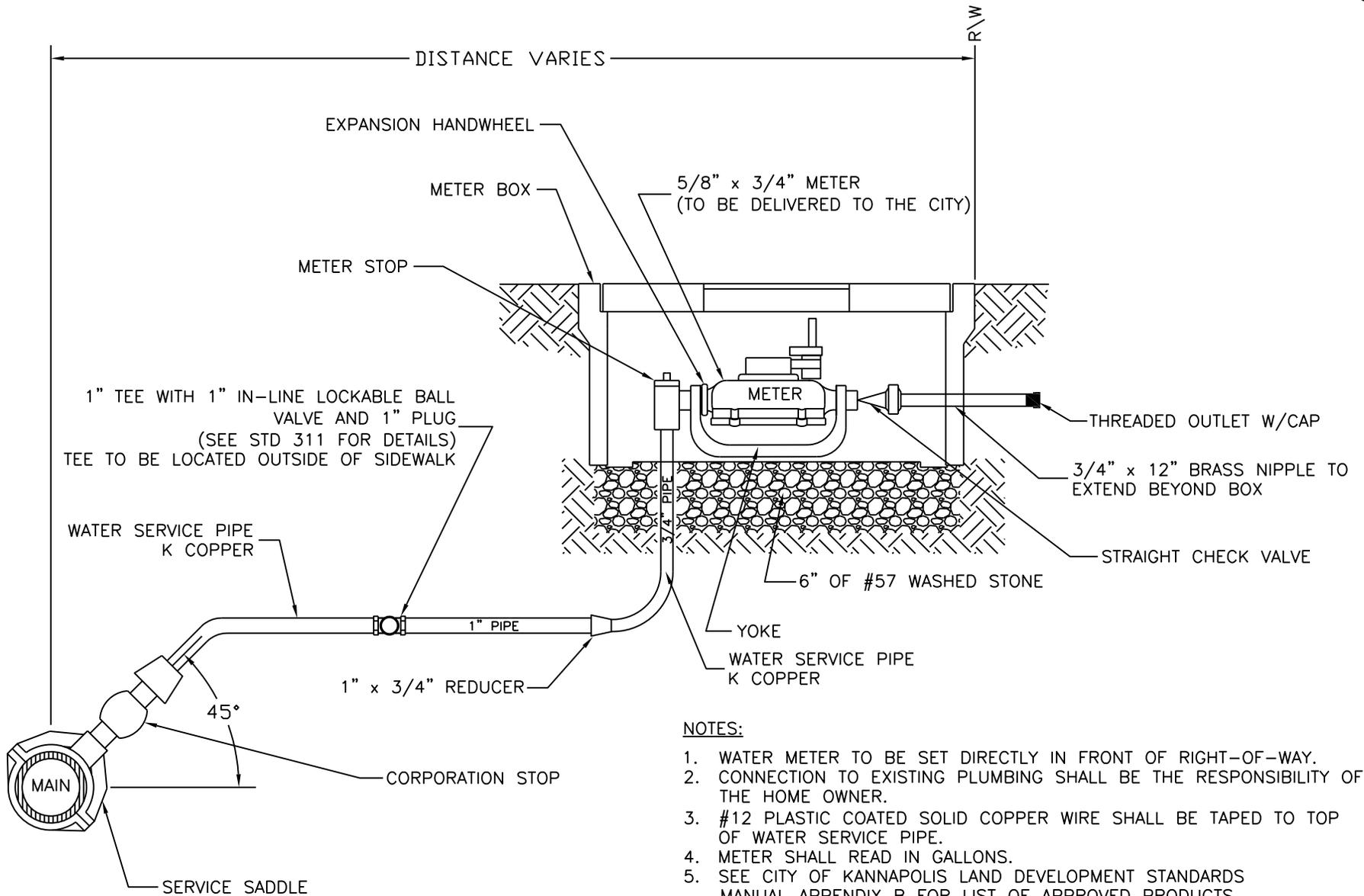
**TABLE OF EMBEDMENT DEPTHS BELOW PIPE**

D	$\frac{o}{2}$ MIN SOIL	$\frac{o}{2}$ MIN ROCK
27" & SMALLER	6"	6"
30" TO 60"	6"	9"
66" & LARGER	6"	12"

**NOTES:**

1. GRANULAR EMBEDMENT MATERIAL SHALL BE CRUSHED ROCK, PEA GRAVEL COARSE AGGREGATE SIZE NUMBER 57. EMBEDMENT MATERIAL SHALL BE PLACED IN LAYERS NOT MORE THAN 6" DEEP AND COMPACTED AS SPECIFIED.
2. HAND PLACED EMBEDMENT SHALL BE COMPACTED FINELY DIVIDED MATERIAL FREE FROM DEBRIS AND STONES.
3. EMBEDMENT ABOVE THE TOP OF THE PIPE SHALL BE AN UNCOMPACTED LAYER FOR ALL INSTALLATIONS.
4. REFER TO SPECIFICATIONS FOR GEOTECHNICAL FABRIC OR SPECIAL EMBEDMENT REQUIREMENTS FOR TRENCHES IN FINE SOILS EXTENDING BELOW GROUNDWATER LEVEL.
5. TRENCH OUTLINES DO NOT INDICATE ACTUAL TRENCH EXCAVATION SHAPE, SOIL CONDITIONS, OR PRESENCE OF SHEETING LEFT IN PLACE. EMBEDMENT MATERIAL SHALL EXTEND THE FULL WIDTH OF THE ACTUAL TRENCH EXCAVATION.
6. CLASS C BEDDING CAN BE USED ON DIP SEWER PIPING ONLY WHEN THE ENTIRE LENGTH OF PIPE BETWEEN MANHOLES IS DIP. FOR SHORT SECTIONS OF DIP INSTALLED IN PVC PIPING, CLASS B BEDDING SHALL BE USED.

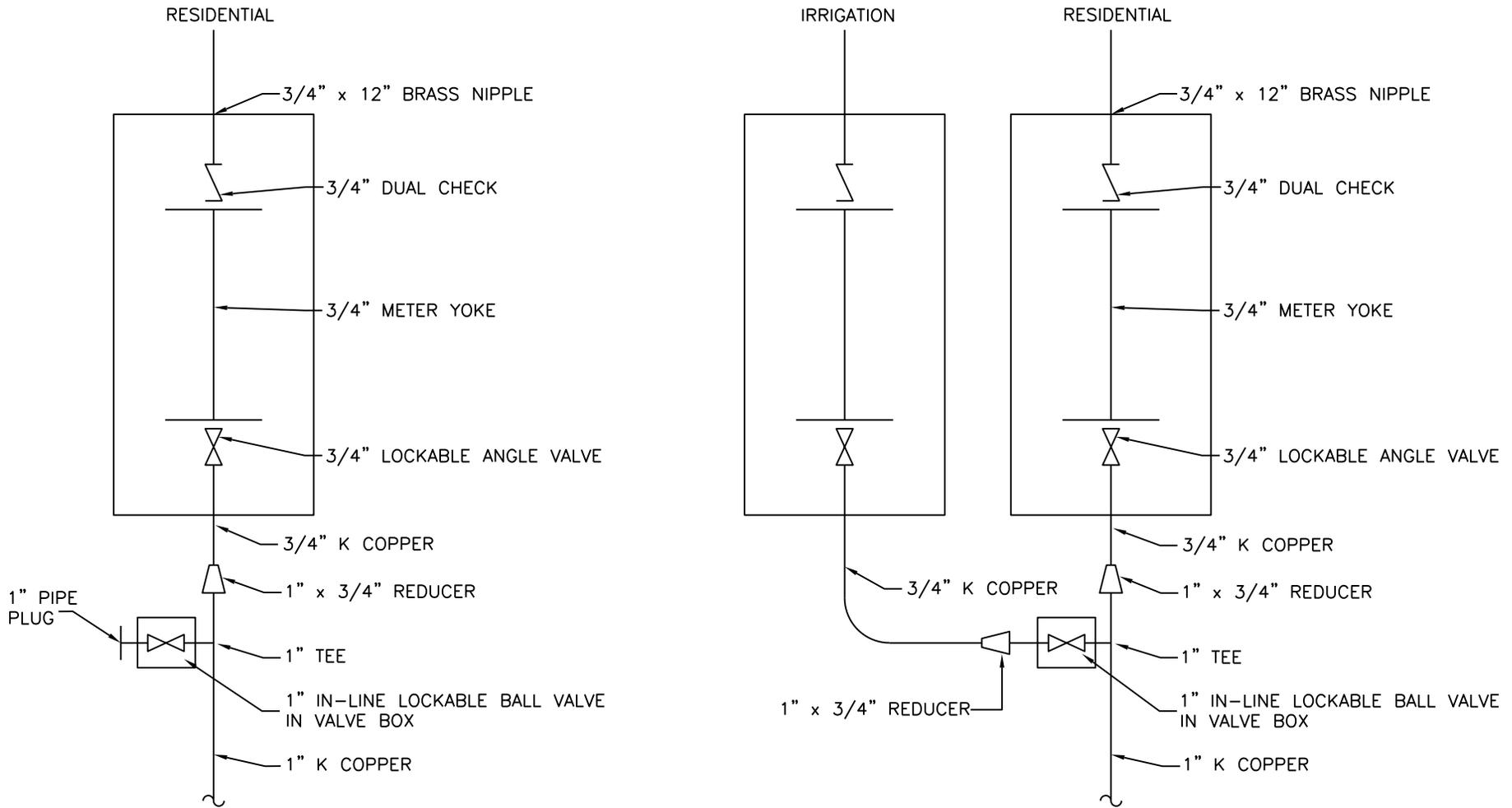
NOT TO SCALE



**NOTES:**

1. WATER METER TO BE SET DIRECTLY IN FRONT OF RIGHT-OF-WAY.
2. CONNECTION TO EXISTING PLUMBING SHALL BE THE RESPONSIBILITY OF THE HOME OWNER.
3. #12 PLASTIC COATED SOLID COPPER WIRE SHALL BE TAPED TO TOP OF WATER SERVICE PIPE.
4. METER SHALL READ IN GALLONS.
5. SEE CITY OF KANNAPOLIS LAND DEVELOPMENT STANDARDS MANUAL APPENDIX B FOR LIST OF APPROVED PRODUCTS.

NOT TO SCALE



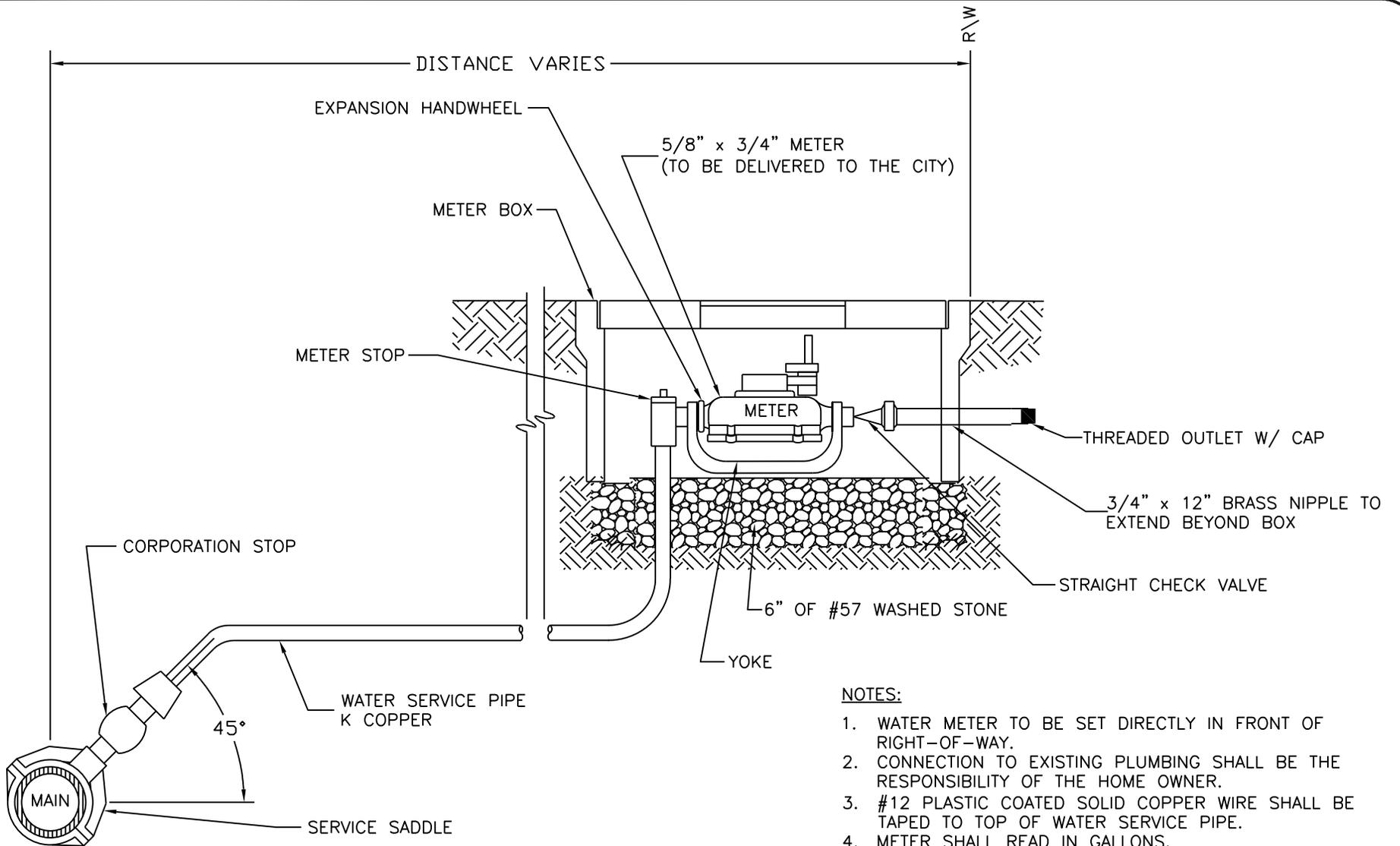
**NOTES:**

1. PLACE METER BOX AT RIGHT-OF-WAY.
2. SEE CITY OF KANNAPOLIS LAND DEVELOPMENT STANDARDS MANUAL APPENDIX B FOR LIST OF APPROVED PRODUCTS.

NOT TO SCALE



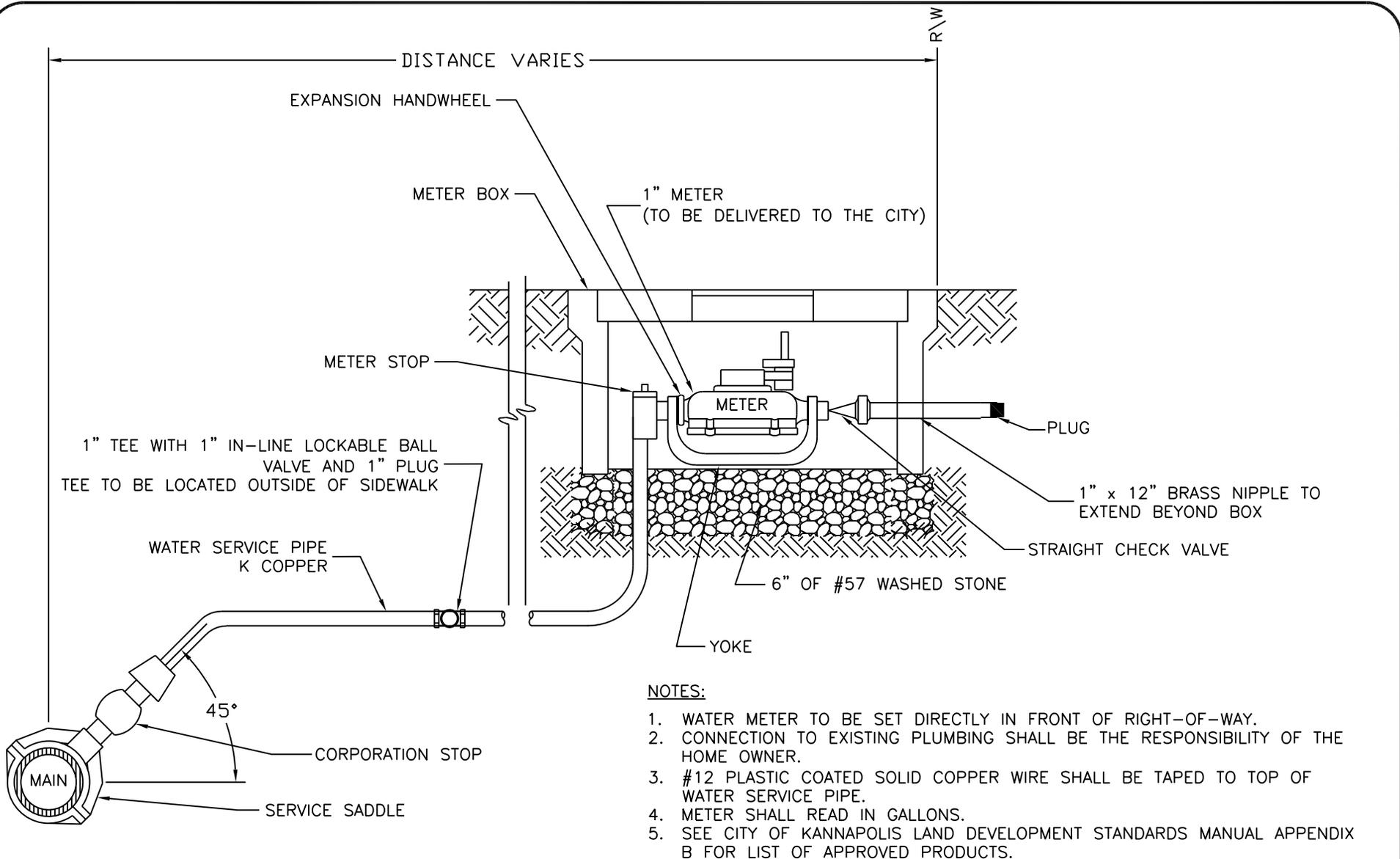
**DOMESTIC WATER SERVICE PLAN  
 3/4" WATER METER CONNECTION WITH  
 1" TEE FOR IRRIGATION CONNECTION**



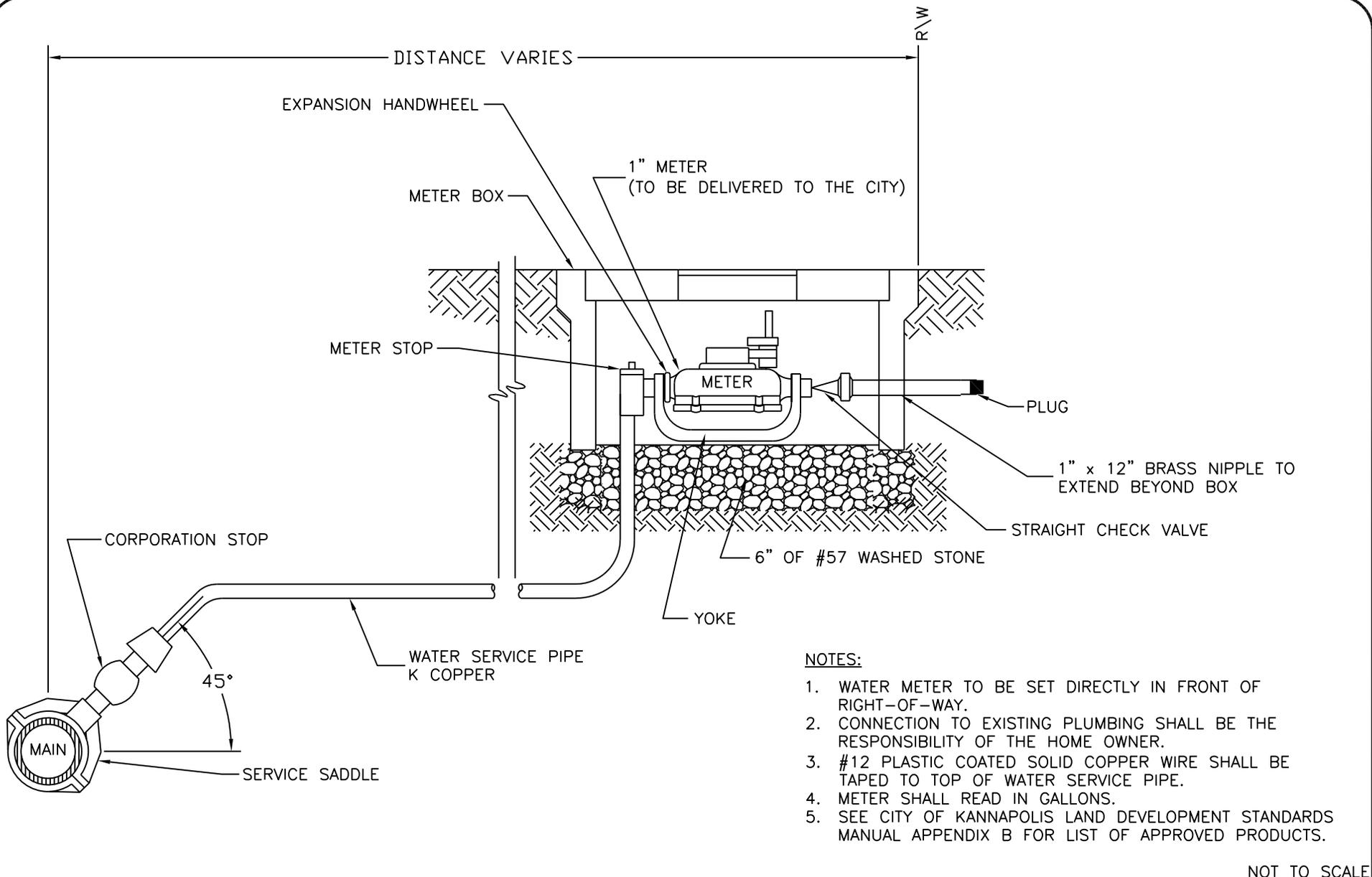
**NOTES:**

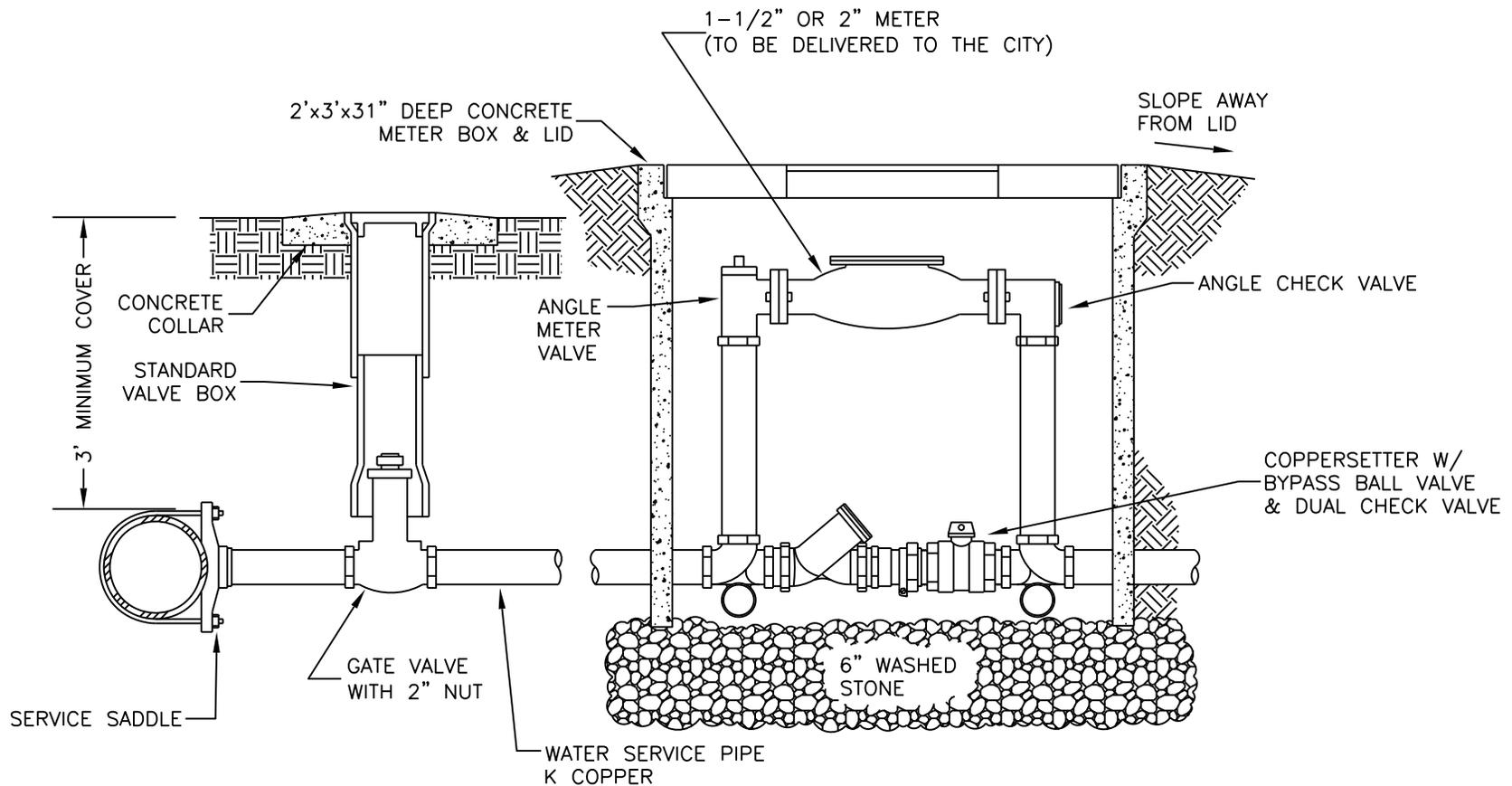
1. WATER METER TO BE SET DIRECTLY IN FRONT OF RIGHT-OF-WAY.
2. CONNECTION TO EXISTING PLUMBING SHALL BE THE RESPONSIBILITY OF THE HOME OWNER.
3. #12 PLASTIC COATED SOLID COPPER WIRE SHALL BE TAPED TO TOP OF WATER SERVICE PIPE.
4. METER SHALL READ IN GALLONS.
5. SEE CITY OF KANNAPOLIS LAND DEVELOPMENT STANDARDS MANUAL APPENDIX B FOR LIST OF APPROVED PRODUCTS.

NOT TO SCALE



NOT TO SCALE

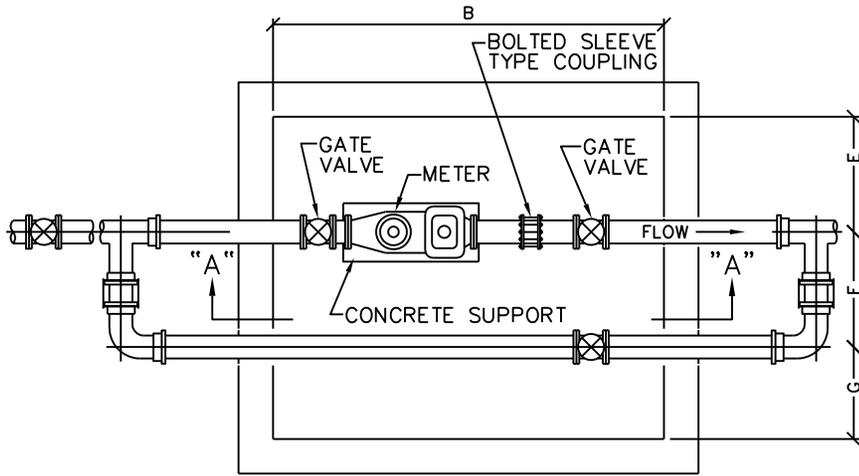




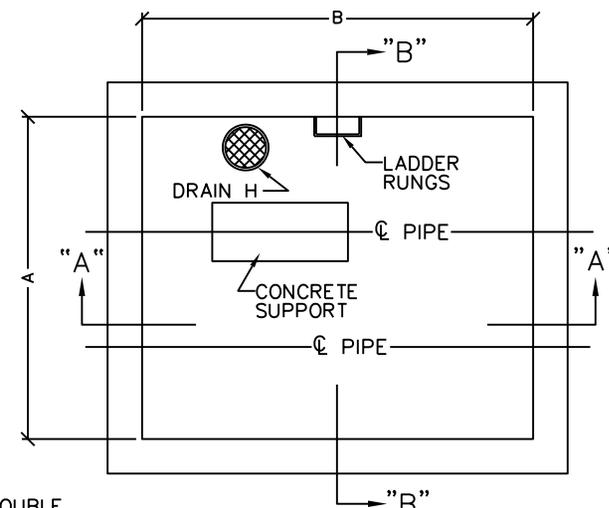
**NOTES:**

1. WATER METER TO BE SET DIRECTLY IN FRONT OF RIGHT-OF-WAY.
2. CONNECTION TO EXISTING PLUMBING SHALL BE THE RESPONSIBILITY OF THE HOME OWNER.
3. #12 PLASTIC COATED SOLID COPPER WIRE SHALL BE TAPED TO TOP OF WATER SERVICE PIPE.
4. METER SHALL READ IN GALLONS.
5. SEE CITY OF KANNAPOLIS LAND DEVELOPMENT STANDARDS MANUAL APPENDIX B FOR LIST OF APPROVED PRODUCTS.

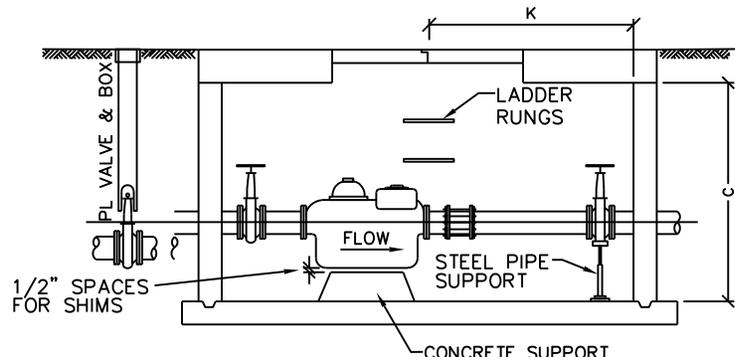
NOT TO SCALE



PLAN OF PIPING

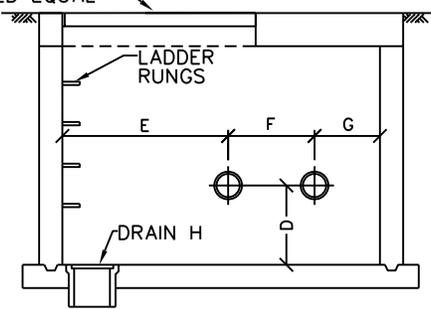


PLAN OF VAULT



SECTION "A"

ALUMINUM DOUBLE LEAF ACCESS DOOR (H-20) BILCO JD-1AL H20 OR APPROVED EQUAL



SECTION "B"

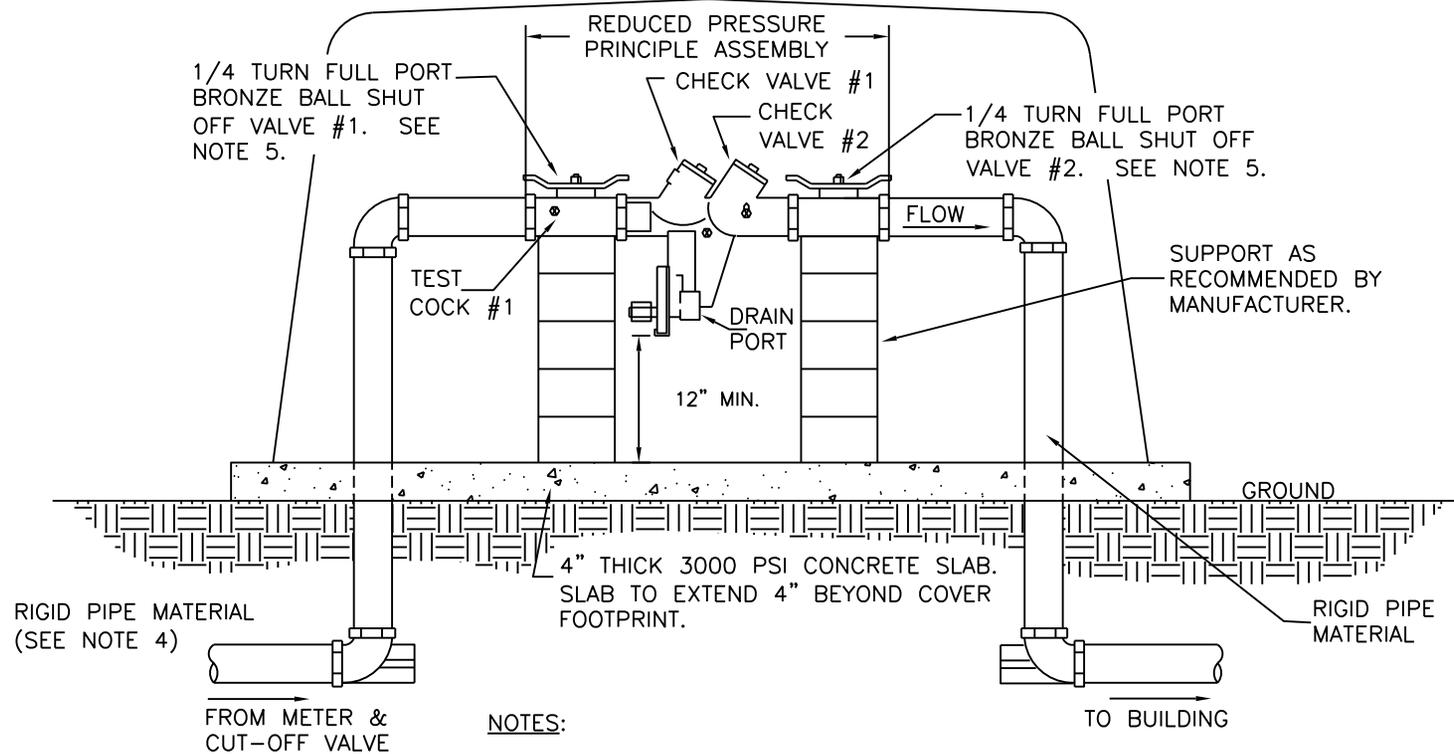
	METER SIZE		
	3"	4"	6"
A	84"	84"	84"
B	72"	72"	96"
C	72"	72"	72"
D	24"	30"	30"
E	30"	30"	30"
F	30"	30"	30"
G	24"	24"	24"
H	12"	12"	12"
K	36"	36"	48"

**NOTES:**

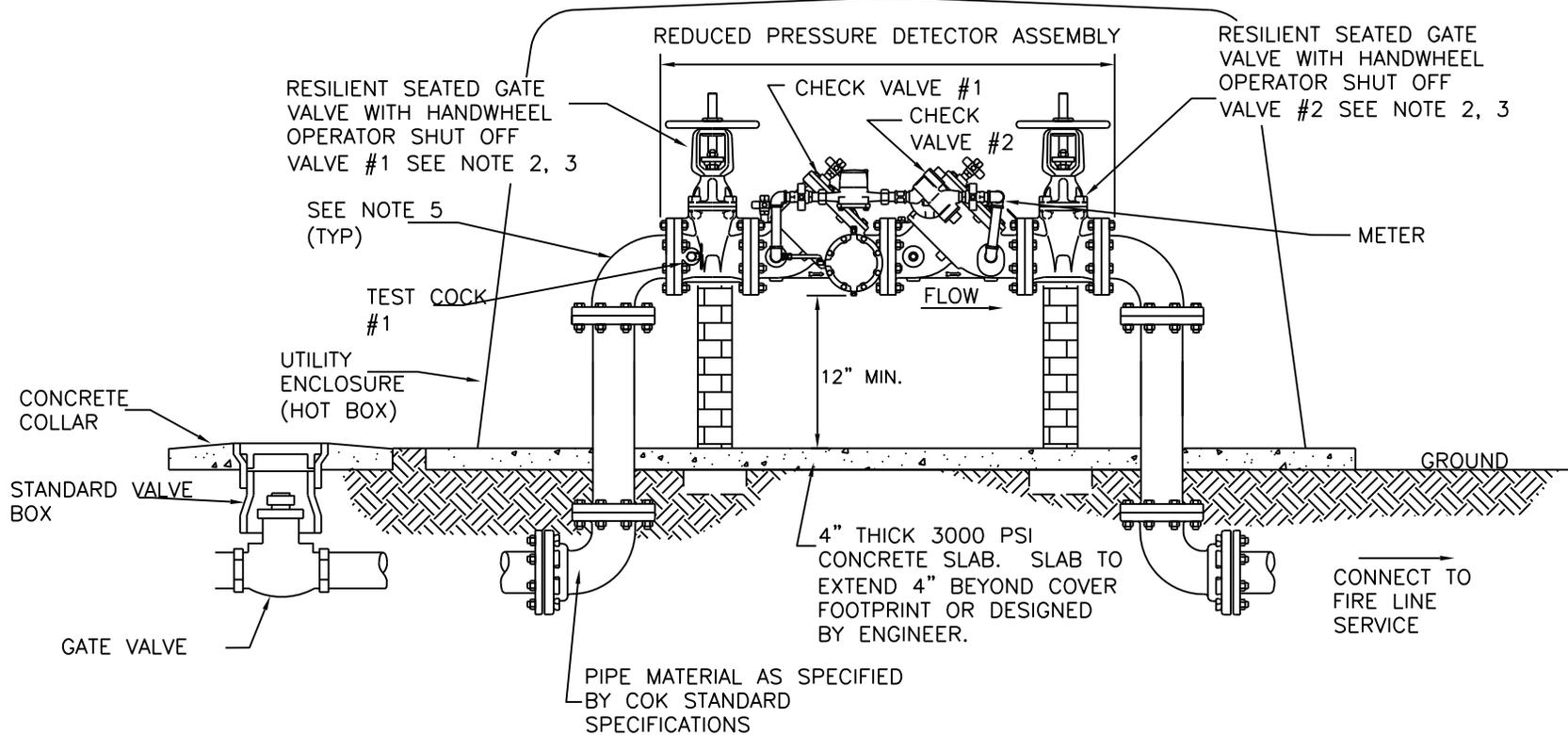
1. SEE CITY OF KANNAPOLIS LAND DEVELOPMENT STANDARDS MANUAL APPENDIX B FOR LIST OF APPROVED PRODUCTS.
2. METER SHALL READ IN GALLONS.
3. COORDINATE INSTALLATION OF METER AND CONNECTION TO THE MI. NET SYSTEM WITH CITY OF KANNAPOLIS.
4. CONCRETE VAULT SHALL BE DESIGNED FOR H-20 TRAFFIC LOADING.
5. ALL INTERIOR PIPE & FITTINGS SHALL BE FLANGED.
6. ALL EXTERIOR PIPE & FITTINGS SHALL BE RESTRAINED JOINT.
7. VAULT SHALL DRAIN TO ATMOSPHERE USING SCHEDULE 40 PVC PIPE.



**WATER SERVICE**  
**3", 4", & 6"**  
**COMPOUND WATER METER & VAULT**



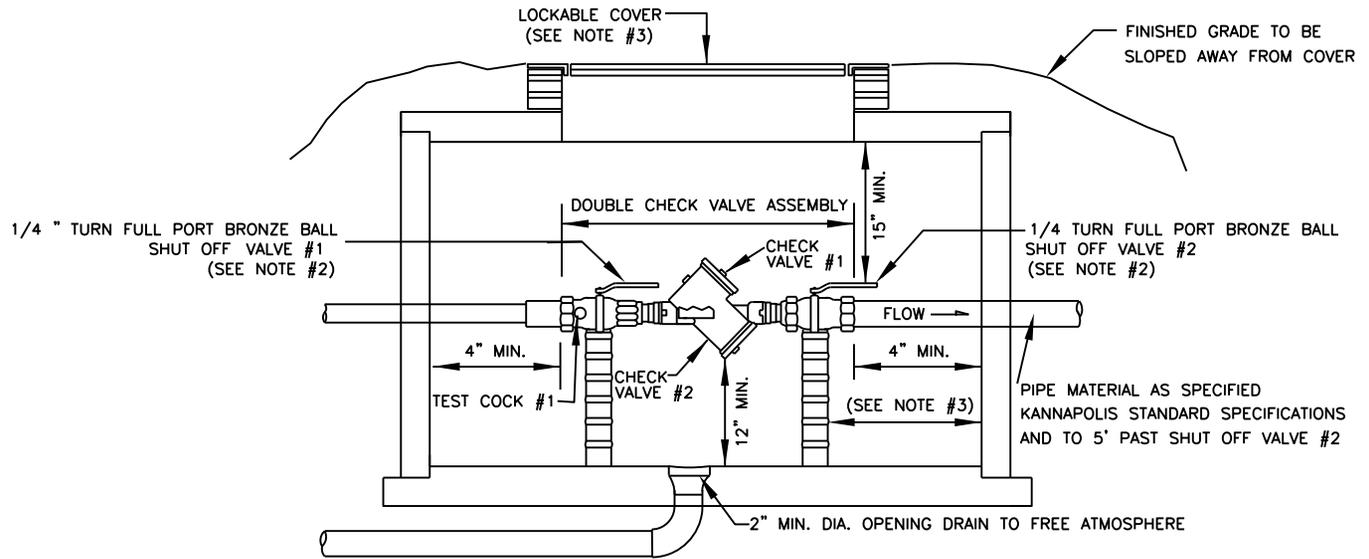
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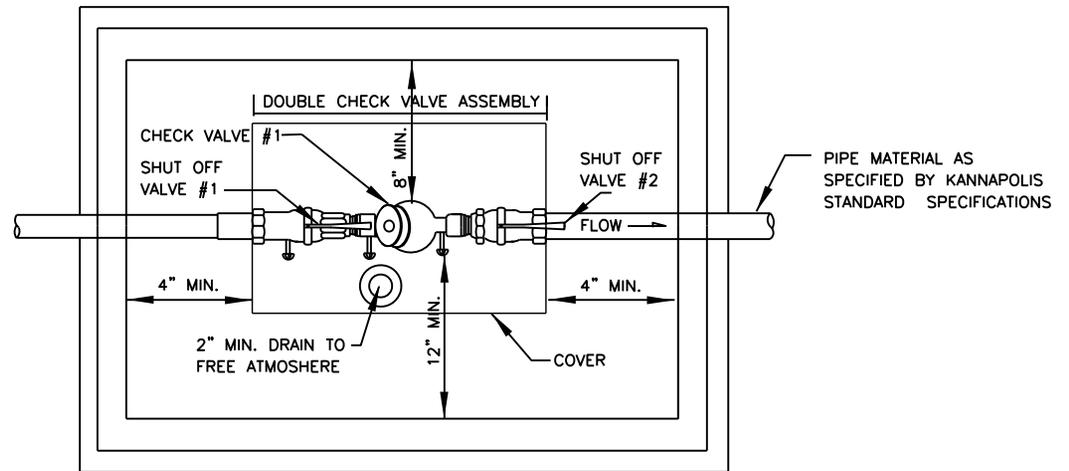
**NOTES:**

1. REDUCED PRESSURE PRINCIPLE ASSEMBLIES (RP) MUST CONFORM TO CITY OF KANNAPOLIS SPECIFICATIONS.
2. APPROVED RP INCLUDES SHUT OFF VALVES #1 AND #2 AS PART OF THE ASSEMBLY. NO SUBSTITUTIONS SHALL BE PERMITTED.
3. FIRE LINE SERVICES SHALL HAVE OUTSIDE STEM AND YOKE (OS & Y) HAND WHEEL OPERATORS.
4. 8"- 10" RP SHALL BE SUPPORTED AT CENTER WITH BRICK PEDESTAL.
5. RESTRAINED JOINTS SHALL BE WITH MEGA LUG RESTRAINTS OR APPROVED EQUAL.
6. TEST COCK #1 SHALL BE UPSTREAM OF SHUT OFF VALVE #1 AND IS PART OF THE APPROVED ASSEMBLY.
7. HOT BOX SHALL BE A 20 MIL. ORTHOTHALIC POLYESTER GELCOAT WITH ULTRA-VIOLET INHIBITORS. GELCOAT SHELL IS BACKED WITH 1/4" CHOP-STRAND POLYRESIN BONDED FIBERGLASS AND LINED WITH POLYURETHANE INSULATION (MIN. R FACTOR 8.5).
8. HEATED ENCLOSURES ARE REQUIRED FOR ALL FIRE LINE CONNECTIONS.
9. SEE CITY OF KANNAPOLIS LAND DEVELOPMENT STANDARDS MANUAL APPENDIX B FOR LIST OF APPROVED PRODUCTS.

NOT TO SCALE



ELEVATION VIEW

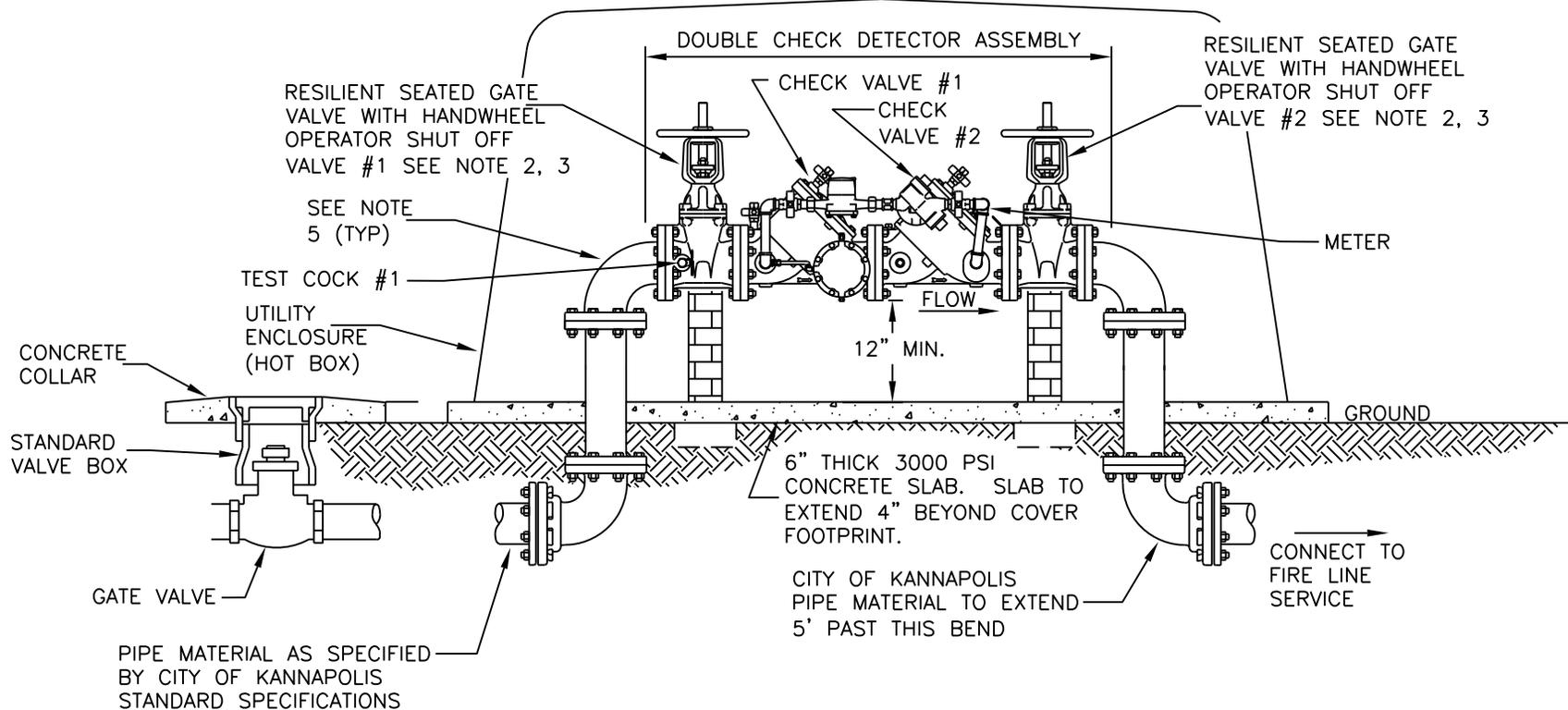


PLAN VIEW

NOT TO SCALE

**NOTES:**

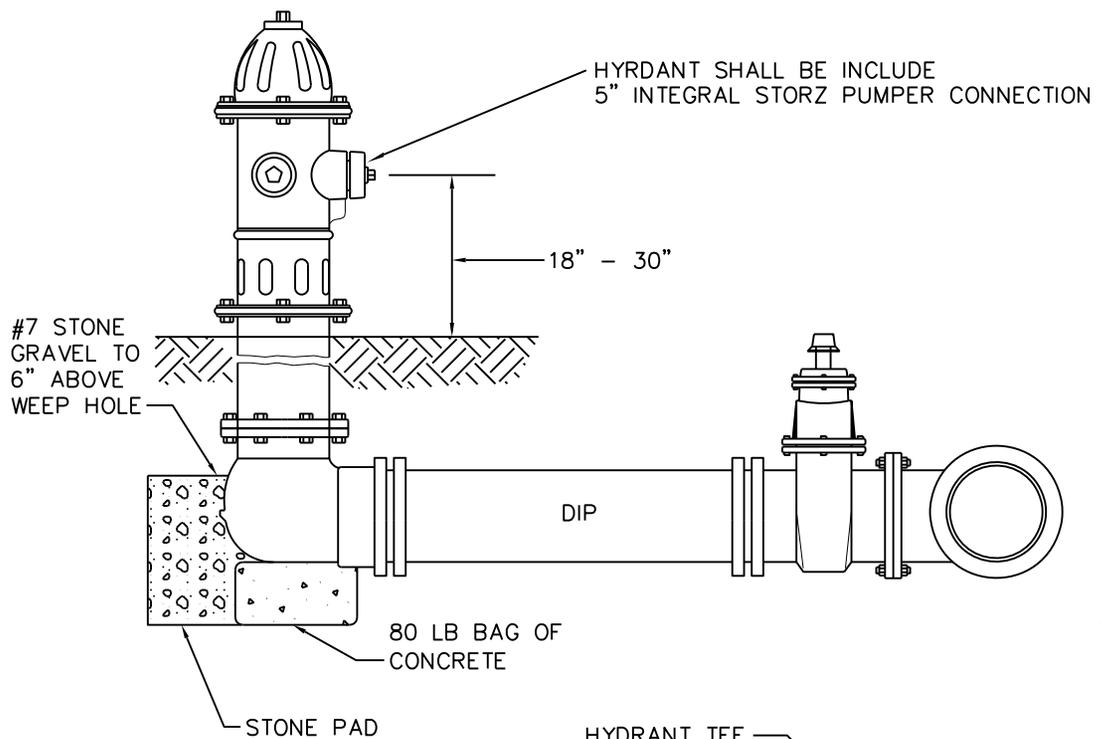
1. DCVA MUST CONFORM TO CITY OF KANNAPOLIS SPECIFICATIONS FOR BACKFLOW PREVENTION ASSEMBLIES 3/4"-2".
2. KANNAPOLIS APPROVED DCVA'S INCLUDE SHUT OFF VALVE #1 AND VALVE #2 NO SUBSTITUTION SHALL BE PERMITTED.
3. VAULT, DOORS OR COVERS AND SUPPORT OF ASSEMBLY SHALL BE DESIGNED BY OWNER AND AS REQUIRED.
4. IF DRAINAGE CANNOT BE PROVIDED TO FREE ATMOSPHERE OR STORM DRAINAGE, THE DCVA'S SHALL BE INSTALLED ABOVE GROUND.
5. TEST COCK #1 SHALL BE UPSTREAM OF SHUT OFF VALVE #1 AND IS PART OF THE APPROVED ASSEMBLY.
6. SEE CITY OF KANNAPOLIS LAND DEVELOPMENT STANDARDS MANUAL APPENDIX B FOR LIST OF APPROVED PRODUCTS.



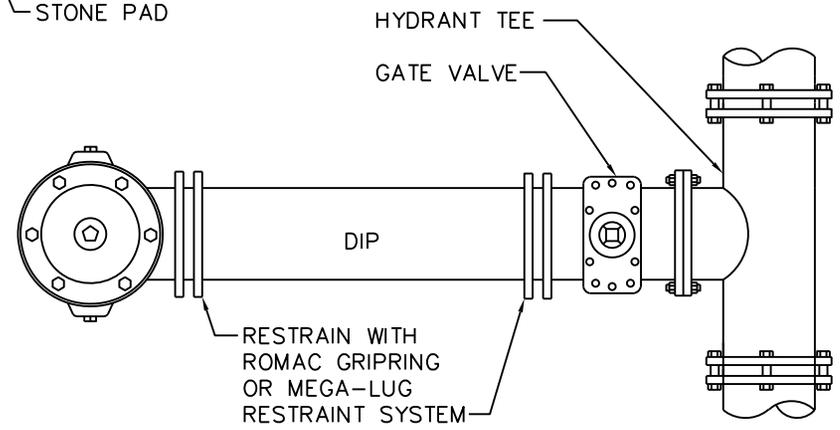
**NOTES:**

1. DOUBLE CHECK DETECTOR ASSEMBLIES (DCDA) MUST CONFORM TO CITY OF KANNAPOLIS SPECIFICATIONS.
2. APPROVED DCDA INCLUDES SHUT OFF VALVES #1 AND #2 AS PART OF THE ASSEMBLY. NO SUBSTITUTIONS SHALL BE PERMITTED.
3. FIRE LINE SERVICES SHALL HAVE OUTSIDE STEM AND YOKE (OS & Y) HAND WHEEL OPERATORS.
4. 8"- 10" DCDA SHALL BE SUPPORTED AT CENTER WITH BRICK PEDESTAL.
5. RESTRAINED JOINTS SHALL BE WITH MEGA LUG RESTRAINTS OR APPROVED EQUAL.
6. TEST COCK #1 SHALL BE UPSTREAM OF SHUT OFF VALVE #1 AND IS PART OF THE APPROVED ASSEMBLY.
7. HOT BOX SHALL BE A 20 MIL. ORTHOTHALIC POLYESTER GELCOAT WITH ULTRA-VIOLET INHIBITORS. GELCOAT SHELL IS BACKED WITH 1/4" CHOP-STRAND POLYRESIN BONDED FIBERGLASS AND LINED WITH POLYURETHANE INSULATION (MIN. R FACTOR 8.5). SEE SPECIAL PROVISIONS FOR CLEARANCE SPECIFICATIONS.
8. SEE CITY OF KANNAPOLIS LAND DEVELOPMENT STANDARDS MANUAL APPENDIX B FOR LIST OF APPROVED PRODUCTS.

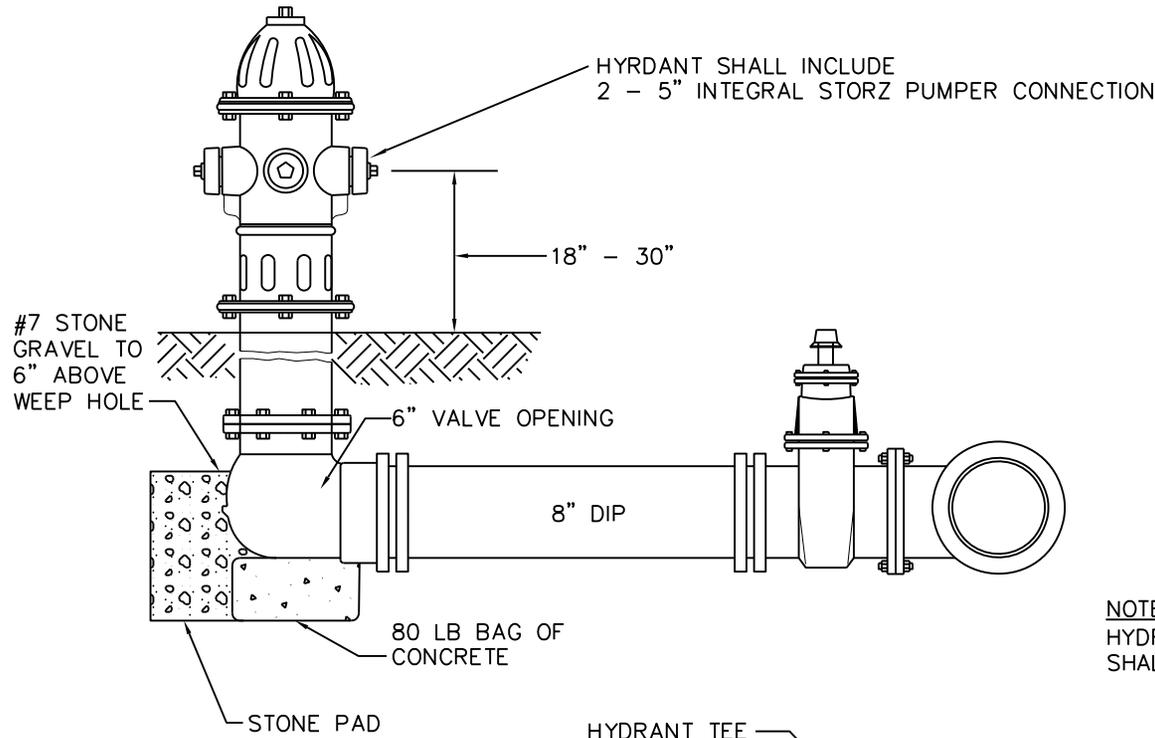
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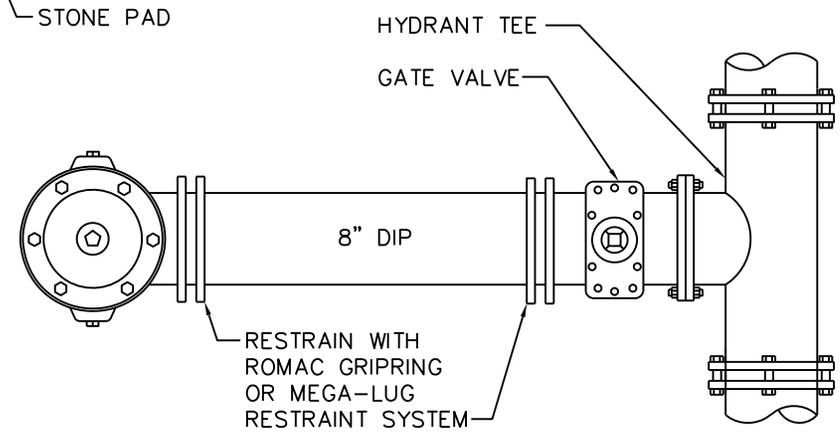
**NOTES:**  
HYDRANTS SHALL HAVE 5- $\frac{1}{4}$ " VALVE OPENING AND  
SHALL CONFORM TO WSACC SPECIFICATIONS



NOT TO SCALE



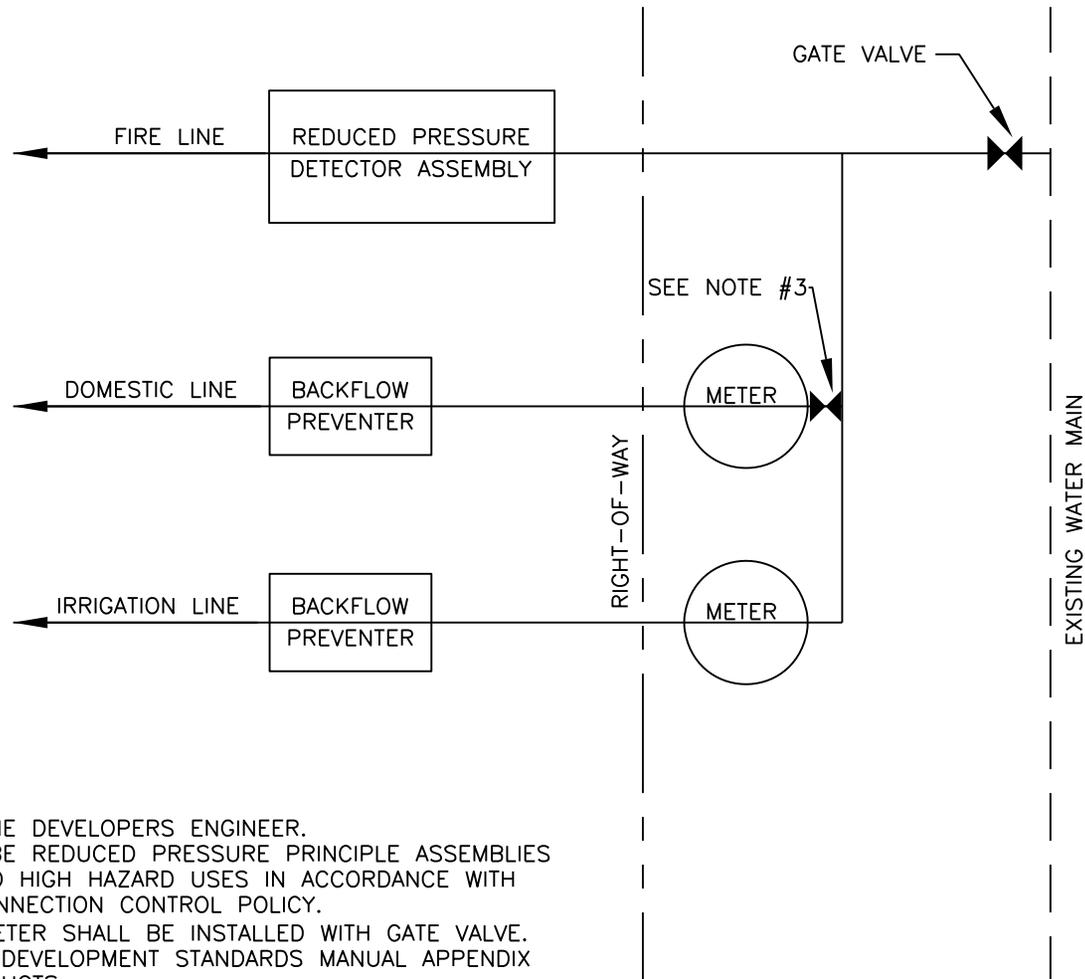
**NOTES:**  
HYDRANTS SHALL HAVE 6" VALVE OPENING AND SHALL CONFORM TO WSACC SPECIFICATIONS



NOT TO SCALE

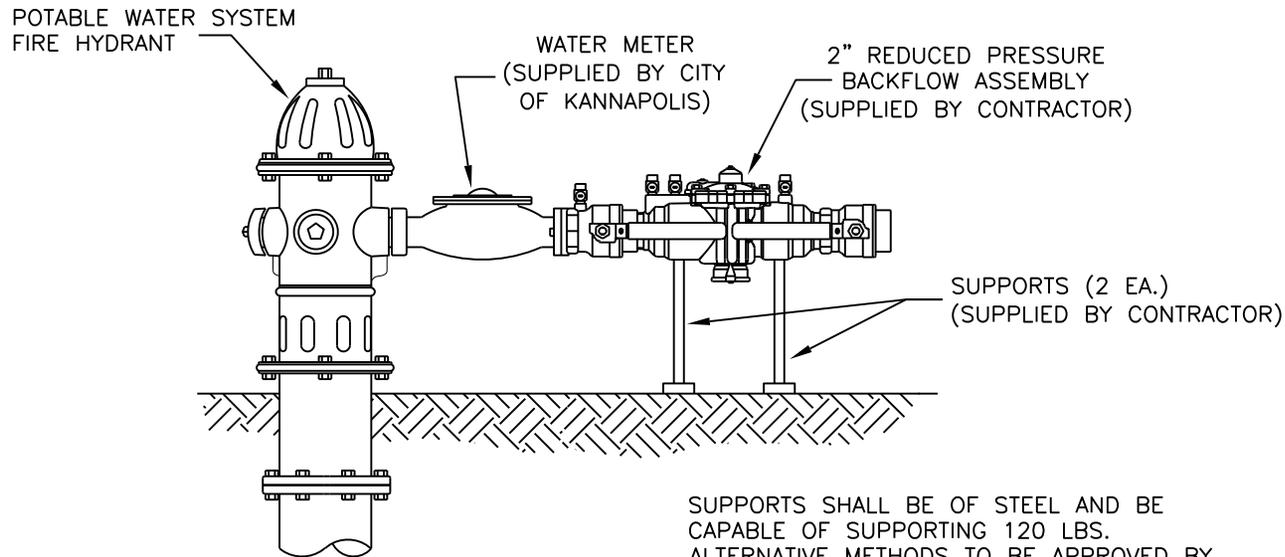


**6" FIRE HYDRANT**  
**WITH 2 STORZ CONNECTIONS**



**NOTES:**

1. SIZES SHALL BE VERIFIED BY THE DEVELOPERS ENGINEER.
2. BACKFLOW PREVENTERS SHALL BE REDUCED PRESSURE PRINCIPLE ASSEMBLIES WHEN LINES ARE CONNECTED TO HIGH HAZARD USES IN ACCORDANCE WITH CITY OF KANNAPOLIS CROSS CONNECTION CONTROL POLICY.
3. 1-1/2" & LARGER DOMESTIC METER SHALL BE INSTALLED WITH GATE VALVE.
4. SEE CITY OF KANNAPOLIS LAND DEVELOPMENT STANDARDS MANUAL APPENDIX B FOR LIST OF APPROVED PRODUCTS.

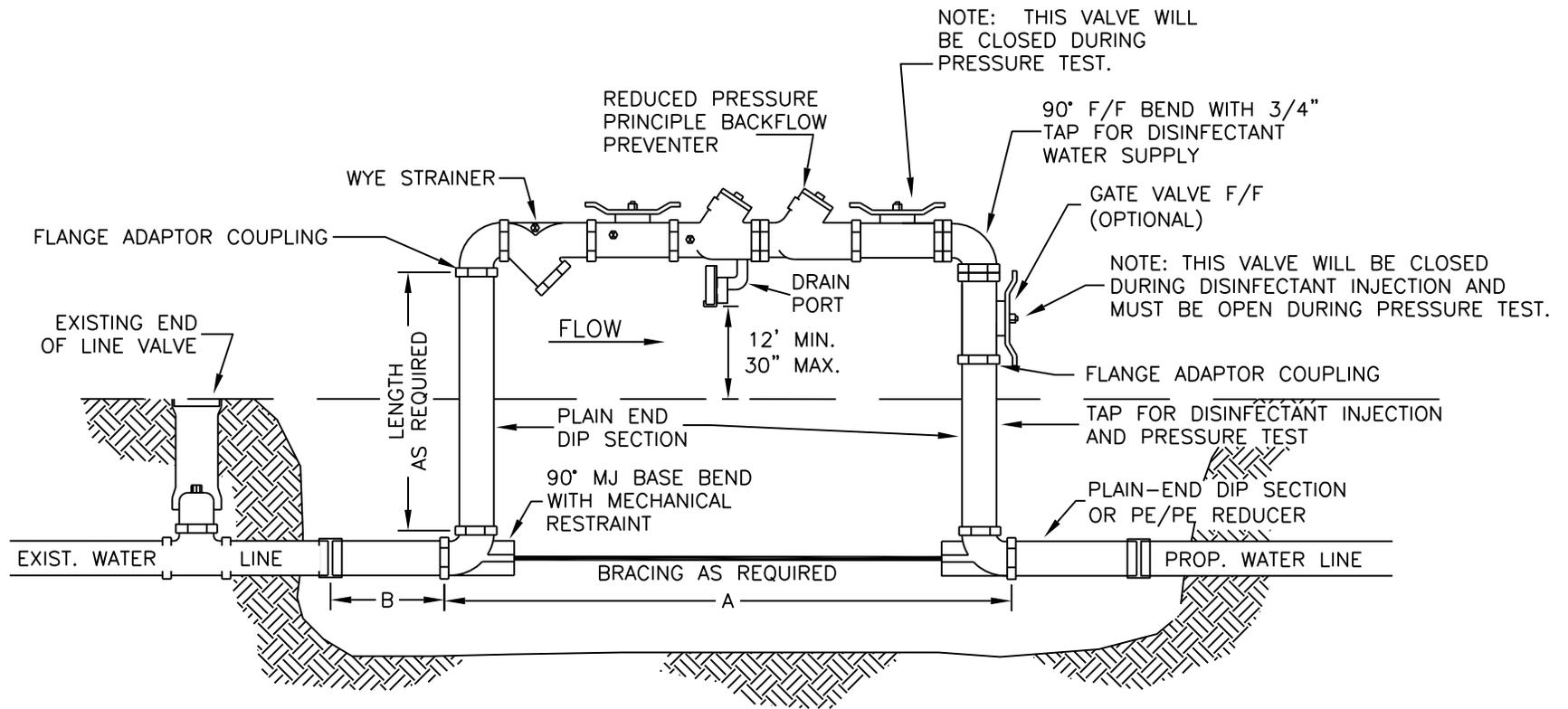


SUPPORTS SHALL BE OF STEEL AND BE CAPABLE OF SUPPORTING 120 LBS. ALTERNATIVE METHODS TO BE APPROVED BY CITY OF KANNAPOLIS BACKFLOW ADMINISTRATOR.

NOTES:

1. THE CONTRACTOR MUST INSTALL A REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTION ASSEMBLY (RP) IMMEDIATELY AFTER THE HYDRANT METER IS SET.
2. BACKFLOW ASSEMBLIES MUST BE TESTED BY A CERTIFIED TESTER PRIOR TO USE.
3. PRIOR TO USE AN INSPECTION BY THE CITY IS REQUIRED FOR ALL HYDRANT METER BACKFLOW PREVENTION ASSEMBLIES.
4. EACH TIME THE HYDRANT METER BACKFLOW PREVENTION ASSEMBLY IS RELOCATED IT MUST BE TESTED.
5. THE CONTRACTOR WILL BE BILLED TO REPLACE AND INSTALL ANY PARTS NOT RETURNED WITH HYDRANT METER.
6. HYDRANT, BACKFLOW ASSEMBLY, AND METER SHALL BE ADEQUATELY INSULATED TO PREVENT FREEZING.
7. HYDRANT WRENCH ONLY, NO PIPE WRENCH ALLOWED
8. SEE CITY OF KANNAPOLIS LAND DEVELOPMENT STANDARDS MANUAL APPENDIX B FOR LIST OF APPROVED PRODUCTS.

NOT TO SCALE



BACKFLOW DEVICE	A
4"	6'-3"
6"	9'
8"	11'-2"

**NOTE:**

SEE CITY OF KANNAPOLIS LAND DEVELOPMENT STANDARDS MANUAL APPENDIX B FOR LIST OF APPROVED PRODUCTS.

WATER MAIN SIZE	B
6"	17"
8"	19"
12"	22"
16"	26"
24"	32"

WATER MAIN SIZE	MIN. BACKFLOW DEVICE SIZE	MIN. END OF LINE BLOWOFF
6" OR 8"	2"	2"
12"	4"	2.5
16"	6"	4"
24"	8"	6"

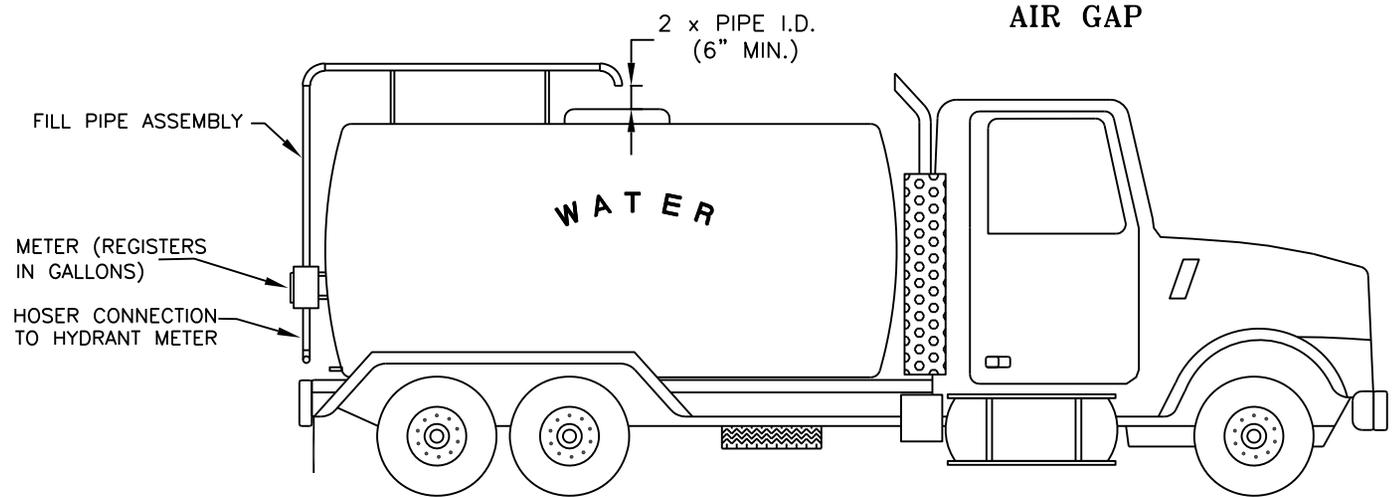
NOT TO SCALE



**BACKFLOW PREVENTION  
BY-PASS CONNECTION FOR FILLING  
NEW WATER MAINS**

DECEMBER 2019

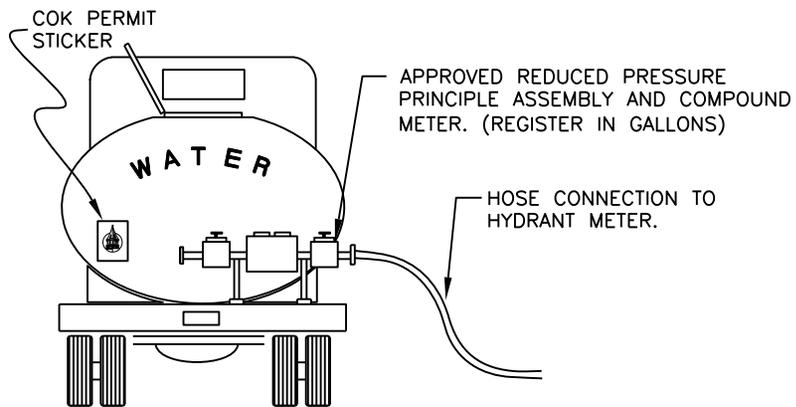
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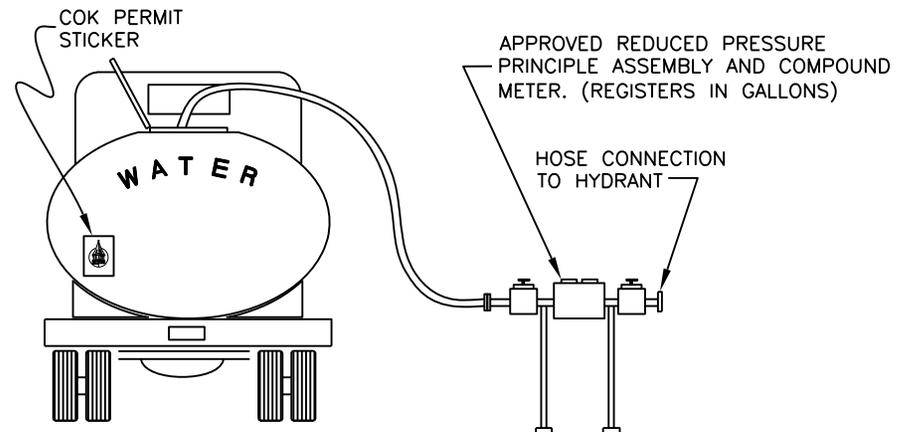
**AIR GAP**

**NOTE:**  
 SEE CITY OF KANNAPOLIS  
 LAND DEVELOPMENT  
 STANDARDS MANUAL APPENDIX  
 B FOR LIST OF APPROVED  
 PRODUCTS.

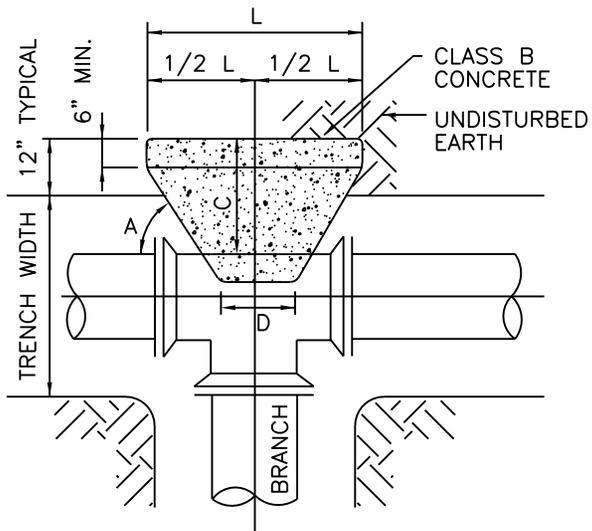
**TRUCK MOUNTED ASSEMBLY**



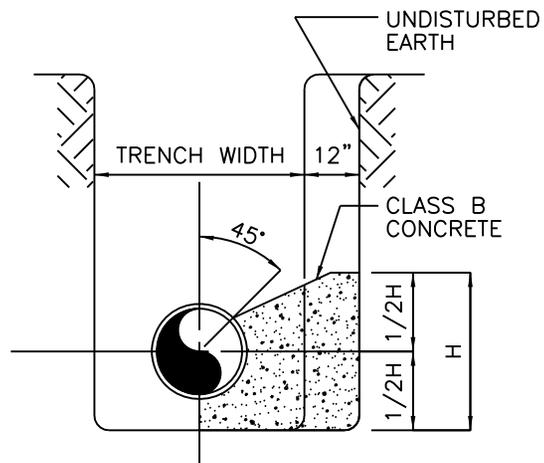
**PORTABLE ASSEMBLY**



**MINIMUM PROTECTION FOR  
 FILLING TANKER TRUCK**



PLAN - TEE



SECTION

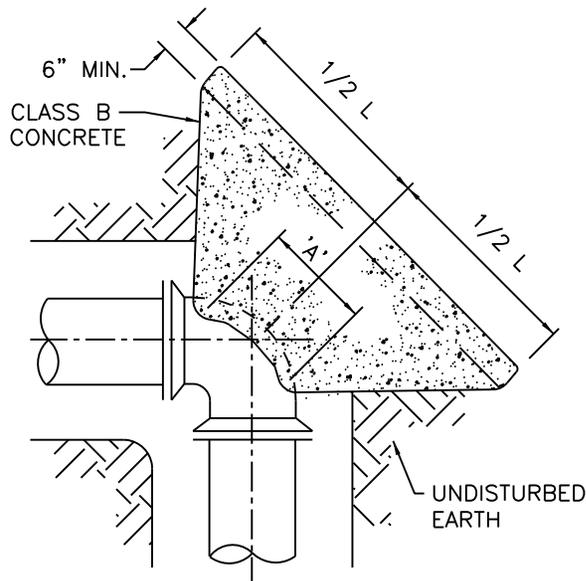
BUTTRESS DIMENSIONS				
B. D.	L	H	C	D
6"	1'-3"	1'-0"	SEE NOTE NO. 1	SEE NOTE NO. 2
8"	1'-6"	1'-4"	SEE NOTE NO. 1	SEE NOTE NO. 2
12"	2'-3"	2'-0"	SEE NOTE NO. 1	SEE NOTE NO. 2

B. D. = BRANCH DIAMETER

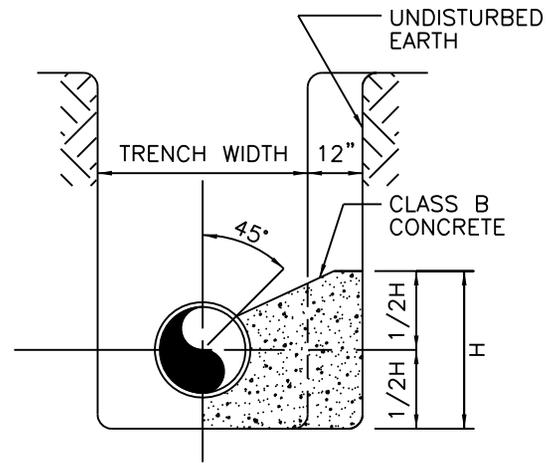
NOTES:

1. DIMENSION 'C' SHOULD BE LARGE ENOUGH TO MAKE ANGLE 'A' EQUAL TO OR GREATER THAN 45°.
2. DIMENSION 'D' SHOULD BE AS LARGE AS POSSIBLE WITHOUT INTERFERING WITH THE MECHANICAL JOINTS.
3. BUTTRESS DIMENSIONS ARE BASED UPON A SOIL RESISTANCE OF TWO TONS PER SQ. FT. AND A WATER PRESSURE OF 150 P.S.I.

NOT TO SCALE



PLAN - BENDS



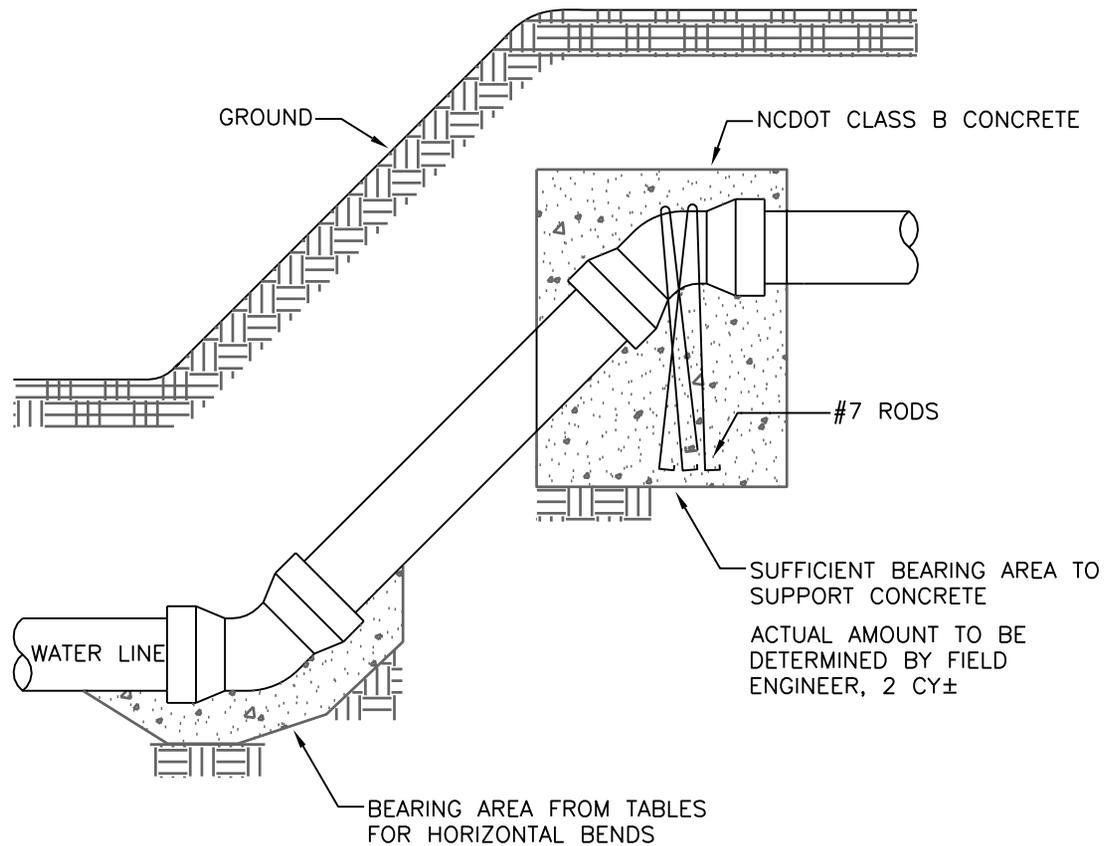
SECTION

BUTTRESS DIMENSIONS						
PIPE SIZE	22 1/2° BENDS		45° BENDS		90° BENDS	
	L	H	L	H	L	H
6"	1'-0"	1'-0"	1'-0"	1'-0"	1'-4"	1'-2"
8"	1'-0"	1'-0"	1'-4"	1'-2"	1'-10"	1'-6"
12"	1'-4"	1'-4"	1'-10"	1'-10"	2'-8"	2'-3"

NOTES:

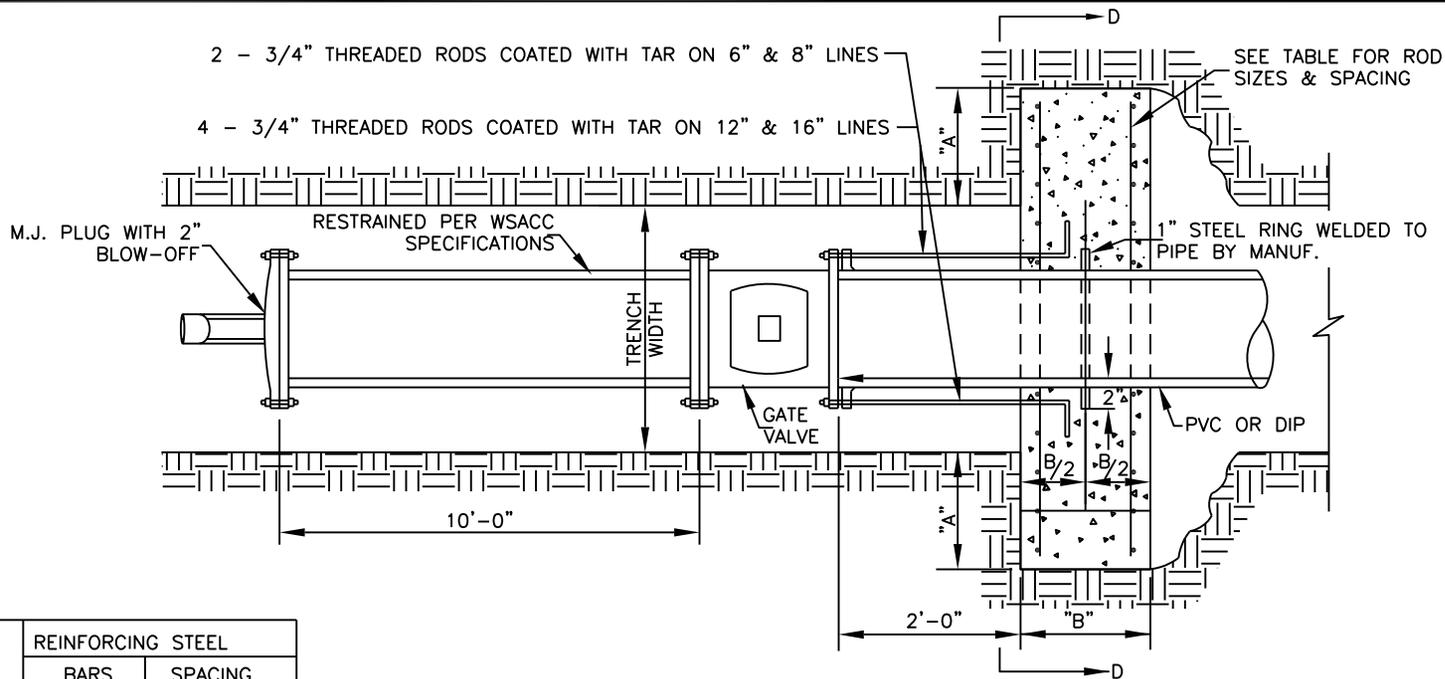
1. DIMENSION 'A' SHOULD BE AS LARGE AS POSSIBLE WITHOUT INTERFERING WITH THE MECHANICAL JOINT BOLTS.
2. THE SHAPE OF THE BACK OF THE BUTTRESS MAY VARY PROVIDED THE CONCRETE IS AGAINST FIRM, UNDISTURBED EARTH.
3. BUTTRESS DIMENSIONS ARE BASED UPON A SOIL RESISTANCE OF TWO TONS PER SQ. FT. AND A WATER PRESSURE OF 150 P.S.I.
4. INSTALL GRIPPER GASKETS WITHIN 60' OF 45° AND 90° BENDS.

NOT TO SCALE

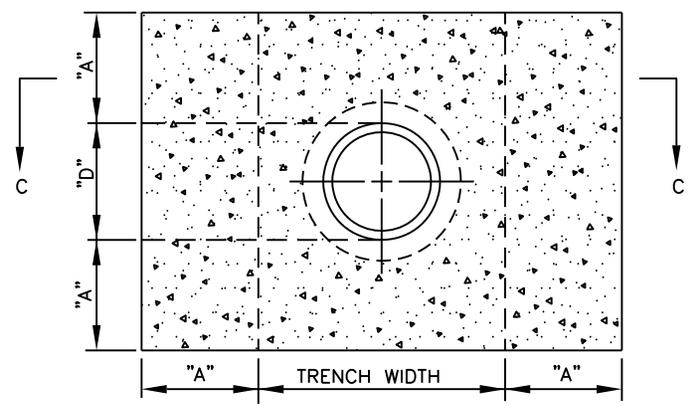


CUBIC YARDS OF CONCRETE TO ANCHOR VERTICAL BEND						
PIPE DIA.	11-1/4° BEND		22-1/2° BEND		45° BEND	
6"	812 #	1/2 CY	1653 #	1/2 CY	3247 #	1.0 CY
8"	1444 #	1/2 CY	2939 #	3/4 CY	5773 #	1.5 CY
12"	3248 #	1.0 CY	6612 #	1-3/4 CY	12988 #	3.5 CY
16"	5775 #	1-1/2 CY	11756 #	3.0 CY	23090 #	6.0 CY

NOT TO SCALE



SECTION C-C  
TOP VIEW



SECTION D-D NOT TO SCALE

NOMINAL DIAMETER "D"	"A"	"B"	TRENCH WIDTH "W"	REINFORCING STEEL	
				BARS "X"	SPACING "Y"
6"	12"	12"	24"	#6	12"
8"	12"	12"	24"	#6	12"
12"	15"	12"	30"	#6	12"
16"	20"	15"	36"	#8	12"
24"	30"	18"	42"	#8	12"

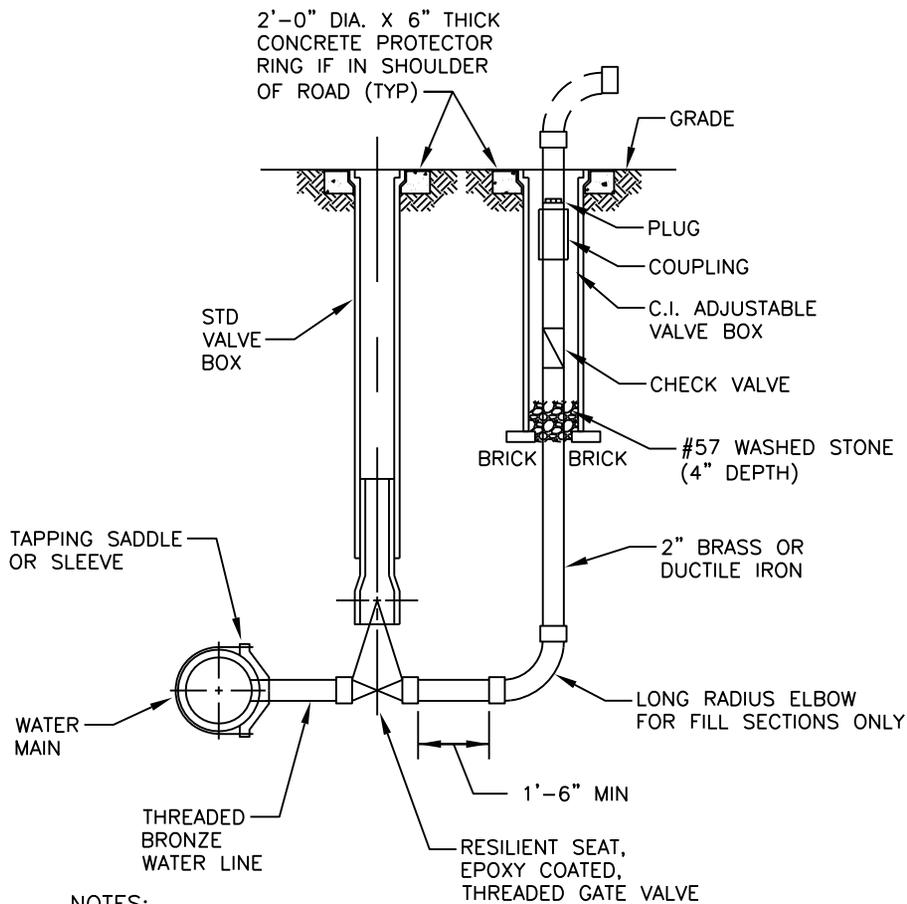
**NOTES:**

1. POUR CONCRETE AGAINST FIRM UNDISTURBED SOIL. FILL AGAINST COLLAR TO BE COMPACTED TO 95% PROCTOR FOR 6' ALONG THE PIPE ON BOTH SIDES OF THE COLLAR.
2. COMPLETELY BACK FILL & COMPACT BEFORE PRESSURE TESTING.
3. TRENCH WIDTHS SHALL CONFORM TO STANDARD TRENCH DETAIL.
4. TIE BOLTS SHALL BE LOAD RATED 22,000 PSI PER BOLT. BOLTS SHALL MEET THE REQUIREMENTS OF ASTM A325 TYPE 3D, TENSILE STRENGTH 60,000 PSI MINIMUM.
5. TIE RODS SHALL BE PLAIN OR CONTINUOUS THREADED AND SHALL BE RATED 50,000 P.S.I.
6. ALL RODS SHALL BE COATED WITH TAR AFTER INSTALLATION.
7. VALVE BOX CONCRETE PAD SHALL BE 24" SQUARE OR 8" MINIMUM FOR EDGE OF VALVE BOX LID TO EDGE OF CONCRETE PAD.

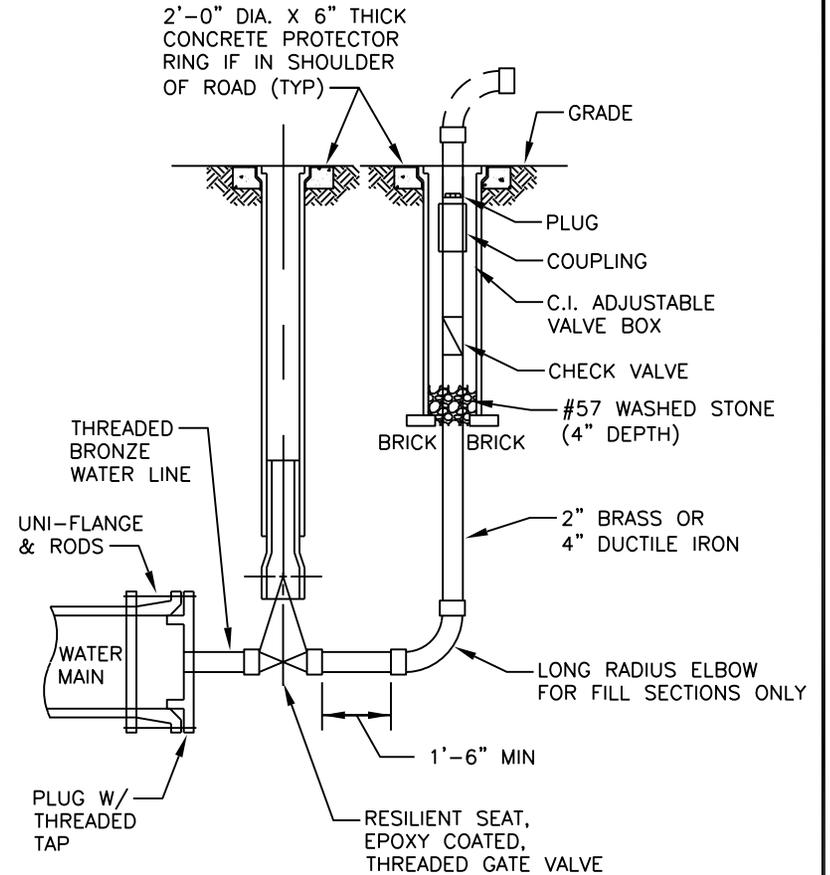


**DEAD END BLOW-OFF WITH THRUST COLLAR**

### IN-LINE BLOW-OFF



### DEAD END BLOW-OFF



**NOTES:**

1. INSTALL 2" BLOW-OFF ON 2" THRU 8" MAINS.
2. INSTALL 2.5" BLOW-OFF ON 12" MAINS.
3. 2" & 2.5" BLOW-OFFS TO HAVE (NPT) COUPLING
4. INSTALL 4" BLOW-OFF ON 16" MAINS.
5. INSTALL 6" BLOW-OFF ON 24" MAINS.
6. IF THE SEPARATION BETWEEN THE CONTROL VALVE AND THE BLOW-OFF DOES NOT ALLOW THE INSTALLATION OF THE CONCRETE PROTECTOR RINGS, A 24" BY 24" BY 6" THICK CONCRETE PAD SHALL BE FORMED AND POURED AROUND THE VALVE BOX. THE EDGE OF THE VALVE BOX RIM MUST BE AT LEAST 8" FROM THE EDGE OF THE CONCRETE PAD.

NOT TO SCALE

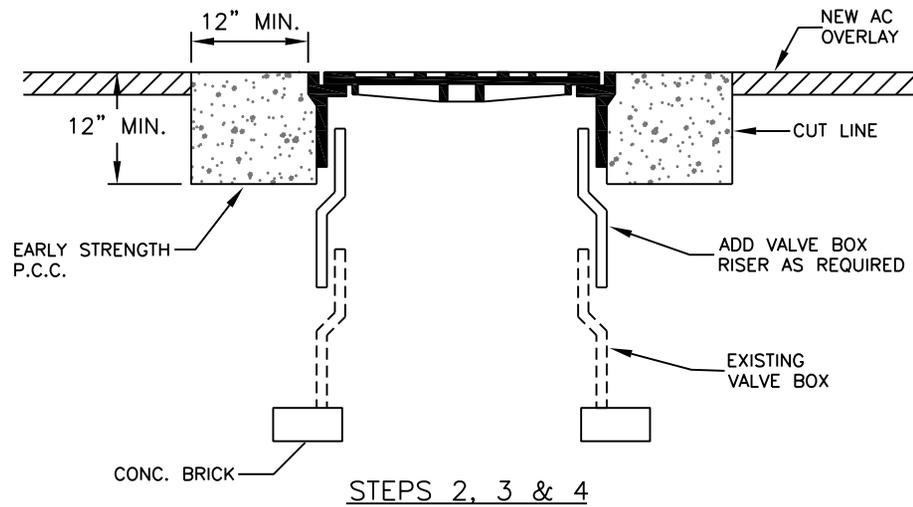
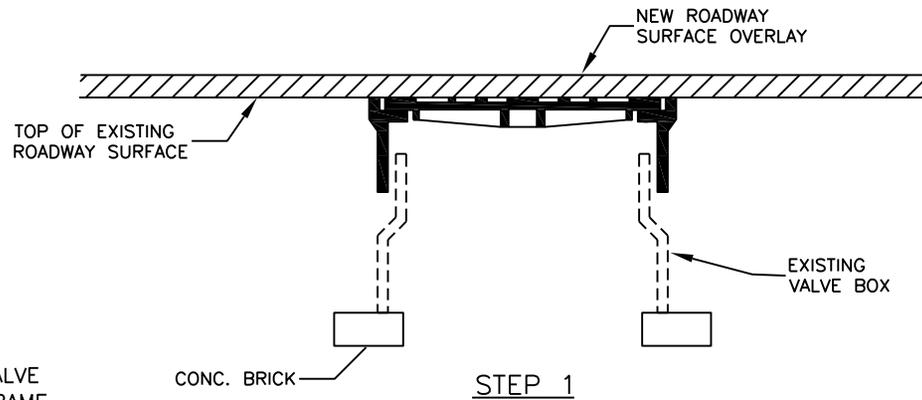


## TEMPORARY BLOW-OFF ASSEMBLY

DECEMBER 2019

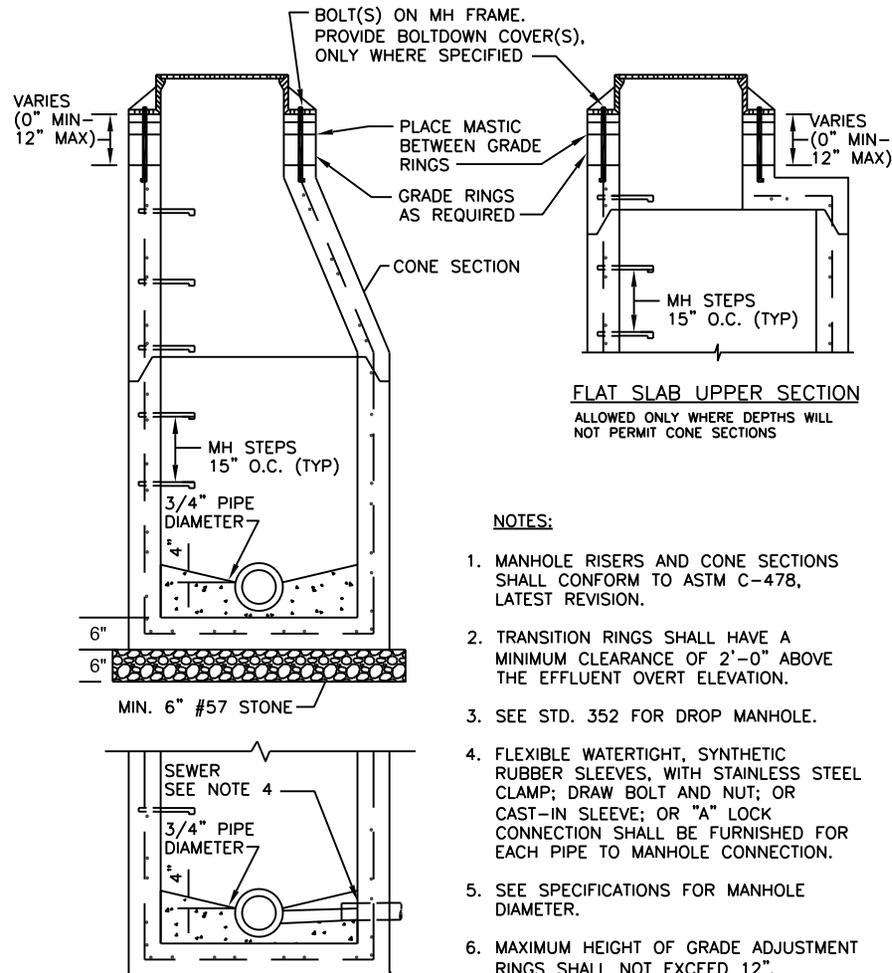
331

- STEP 1 COVER EXISTING VALVE BOX WITH APPROVED MATERIAL AND CONSTRUCT OVERLAY ACROSS TOP OF VALVE BOX.
- STEP 2 SAW CUT EXCAVATION AREA AROUND VALVE BOX 12" MINIMUM FROM VALVE BOX FRAME.
- STEP 3 RAISE VALVE BOX TO FINISH PAVEMENT PROFILE AND CROSS SLOPE.
- STEP 4 BACKFILL WITH EARLY STRENGTH PORTLAND CEMENT CONCRETE (P.C.C.) TO DEPTHS AS DIRECTED.



NOT TO SCALE

## VALVE BOX ADJUSTMENT DETAIL

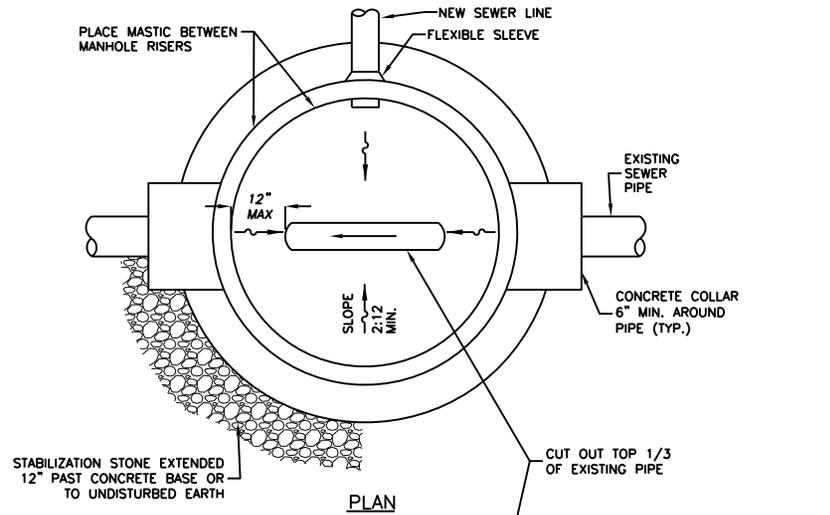


**FLAT SLAB UPPER SECTION**  
 ALLOWED ONLY WHERE DEPTHS WILL NOT PERMIT CONE SECTIONS

**NOTES:**

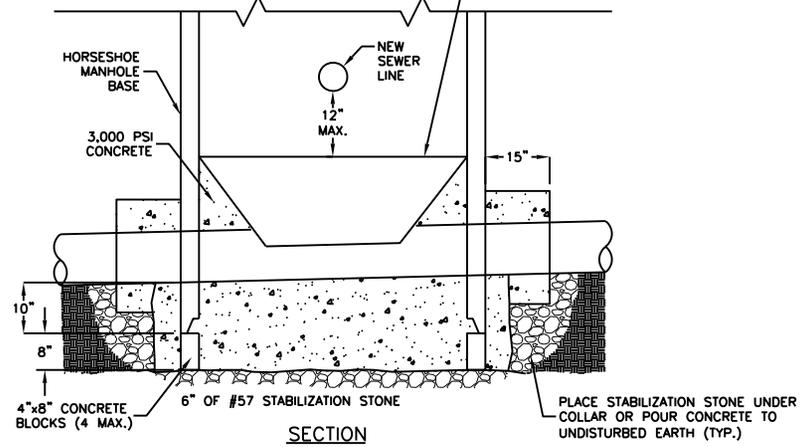
1. MANHOLE RISERS AND CONE SECTIONS SHALL CONFORM TO ASTM C-478, LATEST REVISION.
2. TRANSITION RINGS SHALL HAVE A MINIMUM CLEARANCE OF 2'-0" ABOVE THE EFFLUENT OVERT ELEVATION.
3. SEE STD. 352 FOR DROP MANHOLE.
4. FLEXIBLE WATERTIGHT, SYNTHETIC RUBBER SLEEVES, WITH STAINLESS STEEL CLAMP; DRAW BOLT AND NUT; OR CAST-IN SLEEVE; OR "A" LOCK CONNECTION SHALL BE FURNISHED FOR EACH PIPE TO MANHOLE CONNECTION.
5. SEE SPECIFICATIONS FOR MANHOLE DIAMETER.
6. MAXIMUM HEIGHT OF GRADE ADJUSTMENT RINGS SHALL NOT EXCEED 12".

NOT TO SCALE



**NOTES:**

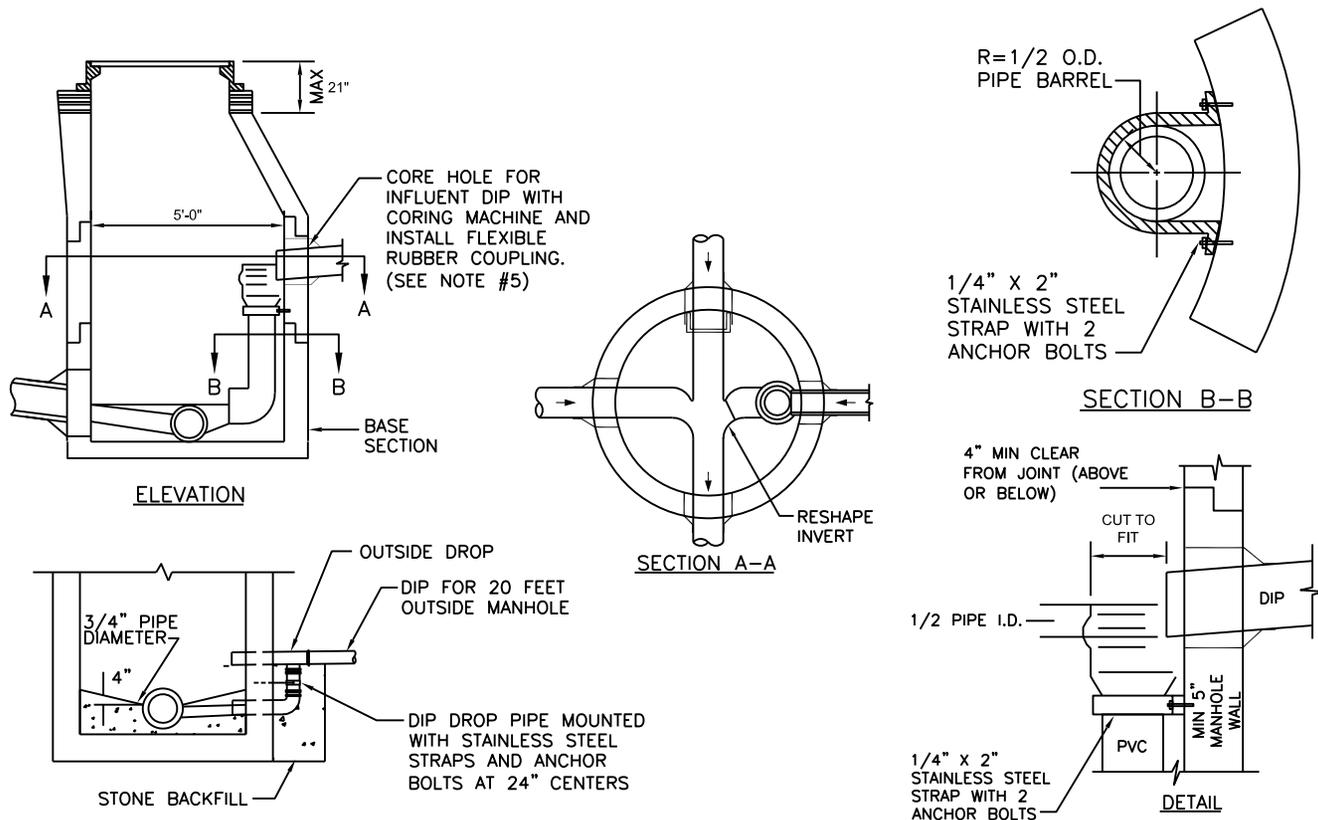
1. PLACE HORSESHOE MANHOLE BASE IN WET CONCRETE (2,500 PSI).
2. CUT OUT TOP THIRD OF EXISTING PIPE. FINISH INVERTS AND WATERPROOF ALL COLD JOINTS AND AROUND ALL PIPES.
3. POUR CONCRETE COLLARS.



NOT TO SCALE



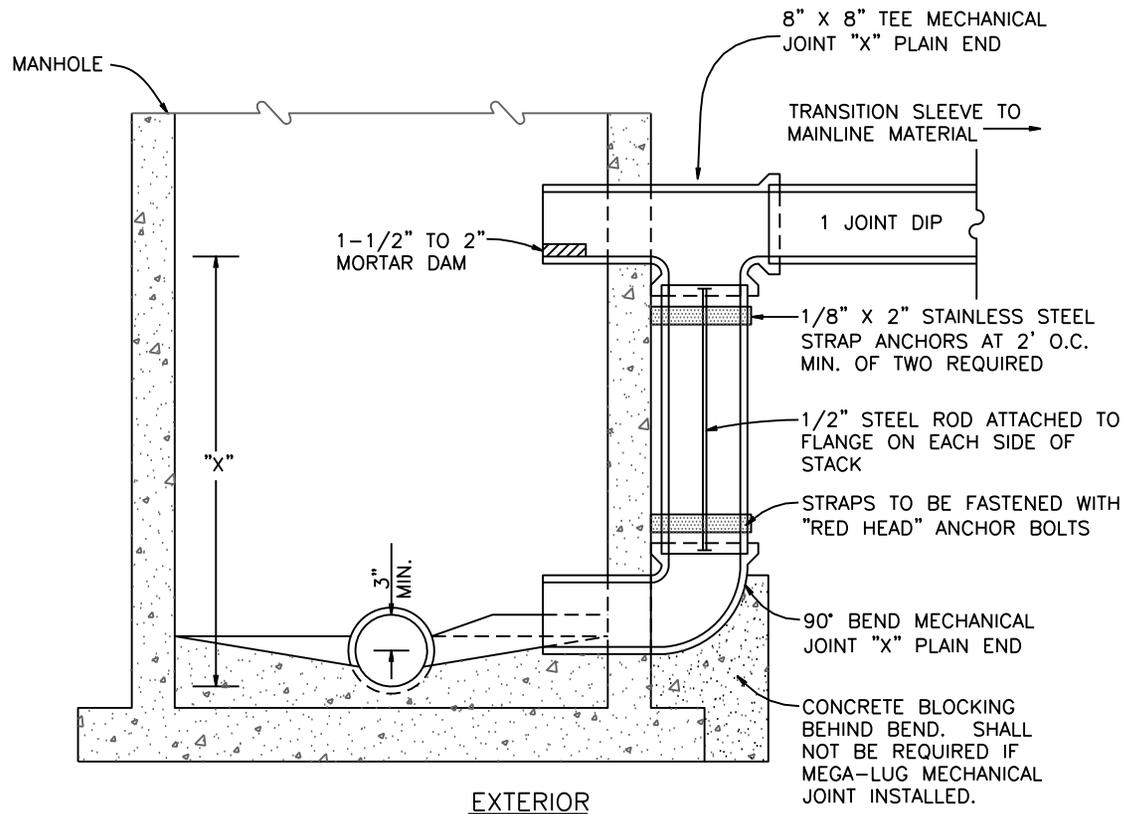
**DOGHOUSE MANHOLE**



**NOTES:**

1. PIPE FOR INSIDE DROP SHALL BE SDR 35 PVC CONFORMING TO ASTM SPECIFICATION D3034.
2. BOTTOM BEND TO BE 90° SHORT BEND, BELLSPIGOT, OF SDR 35 PVC. SPIGOT OF BEND TO REST DIRECTLY ON EXISTING SHELF. CONSTRUCT MASONRY TROUGH FROM DROP EFFLUENT TO MAIN CHANNEL.
3. NOTCH BELL OF PVC DROP TO ACCEPT DIP SPIGOT AS SHOWN.
4. LOCATE STRAPS AT PIPE BELL AND ABOVE BELL OF 90° BEND AS SHOWN. ADD EXTRA STRAPS AS NECESSARY TO MAINTAIN MAXIMUM SPACING OF TEN FEET.
5. HOLE IN MANHOLE WALL TO BE MADE WITH A CORING MACHINE. INSTALL FLEXIBLE RUBBER COUPLING.
6. CORE HOLE SHALL NOT ENTER CONE SECTION.
7. STEPS SHALL BE RELOCATED IF THEY CONFLICT WITH INSIDE DROP.
8. A DROP MANHOLE SHALL BE REQUIRED WHEN THE DROP EXCEEDS A DISTANCE OF 2'-0" FROM INVERT IN TO INVERT OUT EXCEPT WHEN THE INLET PIPE INVERT LIES WITHIN THE LOWER HALF OF THE OUTLET PIPE.

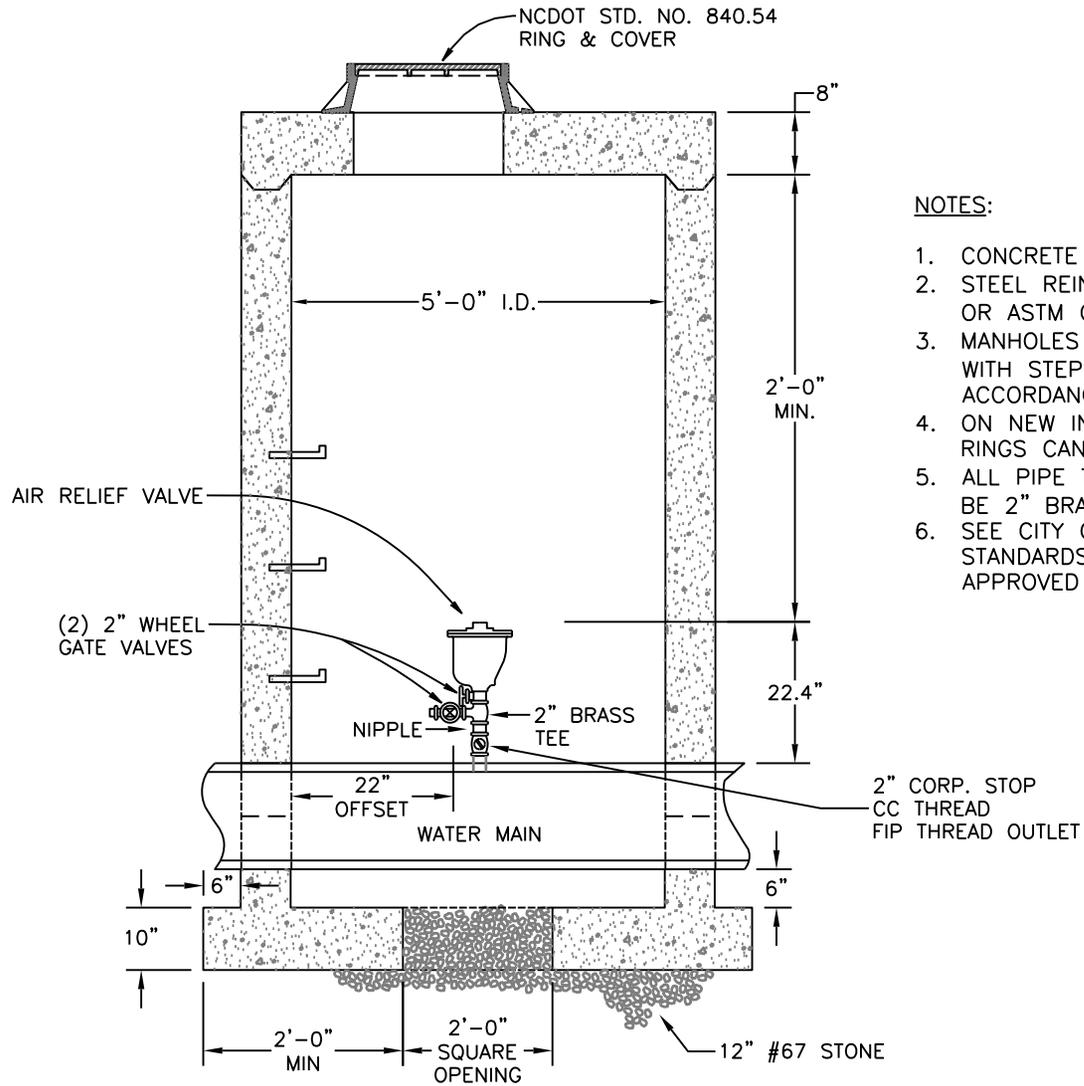
NOT TO SCALE



**NOTES:**

1. THIS DETAIL SHALL BE USED ONLY WHERE INDICATED ON PLANS.
2. ALL EXTERIOR DROP PIPE AND FITTINGS TO BE DUCTILE IRON.
3. MEGALUG MAY BE USED AS A METHOD OF RESTRAINT IN LIEU OF 1/2" STEEL ROD ATTACHED TO FLANGE ON EACH SIDE OF STACK.
4. ALL CONNECTIONS TO PRECAST MANHOLE STRUCTURES SHALL BE WATERTIGHT.
5. PROPOSED CONNECTION TO BE USED WHERE THE DROP EXCEEDS 2'-0" FROM INVERT IN TO INVERT OUT.
6. SEE STD. S-MH-02A & B FOR STANDARD MANHOLE.

NOT TO SCALE



**NOTES:**

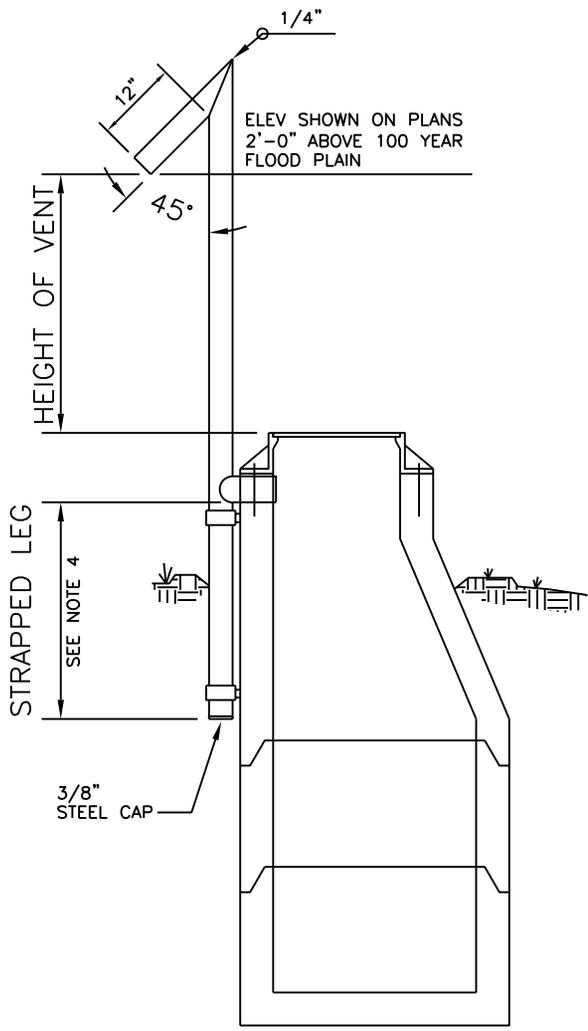
1. CONCRETE SHALL BE 4000 PSI AS PER ASTM C-478.
2. STEEL REINFORCING SHALL MEET ASTM C-185 (4' DIA) OR ASTM C-478 (5' DIA).
3. MANHOLES OVER 3'-6" IN DEPTH SHALL BE PROVIDED WITH STEPS 12" ON CENTERS. STEPS SHALL BE IN ACCORDANCE WITH NCDOT STD. NO. 840.66.
4. ON NEW INSTALLATION A MAXIMUM OF (2) GRADE RINGS CAN BE USED.
5. ALL PIPE TO BE MINIMUM 2" BRASS AND NIPPLES TO BE 2" BRASS.
6. SEE CITY OF KANNAPOLIS LAND DEVELOPMENT STANDARDS MANUAL APPENDIX B FOR LIST OF APPROVED PRODUCTS.

SECTION THROUGH MANHOLE

NOT TO SCALE



**STANDARD AIR RELIEF VALVE WITH ASSEMBLY AND MANHOLE FOR WATER LINES**



**NOTES:**

1. VENT PIPE SHALL BE IN ACCORDANCE WITH WSACC SPECIFICATION SECTION 02605.
2. VENT OPENING TO POINT DOWNSTREAM.
3. TWO 3" X 3/8" STEEL STRAPS, AND 5/8" X 4" EXPANSION ANCHOR BOLTS SHALL BE USED TO SECURELY ANCHOR VENT.
4. THE FOLLOWING TABLE SHALL BE USED TO DETERMINE THE LENGTH OF THE STRAPPED LEG:

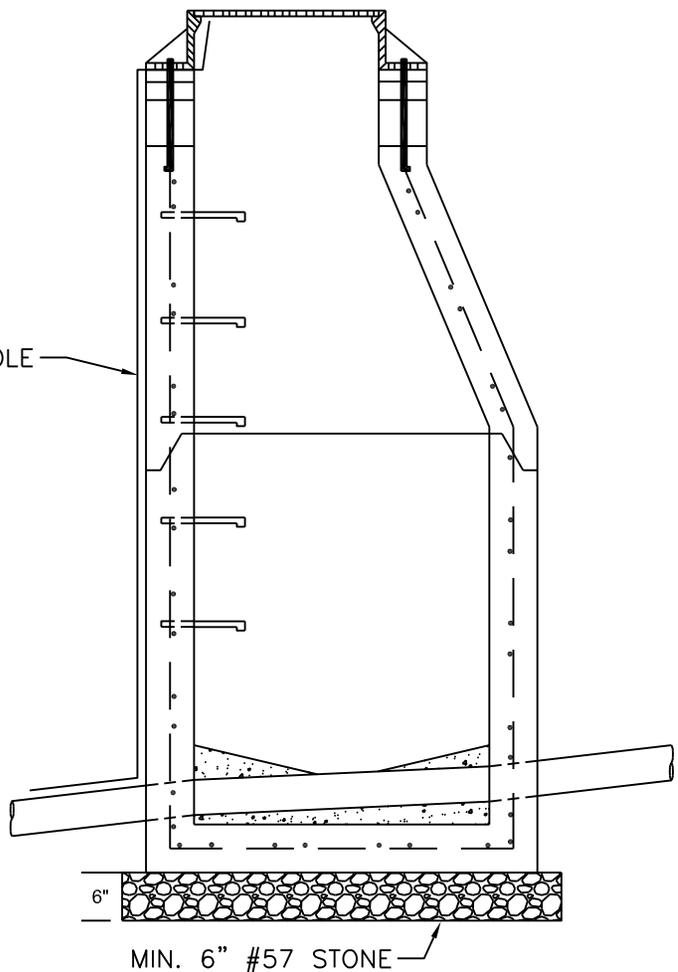
HEIGHT OF VENT PIPE	LENGTH OF STRAPPED LEG
UP TO 6.00'	3.00'
6.01' TO 8.00'	4.00'
8.01' TO 10.00'	5.00'
10.01' TO 12.00'	6.00'
OVER 12.01'	7.00'

NOT TO SCALE



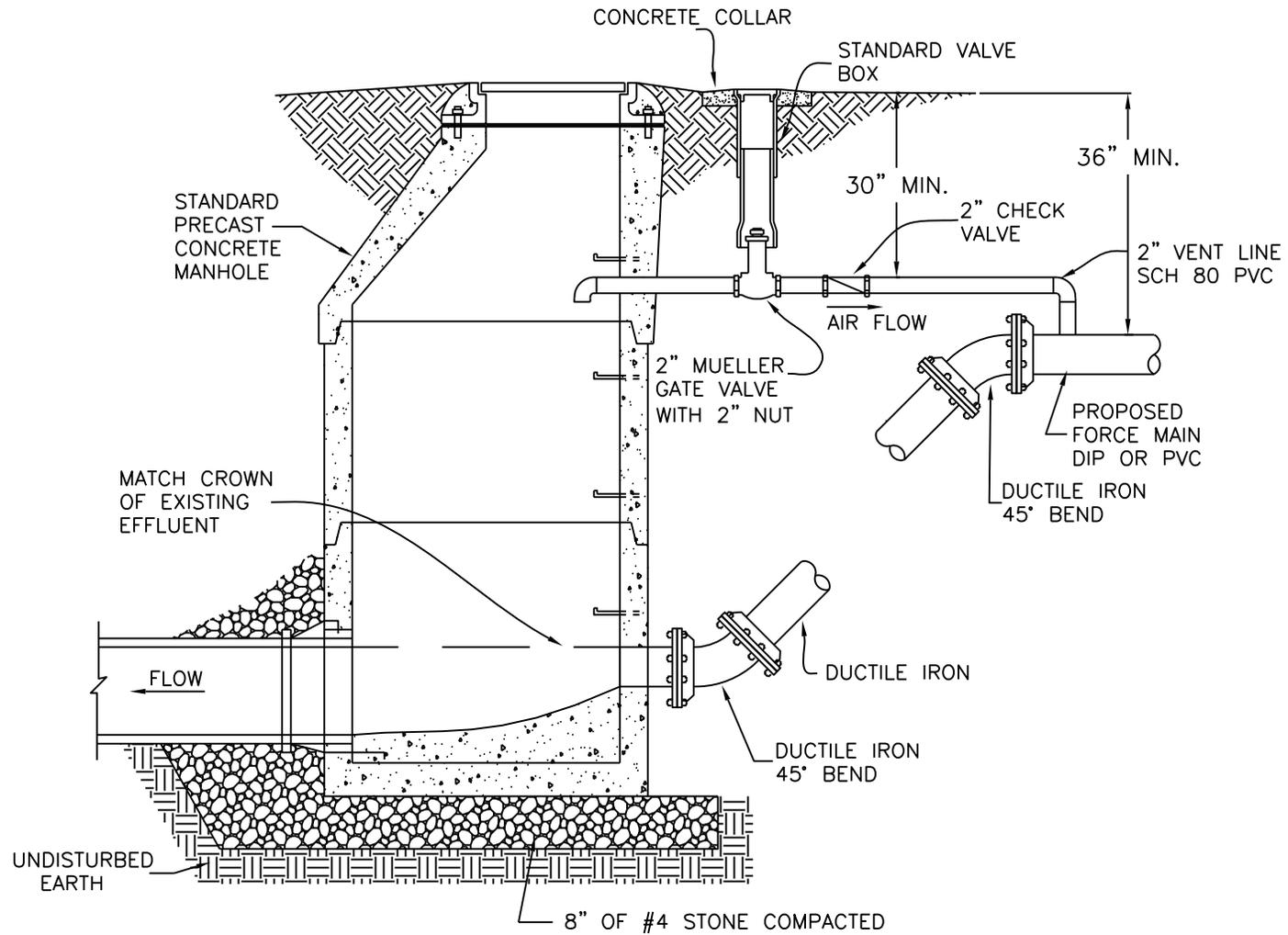
**STANDARD VENT**  
**FOR PRECAST CONCRETE MANHOLE**

#12 GREEN PLASTIC  
COATED SOLID COPPER  
WIRE TAPED TO THE TOP  
OF THE PIPE AND MANHOLE



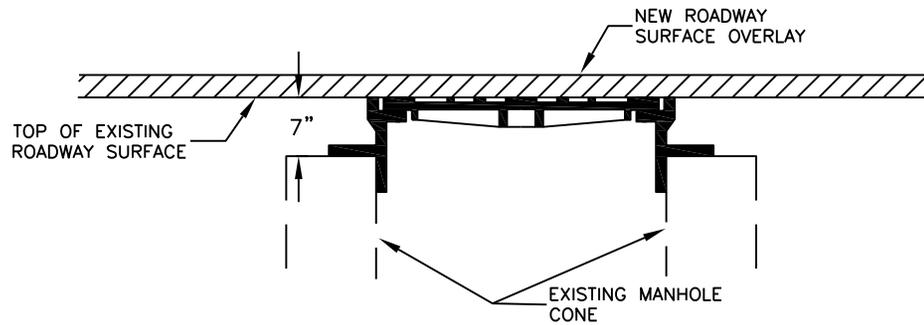
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## SEWER TRACER WIRE



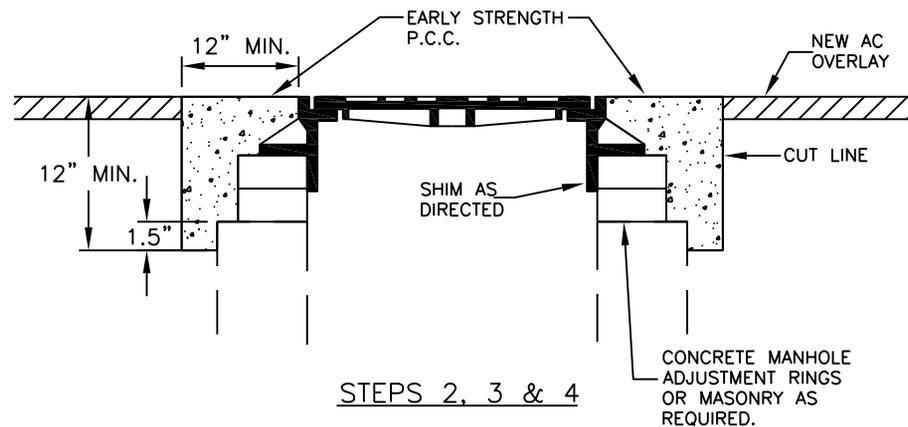
NOT TO SCALE

## MANHOLE FORCEMAIN CONNECTION



STEP 1

- STEP 1 COVER EXISTING MANHOLE WITH APPROVED MATERIAL AND CONSTRUCT OVERLAY ACROSS TOP OF MANHOLE.
- STEP 2 SAW CUT EXCAVATION AREA AROUND MANHOLE 12" MINIMUM FROM MANHOLE FRAME.
- STEP 3 RAISE MANHOLE FRAME RINGS TO FINISH PAVEMENT PROFILE AND CROSS SLOPE.
- STEP 4 BACKFILL WITH EARLY STRENGTH PORTLAND CEMENT CONCRETE (P.C.C.) TO DEPTHS AS DIRECTED.



STEPS 2, 3 & 4

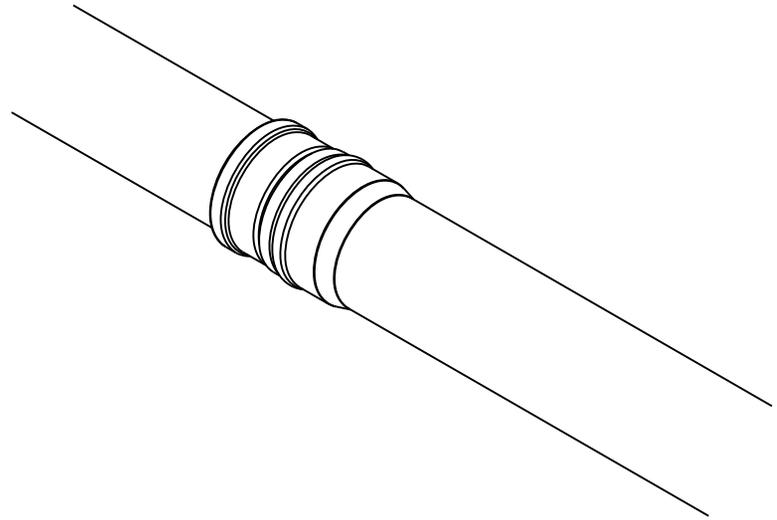
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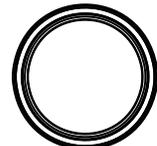
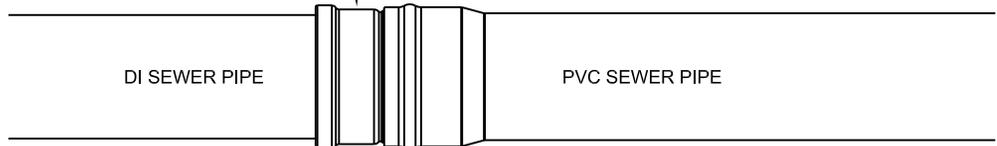
**MANHOLE ADJUSTMENT DETAIL**

DECEMBER 2019

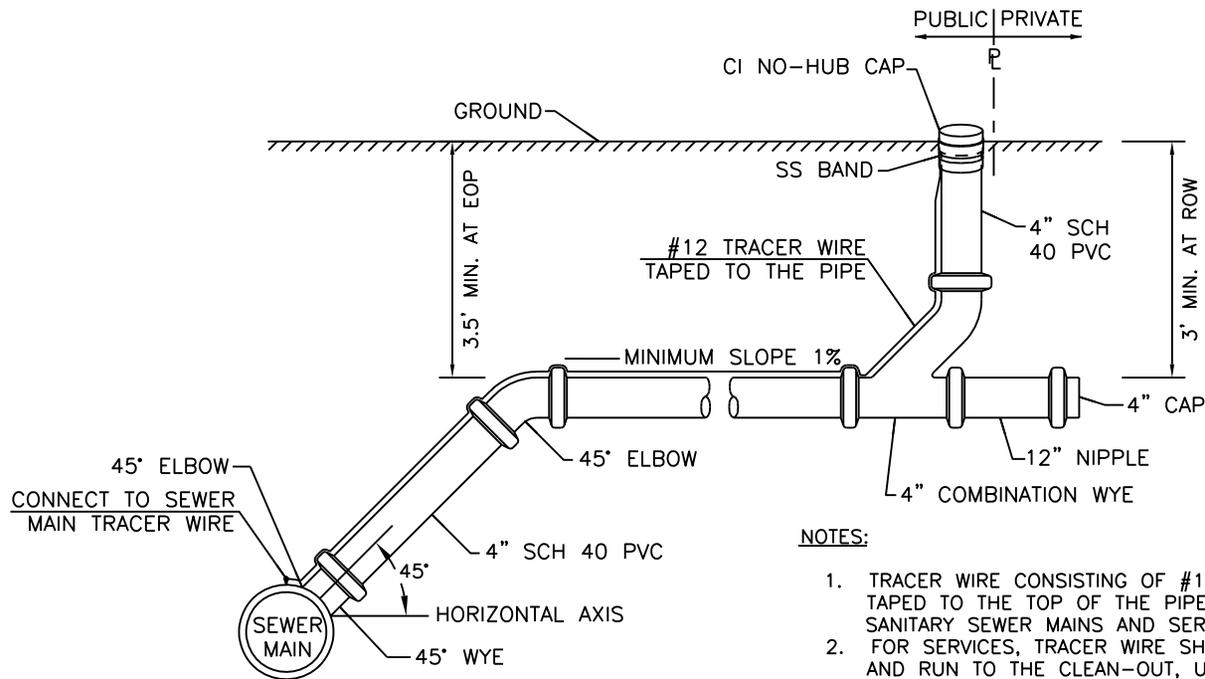
341



ADAPTER COUPLING SWR x DIOD  
HARCO PT # 2834  
OR APPROVED EQUAL

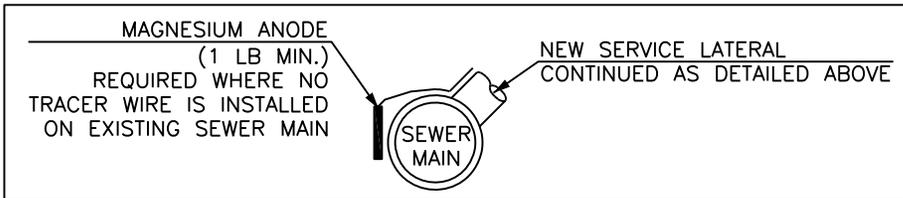


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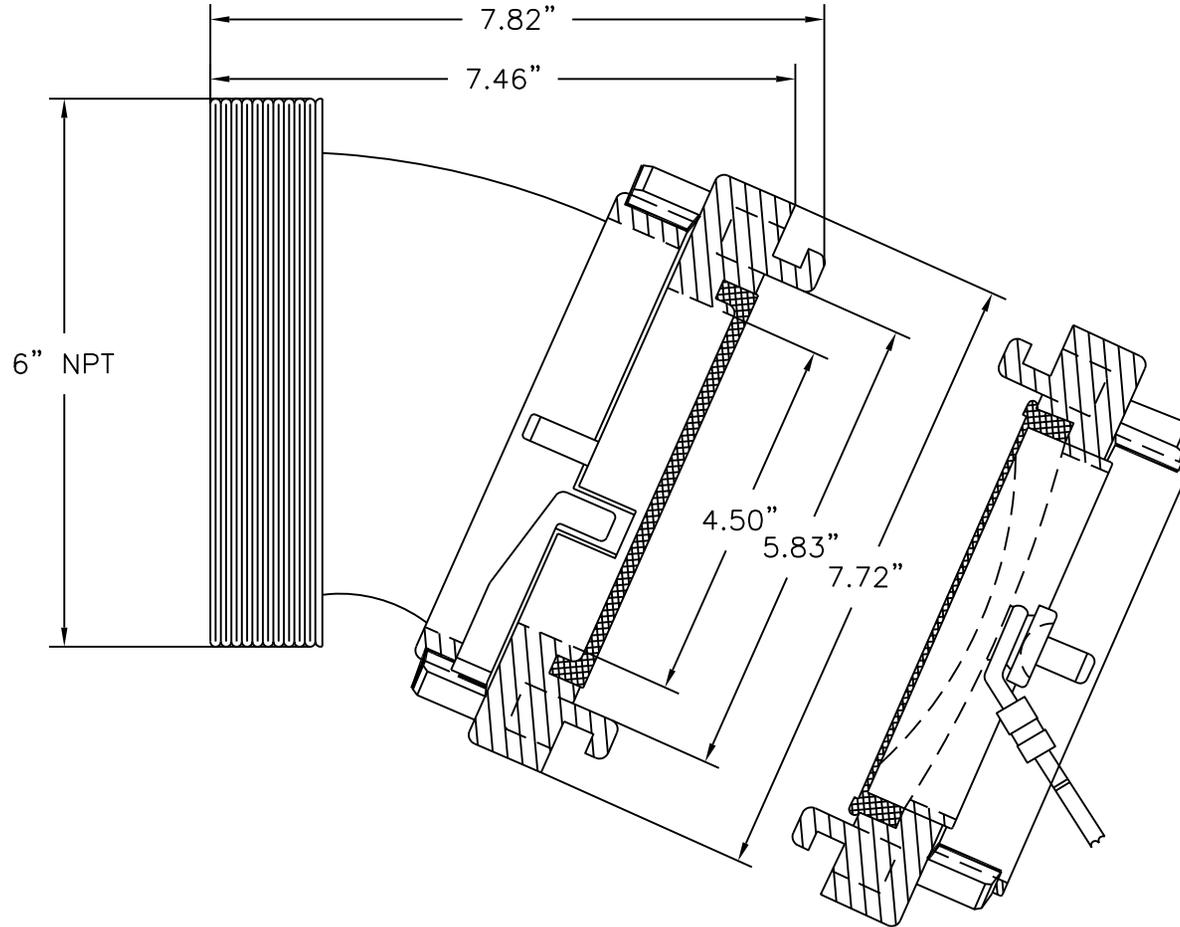


**NOTES:**

1. TRACER WIRE CONSISTING OF #12 PLASTIC COATED SOLID WIRE TAPED TO THE TOP OF THE PIPE SHALL BE INSTALLED ON ALL SANITARY SEWER MAINS AND SERVICES.
2. FOR SERVICES, TRACER WIRE SHALL BRANCH OFF AT THE WYE AND RUN TO THE CLEAN-OUT, UP THE CLEAN-OUT AND BE SECURED UNDER THE CAST IRON CAP. THE SERVICE CONNECTION WIRES SHALL BE CONNECTED TO THE MAIN LINE TRACER WIRE BY SPLICE (CRIMP STYLE) CONNECTORS.
3. THE TRACER WIRE SHALL REMAIN CONTINUOUS TO THE GREATEST EXTENT POSSIBLE. SPLICES IN THE TRACER WIRE SHOULD BE MADE WITH SPLIT BOLT CONNECTORS. WIRE NUTS SHALL NOT BE USED. A WATER-PROOF CONNECTION IS NECESSARY TO PREVENT CORROSION.
4. SERVICE LATERALS SHALL BE INSTALLED WITH A MINIMUM OF 3 FEET OF COVER.
5. PIPING FOR SERVICE LATERALS SHALL BE SCHEDULE 40 PVC EXCEPT FOR LATERALS OR SECTIONS OF LATERALS THAT HAVE MORE THAN 18 FEET OF COVER. THE PIPE SHALL BE DUCTILE IRON PIPE FOR THE LATERAL OR SECTION OF LATERAL WITH MORE THAN 18 FEET OF COVER.
6. ALL PVC SERVICE LATERALS SHALL BE INSTALLED USING CLASS B BEDDING. DIP SERVICE LATERALS SHALL USE CLASS C BEDDING.



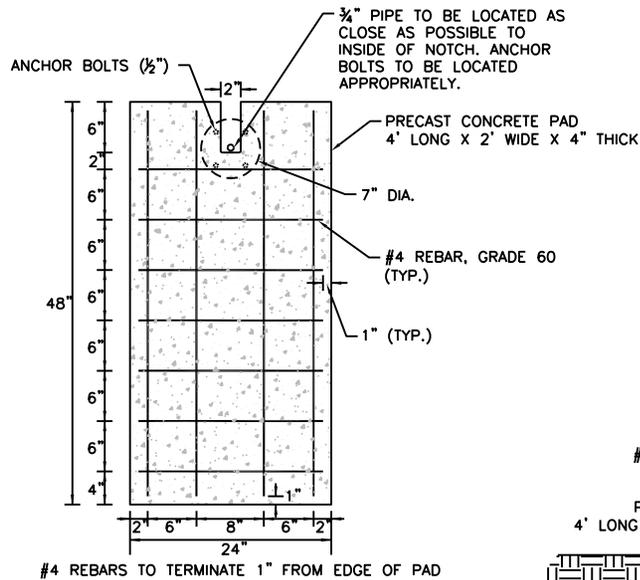
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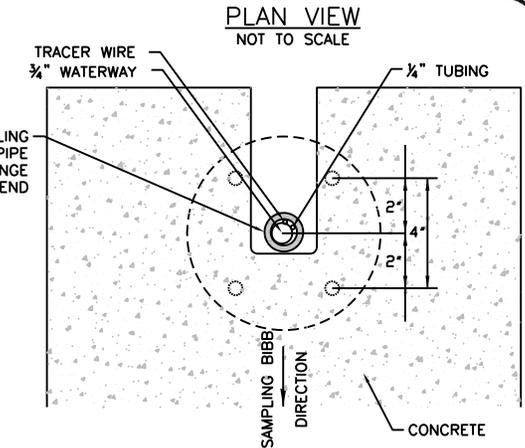
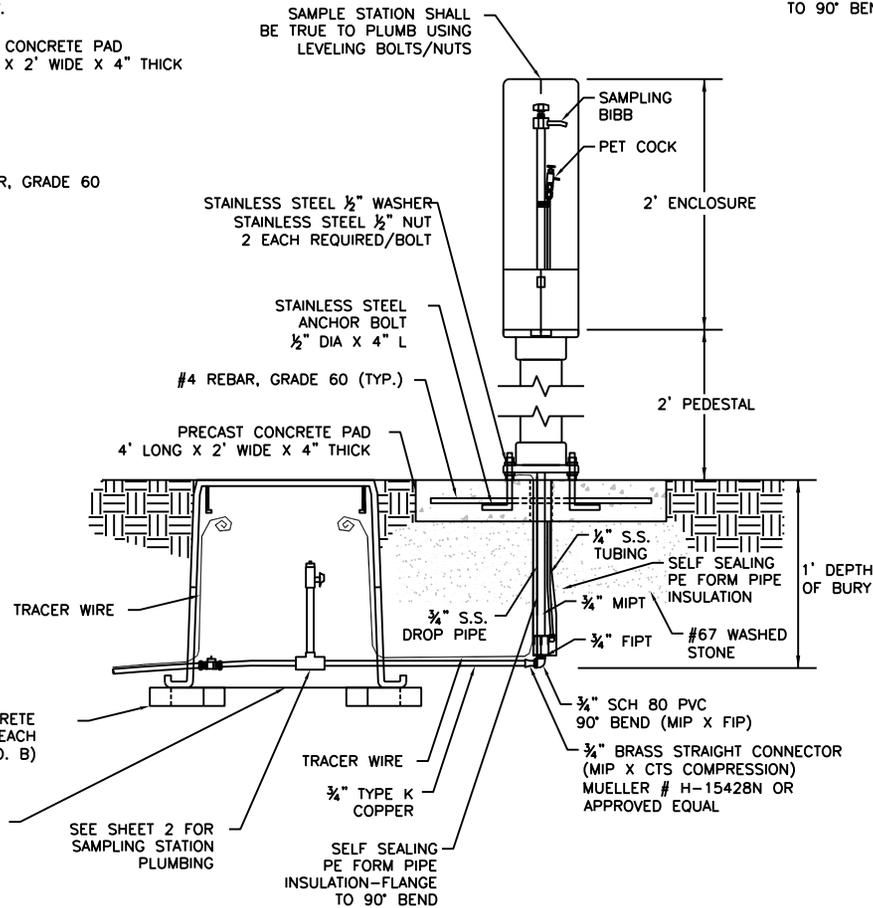
**CONCRETE PAD WITH NOTCH**

NOT TO SCALE



**SECTION VIEW**

NOT TO SCALE



- NOTES:**
1. IN CORROSIVE SOILS, THE BURIED PIPE SHOULD BE PREPARED FOR ADDITIONAL RESISTANCE TO CORROSION. SPRAY ALL UNDERGROUND PIPING AND FITTINGS WITH BITUMINOUS SPRAY TAR, ALLOWING PROPER TIME TO DRY, AND THEN WRAPPING THE PARTS.
  2. SAMPLING STATION SHALL BE 1.0' BURY, INSTALLED ON CONCRETE PAD WITH A 3/8" FIPT INLET, AND 1/16" UNTHREADED BLOW OFF AND 1/4" SAMPLING BIBB.
  3. STATION SHALL BE ENCLOSED IN A LOCKABLE, NON-REMOVABLE ALUMINUM BOX WITH HINGED OPENINGS.
  4. WHEN OPEN, THE STATION SHALL REQUIRE NO KEY FOR OPERATION, AND ALL WATER FLOW SHALL PASS THRU AN ALL STAINLESS STEEL WATERWAY.
  5. ALL WORKING PARTS SHALL BE OF STAINLESS STEEL AND SERVICEABLE FROM ABOVE GROUND WITH NO DIGGING OR REPLACEMENT NEEDED.
  6. A STAINLESS STEEL PETCOCK VALVE WILL BE LOCATED BELOW THE SAMPLING BIBB TO ALLOW PUMPING OF ANY WATER REMAINING INSIDE THE STATION TO ENSURE NON-FREEZING.
  7. CONCRETE PAD SHALL DRAIN AWAY FROM SAMPLE STATION AND SHALL BE FLUSH WITH FINISHED GRADE #67 STONE BASE TO A DEPTH OF 8" UNDER PAD.
  8. THE STATION SHALL BE MODEL #88-SS WITH 2' STEEL PEDESTAL AND EPOXY COATING WITHIN BOX FOR CORROSION PROTECTION AS MANUFACTURED BY THE KUPFERLE FOUNDRY, OR APPROVED EQUAL.
  9. ANCHOR BOLTS - 304 STAINLESS STEEL, WITH NUTS AND WASHERS - 316 STAINLESS STEEL.
  10. AWG #12 GAUGE SOLID COPPER TRACER WIRE-WITH 30 MILS BLUE HDPE INSULATION-TERMINATE IN METER BOX WITH 24" EXCESS WIRE (COILED), AND TERMINATE AT ANCHOR BOLT.
  11. IN MAJOR SUBDIVISIONS, ONE WATER QUALITY SAMPLING STATION SHALL BE INSTALLED WITHIN THE RIGHT-OF-WAY PER EVERY FORTY (40) HOUSES. ALSO REQUIRED IN MULTI-FAMILY DEVELOPMENTS AT THE DIRECTION OF THE CITY.

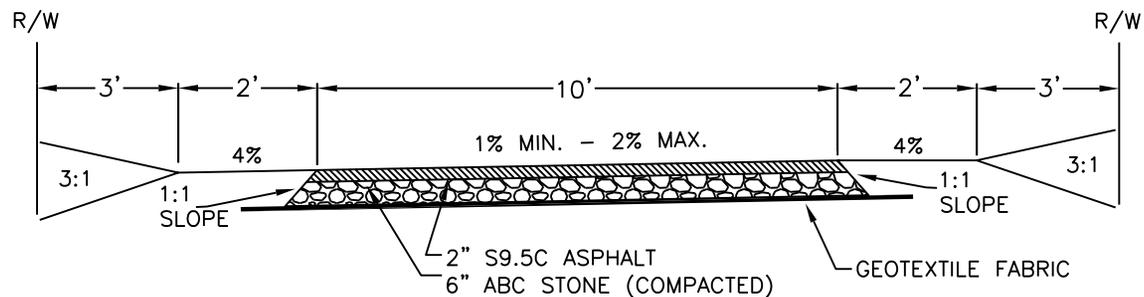
\* TAPS SHALL ONLY BE CONNECTED DIRECTLY TO A CITY OF KANNAPOLIS PUBLIC MAIN AND MAY NOT BE CONNECTED TO WATER SERVICE PIPING, FIRE HYDRANT FEEDER LEG, AIR RELEASE OR BLOW-OFF PIPING.

NOT TO SCALE

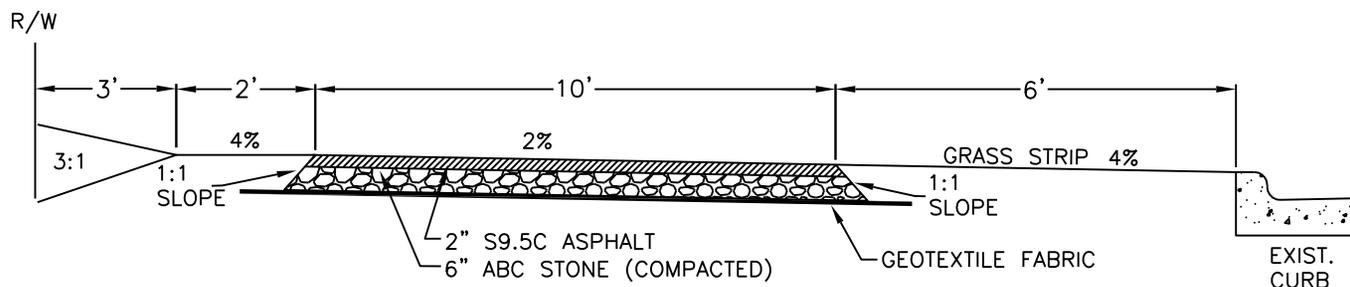
**WATER QUALITY SAMPLING STATION**  
**(1 OF 2)**







TRAIL IN PARK SETTING

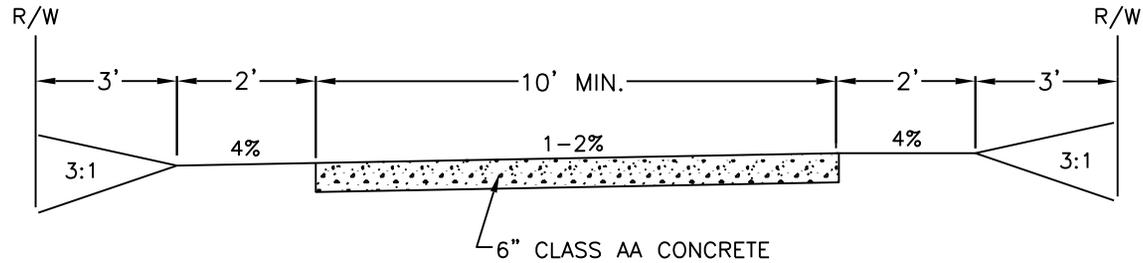


TRAIL PARALLEL TO STREET

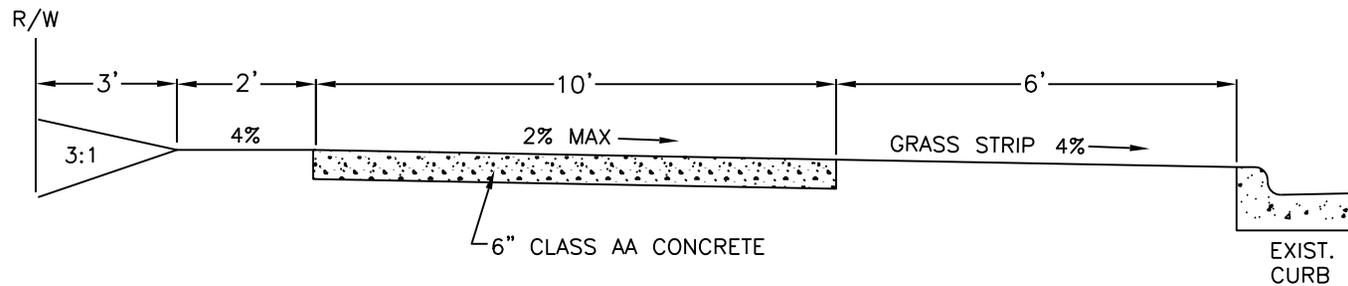
NOTES:

1. MINIMUM WIDTH MUST BE MAINTAINED UNLESS LEGITIMATE CONSTRAINTS DICTATE OTHERWISE.
2. DIRECTION OF CROSS SLOPE FOR TRAIL IN PARK SETTING TO BE DETERMINED BY TOPOGRAPHICAL CONDITIONS.
3. FOR TRAIL NEXT TO ROADWAY, THE AASHTO RECOMMENDED MINIMUM GRASS STRIP BETWEEN THE TRAIL AND CURB IS 6'. IF CONSTRAINTS PROHIBIT A 6' GRASS STRIP, THEN A PHYSICAL BARRIER OR RAILING SHOULD BE PROVIDED PER AASHTO.
4. GEOTEXTILE SHALL EXTEND 1'-6" BEYOND EDGE OF PAVEMENT ON EACH SIDE.

NOT TO SCALE



TRAIL IN PARK SETTING

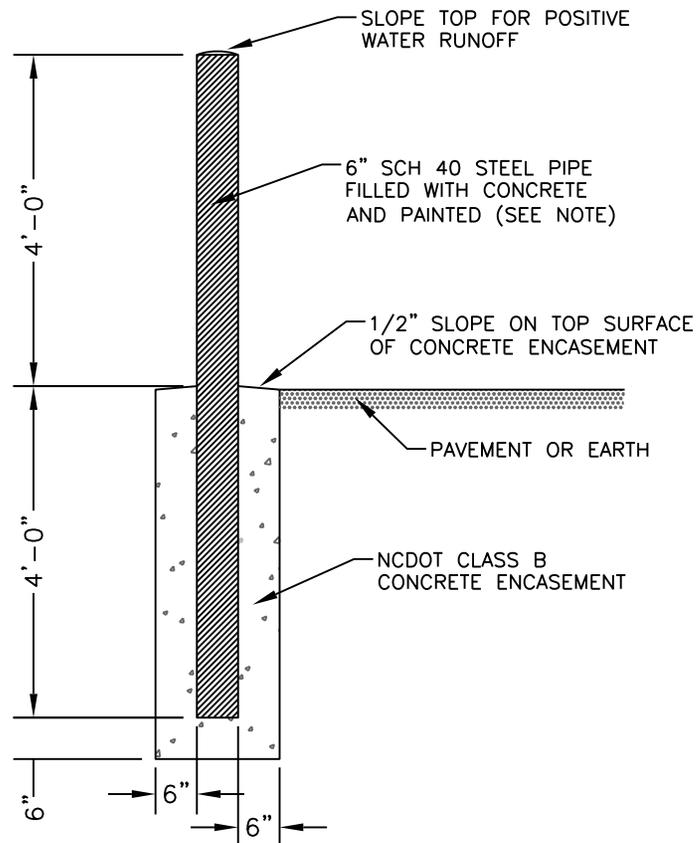


TRAIL PARALLEL TO STREET

NOTES:

1. MINIMUM WIDTH MUST BE MAINTAINED UNLESS LEGITIMATE CONSTRAINTS DICTATE OTHERWISE.
2. DIRECTION OF CROSS SLOPE FOR TRAIL IN PARK SETTING TO BE DETERMINED BY TOPOGRAPHICAL CONDITIONS.
3. CONCRETE MUST BE REINFORCED IF ANY VEHICULAR TRAFFIC FOR MAINTENANCE OR ANY OTHER PURPOSE IS ANTICIPATED.
4. FOR TRAIL NEXT TO ROADWAY, THE AASHTO RECOMMENDED MINIMUM GRASS STRIP BETWEEN THE TRAIL AND CURB IS 6 FEET. IF CONSTRAINTS PROHIBIT A 6' GRASS STRIP, THEN A PHYSICAL BARRIER OR RAILING SHOULD BE PROVIDED PER AASHTO.

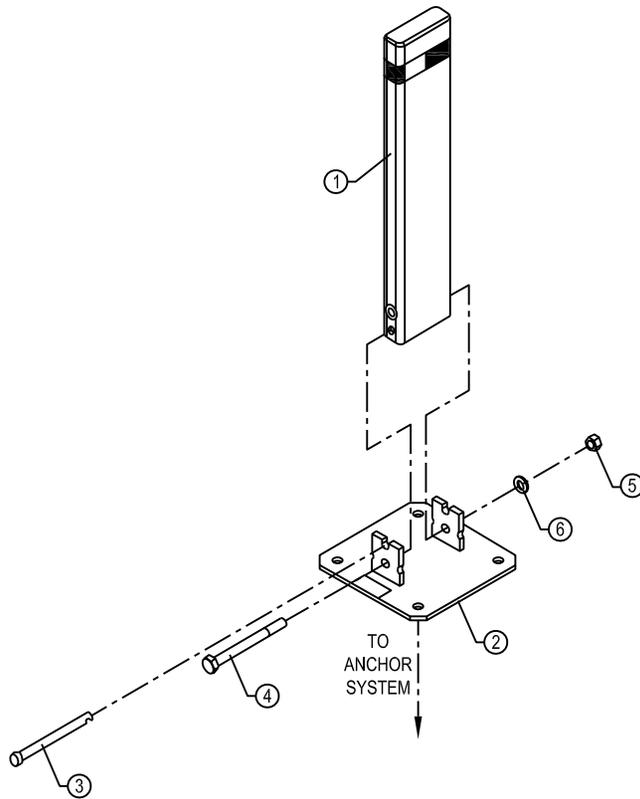
NOT TO SCALE



NOTE:

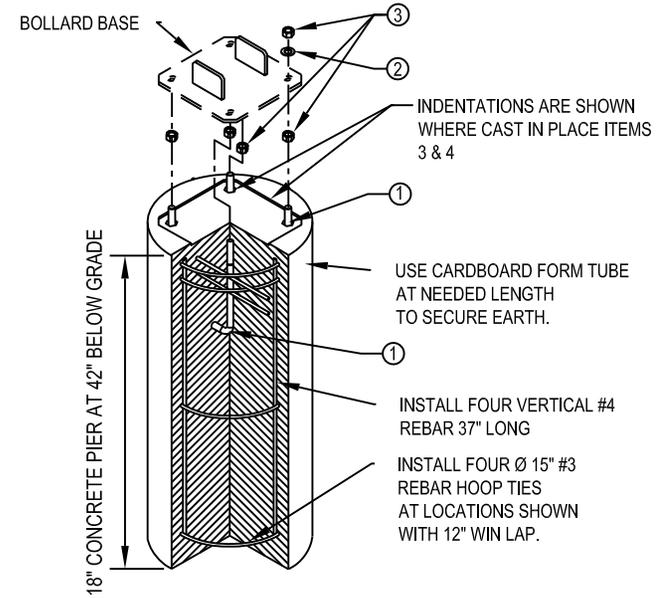
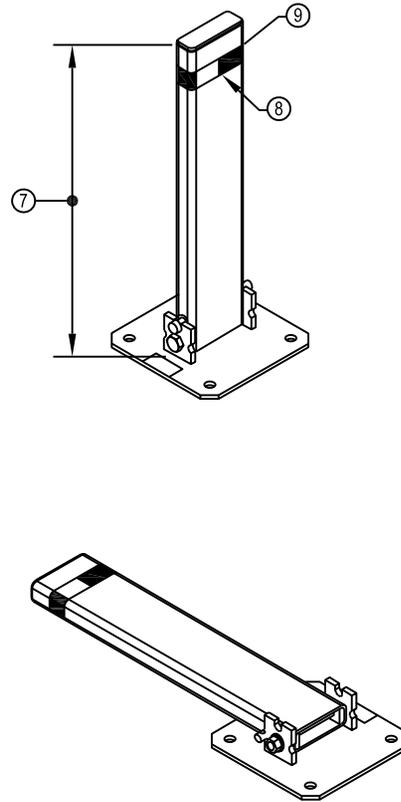
FINISH WITH ONE COAT OF EPOXY PRIMER AND 2 COATS OF ALL WEATHER ENAMEL, COLOR SAFETY YELLOW.

NOT TO SCALE



**BOLLARD LEGEND:**

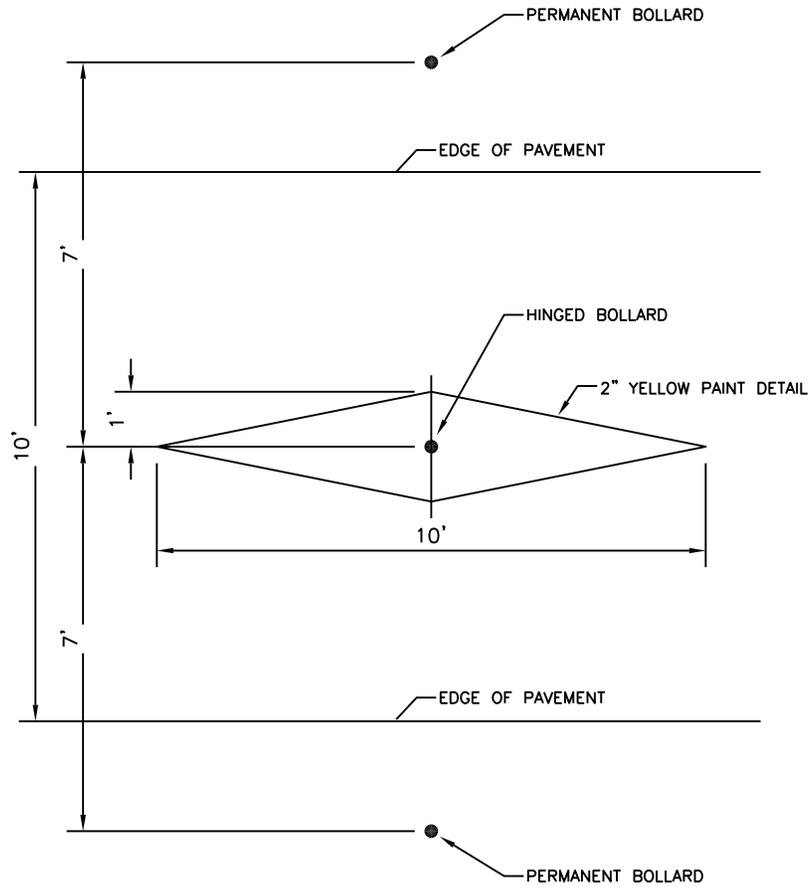
- ① BOLLARD POST WELDMENT
- ② BASE WELDMENT
- ③ PIN
- ④ HEX HEAD BOLT
- ⑤ HEX NUT
- ⑥ WASHER
- ⑦ BOLLARD HEIGHT TO BE 30"
- ⑧ 2" WIDE REFLECTOR - RED AND WHITE WRAPPED AROUND ALL SIDES OF BOLLARD
- ⑨ TOP OF 2" REFLECTOR TO BEGIN 3" FROM TOP OF BOLLARD



**ANCHOR SYSTEM LEGEND:**

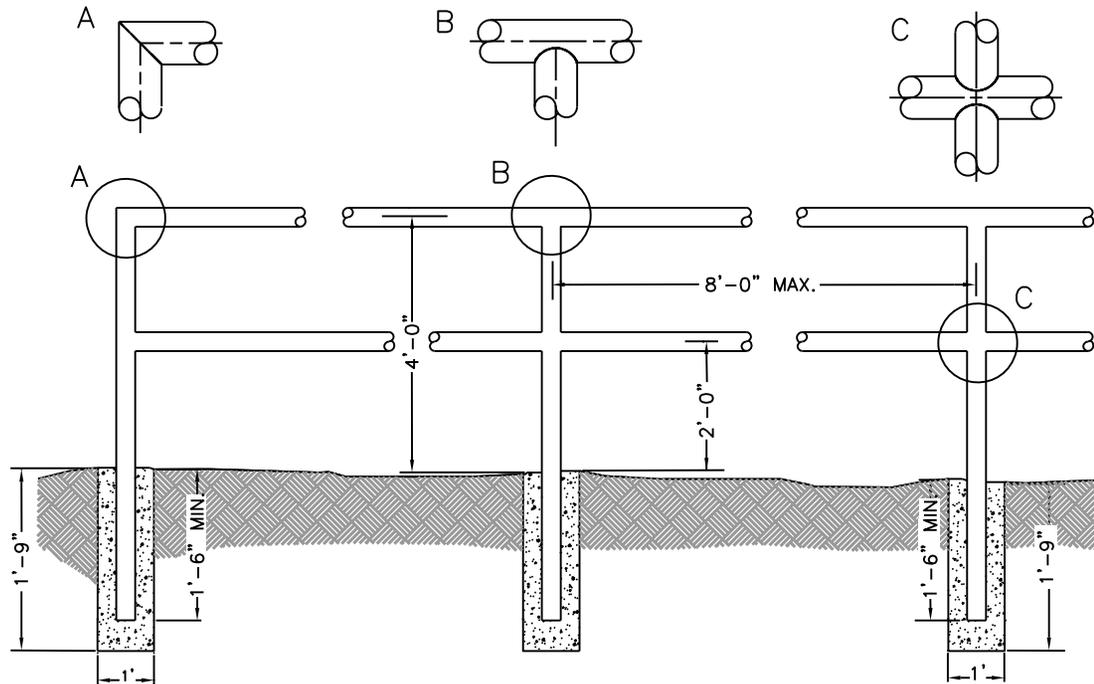
- ① 3/4" X 12" TYPE L ANCHOR BOLT H.D.G
- ② 3/4" TYPE A FLAT NARROW WASHER GALVANIZED STEEL
- ③ 3/4" HEX NUT GALVANIZED STEEL

NOT TO SCALE



NOT TO SCALE

**TYPICAL BOLLARD PLACEMENT**



**NOTES:**

1. ALL CONCRETE TO BE 2500 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 ASSEMBLY WITH BLACK ALL WEATHER ENAMEL.
5. SEE DETAIL STD 407 FOR WARRANTS.
6. ALTERNATIVE DESIGNS SHALL BE SENT TO KANNAPOLIS ENGINEERING DEPARTMENT FOR APPROVAL. ANY ALTERNATE DESIGN WILL BE PRIVATELY MAINTAINED.

NOT TO SCALE

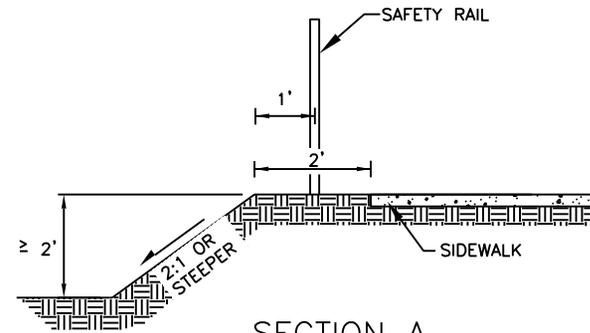
## WARRANTS

STANDARD SAFETY RAIL SHALL BE INSTALLED UNDER ANY OF THE FOLLOWING CIRCUMSTANCES IN BOTH NEW CONSTRUCTION AND IN RETROFITTING OR RECONSTRUCTION OF EXISTING ROADWAYS OR SITES:

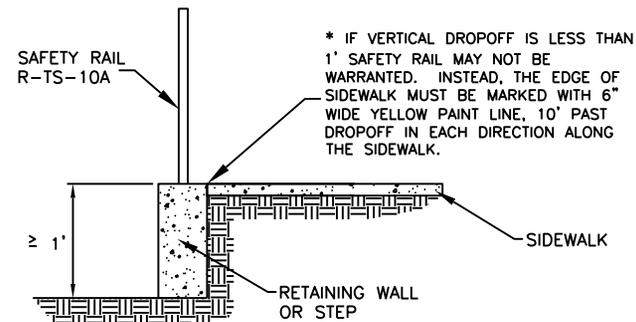
1. WHEN THE CULVERT CROSSING DETAIL APPLIES.
2. IF THERE IS A TWO FOOT OR GREATER DROPOFF WITHIN 2 FEET OF THE EDGE OF THE SIDEWALK (SEE DIAGRAM A).
3. IF THERE IS A 1-FOOT OR LARGER DROPOFF DIRECTLY ADJACENT TO THE SIDEWALK EDGE (SEE DIAGRAM B).
4. AT THE TOP OF ANY DROPOFF WITHIN THE PEDESTRIAN CLEAR ZONE OR WHERE PEDESTRIANS CAN REASONABLY BE EXPECTED IN THE VICINITY.
5. AT THE DIRECTION OF KANNAPOLIS ENGINEERING DEPARTMENT 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.

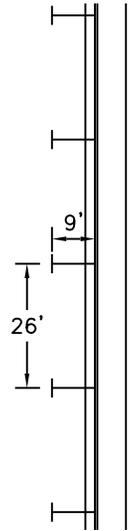
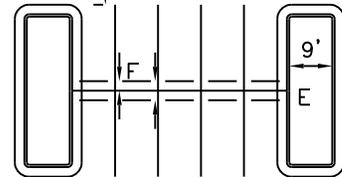
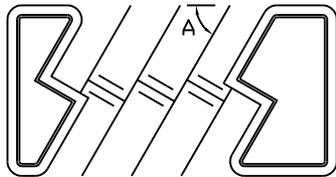
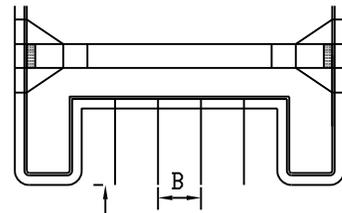
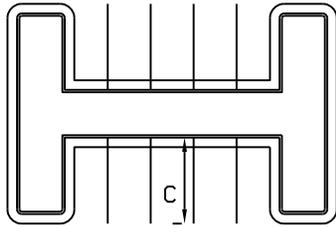


SECTION A  
SLOPED DROPOFF AT BACK OF SIDEWALK



SECTION B  
VERTICAL DROPOFF AT BACK OF SIDEWALK

NOT TO SCALE



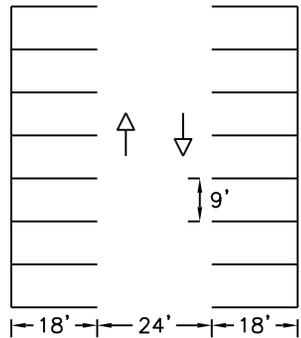
**NOTES:**

1. PARKING LOCATED WITHIN A PARKING STRUCTURE IN THE CC DISTRICT MAY REDUCE PARKING STALLS TO A WIDTH OF 8.5'.
2. WHEEL OR BUMPER GUARDS OR CURBING SHALL BE PROVIDED, LOCATED AND ARRANGED SO THAT NO PART OF ANY PARKED VEHICLE WILL EXTEND BEYOND THE BOUNDARIES OF THE PARKING SPACE AND INTO A PEDESTRIAN CROSSING AREA.
3. PAVEMENT MARKINGS SHALL BE 4" WHITE PAINT OR THERMOPLASTIC.
4. DIMENSIONS ARE TO CENTER OF PAVEMENT MARKINGS.
5. ALL ISLANDS ARE TO BE MINIMUM OF 9' WIDTH FROM BACK OF CURB TO BACK OF CURB.
6. COMPACT SPACES ARE TO BE DESIGNATED WITH A "C" ON EVERY SPACE.
7. SIDEWALK ADJACENT TO PARKING SHALL BE AT LEAST 7' WIDE. SIDEWALK BETWEEN TWP ROWS OF PARKING SHALL BE AT LEAST 9' WIDE.
  - 7.1. A 2' WIDE GRASS PLANTED AREA LOCATED AT THE BACK OF THE CURB CAN BE USED IN LIEU OF 2' OF SIDEWALK WIDTH.
  - 7.2. PARKING AT ANY ANGLE OTHER THAN PARALLEL SHALL BE SUBJECT TO THIS STANDARD.
  - 7.3. IF MONOLITHIC CURB & SIDEWALK IS USED, ADD 6" TO ALL DIMENSIONS (1' IF PARKING ON BOTH SIDES).
  - 7.4. WHEEL STOPS IN LIEU OF ADDITIONAL SIDEWALK WIDTH REQUIRE 2' OF ADDITIONAL DEPTH OF THE PARKING SPACES.

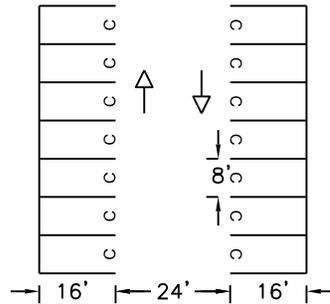
**KEY:**

- A. PARKING ANGLE
- B. STALL WIDTH
- C. STALL DEPTH
- D. AISLE WIDTH
- E. PLANTING ISLAND WIDTH
- F. WHEEL STOP (FRONT/REAR)

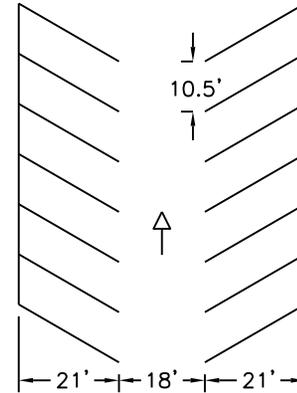
STANDARD SIZE VEHICLES					
A	B	C	D	E	F
0°	9'	26'	12' ONE WAY	N/A	N/A
45°	SEE DIAGRAM BELOW		12' ONE WAY	9'	2' / 4'
60°	SEE DIAGRAM BELOW		18' ONE WAY		
90°	9'	18'	24' TWO WAY		
COMPACT SIZE VEHICLES					
45°	8'	16'	12' ONE WAY	9'	2' / 4'
60°			18' ONE WAY		
90°			24' TWO WAY		



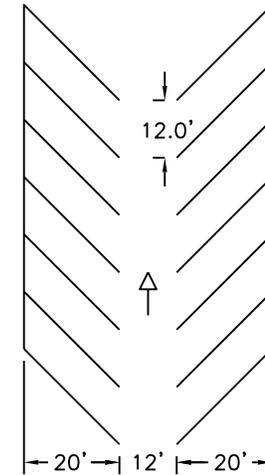
PARKING ANGLE 90°  
(TWO WAY TRAFFIC)



COMPACT PARKING  
(TWO WAY TRAFFIC)



PARKING ANGLE 60°  
(ONE WAY TRAFFIC)



PARKING ANGLE 45°  
(ONE WAY TRAFFIC)

NOT TO SCALE

### ACCESSIBLE PARKING REQUIREMENTS

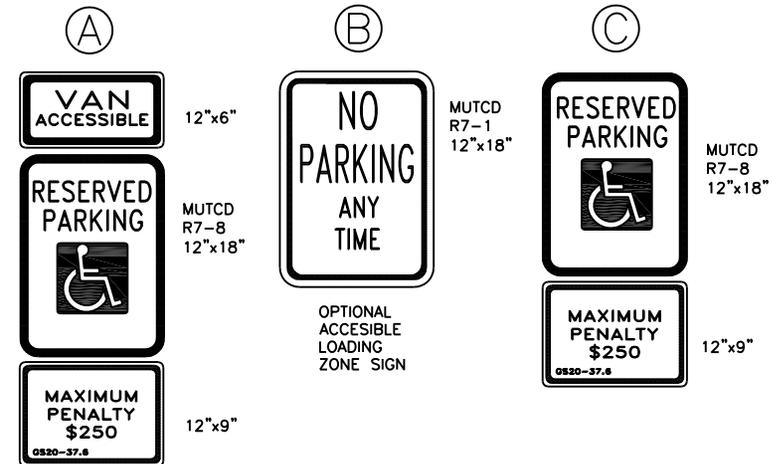
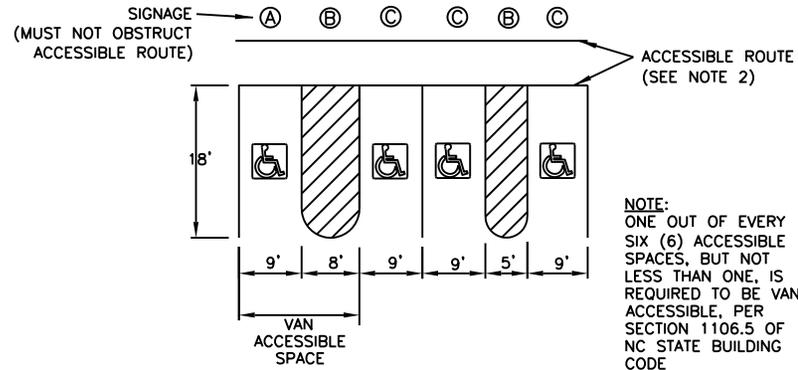
TOTAL PARKING SPACES PROVIDED	MINIMUM NUMBER OF ACCESSIBLE SPACES REQUIRED	MINIMUM NUMBER OF ACCESSIBLE SPACES REQUIRED TO BE VAN ACCESSIBLE
1 TO 25	1	1
26 TO 50	2	1
51 TO 75	3	1
76 TO 100	4	1
101 TO 150	5	1
151 TO 200	6	1
201 TO 300	7	2
301 TO 400	8	2
401 TO 500	9	2
501 TO 1000	2% OF TOTAL	1 IN EVERY 6 ACCESSIBLE SPACES
1001 AND OVER	20 PLUS 1 FOR EACH 100 OVER 1000	1 IN EVERY 6 ACCESSIBLE SPACES

REFERENCE: SECTION 1106 OF NC BUILDING CODE & CH. 4 OF NC ACCESSIBILITY CODE

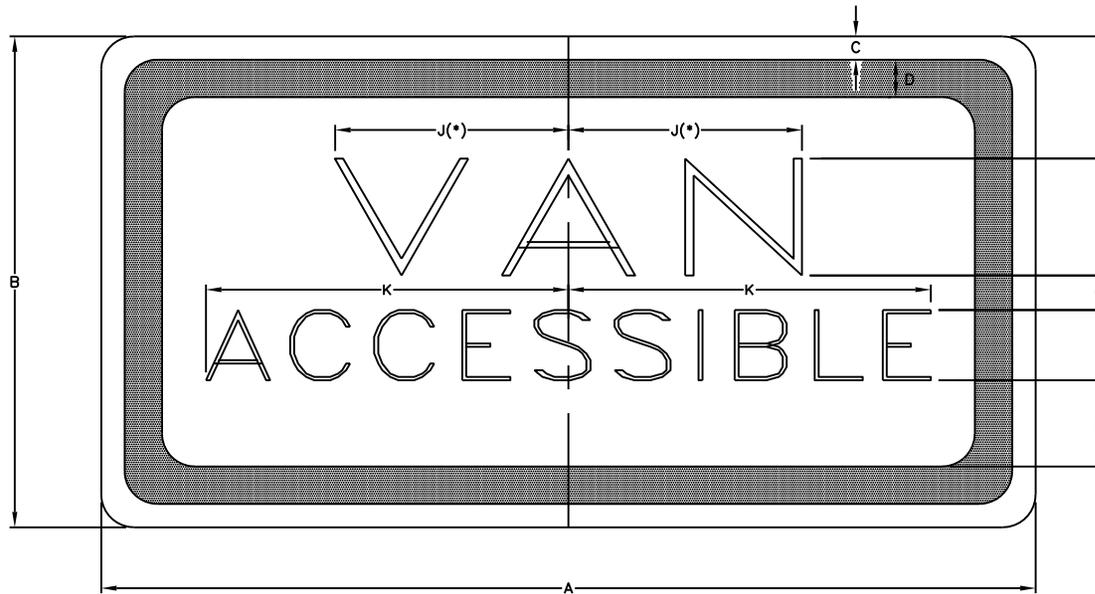
**NOTES:**

- ALL 12"x18" ACCESSIBLE SIGNS (MUTCD R7-8 & 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.
- IF ACCESSIBLE ROUTE IS A RAISED SIDEWALK AREA, THEN RAMPS ARE REQUIRED AT LOADING ZONE AREA. MAINTAIN MIN. 5' WIDE CONTINUOUS PASSAGE.
- VERTICAL CLEARANCE FOR VANS MUST BE GREATER THAN 98-INCHES.
- THIS DETAIL IS TO PROVIDE GENERAL GUIDANCE FOR PARKING LAYOUT AND DESIGN; REFER TO MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) U.S. DEPARTMENT OF TRANSPORTATION AND NORTH CAROLINA DEPARTMENT OF TRANSPORTATION SUPPLEMENT AND NC BUILDING CODE FOR ADDITIONAL INFORMATION.

### PARKING SPACE PAVEMENT MARKINGS



NOT TO SCALE

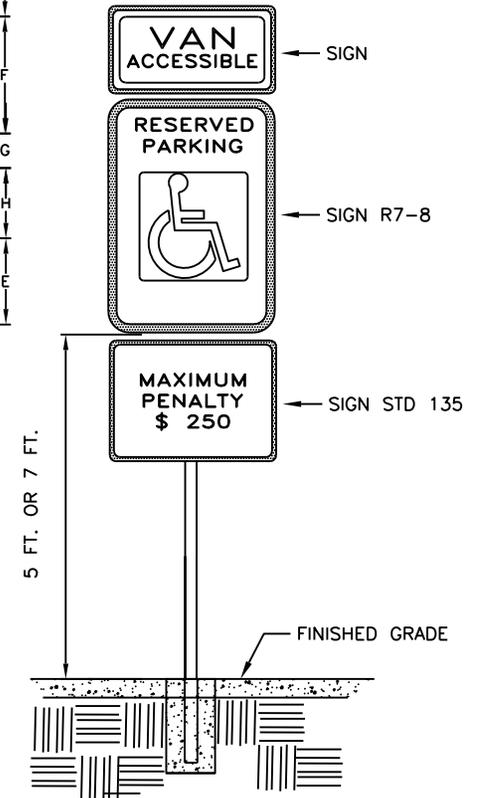


R7-8P

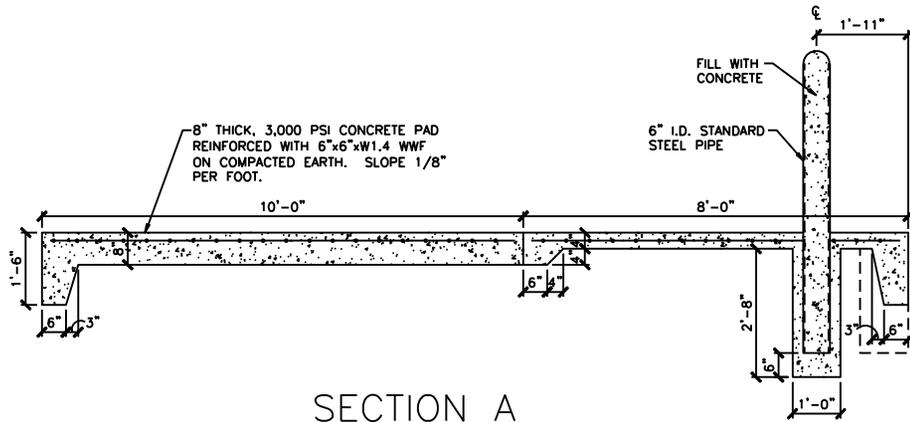
DIMENSIONS (INCHES)										
A	B	C	D	E	F	G	H	J	K	L
12	6	3/8	3/8	1-1/2	1-1/2D	1/2	1D	2-1/2	4	1-1/2

- INCREASE SPACING 50%
- D-FHWA (FEDERAL HIGHWAY ADMINISTRATION/USDOT) SERIES D LETTERS

LEGEND AND BORDER - GREEN  
BACKGROUND - WHITE



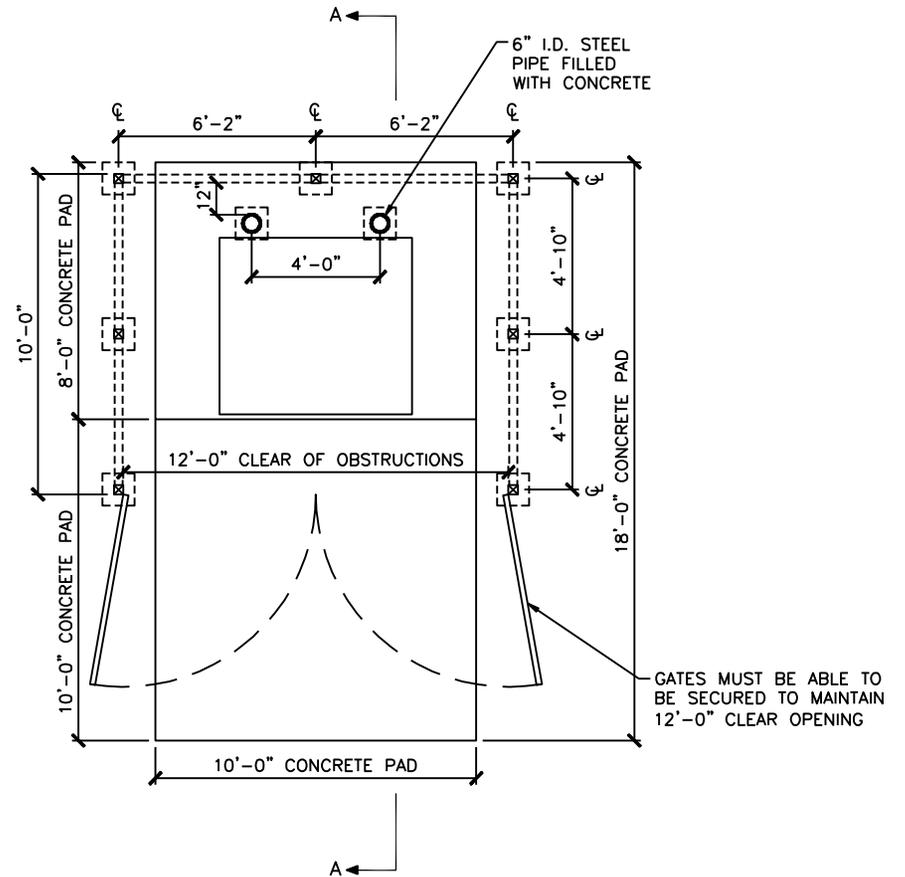
NOT TO SCALE



SECTION A

**NOTES:**

1. ENCLOSURE MATERIAL SHALL MATCH BUILDING MATERIAL.
2. NO CHAIN LINK FENCING W/ SLATS SHALL BE PERMITTED.



PLAN

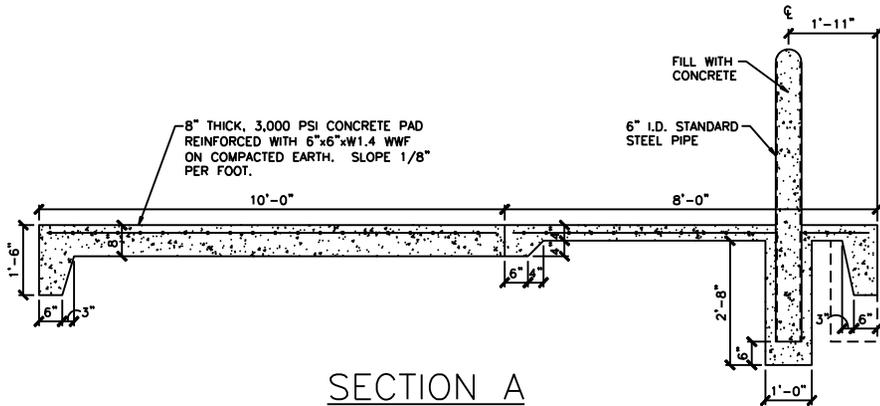
NOT TO SCALE



**SINGLE DUMPSTER PAD**

DECEMBER 2019

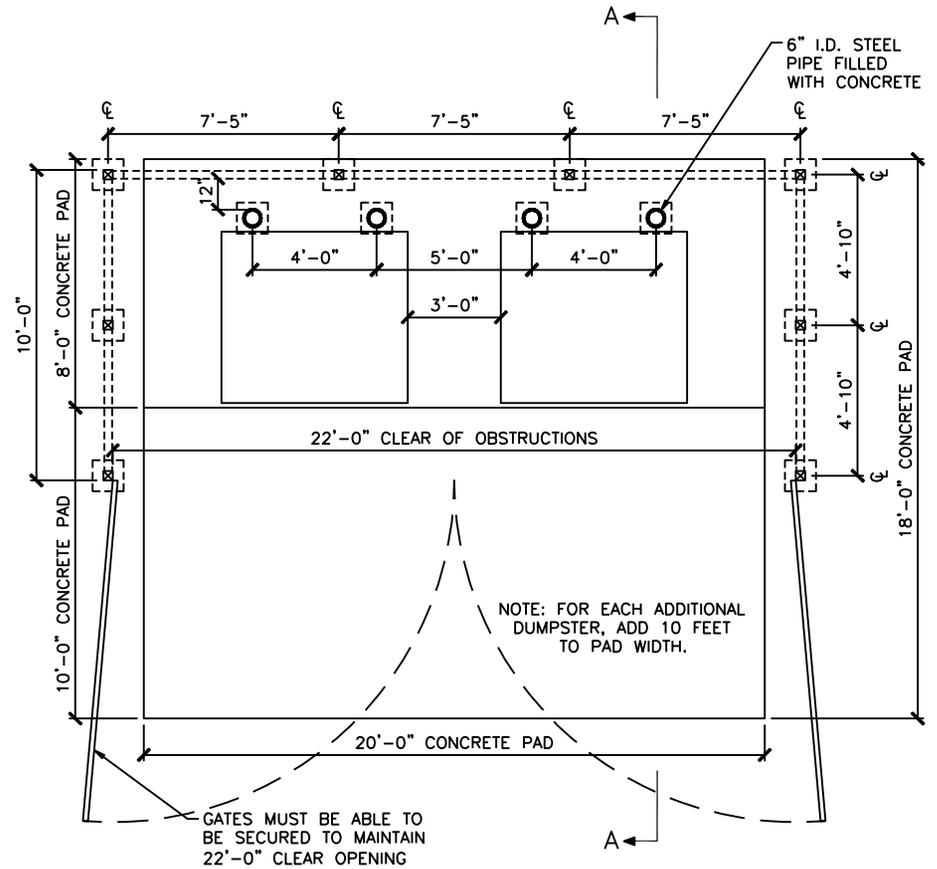
411



SECTION A

NOTES:

1. ENCLOSURE MATERIAL SHALL MATCH BUILDING MATERIAL.
2. NO CHAIN LINK FENCING W/ SLATS SHALL BE PERMITTED.



PLAN

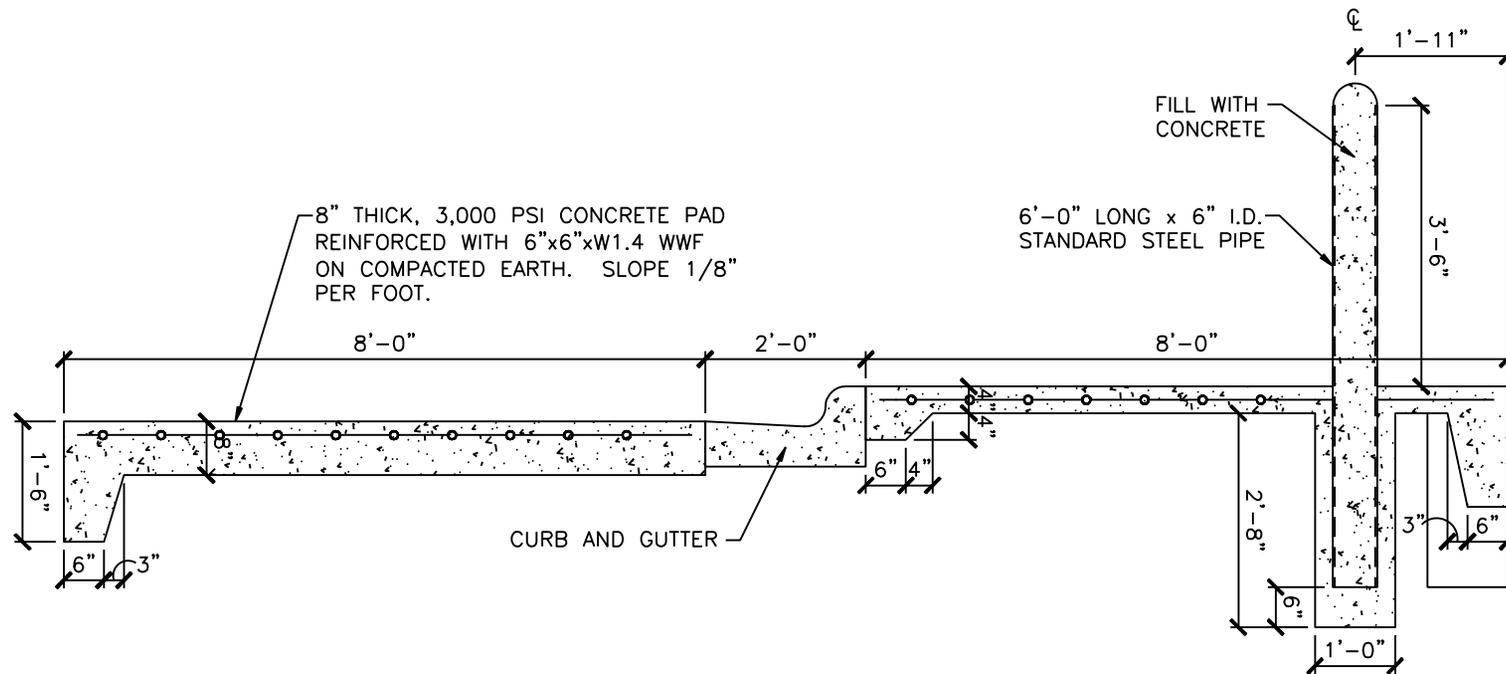
NOT TO SCALE

**DOUBLE DUMPSTER PAD**



DECEMBER 2019

412



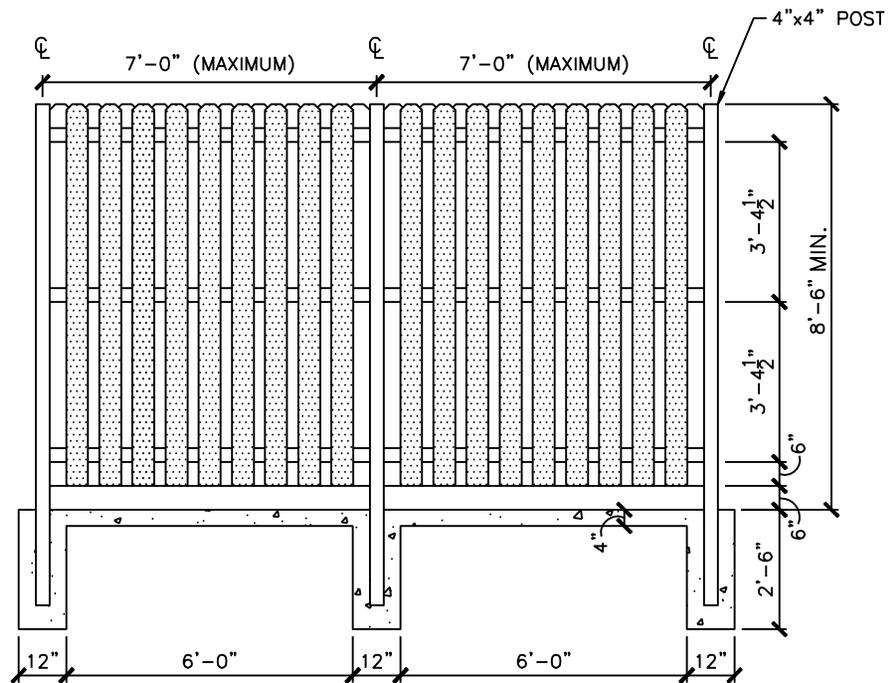
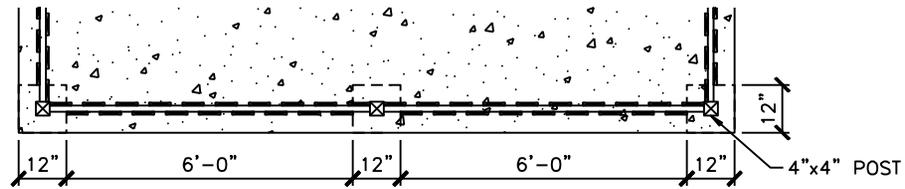
NOT TO SCALE

**DUMPSTER PAD  
SECTION A W/ CURB**



DECEMBER 2019

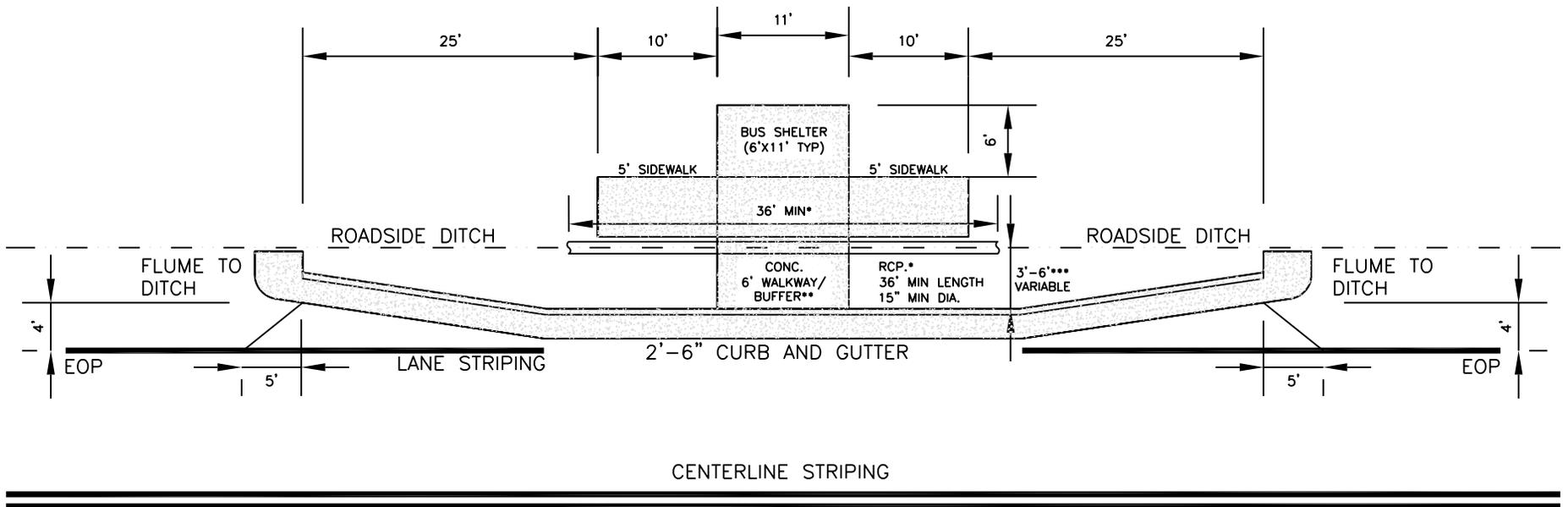
413



**NOTES:**

1. ENCLOSURE MATERIAL SHALL MATCH BUILDING MATERIAL.
2. NO CHAIN LINK FENCING W/ SLATS SHALL BE PERMITTED.
3. SEE DETAILS FOR DUMPSTER LAYOUT DETAIL.
4. HEIGHT SHALL SCREEN ALL EQUIPMENT WITHIN ENCLOSURE, ADJUST HEIGHT AS NEEDED, MIN. HEIGHT IS 8'-6".

NOT TO SCALE



**NOTES:**

1. \* RCP PIPE UNDER 6FT WALKWAY TO HAVE MIN. 36FT LENGTH AND MIN. 15" DIA. WITH 2FT SHOULDER ON BOTH ENDS OF SIDEWALK.
2. \*\* BUFFER DISTANCE TO BE REGULATED BY POSTED SPEED LIMIT AS FOLLOWS:
  - 6FT BUFFER FOR 45 MPH POSTED SPEED
  - 5FT BUFFER FOR 35 MPH POSTED SPEED
  - 3FT BUFFER FOR 25 MPH POSTED SPEED
3. \*\*\* VARIABLE DISTANCE OF 3FT TO 6FT FROM BACK OF CURB TO FRONT OF SIDEWALK.
4. EXISTING ROADWAY TO BE SAW CUT TO REMOVE THE EXISTING EDGE LINE AND PROVIDE A SMOOTH TIE IN TO THE PROPOSED CURB AND GUTTER.
5. BUS SHELTERS WITHIN NCDOT R/W MUST FOLLOW THE NCDOT BUS SHELTER AND STOP GUIDELINES.

NOT TO SCALE



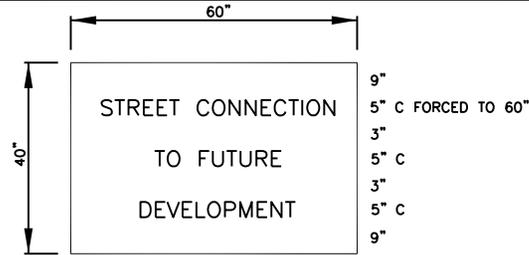
**TYPICAL CK RIDER  
BUS STOP DETAIL**

JUNE 2020

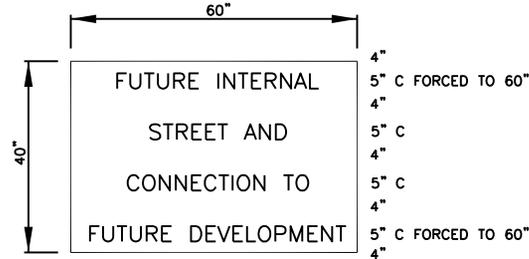
415

**NOTES:**

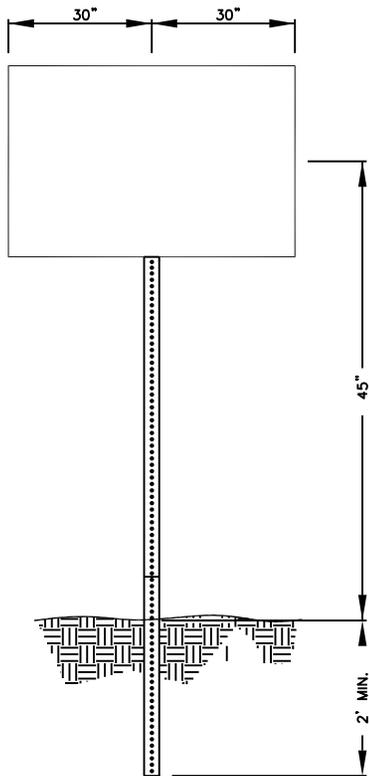
1. REQUIRED WHERE A STUB STREET WILL HAVE A FUTURE CONNECTION.
2. SIGN BACKGROUND SHALL BE COVERED WITH HIGH INTENSITY WHITE REFLECTIVE MATERIAL.
3. SIGN LEGEND AND BORDER SHALL BE HIGH INTENSITY BLACK.
4. LETTERING SHALL BE 5" HIGHWAY GOTHIC "C".
5. SIGN BLANKS SHALL BE MANUFACTURED FROM 0.080" COATED ALUMINUM.



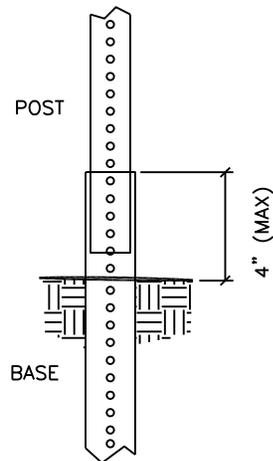
TYPE "A" REQUIRED FOR ALL PROJECTS WHERE INTERCONNECTION STUB STREET IS CONSTRUCTED AS PART OF THE INITIAL OR ONLY PHASE OF CONSTRUCTION.



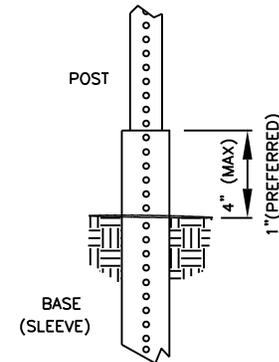
TYPE "B" REQUIRED FOR ALL PROJECTS WHERE INTERCONNECTION WILL BE CONSTRUCTED IN FUTURE PHASES.



CROSS SECTION OF POST (2 #/FT.)



CROSS SECTION OF POST (14 GAUGE)



NOT TO SCALE

**STUB STREET SIGN DETAIL**

