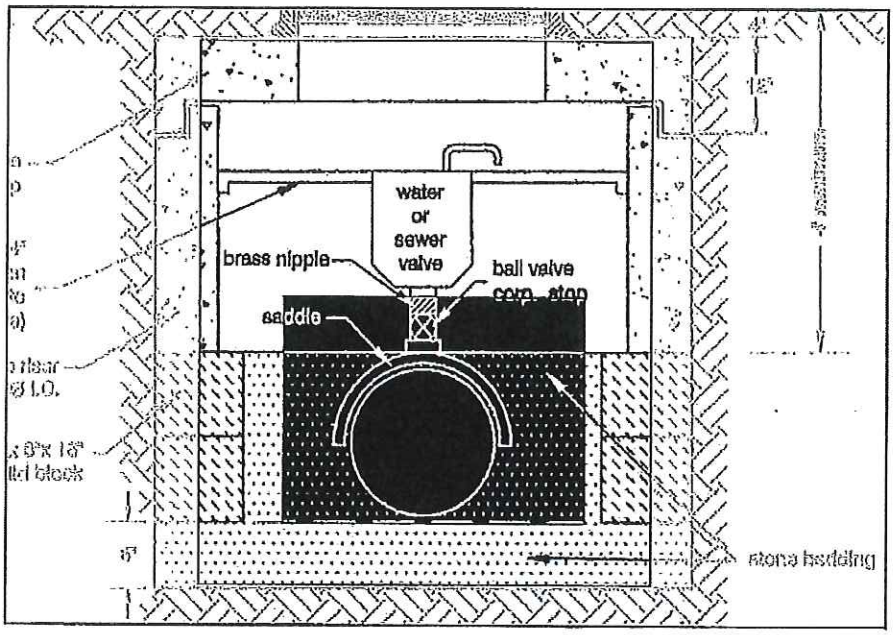
Town of Berryville



Construction Standards & Specifications

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COMMONWEALTH OF VIRGINIA
E. R. SUTHERLAND
CERTIFICATE No.
5078
CERTIFIED PROFESSIONAL ENGINEER
28 JUN 15

Section 1

General Information

I. Purpose and Authority

This document, entitled Town of Berryville Construction Standard and Specifications establishes standards for design and construction of public facilities being built for dedication to the Town of Berryville. This document shall be an administrative document that is approved by the Town Council.

II. Interpretation and Revision

These standards and guidelines are intended to supplement the provisions of applicable Federal and State regulations. Nothing herein shall be deemed to waive or modify other requirements of existing codes. Except as expressly provided otherwise in this document, the Assistant Town Manager for Community Development is the designated official charged with the administration of the standards and requirements contained in this manual. The Assistant Town Manager for Community Development may allow for variations of given standards where the effect of such variations is in keeping with established engineering practices and procedures and shall make the final decision on all questions regarding interpretation of this document, after reviewing recommendations from the designated departments, authorities, boards, and committees. For any areas where this document or the reference documents provide conflicting requirements, the Town of Berryville exceptions shall be followed. For other conflicts between requirements, the stricter of the two requirements shall be followed.

Qualified professionals are encouraged to seek innovative solutions to technical problems. However, to promote orderly development and to expedite plan processing and subsequent construction, standardized procedures and the use of minimum design standards must be employed. Familiarity with, and use of the standards set forth herein by designers, contractors, and inspection personnel, will result in more timely and economical project review, approval, and completion.

New information on design criteria, and changes in pertinent Federal and State laws, regulations, and standards will be reflected in periodic reviews and subsequent changes to the document. Appropriate notice will be given for public input and comment during the updating process. Any record plats, final site plans or construction plans and profiles submitted prior to the approval of any revisions shall comply with the standards in effect at the time of formal application.

Where standards of organizations such as the American Society for Testing and Materials (ASTM), the American Waterworks Association (AWWA), the American National Standards Institute (ANSI), the Commonwealth of Virginia, or Virginia Department of Transportation (VDOT) are referenced, the most current edition of the standard shall apply.

III. Severability

Should any section or provision of the document be decided by the courts to be unconstitutional or invalid, such decision shall not affect the validity of the document as a whole, or any section thereof, other than the section or part thereof so held to be unconstitutional or invalid.

IV. Materials Specification Booklet

The Materials Specifications Manual shall be approved by the Director of Public Works These materials have been specified because they most suit the specific design criteria, maintenance needs, and cost requirements for the Town of Berryville. No substitutions beyond those listed in this book will be allowed. The Materials Specification Booklet will be updated regularly so care should be taken to ensure that contractors are using the latest booklet when preparing bids.

V. Noise

All contractors must comply with Town of Berryville Code Chapter 11 Noise.

VI. Dust Control

All contractors shall be responsible for minimizing dust while performing work associated with any approved permit or job award. The contractor, at the discretion of the Director of Public Works may be required to water down job sites. The contractor shall keep all road surfaces clean and free of debris in accordance with the Virginia Erosion and Sediment Control Handbook.

Section 2

General Design Standards

I. Provision for Future Growth

The Town may require the modification of certain proposed public improvements to provide adequate capacity for the logical extension of said improvements. Proposed facilities would include, but not be limited to, water lines, booster stations, water pressure control valves, sewer lines, sewer pump stations, and streets and associated stormwater management facilities. Costs for the provision of additional capacity or modifications as required above may be reimbursed by the Town or through agreements with other owners/developers.

II. Phased Construction

A. Delineation

If development is to be constructed in phases, plans shall clearly indicate by phase lines and notes, which facilities are to be constructed under each phase. Plans shall indicate locations of contour tie-ins for each phase and specific measures for phased termination of all water, sewer, storm drainage, streets and other public improvements. Construction plans for public improvements and utilities shall be designed so as to be fully functional at the completion of each phase and allow for construction of the next phase with a minimal impact to existing improvements. A temporary marker identifying the location of the utility termination shall be provided.

B. Bonding

Bonding of public improvements and erosion and sediment control measures as required by Town Ordinance shall be provided independently for each proposed phase.

III. Drainage

A. General

1. An evaluation shall be performed for all proposed drainage systems to ensure adequate hydraulic capacity for conveyance of the minimum ten-year event including, but not limited to, channels, storm water management facilities and conduits.
2. Hydraulic capacity must be verified with engineering calculations, in accordance with the procedures outlined in the *Virginia Erosion and Sediment Control Handbook*, the *Virginia Department of Transportation Drainage Manual*, *Town of Berryville Storm Water Management Ordinance*, and this manual. Submit two complete copies of drainage calculations with construction plans.

   Calculations shall include a copy of the site grading and drainage plan, at the plan scale, upon which the boundaries, acreages, time of concentration paths and C-factors of the interior drainage areas shall be shown. Calculations shall

also include a map at an appropriate scale delineating the boundaries, acreages, time of concentration paths and C-factors of the drainage areas, upstream of the development, which would contribute storm water to the development.

3. Due consideration must be given to infrequent events (100-year) resulting in runoff quantities greater than minor system design capacity. The design for the major drainage system shall provide for overland relief of the 100-year event without flooding or damaging buildings and structures and without reliance upon the minor drainage system. The limits of the area affected by the 100-year event shall be represented on construction plans.
4. The drainage system shall be designed to honor all natural drainage divides and create no adverse impact on downstream properties; to account for all off-site storm water and; to convey discharge surface waters to the flow line of a natural watercourse or an existing underground or above-ground adequate conveyance system.
5. The owner or developer may not create a new discharge or concentrated storm water from a pipe, culvert, channel, or other drainage structure, onto or through lands of another, without first obtaining a permanent storm drainage easement and constructing improvements to guarantee continuity of an outfall from the point of discharge to the nearest natural or man-made watercourse.
6. If off-site downstream construction and easements are required to construct an adequate channel outfall, no plans shall be approved until such storm drainage easements, extending to the nearest natural or man-made watercourse, have been obtained and recorded. It will be the responsibility of the developer to obtain all off-site easements.
7. Energy dissipation devices and/or friction channel lining shall be used at and downstream of outfalls when discharge velocities exceed the maximum permissible as defined by the *Virginia Erosion and Sediment Control Handbook.*
8. Plans shall be prepared to preclude adverse impacts because of higher flow rates that may occur during construction.
9. Construction plans shall show the location, size, flow line elevations, profiles and details of all drainage facilities and structures, existing or proposed, including, but not limited to, swales, ditches, culverts under public streets and private drives, drop inlets, storm sewers and detention/retention ponds and pond outlet structures. Typical cross sections of all swales and ditches shall be shown.
10. Profiles of streets shall show profiles of storm sewers and cross sections of culverts together with point of intersection. Profiles shall show clearance of such drainage facilities with water mains and sanitary sewer.

B. Storm Sewer Systems **(09/16)**

1. General
   A. The following minimum requirements are considered acceptable to the Town of Berryville for the collection and detention of stormwater runoff. Deviation from these may be allowed if: a) the deviation is in accordance with sound

engineering standards; b) the deviation will not increase the likelihood of a system failure; c) the deviation will not adversely impact the environment or others.

B. As a general guideline, standards shall be those set forth in the latest editions of the Virginia Erosion and Sediment Control Handbook, the Virginia Stormwater Management Handbook, and the Virginia Department of Transportation Drainage Manual. If the standards set forth in this manual conflict for a particular application, the Director of Public Works shall determine which standard is to be applied.
C. When the Town of Berryville standards differ from state and/or federal requirements, the most stringent requirement shall apply.
D. All drawings, specifications, and engineer's reports submitted for approval shall be prepared by or under the supervision of a registered professional engineer with a current registration in the Commonwealth of Virginia in accordance with Title 54.1, Chapter 3 of the Code of Virginia, 1950, as amended. Where applicable, design may be performed under the direction of a certified Land Surveyor B, in accordance with § 54.1-408 of the above-cited code. The front cover of each set of drawings, of each copy of the engineer's report, and of each copy of the specifications submitted for review shall bear the signed imprint of the seal of the above licensed professional who prepared or supervised the preparation, and shall be signed with an original signature and date.
E. The engineer shall be responsible for obtaining the review and necessary approvals of all drawings and specifications by applicable Town, County, State and Federal agencies having jurisdiction. Copies of such approvals shall be submitted to the Town of Berryville Department of Public Works at the time of final approval.

2. Stormwater Report
   A. All drainage calculations shall be incorporated into a stormwater report, which shall present the following information as applicable. If the necessary calculations are minimal, they can be included on the plan sheets.
      1. A description of the computer software used and references to charts and tables used. Computer spreadsheets or programs created "in-house," used in lieu of standard forms or standard manual calculations, shall be substantiated, at least initially, with manual calculations showing equivalent results. Acceptance of, or request for substantiation of "in-house" spreadsheets and programs will be the decision of the Director of Public Works.
      2. The following computations shall be shown for both pre-developed and post-developed conditions:
         a. The stormwater report or plan set shall show the grading plan with the boundaries, acreages, and C-factors or CN values for all drainage areas contributing storm water to the site.
         b. Flow paths and calculations of times of concentration.
         c. Runoff computations.

3. Stormwater Design
   A. General
      1. An evaluation using verifiable engineering calculations shall be performed for all proposed drainage systems including, but not limited to, channels, inlets, and conduits. At a minimum, this evaluation shall show adequate hydraulic capacity for conveyance of the ten year storm event.
      2. Due consideration must be given to less frequent storms, up to and including the 100-year storm event. The design of drainage systems shall generally provide for overland relief of the 100-year storm event without flooding or damaging buildings and structures.
      3. The drainage system shall be designed with an attempt to closely maintain existing drainage divides and must not create adverse impacts on upstream or downstream properties.
      4. Drainage designs must account for any off-site drainage that will be collected by the drainage system or that will flow through any part of the site. Ultimate developed condition of currently undeveloped areas within a watershed shall be based upon the current or anticipated zoning of those areas.
      5. All systems shall be designed to convey runoff to the flow line of a natural watercourse or to an adequate conveyance system.
      6. The owner or developer may continue to discharge stormwater as sheet flow (non-concentrated) onto an adjoining property if, at the same location:
         a. The post-development peak runoff rate based on documentation and calculations does not exceed the pre-development peak rates.
         b. The duration of the flow does not increase under post-development conditions.
      7. The owner or developer may not create a new discharge of concentrated storm water from a pipe, culvert, channel, or other drainage structure, onto or through lands of others without first obtaining a permanent storm drainage easement, and ensuring that adequate conveyance exists downstream between the point of discharge and the nearest natural or man-made waterway.
      8. If off-site downstream construction and easements are required to construct an adequate channel outfall, no plans shall be approved until such storm drainage easement, extending to the nearest natural or man-made watercourse, has been obtained and recorded. It will be the responsibility of the developer to obtain all off-site easements.

   B. Storm Sewer Systems
      1. All publicly owned storm inlets and manholes shall include inlet/invert shaping per VDOT standard IS-1.
      2. No concentrated flow greater than one cubic foot per second, based on the 10-year storm, shall cross a sidewalk or curb.
      3. Culverts and storm sewers shall be of adequate size to transport runoff from the 10-year storm, for the ultimate developed condition of the subject

property. Contributions of off-site flow from permanently developed properties shall be based upon existing conditions. Contributions of off-site flow from undeveloped properties shall be calculated based upon the two-year fully developed flow (undetained) from such properties. Plans shall account for overland relief resulting from less frequent events.

4. The hydraulic grade line of storm sewers for the post-developed 10-year storm shall be lower than the gutter line or grate inlet top elevation at all points.
5. All publicly-owned storm sewer pipes within traffic-bearing areas shall be reinforced concrete pipe with a minimum diameter of 15 inches or equivalent elliptical size. Publicly-owned storm sewer pipe in non-traffic bearing areas may be corrugated HDPE pipe with a minimum diameter of 15 inches.
6. All pipes shall terminate with flared end sections or concrete headwalls. Box culverts shall include concrete headwalls and end walls, which shall be located a minimum of 25 feet from the edge of pavement if the culvert is subject to vehicular traffic.
7. The outfall conditions of pipes and culverts shall be designed to withstand the velocities produced during the 2-year storm event without erosion.
8. Pipe shall not deflect between storm structures. Pipe on slopes greater than 20 percent shall be anchored.
9. Minimum cover for storm sewer pipe within the right-of-way shall be according to the Town of Berryville Standard Details 22 and 24. Outside the right-of-way, the minimum cover, from finished grade to the outside crown of pipe, shall be the greater of one foot or half the pipe diameter.
10. In parallel installations, under normal conditions, storm sewer pipes shall be laid at least 10 feet horizontally from water lines and sanitary sewer lines. The distance shall be measured from outside edge to outside edge.
11. In general crossing situations, storm sewer pipes shall maintain a minimum vertical distance of 18 inches from water mains and 12 inches from sanitary sewer lines. In cases where this separation is impossible to achieve, the water or sanitary sewer line shall be protected in accordance with the appropriate Town of Berryville utility standard. In cases where the water or sanitary sewer line is not owned by the Town of Berryville, the crossing shall be governed by the regulations of the authority which owns the utility in question.
12. Test pits will be required and shall be shown on the plans for all crossings which involve gas lines, water mains 12 inches in diameter and larger, sanitary sewer crossings that have minimum clearance, and all fiber optic telephone service lines. Test pits shall be dug and clearances verified prior to installing any portion of the storm sewer system.

C. Easements

1. An "easement" shall mean any area to which the Town has unlimited access for maintaining adequate drainage.

2. Permanent easements shall be a minimum width of 20 feet. Wider easements may be required where more than one facility may occupy an easement, or in consideration of structure size, depth, or access requirements. The extent of drainage easements shall be dependent on upstream and downstream conditions and the scope of maintenance needed to maintain adequate drainage.
3. Easements shall be recorded and the Deed Book and Page Numbers of the recordation provided to the Planning Department before approval of the as-built plans and release of the construction bonds.
   a. No building or other structure, including but not limited to fences and decks, shall be erected over permanent easements.
   b. Any plantings installed within an easement may be damaged or destroyed during the course of servicing. The Town is not liable for damage to any improvements or plantings within an easement. The Town will re-seed as necessary any bare or disturbed soil for erosion control purposes.
   c. Small and medium shrubs, groundcovers, or grasses may be planted within an easement. Their suitability shall be determined by their likelihood to create or entrap debris, or to obstruct natural flow.

D. Storm Inlet Design
1. Drop inlets shall be sized and spaced such that a minimum of one half of the travel way in each direction shall be free from flooding at the inlet design flow.
2. To properly drain sag vertical curves, it is required on roads classified as minor arterial or higher to place three inlets on each side of the road; one inlet at the low point and one flanking inlet on each side of the low point. The flanking inlets shall be placed so that they will limit the spread in the low gradient (flatter) approaches to the sag point and will act in relief of the sag inlet should it become clogged.
3. Drainage flowing in street gutters shall be intercepted 100 percent, at design flow, prior to entering an intersection with another public street.
4. Inlets which have bypass flows shall be clearly marked on the plans and bypass flow must be included in the total gutter flow contributing to the next downstream inlet.
5. Downstream flow for drop inlets in streets and parking areas shall be computed using the rational method and applying a rainfall intensity of four inches per hour. Design flow for grate inlets located near structures that could be damaged by flooding shall be computed using the 100-year storm and assuming 50 percent blockage of the grate. Design flow for all other grate inlets shall be the same as street inlets but must assume 50 percent blockage.

E. Stormwater Conveyance Channels
1. Channel adequacy, hydraulic capacity, maximum velocities, channel linings, and other related design variables shall be determined by the

procedures outlined in Chapter 5 of the Virginia Erosion and Sediment Control Handbook, or by approved computer software.

2. All open channels shall be designed to contain the 10-year storm with six inches of freeboard below the banks of the channel. Contributions of off-site flow from permanently developed properties shall be calculated based upon the two-year fully developed flow (undetained) from such properties. Plans shall account for overland relief resulting from less frequent events.
3. Unless otherwise approved, the need, type, and dimensions of lining for erosion control shall be based on the velocity and depth of flow associated with the ten-year event.
4. Maximum side slope for grass lined conveyance channels shall be 3:1 (H:V) with a minimum longitudinal slope of two percent.

F. Stormwater Quantity

1. To protect downstream properties and receiving waterways from flooding, the ten (10) year post-development peak rate and velocity of runoff from the land development shall not exceed the two (2) year pre-development peak rate of runoff.
2. To protect downstream properties and receiving waterways from channel erosion, the two (2) year post-development peak rate and velocity of runoff from the land development shall not exceed the two (2) year pre-development peak rate and velocity of runoff.
3. If the land development is in a watershed for which a hydrologic and/or hydraulic study has been conducted or a stormwater model developed, the program authority may modify the requirements of items 1 and 2 above so that runoff from the land development is controlled in accordance with the findings in the study or model, or to prevent adverse watershed storm flow timing, channel degredation, and/or localized flooding problems.
4. The program authority may also require that the plan include additional measures to address damaging conditions to downstream properties and receiving waterways caused by the land development.
5. Pre-development and post-development runoff rates shall be verified by calculations that are consistent with accepted engineering practices as determined by the program authority.

G. Stormwater Quality

1. Best management practices shall be designed and sited to capture runoff from the entire land development project area and, in particular, areas of impervious cover within the land development, to the maximum extent practicable.
2. Best management practices shall be designed to remove the difference between post-development and pre-development total phosphorus loads in cases where post-develop loads exceed pre-development loads. The calculation method in Appendix 5D of the Virginia Storm Water Management Handbook shall be used to perform the calculations.

4. Materials
   A. Concrete Pipe
      1. Circular reinforced concrete culvert and storm sewer pipe shall be in accordance with ASTM C76 and be Class III minimum.
      2. Elliptical reinforced concrete culvert and storm sewer pipe shall be in accordance with ASTM C507.
      3. Gasketed joints shall be bell and spigot with rubber gasket seal in accordance with ASTM C443. Tongue and groove joints shall be sealed with mortar or pre-formed flexible sealant per ASTM C990, or other suitable sealant.
   B. Corrugated Plastic Pipe
      1. Pipe shall be in accordance with AASHTO M294 or ASTM 2306.
      2. Pipe shall be joined using a bell and spigot joint meeting AASHTO M252, AASHTO M294, or ASTM F2306. The joint shall be soil-tight and gaskets, when applicable, shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris. A joint lubricant supplied by the manufacturer shall be used on the gasket and bell during assembly.
      3. Fittings shall conform to AASHTO M252, AASHTO M294 or ASTM F2306. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the soil-tight joint performance requirements of AASHTO M252, AASHTO M294, or ASTM F2306.
      4. All installation of corrugated plastic pipe shall be per manufacturer's specifications.
   C. Drop Inlets
      1. Standard drop inlets shall be per VDOT specifications.
      2. For drop inlets in shallow conditions, structures shall be consistent with Standard Details 25A, B and C or shall be a precast or cast-in-place concrete box with a top consistent with Standard Detail 26.
      3. For drop inlets requiring a manhole frame and cover for access, the manhole frame and cover shall be as manufactured by Neenah Foundry per Standard Detail 26. Frames and covers shall be manufactured in the United States.
   D. Manholes
      1. Storm manholes shall be per VDOT specifications.
      2. Frames and covers shall be as manufactured by Neenah Foundry per Standard Details 27 - 30, or approved equivalent.

5. Inspection and Testing
   A. Concrete Pipe
      1. Concrete pipe shall be inspected visually during installation by the Director of Public Works or his/her designee.
      2. After installation and backfill, all sand, dirt, and debris from the lines shall be flushed prior to inspection.

3. All lines and manholes shall be visually inspected by the Town of Berryville from every manhole by use of television cameras. The cost shall be the responsibility of the Owner/Developer as identified on the Planning and Zoning Fee Schedule, 2012, as amended.
4. The lines shall exhibit a fully circular pattern when viewed from one manhole to the next.
5. Lines which do not exhibit a true and correct line and grade, or have obstruction or structural defects, shall be corrected to meet these specifications and the barrel left clean for its entire length.

B. Corrugated Plastic Pipe
   1. Corrugated plastic pipe shall be inspected visually during installation by the Director of Public Works or his/her designee.
   2. Following installation, the contractor shall perform cleaning and video inspection of the installed plastic pipe. The processes listed below shall be followed:
      a. The CCTV inspection must be completed per this manual and by an impartial, qualified and reputable Inspection Agency in the presence of a Town inspector. The Town reserves the right to reject an Inspection Agency.
      b. The Owner/Developer shall provide 48 hours notice to the Town prior to televising any pipe to allow an inspector to be on site.
      c. A written inspection report accompanied by visual recording shall be provided to the Town's Inspector at the end of each day of CCTB inspection. Visual recording shall be digital mpeg4 format. The written report shall be in both list form and plan view. PLEASE NOTE: VHS video tapes will not be accepted.
      d. It will be the Developer/Contractor's responsibility to demonstrate acceptable joint spacing.
      e. Deflection visible on the CCTV monitor will be assumed to be greater than 5%. The Developer/Contractor has the right to challenge this decision by direct measurement or by the use of a GO-NO-GO Mandrel. The pipe will be rechecked for damage after use of the Mandrel.
      f. The Developer/Contractor must repair all defects found during inspection. A follow-up CCTV inspection shall be performed by the Developer/Contractor to assure the repairs have been completed satisfactorily.

IV. Water & Sewer

A. General

A Preliminary Design Report shall be submitted to the Town which shall describe the additions to the water distribution and sewerage collection systems, and at a minimum shall include:

1. Number of units, with the estimates for water usage and wastewater production.

2. Hydraulic calculations for the proposed water system and existing water system to insure that adequate pressure and volume can be sustained to the new development without reducing pressure or volume in other areas of the existing system.
3. Hydraulic calculations for the proposed sewerage collection system and all existing lines or pump stations that may be impacted.

B. Design Practices

1. Scope
   a. This section is included for the clarification, information and benefit of the engineering design community, to act as a guide to the practices of the Town. This section is a compilation of a variety of typical practices to be followed in the layout and design of water distribution and wastewater collection systems of the Town. The information contained in this section must be applied in conjunction with the regulations of the Commonwealth of Virginia Department of Environmental Quality, Virginia Department of Health Waterworks Regulations and the other sections of this manual.
   b. Many criteria listed are minimums. Additional separations and clearances are to be furnished as practical to optimize each design. Attention shall be given to locating utilities so as to facilitate their re-excavation. The Town will consider factors such as depth and magnitude of facility in determining the adequacy of each design, and may relax or increase dimensional requirements accordingly. In general, a design is to be sought which minimizes length of piping and number of appurtenances, while providing a system which minimizes maintenance costs.
   c. Because of the wide variety of situations that arise, it is impossible to address all scenarios. The Town reserves the right to exercise engineering judgement and will have the final decision on the acceptability of design.
   d. The Town reserves the right to amend or modify this document without notice and to interpret the meaning of all statements made herein.

2. Water Distribution
   a. Design Flows
      (i) Fire Flows. The water distribution system piping and any extensions thereof shall have adequate capacity to supply the normal (average) and peak hour demands of all customers – domestic, public, commercial and industrial – while maintaining a pressure of not less than 30 pounds per square inch at all points of delivery. In addition, the piping system shall be capable of delivering on the day of maximum customer demand, flows required for fire protection to at least one (1) point within 300 feet of each building being served or proposed to be served by such system and extension, while maintaining a residual pressure of not less than 20 pounds per square inch at the point of service. Flows required for fire protection shall be a minimum of 750 gpm for Single Family Detached Dwelling developments, 1,500 gpm for

Attached Residential or Apartment (3 stories or less), and 2,000 gpm for Commercial and Industrial developments.

(ii) Daily Demands. The following criteria will be used in estimating demands for water and accomplishing hydraulic design of the system.

(a) Average day, maximum day and peak hour demands to be used in system hydraulic design will be estimated using the following parameters:

1. Residential Population
   = N = number of dwelling units x 2.75
2. Average daily water demand of residential population in gallons per day (g.p.d.)
   = R = Nx100
3. Average daily commercial and industrial water demand in g.p.d.
   = C = number of commercial and industrial employees x100*
   *NOTE: Appropriate additional water demand allowance shall be made for commercial and/or industrial establishments of types having water demands in excess of 100 g.p.d. per employee.
4. Average daily school water demand in g.p.d.
   = S = number of staff employees and students x 20
5. Average daily water demand in g.p.d.
   = A = R + C + S
6. Maximum daily water demand in g.p.d.
   = M = A x 2
7. Peak hour demand in g.p.m. is calculated using the formula provided in the Waterworks Regulations 12 VAC 5-590-690
   =Q = 11.4 x $N^{0.544}$

(iii) Distribution piping design will be based upon providing flows and service pressures in accordance with these standards from the supply design gradient (HGL) furnished by the Town. Hydraulic design of distribution piping will be based on pipe carrying capacities consistent with head losses determined in accordance with the following:

Pipe Diameter	Hazen-Williams Coefficient "C"
6"	100
8"	110
10"	115
12" or greater	120

3. Wastewater Collection
   a. Design Flows

(i) Tributary Population

(a) Sewer systems, which provide for a complete watershed, shall be designed and sized assuming the entire watershed to be completely developed according to present or planned land use designation whichever requires the greater capacity.

(b) Sewer systems initially developed for only a part of a complete watershed shall be sized to provide for the entire watershed. Otherwise, if acceptable to the Town, physical provision shall be made for future increased capacity. Proper modification to allow for the characteristics (i.e. domestic, commercial and industrial wastes, and ground water infiltration) of the area under consideration shall be made.

(ii) Capacities

(a) In determining the required capacities of sanitary sewers, the following factors shall be considered:

(1) Maximum hourly quantity of domestic sewage.

(2) Additional maximum sewage or waste from industrial plants and commercial areas.

(b) New sewer systems shall be designed on the basis of an average per capita flow of sewage from the equivalent population served of not less than 100 gallons per capita per day. Lateral and submain sewers shall be designed for a minimum of 400% of the average flow, main and trunk sewers shall be designed for a minimum of 250% of the average flow, and interceptors shall be designed for a minimum of 200% of the average flow.

(c) Computations shall use a roughness coefficient (n) in the Mannings Formula of 0.014. However, other values may be used for situations where sufficient engineering justification can be demonstrated.

(d) The 100 gallons per capita per day figure is assumed to cover normal infiltration, but an additional allowance shall be made where conditions are especially unfavorable.

(e) The minimum allowance for flow from single-family detached residences shall be based on 3.5 people per home. For single-family attached residences or dwelling units in multifamily structures, a basis of 3 people per unit may be used.

(f) Unless evidence is presented to prove a different flow from industry at ultimate development, the minimum allowance for industrial flow shall be determined by providing an equivalent population of 40 persons per acre or one (1) equivalent population per employee, whichever is the greater, in the industrial area. "Area" shall include the entire area zoned for industry, except public road, street, and highway rights-of-way, flood plains on which construction is prohibited, and "green

zones" separating industrial from residential areas, on which construction is prohibited.

(g) The minimum allowance for flows from commercial areas shall be determined by providing an equivalent population of 30 persons per acre, or one-half (1/2) equivalent population per employee, whichever is the greater, in the commercial area. "Area" shall include entire area zoned for commercial development, including off-street parking and landscaped areas, but excluding the rights-of-way of public roads, streets and highways, flood plains of streams on which construction is prohibited and "green zones" 100 feet or more wide separating commercial from residential areas, on which construction is prohibited.

(h) Sewer size shall not be less than eight inches in diameter, except under the following condition:

1. Laterals serving six connections or fewer on cul-de-sacs or as sidewalk collector lines may be six inches in diameter.

(i) Minimum Gravity Sewer Slopes

Sewer Size	Minimum Slope in Feet per 100 Feet Nonsettled Sewage
3 inch	Not Allowed
4 inch	Not Allowed
6 inch	0.49
8 inch	0.40
10 inch	0.28
12 inch	0.22
14 inch	0.17
15 inch	0.15
16 inch	0.14
18 inch	0.12
21 inch	0.10
24 inch	0.08
27 inch	0.067
30 inch	0.058
36 inch	0.046

All sewer shall be nonsettled unless pre-approved by the Director of Public Works.

(j) Minimum flow velocities of 1.3 fps and 2 fps are required for settled and non-settled sewage, respectively.

(k) Special provisions must be made to protect against internal erosion when flow velocities exceed 15 fps.

(l) A minimum sewer burial depth to protect against freezing shall be 24".

(m) In cases where the above criteria are not applicable, an alternate design procedure may be submitted to the Town for

approval. A description of the procedure used and justification for the modifications for sewer design proposed shall be included with the Design Analyses and plans submitted for approval.

V. Easements

Where the Town of Berryville permits the construction of water, sewer, or storm water improvements (town utilities) outside of the public right-of-way, the following shall apply:

A. Town utilities approved such that they will not be in the public right-of-way shall be located in easements conveyed to the Town of Berryville. Such easement shall include language and conditions as required by the Town and will be approved by the Town prior to recordation.

B. Easements shall be located so as to provide access to all parts of the utility without interference from abutting buildings, fences, and other private improvements.

C. Easements shall not be centered on property lines but shall run parallel to boundary lines to the greatest degree practical. Easements may straddle boundaries, provided that the associated channel or pipeline is offset from the boundary.

D. Easements must remain clear of buildings, trees, fences, and other improvements, and underground structures other than the designated utility. Fence sections may be erected across an easement section so long as the section contained within the easement is a gate through which personnel and equipment may enter the property. Trees planted in and/or improvements erected within a utility easement that are damaged or destroyed in the course of utility inspection, maintenance, or reconstruction will not be replaced or paid for by the Town of Berryville.

E. Easements shall be a minimum of twenty (20) feet in width; however, the Town reserves the right to require wider easements as deemed necessary.

F. Town utility easements are exclusive. Other utilities may only cross the town's easement, and such crossings must be at or near a 90-degree angle.

VI. Submission of Calculation Data in Digital Format

A. Engineering calculations used in the design of public improvements shall be submitted to the Town in digital format for review.
B. Submissions for water system design shall be on a master development plan that includes the locations of the water mains. The plan(s) shall be paper drawings or provided in an AutoCad compatible format. In addition, the plans shall be a scale accurate drawings referenced to the State Plane Coordinate System.
C. Submissions for sanitary sewer system design should be provided in Microsoft Excel format, or Heastead input/output files.

D. Submissions for storm drain system, and storm water management design should be provided in Microsoft Excel format, or Heastead input/output files, or Soil Conservation Service TRT –20 or 55 format.

VII. Transferring of Pump Station Ownership

A Ownership of pump stations will occur only after final acceptance in writing of a completed project.

B. The developer will be responsible for any maintenance as a result of construction defects of said facilities for one year from the date of Final Acceptance.

VIII. Streets and Related Improvements in the Public Right-of-Way

A. All activity performed in the public right-of-way requires an approved permit from VDOT or the Town of Berryville. VDOT maintains public primary roadways (Business Route 7 and SH 340). The Town of Berryville maintains public secondary roadways.

B. All work performed under a permit issued by the Town of Berryville must be performed in accordance with the following as applicable:
   1. Berryville Town Ordinances
   2. Berryville Construction Standards and Specifications
   3. VDOT Road and Bridge Standards, current edition
   4. VDOT Road and Bridge Specifications, current edition
   5. Manual on Uniform Traffic Control Devices (MUTCD) including the VDOT supplement
   6. VDOT Manuals on Planting and Irrigation in the Right-of-Way
   7. VDOT Land Use Permit Manual
   8. Virginia Erosion and Sediment Control Handbook

C. Right-of-way dedication and acceptance of public streets not maintained by VDOT shall be evidenced by authorized signatures on the deed of dedication or other instrument deemed acceptable by the Town of Berryville.

D. In order to obtain guarantee of performance to assure timely completion and competent construction of physical improvements, the applicant is required to post a bond or other acceptable surety as identified in Article VII. Performance Surety, of the Town of Berryville Subdivision Ordinance and Article III, Section 314.8 Construction and Bonding of the Town of Berryville Zoning Ordinance.

E. Performance bonds shall be submitted to the Town of Berryville for review and approval for those streets in the Town's system (secondaries).

F. Dedication and acceptance of public streets shall be in compliance with VDOT Memorandum SR-50-93, Guide for Additions, Abandonments, and Discontinuances, current edition.

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Section 3

Water Main and Appurtenances

I. General

A. This section includes construction of distribution system mains, service laterals, and other associated appurtenances. Also included are testing and disinfection requirements.

B. All mains shall be cement mortar lined ductile iron or PVC (C909), with a minimum diameter of six inches (6"). The pipe shall have rubber gasket push-on joints, and all fittings shall be mechanical joint except as approved by the Town. Where special fabrication of ductile iron pipe is required to fit water mains within vaults, structures and buildings, the Contractor shall submit fully dimensioned drawings showing the piping in full detail with exact locations, dimensions, and schedules of all pipe, fittings, hangers, supports, and appurtenances before starting fabrication of the pipe and/or fittings. Where special fittings are required, they shall be shown in detail with all necessary dimensions. The design of such installations shall provide adequate space within the housing, and around the fittings to allow easy disassembly of pipe sections or other appurtenances.

C. Utility Locations: Water mains shall be located a minimum of three (3) feet from the gutter of the streets with curb and gutter; or three (3) feet within the pavement edge of streets without curb and gutter. Whenever practical, sewer mains shall be located in the center of the street. A minimum 10 foot horizontal separation (outside to outside), or 6 feet horizontal separation with at least 1.5 foot vertical separation from bottom of water to top of sewer, shall be provided between all water lines and sanitary sewer lines. Should conditions require the water and sewer lines to be installed in the same trench, the water line must rest on a shelf of undisturbed earth to one side of the sewer with at least 18 inches of vertical separation between the top of the sewer line and bottom of the water line. Approval from the Town Engineer and Director of Public Works must be acquired before same trench installation is permitted. Typical minimum cover of four feet is to be provided for water mains. For short distances, reduced cover of as little as three feet may be approved, so as to preclude locating water below a crossing utility.

II. Mains

A. Ductile Iron Pipe

1. Ductile iron pipe shall be manufactured in accordance with ANSI A21.51/ AWWA C151. All pipe shall have a minimum Class 52 thickness.
2. End designs shall conform to the ANSI/AWWA C 111/ A21.11 – "Rubber Gasket Joints Ductile Iron and Gray Iron Pressure Pipe and Fittings" Push-on

joints shall be "Tyton," "Super Bell Tite" or "Fast-Tite" joint, or approved equal.

3. The inside of the pipe shall be cement lined in accordance with ANSI/AWWA C 104/ A21.
4. Flanged connections shall only be permitted where indicated on construction plans and pre-approved by the Town, and shall conform to ANSI/AWWA C115/A21.15.

B. PVC (C909) Pipe
   1. Select Backfill
      a. There shall be 24" of select backfill above the stone aggregate which shall be compacted in eight inch lifts. The maximum particle size of the backfill material shall be no greater than one (1) inch. Backfill shall be compacted to 95% of maximum density.
      b. Above the select backfill, material shall be deposited in lifts not to exceed two (2) feet, and have a compaction to 95% of maximum density.
      c. A six (6) inch wide magnetized locating ribbon labeled "WATER LINE BURIED BELOW" shall be placed above the select fill.
      d. No rock shall be used in the select backfill. Any rock used *above* the select backfill shall be no larger than six (6) inches in diameter.
      e. A #12 gauge wire shall be placed next to the PVC (C909) line during installation of the main. This wire must maintain positive continuity at all times.
   2. Stone Bedding
      1. For excavation in dirt or clay, there must be six (6) inches of stone under and over the pipe.
      2. For excavation through rock, there shall be twelve (12) inches of stone under and over pipe in rock trenches.

C. Fittings
   1. All fittings shall be cast of ductile iron, and shall conform to ANSI/AWWA C153/A21.53. Fittings shall be made with mechanical joint ends in accordance with ANSI/AWWA C 111/A21.11.
   2. A sufficient number of bolts, nuts, glands and gaskets shall be provided for each fitting. These accessories shall be of the proper dimensions for the size pipe. The bolts shall be made of high strength low alloy steel in accordance with ANSI/AWWA C 111/ A21.11.
   3. The cement lining, shall conform to ANSI/AWWA C 104/A21.4.

III. Handling Ductile Iron Pipe and Fittings

A. It shall be the responsibility of the pipe manufacturer to thoroughly inspect each length of pipe according to the applicable ANSI and AWWA standards and other requirements as set forth in these specifications.

B. Ductile iron pipe, fittings, valves and accessories shall be handled in strict accordance with the provisions of ANSI/AWWA C 600, so as to ensure that these items are sound, undamaged, and entirely suitable in all aspects to the specified requirements of each particular fitting, pipe and accessory. Particular care shall be taken not to injure either the coating, the pipe or threads. Equipment, tools and methods used in loading, reloading, unloading, hauling and lying pipe and fittings shall be such that no damage is done to the pipe or the coatings. Where hooks are used for lifting, they shall have broad well-padded contact surfaces. Repair of defective or damaged coatings or linings shall be made under the direct supervision of a representative of the pipe manufacturer. No field repair work may be done on any damaged pipe coating or lining without the prior approval of the Town. Any bituminous pipe coating that is damaged by shipment or by the Contractor shall be repaired, prior to installation or placing of any backfill or hanging within hangers. Repairs shall be made by removing all damaged coating, then wire brushing to expose the metal, and applying two coats of coal tar coating material of a type and quality equal to that used originally for the bituminous coating of the pipe.

C. Cutting, cleaning and inspecting ductile iron pipe: The cutting pipe for closure pieces or for other reasons shall be done in a neat and workmanlike manner by a method that will not damage the pipe or its lining. Sections shall be thoroughly swabbed or cleaned of all foreign matter before being installed into the system and shall be kept clean during and after installation. Before installation of any pipe or fitting, each piece shall be inspected for defects. All defective, damaged or unsound pipe or fittings shall be rejected.

IV. Installation

A. Pipe laying shall be conducted in strict accordance with the provisions of ANSI/AWWA C 600. The lay shall proceed with the bell end of the pipe pointing in the direction of the next pipe joint to be laid. Each pipe shall be laid true to line and grade and in such manner as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets of the flow line. Proper precautions shall be taken to keep the interior of the pipe free of all dirt and superfluous materials of every description as the work progresses.

B. Trenches shall be kept free from water until the pipe jointing is complete. At all times when work is not in progress, open ends of pipe and fittings shall be securely closed to the satisfaction of the Town so that no trench water, earth or other substance will enter the pipe or fittings. Adequate backfill shall be deposited on the pipe to prevent floating. Any pipe which has floated shall be removed from the trench and be re-laid.

C. All tees, bends and dead ends shall be restrained by means of concrete blocking, and be installed with Megalug™ retainer gland or approved equal.

D. ScotchMark Electronic Marker System (EMS 1257) or approved equal shall be included with the installation of all water mains. The markers shall respond to a frequency of 145.7 kHz, with placement as follows:
   1. 50-foot intervals on mains.
   2. Each bend
   3. The end on each joint that is deflected and each "T"
   4. Any additional location directed by the Town of Berryville

E. A six-inch wide magnetized location ribbon labeled [water line buried below] shall be installed above the select backfill.

F. A #12 gauge wire shall be placed next to all main lines and service laterals. The wire shall maintain continuity at all times.

V. Separation of Water Lines and Sewers

A. General – The following factors shall be considered in providing adequate separation:
   1. Materials and types of joints for water and sewer pipes.
   2. Service branch connections into the water line and sewer lines.
   3. Space for repairs and alterations of water and sewer pipes.
   4. Avoiding offset of pipes around manholes.

B. Parallel Installation
   1. Normal Conditions – Water lines shall be laid at least ten feet horizontally from a sewer or sewer manhole wherever possible. The distance shall be measured edge-to-edge.
   2. Unusual Conditions – When local conditions prevent a horizontal separation of ten feet, the water line may be laid closer to a sewer or sewer manhole provided that:
      a. The bottom (invert) of the water main shall be at least 18 inches above the top (crown) of the sewer. Should conditions require the water and sewer lines to be installed in the same trench, the water line must rest on a shelf of undisturbed earth to one side of the sewer with at least 18 inches of vertical separation between the top of the sewer line and bottom of the water line. Approval from the Town Engineer and Director of Public Works must be acquired before same trench installation is permitted.
      b. The sewer manhole shall be of watertight construction and tested in place.
      c. Where vertical separation of at least 18 inches cannot be maintained between the bottom of the waterline and the top of the sewer, the sewer line shall be constructed of water pipe conforming to AWWA C 900 and shall be pressure tested in place, as specified in AWWA standard C 600, with a minimum test pressure of 30 psi. Leakage is not permitted during the AWWA C600 pressure testing.
      d. When sanitary sewers cross over water lines, the sewer joints must also be centered at the point of crossing so that joints are equidistant and as far as possible from the water line.

e. Sewer Manholes and Drainage Structures —A minimum of 10 feet (outside to outside) of separation shall be provided between water pipes and sanitary sewer manholes. Where this distance cannot be maintained, the manhole shall be of watertight construction and tested in place. A minimum of 6 feet of separation shall be maintained between waterlines and drainage structures.

C. Crossings

1. Normal Conditions – Water lines crossing sanitary and storm sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer.

2. Unusual Conditions – When local conditions prevent a vertical separation described in C.1., or where waterline must cross below sanitary sewers, the sewer line shall be constructed of water pipe conforming to AWWA C 900 and shall be pressure tested in place, as specified in AWWA standard C 600, with a minimum test pressure of 30 psi. Water lines passing under sewers shall, in addition, be protected by providing:
   i) A vertical separation of at least 24-inches between the bottom of the sanitary sewer and the top of the water line.
   ii) Adequate structural support for the sewer to prevent excessive deflection of the joints and the settling on and breaking of the water line.
   iii) That the length of the water line be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sewer.
   iv) When conditions do not allow for water lines to pass over storm sewers, a minimum of 18 inches clearance shall be maintained from top of water line to bottom of storm sewer.
   v) If conditions do not allow for separation during installation around existing structures, bridging or other methods of protecting water quality and pipe integrity may be submitted and considered for approval by the Town Engineer. New Construction must maintain required separations.

3. Stream Crossing and highway crossings shall be installed as shown in the Standard Details unless otherwise specified. The crossing shall be made in such a manner to minimize erosion and blockage of the stream flow. Backfill under the rip-rap shall be compacted to ninety percent density.

VI. Testing and Disinfection of Water Lines

A. General

The Contractor will supply the water used for flushing, disinfection, and testing. If Town water is used, the water shall be metered and the contractor shall pay the Town for its cost. Filling of water lines may not be performed until permission has been obtained from the Town Superintendent. The contractor is not permitted to operate valves on any existing water line.

B. Testing

1. All new water mains and hydrant connections shall be subject to a hydrostatic pressure test after thrust restraints have been installed, the line has been backfilled, and at least 3 days after the last concrete reaction anchor has been poured and all water house connections have been installed (lateral from main to meter box). Testing shall be in accordance with AWWA C-600. Water mains shall be filled with clean water at a velocity of approximately 1 foot per second while necessary measures are taken to eliminate all air. A hydrostatic pressure of not less than 150 psi or 150% of normal operating pressure, whichever is greater, shall be maintained for two (2) hours. Lines of different sizes shall be tested separately. Hydrants shall be in the closed position. All high points in the portion of the system under test shall be vented and air shall be expelled from the system prior to beginning the test.
2. After the portion of the system under test has reached the required pressure as stated herein, the pressure shall be maintained for two (2) hours. At the conclusion of the pressure test, the volume of the makeup water required to refill the pipeline shall be determined by measurement with a displacement meter or by pumping from a vessel of known volume.
3. All visible leakage must be eliminated by the contractor, regardless of the amount. Should test results show displacement, damage or leakage in excess of the allowable amount (see table below for representative values), the contractor shall repair the displacement and damage to eliminate the leakage. The contractor shall retest until the specified conditions are met to the satisfaction of the Town Superintendent.

Allowable Leakage per 1,000 feet of Pipeline – gph
Nominal Pipe Diameter – in

Psi	4	6	8	10	12	16
250	0.47	0.71	0.95	1.19	1.42	1.90
225	0.45	0.68	0.90	1.13	1.35	1.80
200	0.43	0.64	0.85	1.06	1.28	1.70
175	0.40	0.59	0.80	0.99	1.19	1.59
150	0.37	0.55	0.74	0.92	1.10	1.47

The above table is presented for convenience only. Please refer to AWWA C600 for complete up-to-date table.

C. Disinfection

1. After leakage testing, and before final inspection of the completed systems, water mains shall be flushed and then disinfected in accordance with ANSI/AWWA C-651 standards. All disinfection procedures and final testing shall be carried out under the observation of a utility inspector approved by the Town Superintendent. Either the tablet method or continuous feed method shall be used.
   a) The tablet method can only be used if the pipes and appurtenances are kept clean and dry during construction. The mains should be filled at the rate of 1 ft/sec or less. Water must remain in the main for a minimum of 24 hours when the water temperature is 41 F (5 C) or more. If the water temperature drops below this then the water must remain a minimum of 48 hours. A detectable chlorine residual should be found at each sampling point after the prescribed contact time.
   b) If the continuous feed method is to be used, a preflushing shall be accomplished at a flow velocity of not less than 2.5 feet per second. All valves, hydrants, and water house connection shall be operated during this operation. Clean water shall be flushed throughout the system until there is no trace of cuttings, oil, dirt, or other foreign matter flowing out of the pipe. The water shall be chlorinated so that after the 24 hour contact time, a free chlorine residual of not less than 10 ppm is maintained.
2. Final flushing will occur as soon as practically possible after the required contact time to prevent damage to the pipe lining or to prevent corrosion damage to the pipe itself. When the chlorine residual has been reduced to within the range of 0.2 and 2.0 ppm, bacteriological samples can be collected.
3. Bacteriological Sampling – Water samples for bacteriological analysis shall be taken by the contractor at regular intervals not exceeding 2,000 feet, as approved by the Town, witnessed by the utility inspector, and analyzed by a certified laboratory. Two satisfactory bacteriological samples, collected twenty-four hours apart must be obtained prior to placing the lines in service. Satisfactory samples are those that indicate the presence no coliform bacteria. If contamination is found in one or both sets of samples, the entire disinfection and bacteriological sampling procedure must be repeated.
4. It is expected that any water flushed from the mains will have to be dechlorinated with a neutralizing chemical to insure that environmental damage will not occur. The recommended neutralizing chemicals, and procedural guidelines for dechlorination are explained in the ANSI/AWWA C-651 standards. The contractor shall be responsible for the proper application of the neutralizing chemicals to reduce the chlorine residual to a non-detecable level. The contractor shall assume full responsibility for the discharge of all water used during any flushing, and shall be responsible for any environmental damage including, but not limited to, vegetation, trees, streams, ponds, lakes, or any other damage to public or private property.

VII. Service Laterals

A. General
1. All material used shall meet or exceed ANSI/AWWA C800 standards.
2. All taps made on ductile iron mains shall be made direct, without a saddle, unless otherwise specified or approved by the Town.
3. Where applicable, and when tapping PVC mains, a Ford Style FS202 or approved equal shall be used.
4. All water services shall be installed as per Standard Detail shown in Specification Detail section.
5. Service lines shall be type 200 psi HDPE copper tubing sized piping conforming to ANSI/ASTM standard specifications. The line shall be one continuous piece from corporation stop to meter setter and the line will be equal to the size of the corporation stop. Line must be accompanied by a twelve gage copper tracer wire.
6. Meter boxes will be set on the street side at the property line, unless approved by the Town.

B. ¾-Inch Water Service
1. Corporation stop shall be ¾" ball style and conforming to the requirements of the AWWA Standards. Connection at the corporation stop shall be compression.
2. The meter box shall be 18 inches in diameter, and 30 inches in depth, with an 18 inch diameter frame and 11½ inch diameter lid. The frame and lid shall be made of cast iron, and lid shall include the FP cast iron plug where applicable.
3. The meter setter shall consist of a copper setter, inlet angle valve, and outlet angle ASSE approved dual check valves (top loading).

C. 1 Inch Water Service
1. Corporation stop shall be 1 inch in size and ball style and conforming to the requirements of the ANSI/AWWA B88 Standards. Connection at the corporation stop shall be compression type.
2. The meter box shall be 18 inches in diameter, and 30 inches in depth, with an 18 inch diameter frame and 11½ inch diameter lid. The frame and lid shall be made of cast iron, and lid shall include the FP cast iron plug where applicable.
3. The meter setter shall consist of a copper setter, inlet angle valve, and outlet angle ASSE approved dual check valves (top loading).

D. 1½ and 2 Inch Water Services
1. Service shall be taken off the main by means of a wet tap or an anchoring tee, with 6 inch branch and a 6 inch branch valve. A tapped mechanical joint plug shall be used in the downstream side of this valve, with a male IPT to compression adapter.
2. The meter shall be set in a custom box with a custom meter setter consisting of a flanged angle valve on the inlet and an ASSE approved dual check valve on the outlet. The setter shall include a by-pass with ball valve and locking cap.

3. Meter vault shall conform to the dimensions shown in the Standard Details, or as approved by the Town.

VIII. Backflow Prevention Assemblies

A. Each metered service connection must have an A.S.S.E. (American Society of Sanitary Engineers) approved backflow prevention device installed for service line protection. The Town must approve the type of device submitted based on the degree of hazed of the planned use.
   1. Metered service lines with a low degree of hazard must be provided with a double-check valve backflow prevention assembly that is tagged, stamped, or embossed to indicate it meets A.S.S.E. Standard No. 1015.
   2. Metered service lines with a high degree of hazard must be provided with a reduced pressure zone device that is tagged, stamped, or embossed to indicate it does meet A.S.S.E. Standard No. 1013.
   3. Backflow prevention devises that require yearly inspection must be installed above grade and/or in a location not subject to flooding. The location of a backflow prevention devise in to be approved by the Town's Director of Utilities.

B. Each fire line service connection must have an A.S.S.E. approved backflow prevention device with leak detector installed for fire service line protection. The Town must approve the type of device submitted based on degree of hazard of the planned fire service.
   1. Fire lines with a low degree of hazard (no additives or antifreeze) must be provided with a detector double check backflow prevention assembly with A.S.S.E. Standard No. 1048 identification made part of the device.
   2. Fire lines with a high degree of hazard (additives or antifreeze) must be provided with a reduced pressure assembly with A.S.S.E. Standard No. 1047 identification made part of the device.

C. All detector (metered) assemblies are required to have a meter that is compatible with the Town's meter reading device.

D. All backflow prevention devices must be inspected annually by the owner and a report submitted to the Town's Director of Utilities for review. Residential premises without secondary uses, exclusive of multifamily that present a low degree of hazard (no additives or anti-freeze), are not required to submit annual reports.

A written request to the Director of Public Works is required for necessary inspections for acceptance of improvements. The request shall include as-built drawings, easements and other pertinent information as deemed necessary by the Department of Public Works and the Town's Engineer. A response from the Department of Public Works after review will be forwarded to the applicant outlining deficiencies or for approval of the project.

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Section 4

Valves and Hydrants

I. General

A. Valve or hydrant manufacturer shall be regularly engaged in the design, manufacture, and maintenance of valves or hydrants of the type specified, and shall have furnished valves or hydrants of the same general design, type, and comparable size specified herein, which have been used and proved satisfactory under similar test, service, and operating conditions for at least five years. The manufacturer shall furnish satisfactory evidence of adequate facilities for furnishing parts for repairs and for maintenance of the hydrants or valves furnished. Unless otherwise indicated, valves shall be designed to provide tight shut-off at the following pressure differential: 250 psi upstream and 0 psi downstream in either direction. Design flows shall be a minimum 15 feet per second for opening and closing.

B. All valves furnished through 12 inches shall be resilient wedge-valves with nonrising stems. Valves larger than 12 inches shall be butterfly type unless otherwise required by the Town.

C. A valve box shall be provided for each buried valve. Boxes shall be screw type. Telescoping type are prohibited. Extension stems shall be provided for valves where the operating nut is greater than 4'-0" below grade. The stem shall extend to a minimum of 2'-0" below finished grade.

D. Unless otherwise specified herein, 4-inch and larger valves and all hydrants shall have mechanical joint ends.

II. Gate Valves

A. General

1. Gate Valves shall be manufactured to meet, and/or exceed, all the requirements of ANSI/AWWA C509-01 or ANSI/AWWA C515 Standard for resilient wedge ductile iron gate valves.
2. The manufacturer must provide a ten (10) year warranty against defective material and workmanship.

III. Specifications

Valves shall meet the following minimum design criteria:

1. Valve body shall be manufactured of ductile iron, and have a working pressure of 250 psi.
2. All ferrous components shall be ductile iron, body, wrench nut, stuffing box, and valve wedge.
3. The marking "DI" or "ductile iron" shall be cast into the valve body along with "250W" or "250 psi".

4. The valve wedge shall be ductile iron, encapsulated with nitrite rubber. The wedge shall be symmetrical and seal equally well with flow in either direction.
5. Valves shall have a fusion-bonded epoxy coating inside and out for maximum corrosion resistance, complying with ANSI/AWWA C550 Standard, applied electrostatically prior to assembly.
6. The valve shall have a smooth full diameter waterway with no recesses to trap debris or obstruct flow.
7. Valve stem shall be high strength corrosion resistant bronze. Stem shall be sealed by three o-rings. The top two o-rings shall be replaceable with valve fully open and while subject to full rated working pressure. O-ring set in a cartridge shall not be allowed.
8. Sealing gaskets shall be pressure energized o-rings.
9. Torque minimizing thrust washers located with one (1) above, and one (1) below the thrust collar, to assure trouble free operation of the valve.
10. Valves shall conform to (U.L.) Underwriters Laboratories, and (F.M) Factory Mutual Research Corporation. Valves shall be NSF standard G1 certified.
11. Bolting materials shall develop the physical strength requirements of ASTM A307 Standard, and may have either regular square or hexagonal heads with dimensions conforming to ANSI B18.2.1 Standard. Metric size socket head cap screws are not allowed. Bolts and nuts securing valve bonnets, stems and operating nuts shall be stainless steel.
12. Operating nut shall have four flats at stem connection to assure even input torque to the stem.
13. Flanged valves shall be O S & Y 125 lb. flanges. The manufacturer shall be able to furnish 250 lb. flanges upon request.

IV. Tapping Sleeves

A. Mechanical joint tapping sleeves meet the following design criteria:
   1. Sleeves shall be the split type mechanical joint with side and end gaskets, manufactured of ductile iron.
   2. Sleeves shall conform to all applicable requirements of ANSI/AWWA C110 A21.10; ANSI/AWWA C111 A21.11; and ANSI B16.11 Class 125 flange.
   3. When sleeves are to be installed on pipe that is larger than 12", field verification by the contractor of the existing pipe's outside diameter shall be required before ordering said sleeve.
   4. All tapping sleeves shall be iron, mechanical joint tapping sleeves unless otherwise approved by the Town's Superintendent. Stainless steel tapping sleeves will be considered where the existing main is PVC pipe, or cast iron of irregular outside diameter.

V. Fire Hydrants

A. General
   1. Fire hydrants shall be the dry-barrel type manufactured to meet, and/or exceed, all the requirements of ANSI/AWWA C502-94 Standard.

2. Drainage capability must be provided for fire hydrant weep holes. If areas of high water table are encountered, the contractor shall contact the Director of Public Works or the Town Engineer to relocate the hydrant to prevent possible cross contamination.
3. Fire hydrants shall be painted in accordance with standards established in the Materials Specifications document.
4. The manufacturer must provide a ten (10) year warranty against defective material and workmanship.
5. Fire hydrants shall be located as follows:
   a. At street intersections and at intermediate locations where deemed necessary by the Town Director of Public Works and/or the State Fire Marshall's Office after consultation with the Fire Chief.
   b. At the end of all cul-de-sacs in a location determined by the Town Superintendent.
   c. No closer than fifty (50) feet and no further away than one hundred (100) feet of any standpipe or sprinkler system fire department connections.
   d. As required by the following schedule according to use group. The distance shall be measured along an unobstructed path around the structure, to the most remote part of the structure that the hydrant will serve.

Industrial Buildings	250 feet
School Buildings	300 feet
Commercial, Church and Office Buildings	350 feet
Apartments, Multifamily, and Town Houses	250 feet
Single-Family Detached and Two-Family Attached Dwellings	400 feet

   e. All hydrants shall be a minimum of fifty (50) feet away from any buildings other than single-family detached and two-family attached dwellings unless deemed appropriate by the Town Superintendent.
   f. In no case shall the distance between fire hydrants, measured along the centerline of accessible streets, be greater than six hundred (600) feet.
6. No landscaping shall be permitted within five (5) feet of a fire hydrant, with the "no landscape" area indicated on the plat.

B. Specifications

Hydrants shall meet the following minimum design criteria:

1. Hydrant shall have a rated working pressure of 200 psi with a test pressure of 400 psi.
2. The main valve closure shall be of the compression type, opening against the pressure and closing with the pressure.
3. Traffic feature to be designed so that the nozzle section of the hydrant can be rotated (by degree) to full 360 circle during field installations, if necessary.
4. The main valve opening shall not be less than 5 ¼" and be designed so that removal of seat, drain valve mechanism, internal rod, and all working parts, can be removed through the top of the hydrant, without disturbing the ground line joint or the nozzle section of the hydrant.

5. The bronze seat shall be threaded into mating threads of bronze for easy field removal.
6. The draining system of the hydrant shall be bronze, and activated by the main stem without the use if auxiliary rods, toggles, pins, etc. The drain mechanism shall be completely closed after no more than three turns of the operating nut in the opening direction, allowing throttling of the hydrant as needed. Provide a minimum of two inside ports and four drain port outlets to the exterior of the hydrant, to insure positive drain when closed. Drain shut-offs shall be by direct compression closure.
7. The operating nut, main stem, coupling, and main valve assembly shall be capable of withstanding input torque of 200 ft/lbs in opening or closing directions.
8. There shall be an internal top housing with triple o-rings to seal operating threads from the waterway and accommodate an antifriction washer.
9. Nozzle sections of the hydrant shall be designed to permit field replacement of damaged threads without special tools, excavation, or disturbing the ground line joint. Bronze nozzles are to be locked into the hydrant barrel with locking lugs, and be sealed by heavy duty 0-rings. The operating nut size, as well as hose and pumper threads, shall conform to National Standard Specifications.
10. Hydrants shall conform to (U.L.) Underwriters Laboratories U.L. 246 standards, and (F.M) Factory Mutual Research Corporation.
11. The maximum friction loss through the hydrant shall not exceed 2.8 psi at 1000 gpm through the pumper nozzle. The flow test and certification of this feature shall be conducted by an independent testing laboratory, and be in accordance with ANSI/AWWA C502-94 standard. The records of all tests performed shall be made available to the Town upon request.
12. The standard depth of bury shall be a minimum of 4' to a maximum of 7' without the use of extensions. When the water main is deeper than the standard depth, the use of quarter and eighth bends between the tee at the main and the fire hydrant will be required to bring it to the proper grade.

VI. Installation

A. Valves
   1. Valves shall be carefully erected in their respective positions and free from all distortion and strain with stems vertical. The valve box shall be set over the operating nut and shall have its top flush with the final surface. The valve box top section shall overlap the lower section by at least 6 inches.
   2. Restraint of valves shall be performed by the Contractor in accordance with the Standard Details, or as specified by the Town Engineer.
   3. Where valves occur on the end of the pipeline, a mechanical joint plug shall be placed and secured in the exposed bell before backfilling the trench.
   4. The contractor shall backfill and compact under and around valve boxes to ensure no vertical loads are transmitted to the valve operators.

5. All valves shall be installed with Megalug™ retainer gland or approved equal.

B. Fire Hydrants
1. Fire hydrants shall be installed where indicated on the Plans, in accordance with the Standard Details, and set plumb, with bury line at finished grade. The pumper outlet shall be placed facing the street.
2. Bollards shall be installed as shown on plans or as directed by the Town.
3. Every effort shall be made to avoid the use of barrel extensions, and such extensions shall only be used when approved on a case by case basis by the Director of Public Works.
4. A 6 inch valve shall be provided in the lead of each hydrant. This valve shall be restrained to the main by an anchoring tee or anchoring coupling. Where a hydrant is used to terminate the main, restraint of this valve shall be by means of a dead end anchor, cast around the main.
5. All privately owned hydrants shall have stenciled on the hydrant the word "PRIVATE" to identify the unit as a privately owned hydrant. The stenciling shall be sized and placed to be easily seen from the direction of hydrant access.
6. Hydrants shall be located no more than ten (10) feet from the face of curb and at least ten (10) feet from any entrance or driveway.
7. Prior to acceptance, hydrants shall be flow tested under Town supervision to assure compliance with the Town of Berryville Construction Standards Manual. The flow report shall be submitted to the Town Director of Public Works for review and approval.

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Section 5

Sanitary Sewer

I. General

A. This section includes construction and testing of all sanitary sewer piping. The installation of sanitary sewers will be in accordance with this section of the specifications and applicable standard details.

B. Utility Locations: Whenever practical, sewer mains shall be located in the center of the street. Water mains shall be located a minimum of three (3) feet from the gutter of the streets with curb and gutter; or three (3) feet within the pavement edge of streets without curb and gutter. A minimum 10 foot horizontal separation (outside to outside), or 6 feet horizontal separation with at least 1.5 foot vertical separation from bottom of water to top of sewer, shall be provided between all water lines and sanitary sewer lines. The water line must rest on a shelf of undisturbed earth to one side of the sewer.

   Manholes shall be placed at the intersection of all mains, at all changes in horizontal or vertical alignment, at a maximum of three hundred (300) foot intervals, where pipe size changes occur, and at any other locations as directed by the Town Engineer or Superintendent. Where a temporary or permanent termination of the main is proposed, a manhole shall be provided.

C. A minimum separation of 50 feet must be maintained between sanitary sewer and any well producing potable water.

D. A minimum separation of 15 feet must be maintained between sanitary sewer and all existing or proposed buildings.

E. Sewers shall be extended to beyond the limits of all proposed improvements, prior to final grading and/or street construction.

II. Materials

A. General – All pipe shall be of the same material and shall be furnished by the same manufacturer. Each pipe length and all fittings shall be clearly marked at intervals of five feet or less with the manufacturer's name or trademark and pipe type.

B. PVC Sewer Pipe
   1. The pipe and fittings shall be manufactured in accordance with ANSI/AWWA C900/C905 for Polyvinyl Chloride (PVC) pressure pipe and fittings, utilizing a rubber gasketed joint to provide for expansion and contraction. The pipe shall have a minimum DR ratio of 25, with cast-iron-pipe-equivalent Outside Diameters (ODs).
   2. The pipe shall be joined with an integral bell, bell-and-spigot type rubber gasketed joint. Each integral bell joint shall consist of a formed bell complete with a single rubber gasket. Gaskets shall conform to ASTM F-477. All fittings shall utilize gasketed joints.
   3. Pipe and fittings shall be homogeneous throughout and free from cracks, holes, foreign inclusions, or other injurious defects. The pipe shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.
   4. Manhole connections shall be accomplished by means of an elastomeric gasket to provide flexibility and adequate joint tightness.
   5. Manholes shall be placed at the intersection of all mains, at all changes in horizontal direction, and at a maximum of three-hundred (300) foot intervals on straight sections, where pipe size changes occur, and at any other location as so determined by the Town Engineer.

III. Installation

A. Only proper and suitable tools and appliances for the safe and convenient handling and laying of pipes and fittings shall be used. Pipe and fittings shall be carefully handled and lowered into the trench. Under no circumstances shall any pipe or fittings be dumped or rolled into the trench or be allowed to drop against the pipe or fitting already in the trench. Before being lowered and while suspended, the pipe shall be inspected for defects. Defective, damaged, or unsound pipe will be rejected.

B. The interior of the pipe shall be thoroughly cleaned of all foreign matter before being lowered into the trench and shall be kept clean during laying operations by means of plugs or other approved methods. The pipe shall not be laid in water or when the trench or weather conditions are unsuitable for such work. When work is not in progress, open ends of pipe and fittings shall be closed securely so that no trench water, earth, or other substances will enter the pipe or fittings.

C. All pipe being installed shall have no less than 6 inches of bedding under and over the pipe. The stone to be used for bedding shall be VDOT #68 type. The full length of each section of underground pipe shall rest solidly upon the pipe bedding, any defects due to settlement shall be made good by the contractor at his own expense. The ends of pipe shall abut against each other in such a manner that there shall be no shoulder or unevenness on the inside of the main. Bell holes shall be dug sufficiently large to ensure the making of proper joints. Special precautions shall be exercised to prevent any pipe from resting on rock.

D. Any pipe that has the grade or joint disturbed after laying shall be taken up and re-laid. Any pipe, pipe fittings, or appurtenance found defective after installation shall be replaced.

E. Except where otherwise necessary in making connections or closures, or as authorized by the Town Engineer, bell-and-spigot pipe shall be laid with bells facing in the direction of laying.

F. Where pipe cutting is necessary, it shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise authorized, cutting shall be done by means of an approved type of mechanical cutter that will leave a smooth end at right angles to the axis of the pipe and not otherwise damage the pipe.

G. Joints on PVC pipe and fittings shall be made in accordance with the recommendations of the joint manufacturer and as approved by the Director of Public Works.

H. All transition joints in sewers between similar or dissimilar materials of equal or unequal size shall be made water and gas tight by means of an approved connector or adapter of the compression or mechanical seal type.- Please see Materials Specifications section of this document for approved materials. Couplings of the mechanical seal type shall have tightening clamps or devices made of 304 stainless steel. The compression joint connector or adapter and flexible coupling shall be installed as recommended and specified by the manufacturer and each connector shall bear the manufacturer's name clearly visible when installed.

I. Pipe excavation shall be kept free from water and no joint shall be made under water. The Contractor shall be careful during backfilling to prevent damage to or disturbing of joints and to protect the watertight integrity of the pipes at all times. There shall be no walking on or working over pipe until backfill is over the pipe. Backfilling shall be in accordance with the standard details and Section 8 of the construction standards. The maximum depth of burial shall be no greater than twenty (20) feet unless approved in writing by the Town of Berryville.

J. Sheeting and shoring shall be in accordance with construction methods established in the Associated General Contractors of America Safety Code. The Contractor shall follow this AGC Manual in determining whether or not sheeting and shoring is required and shall follow the AGC recommended procedure for installation.

K. Stream Crossings and highway crossings shall be installed as in the Standard Details unless otherwise specified. The crossing shall be made in such a manner to minimize erosion and blockage of the stream flow. Backfill under the rip-rap shall be compacted to ninety percent density. Sanitary sewer entering or crossing

a stream must be constructed of watertight pipe and exhibit zero infiltration when tested in place.

L. Slope anchors shall be provided on sewers with slopes exceeding twenty percent. Minimum anchorage shall be as follows:
   1. Not over 36 feet center-to-center on grades 20% and up to 35%.
   2. Not over 24 feet center-to-center on grades 35% and up to 50%.
   3. Not over 16 feet center-to-center on grades 50% and over.

M. ScotchMark Electronic Marker System EMS 1258 or approved equal shall be included with the installation of all sewer force mains. The markers shall respond to a frequency of 122.5 kHz, with placement as follows:
   1. 50-foot intervals on force mains.
   2. All laterals (pegs placed where lateral leaves right-of-way or easement and enters private property).
   3. Any additional location directed by the Town of Berryville.

N. A six-inch wide magnetized locating ribbon labeled [sewer line buried below] shall be installed above the select backfill.

O. A #12 gauge wire shall be placed next to all sewer mains, force mains and laterals. This wire must maintain positive continuity at all times.

IV. Final Inspection and Testing

A. All sewer construction shall be subject to testing and final inspection, including internal television inspection prior to acceptance.

B. The Contractor shall furnish weirs, stand pipes, pipe plugs, pressure gauges, stop watches, air compressors, hose, and such materials and assistance as required to perform these tests. All acceptance tests shall be conducted by the Contractor in the presence of a utility inspector approved by the Town Superintendent. The Contractor shall schedule all acceptance tests with an approved utility inspector and provide the Town Superintendent at least forty-eight (48) hours notice of the test.

C. Prior to the final inspection by the Town, the Contractor shall locate and adjust all manholes, valve boxes, etc. to final grade and clean all gravity lines and manholes.

D. All gravity sewer lines, to include building sewers, shall be tested after backfill using a low-pressure air test in accordance with applicable ASTM specifications. The air test shall be conducted as follows: provide test plugs at each manhole and securely brace. Provide suitable means of determining depth of groundwater level above the inverts immediately before testing. The testing pressure will be increased accordingly but the total pressure including the increased amount of groundwater backpressure at the spring line of the pipe shall not exceed 5.5 psi. Add air slowly to the test section until the internal air pressure, as indicated on the

gauge, stabilizes at 4 psi or at the increased pressure determined for the correction of the groundwater backpressure. Do not allow personnel in manholes while the test is being performed or when test section is under air pressure. If leakage is indicated at the test plugs, relieve pressure before taking steps to eliminate the leak. When the air pressure is stabilized, disconnect the hose and compressor and allow the pressure to decrease to 3.5 psi, plus correction for groundwater backpressure. Record the time period for the pressure to drop ½ psi. Pipes failing to maintain minimum holding times set forth in the table below will not be accepted.

AIR TEST TABLE
Pipe Size – Diameter

Length	6"	8"	10"	12"	15"	18"	21"	24"	27"
25'	2:50	3:47	4:43	5:40	7:05	8:30	9:55	11:24	14:25
50'	2:50	3:47	4:43	5:40	7:05	8:30	9:55	11:24	14:25
75'	2:50	3:47	4:43	5:40	7:05	8:30	9:55	11:24	14:25
100'	2:50	3:47	4:43	5:40	7:05	8:30	9:55	11:24	14:25
125'	2:50	3:47	4:43	5:40	7:05	8:30	10:54	14:15	18:02
150'	2:50	3:47	4:43	5:40	7:47	11:13	15:16	19:56	25:14
200'	2:50	3:47	4:43	5:42	8:54	12:49	17:27	22:48	28:51
225'	2:50	3:47	4:43	6:25	10:01	14:25	19:38	25:38	32:37
250'	2:50	3:47	4:57	7:08	11:08	16:01	21:49	28:30	36:04
275'	2:50	3:47	5:26	7:50	12:15	17:37	24:00	31:20	39:40
300'	2:50	3:48	5:56	8:33	13:21	19:41	26:11	34:11	43:16
325'	2:50	4:07	6:26	9:15	14:28	20:50	28:21	37:02	46:52
350'	2:50	4:26	6:55	9:58	15:35	22:26	30:32	39:53	50:30
375'	2:50	4:45	7:25	10:41	16:42	24:02	32:43	42:44	54:05
400'	2:50	5:04	7:54	11:24	17:48	25:38	34:54	45:35	57:42

Minimum holding time in minutes and seconds by size and length of pipe.
Pressure drop from 4.0 psi to 3.5 psi (test pressure shall be increased by amount of groundwater backpressure at springline of pipe, but shall not exceed 5.5 psi).

E. Should the test show displacement, damage or leakage in excess of the allowable amount, the Contractor shall repair the displacement and damage and eliminate the leakage. He shall retest until the specified conditions are met to the satisfaction of the Town Superintendent.

F. All gravity sewer lines (not including building sewer) shall be internally inspected by closed circuit television camera prior to acceptance. All deficiencies noted during the inspection shall be corrected. Such inspection shall be made by the Town, after sewer has been fully backfilled and completion of associated roadway sub-grade construction. The cost of this inspection will be borne by the project's owner, and will be billed by the Town, pursuant to the current schedule of fees. Requests for such inspection shall only be made after the system is fully cleaned. Inspections will be scheduled within ten business days of receipt of a valid

request. Should the Town be unable to perform the inspection within this period, then an approved third party may be contracted by the project's owner to conduct the work. A follow-up inspection will be made eleven (11) months following the initial inspection. Any required repairs shall be made at project developer's expense and prior to release of any Maintenance Bond. An additional twelve (12) month Maintenance bond may be required at the discretion of the Director of Public Works.

G. Building sewers shall provide a standard cleanout within five (5) feet of building exit to allow for internal inspection by closed circuit camera by Town personnel prior to being given a Certificate of Occupancy. Any required repair shall be performed by project owner prior to being granted a Certificate of Occupancy. Forty-Eight (48) hours notice is required for the inspection. Line must be cleaned by project owner prior to inspection. The cost of the inspection to be covered by the project owner. Should Town personnel be unable to inspect the line due to improper preparation by owner or repairs are required, additional fees will be charged.

H. All manholes shall be tested for water tightness by vacuum testing after the manhole rim has been installed to final grade and prior to final acceptance.

I. Vacuum tests shall be conducted in accordance with ASTM C1244. Stubouts, manhole boots and pipe plugs shall be secured to prevent movement while the vacuum is drawn. Vacuum equipment shall be approved by the Town Superintendent prior to its use. A measured vacuum of 10 inches (10") of mercury shall be established in the manhole. The time for the vacuum to drop to nine inches (9") of mercury shall be recorded. The following are the minimum allowable test times for manhole acceptance at the specified vacuum drop:

Depth of Manhole (feet)	Time (seconds) Manhole Diameter (inches)								
	30	33	36	42	48	54	60	66	72
8	11	12	14	17	20	23	25	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	35	41	48	51	57
16	22	24	29	34	40	45	52	58	67
18	25	27	32	38	45	52	59	65	73
20	28	30	35	42	50	53	65	72	81
22*	31	33	39	48	55	64	72	79	89
24*	33	38	42	51	59	64	78	87	97
26*	36	39	46	55	64	75	85	94	105
28*	39	42	49	59	69	81	91	101	113
30*	42	45	53	63	74	87	98	108	121

*requires written approval by the Town of Berryville

J. If a manhole joint mastic is completely pulled out during the vacuum test, the manhole shall be disassembled and the mastic repaired.

K. Manholes that fail the vacuum test shall be repaired and the test and repairs shall be repeated until the manhole passes the test.

V. Gravity Sewer Laterals

A. In new construction, wyes shall be used to connect to lateral main.

B. When connecting to existing lines, an approved saddle and stainless bands shall be used.

C. Connections to existing manholes must be made by core drilling. The connection between pipe and manhole will be with an approved watertight boot.

D. A cleanout must be installed at locations determined by site plan and current Town standards.

E. Pipe shall be DR25 as listed on the materials listing sheet.

F. Refer to Standard Detail #1 for bedding requirements.

G. Location markers must be installed at the end of each lateral.

H. Connection at main will be inspected prior to back-filling.

I. Lateral connections greater than half the diameter of the main will require approval from the Director of Public Works or the Town Engineer. Installation of a manhole may be required for laterals larger than half the main line diameter.

J. No gravity connection will be made to a force main.

Section 6

Sanitary Sewer Manholes

I. General

A. This section includes the furnishing of all plant labor, equipment, appliances, and materials and the performance of all operations in connection with the construction of manholes, in strict accordance with this section of specifications and the applicable Standard Details.

B. All manholes shall be precast concrete unless otherwise noted on the plans and approved by the Town. Any manhole being installed within one thousand (1,000) feet of the discharge from a pressure sewer main or existing manhole having a pressure sewer main installed from a pump station designed for more than 100 gpm shall be lined with a high density Poly Ethylene (HDPE) sheets to protect the concrete from hydrogen sulfide and other sewer gasses which will cause the concrete to deteriorate. Where pressure sewer is being connected to existing gravity collection system, manholes within 1000 feet of the connection shall be protected by lining with a high alumina cement mortar (Strong Seal™ or approved equal).

C. Applicable Standards
1. American Society for Testing Materials ASTM) C478, D1752
2. Federal Specification QQ-I-652 for Gray Iron Castings
3. Corps of Engineers CRD-588

II. Precast Base

A. Precast Base: Precast base sections shall be installed on a firm stabilized foundation prepared similarly to that required for the proper installation of the adjacent pipeline, as described elsewhere in the specifications. Precast base sections may be supplied by the manufacturer with precast inverts or the Contractor may cast the inverts in the field. Inverts shall be smooth and accurately shaped to a semicircular bottom conforming to the inside of the adjacent sewer sections. Changes in direction of the sewer and entering branches shall have a circular curve of as large a radius as the manhole will permit, as shown in the Standard Details. The invert channel's depth is to be at least 0.7 times the diameter of the pipe. Manhole base shall be integrally cast with walls.

III. Precast Sections

A. Precast manhole sections shall be manufactured in accordance with current ASTM Standard C478. Joints of the manhole sections shall be formed entirely of concrete, employing a round rubber gasket, and when assembled, shall be self-centering and make uniform watertight joints. Except for those surfaces within the gasket groove, all inside surfaces of the bell or outside surfaces of the spigot, or

both, on which the rubber gasket may bear during the closure of the joint and at any degree of partial closure, shall be parallel within1degree and have an angle of not more than 2 degrees with the longitudinal axis of the pipe. In joints formed entirely of concrete, the distance from either side of the gasket to the end of the bell or spigot shall be not less than 3/4 inch. The gasket spaces between the bell and spigot shall be so shaped as to provide either grooves or shoulders that will prevent the gasket from disengaging from its compression surface or being blown out by hydrostatic pressures. The gasket shall be the sole element utilized in sealing the joint from either internal or external hydrostatic pressure.

IV. Invert Channels

A. Invert channels shall be smooth and semicircular in shape, conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit.

B. Changes in size, direction and grade of the channels shall be made gradually and evenly. The invert channels may be precast or; may be built up with Portland cement grout and mortar (1 part cement to 2 parts sand); or may be formed with sewer pipe laid through the manhole and breaking out the top half after the surrounding concrete has hardened. The bench of the manhole outside the channels shall be smooth and shall slope toward the channels at 1 inch per foot minimum. The invert channel is to be at least 0.7 times the diameter of the pipe depth.

V. Drop Connections

A. Designs shall minimize the use of drop connections, favoring increased slope and covers on main where practical. Drop connections may be approved where influent main is to be at least 4 feet above effluent main. Outside drop connections are typically employed. Inside drop connections may be approved on a case by case basis. Where inside drop connections are approved, particular care must be taken to ensure adequate foundation for influent line.

VI. Gradient Across Manholes

A. At a manhole, design shall provide 0.2 foot, to a maximum of 0.5 foot, of difference between invert elevations of influent and effluent mains of like diameters. A minimum difference of 0.1 foot will be permitted where 0.2 foot cannot be practically attained. Where a service or smaller main flows into a manhole, its crown shall be no lower than that of the effluent main.

VII. Watertight Work Required

A. Manholes shall be completely watertight. All leaks shall be repaired immediately with a non-shrink material, or the entire work removed and rebuilt. Groundwater must be kept below all parts of the masonry or concrete foundations and walls until the mortar and concrete has obtained an adequate set.

VIII. Frames and Covers

A. Manhole frames and covers shall be manufactured true to pattern. Component parts shall fit together in a satisfactory manner. Castings shall be smooth and well cleaned by shotblasting. They shall be manufactured from gray cast iron, free from cracks, holes and cold shuts, and conforming to ASTM-A-48 Class 35B gray iron. For consistency, the Town has adopted standard dimensions, which are shown in the Standard Details.

B. Covers shall have the words "SANITARY SEWER" cast in them.

C. Watertight manhole covers shall be required when the manhole top is below the elevation of the 100-year flood.

D. All manholes, except those outfitted with watertight covers, shall be fitted with plastic inserts to eliminate the entrance of surface water.

IX. Manhole Steps

A. Manhole steps shall be made of plastic- or rubber-covered steel and shall conform to the requirements of ASTM C478.

X. Connecting to Existing Manholes

A. When sewer line construction starts at an existing manhole, the sewer line shall be securely plugged, watertight, in a manner satisfactory to the inspector, as soon as the pipeline stub has been installed in the manhole. This plug shall be maintained in a watertight condition throughout the construction of the new sewer system until the system has been completed and the Contractor has been instructed by the Town to place the system in operation. The sewer shall be plugged in such a manner that the plug can be removed for pressure testing of the sewer. When the pressure tests have been completed, the plug shall be replaced and maintained as set forth above until the new sewer line is placed in service.

XI. Appurtenances

A. Flexible gaskets for pipe connection to manholes shall be PSX™ or Press-Boot™ by Press-Seal Gasket Corporation, or KOR-N-SEAL by NPC Inc., or approved equal.

B. Jointing mastic shall be an elastic, water-resistant formulation of plastic bituminous materials and inert fillers so combined that, when applied to a vertical metal surface and heated to 120 degrees F, the jointing mastic will neither slump nor lose plasticity. When applied directly from the container without further fixing, the jointing mastic shall provide even, adherent coating within the temperature range of 20 degrees to 100 degrees F.

C. Asphalt-based waterproof coating for exteriors of manholes shall be mineral-filled, solvent type meeting all requirements of MIL-C-82052.

D. Quick-setting, non-shrink grout shall conform to all requirements of Corps of Engineers CRD-588 (Octocrete, Speedcrete, or equal).

E. Sanitary sewer vents shall be provided where continuous watertight sections are greater than 1,000 feet in length.

XII. Protective Ring of Asphalt

At the time base pavement is laid on a street, if the final coat of asphalt is not to be applied at that time, a ring of asphalt must be placed around each sanitary sewer manhole to avoid damaging vehicles and snowplows. This protective ring of asphalt must be ramped around the manhole to permit a snowplow to travel over it without removing the manhole frame and cover from the structure. In the event that settlement occurs in any base pavement around manholes, remedial measures shall be taken to restore the pavement prior to final acceptance of the sanitary sewer and the street.

Section 7

Erosion and Sedimentation Control

I. General

A. The work in this section shall include, but is not limited to, construction and maintenance of berms and dikes, temporary diversion barriers, sediment traps, siltation ponds, temporary vegetation covers, and other measures to prevent and control erosion and sedimentation.

B. Plans submitted for approval shall conform to applicable Town and State Erosion and Sedimentation laws and regulations. In accordance with the Town of Berryville Erosion and Sedimentation Control Ordinance, the Lord Fairfax Soil and Water Conservation District is the plan-approving authority in the Berryville Area.

C. All work performed in the Berryville Area shall conform with the provisions of the Town of Berryville Erosion and Sedimentation Control Ordinance, the Commonwealth of Virginia Erosion and Sedimentation Control Handbook, and approved plans.

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Section 8

Excavation and Backfill

I. Excavation

A. General

The trench excavation shall be of sufficient size to permit the work to be properly performed in the manner specified. All work shall meet OSHA regulations. The width of trenches shall be such as to provide adequate space for workmen to place and join the pipe properly and in accordance with these specifications, but shall be kept to a minimum. Unless otherwise approved by the Engineer, the clear width of the trench at the level of the top of the pipe shall be related to the outside diameter (O.D.) of the pipe barrel as follows:

Pipe Size Inches	Trench Width Inches
less than 4"	24
4"- 12"	I.D. + 18
Larger than 12"	I.D. + 24

B. Earth Trench Excavation

1. The term "earth" as used herein shall include all material not requiring blasting, barring, or wedging for its removal from its original beds and specifically excludes all ledge or bedrock, boulders, or masonry larger than 1 (one) cubic yard in volume.
2. Material in the bottom of the trench deemed unsuitable by the Engineer shall be removed and replaced with material as hereinafter specified. Depth and width of removal shall be as directed by the Engineer. Excavation shall be performed in the immediate vicinity of adjacent and contiguous facilities by means that will not damage the facilities. Damage caused to existing facilities by the Contractor's operations shall be repaired at no expense to the Town.
3. The bottom of all pipe trenches shall be carefully graded and aligned so that the barrel of the pipe will have bearing for its full length. Where the nature of the soil is such that this cannot be readily accomplished, granular material shall be placed in the bottom of the trench and shaped to provide a continuous, firm bearing for the pipe barrel. Various laying conditions are shown on the Standard Details.
4. Trench excavation shall proceed no more than 75 feet in advance of the placing of backfill unless otherwise authorized by the Engineer. The Engineer may require backfilling and subsequent re-excavation on trenches left open an unreasonable amount of time in advance of laying of pipe, at no expense to the Town. Trenches left open overnight, or during periods when the

Contractor's forces are not present, shall be so protected or enclosed and marked as to cause no danger to the public or others.

5. Sides of trenches in improved public right-of-ways and adjacent to other structures shall be practically plumb. Where permitted by the Town, sides of trenches in other areas may be sloped from a point 1 foot above the top of the pipe to grade. Such slopes shall be at no additional cost to the Town. Slopes shall be such as will not allow displacement of material or danger to personnel.
6. Work performed in county or state highways shall be in accordance with Section 10 of these Specifications, as shown or specified herein, and as directed.

C. Rock Excavation

1. Rock shall be excavated, within the boundary lines and grades shown on the plans, or given by the Engineer, and shall be removed and disposed of as directed by the Engineer.
2. The term "rock" as used herein shall include all material requiring blasting, barring, or wedging for its removal from its original bed
3. For excavations in which pipe will be laid, the rock shall be excavated to a depth of 12 inches below the lower outside surface of the pipe barrel or bell and filled in to the proper grade with selected fill material properly graded and compacted to provide uniform support for the barrel of the pipe. The furnishing, placing, compacting, and shaping of the selected fill material shall be included as part of the rock excavation and no extra payment will be made therefor. Vertical limits for rock excavation shall be as specified hereinbefore.
4. For structures, the rock shall be excavated only to the bottom of the structure.
5. For pre-cast structures, a minimum of 12" bedding is required.
6. Where applicable, other requirements of this section, "Earth Trench Excavation," shall be followed.

D. Blasting

1. Blasting shall be performed by qualified personnel holding the required license issued by the Commonwealth of Virginia Fire Marshalls Office.
2. A pre-blast survey shall be made available to all property owners whose structures are within three-hundred (300) feet of the blast zone. Notification of the property owners is the responsibility of the developer. A minimum of 48-hour notice shall be given.
3. The Town Planning office shall be notified 48 hours prior to the commencement of blasting.
4. Blasting shall be performed as directed or approved as to number, length, placement, and direction, and loading of holes. The charges used shall not make the excavation unduly large or irregular, nor injure masonry or existing structures at the site or in the vicinity thereof. Each blast shall be covered with heavy timer or steel mats. Equipment used for drilling or holes shall have a positive means of dust control, subject to the Engineer's approval.

5. Whenever the Engineer determines the further blasting may injure or damage adjacent rock, masonry, or other structures, blasting shall be discontinued. In such case, the remaining rock shall be excavated by boring, wedging, or other approved method.
6. Blasting shall not be permitted within 25 feet of pipes or structures where sewers, gas, water, steam, or other utility ducts or lines, basin connections, or other structures have been exposed during excavation, such structure shall be adequately protected from damage before proceeding with the blasting. Any structure, pipeline, or conduit damaged by blasting shall be promptly repaired at no cost to the Town. Additional buffer distance may be required for blasting due to site conditions and type of pipe in ground. Inspection by the Public Works Director is required to determine blasting setbacks. Forty-eight (48) hours notice is required for the inspection.
7. Blasting shall not be carried on within 300 feet of any radio transmitter or radio frequency emission equipment such as high-frequency welders. Blasting caps shall be kept in tightly closed, all-metal cans when in the vicinity of such equipment.
8. Explosives
    a. A sufficient quantity of explosives shall be kept on the site to avoid delay to the work, but at no time shall there be a quantity in excess of that which will be required for use within the following 12 hours. Such explosives shall be stored, handled, and used in conformity with all state and local laws, ordinances, and regulations governing the storage and use of explosives. The Contractor shall take out permits and execute a bond therefor, as required by the ordinances of the jurisdiction in which the work is being done, relating to permits and bonds for blasting.
    b. The magazine keeper shall keep an accurate daily record and account for each piece of explosive, detonator, and equipment from the time of delivery at the magazine until used or removed from the site. In the event of loss or misplacement of blasting materials, the Contractor shall immediately notify the Engineer and local authorities having jurisdiction in such matters.

E. Unsuitable Material

In case the materials encountered at the elevations specified are not suitable, or in case it is found desirable or necessary to go to an additional depth, the excavation shall be carried to such additional depth as the Engineer may direct in writing. The Contractor shall refill such excavated space with either Class B concrete or sand, gravel, or other selected fill material, as ordered. Additional depth of excavation so ordered, and concrete or selected fill materials ordered for filling such additional excavation, will be paid for under the appropriate unit price items.

F. Unauthorized Excavation

Wherever the excavation is carried beyond or below the lines and grades given by the Engineer, except as specified herein, all such excavated space shall be refilled with such material and in such manner as may be directed in order to ensure the

stability of the various structures. Beneath all structures, space excavated without authority shall be refilled by the Contractor at his own expense, with Class B concrete or selected fill materials, as ordered by the Engineer.

G. Disposal of Material

Topsoil suitable for final grading shall be stored on the site separately from other excavated material. Other surplus excavated material, in excess of that required for backfilling around structures and in trenches, and for constructing fills and embankments as shown on the plans, shall be removed by the Contractor.

H. Shoring and Sheeting

1. All excavations shall be properly shored, sheeted, and braced to furnish safe working conditions and to prevent damage, accidents, and cave-ins. Such sheeting, shoring, and bracing shall be placed so as not to interfere with the construction work and shall be entirely independent of all footings and structures. If the Engineer is of the opinion, at any point, that the sheeting or supports furnished are inadequate or unsuited for the purpose, he may order additional sheeting and supports to be installed. Whether so ordered by the Engineer or not, sufficient sheeting or supports shall be installed to protect the work from any damage and to prevent damage to new or existing structures or property.
2. In general, the sheeting and bracing shall be removed, as the excavation is refilled, and in such a manner as to avoid the caving-in of the bank or disturbance to adjacent areas or structures. The voids left by the withdrawal of the sheeting shall be carefully filled by jetting, ramming, or otherwise, as directed. Permission of the Engineer shall be obtained before the removal of any shoring, sheeting, or bracing.
3. Such permission by the Engineer shall not relieve the Contractor of the responsibility for injury to structures or to other property or persons from failure to leave such sheeting and bracing in place.
4. The method of making excavation below groundwater level shall be submitted, in detail, to the Engineer and shall receive his approval before the work is started.

I. Sheeting Left in Place

1. The Engineer may order, in writing, any or all wood or steel sheeting or bracing to be left in place for the purpose of preventing injury to the structures, or to other property or persons, whether such sheeting or bracing was shown on the plans or placed at his direction, or otherwise. If left in place, such sheeting shall be cut off at the elevation ordered, but in general, such cutoffs shall be at least 18 inches below the final ground surface. Bracing remaining in place shall be driven up tight.
2. The right of the Engineer to order sheeting and bracing left in place shall not be construed as creating any obligation on his part to issue such orders.

J. Removal of Water
   1. All excavated areas shall be kept dry. No water shall be allowed to rise over or to come in contact with masonry placed during construction until the concrete and mortar has attained a set satisfactory to the Engineer and, in any event, no sooner than 12 hours after placing the masonry. Water pumped, drained, or otherwise removed from the work hereunder shall be disposed of in a suitable manner without damage to adjacent properties, to other work under construction, or to the street pavement. Water shall not be discharged onto streets without adequate protection of the surface at the point of discharge. No water shall be discharged into sanitary sewers and no water containing settlable solids shall be discharged into storm sewers.
   2. Any and all damage caused by dewatering the work shall be promptly repaired by the Contractor.

II. Backfilling

A. General
   1. All excavations shall be backfilled to the original surface of the ground or to such other grades as may be shown or directed. Before depositing fills, the Contractor shall remove all vegetative matter, mud, muck and otherwise unsuitable soils from the surfaces upon which fill materials are to be placed and fill irregularities and cavities.
   2. Backfilling and tamping specifications shall assure, at a minimum, that:
      a. Trenches are carefully backfilled with excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand and gravel, soft shale, or other approved material, free from large clods of earth or stones larger than 1 inch in diameter, deposited in 6-inch layers, and thoroughly and carefully tamped until the pipe has a cover of not less than 1 foot.
      b. The remainder of the backfill is placed in the trench in layers not exceeding 1 foot and thoroughly tamped. No stone or rock larger than 5 inches in its greatest dimension shall be used in backfilling.
      c. Trenches in public roadways shall be excavated, backfilled and compacted in accordance with the requirements of the Virginia Department of Highways and Transportation's Road and Bridge Specifications or other criteria approved by the Department.

B. Backfilling Around Structures and Conduits
   1. The backfilling around structures and conduits shall be carefully done by hand and tamped, with suitable tools of approved weight, to the top of such structures and conduits. The backfilling around pipes shall be carefully done by hand and tamped with suitable tools of approved weight. This material shall be approximately 6 inches thick, tamped and compacted in place.
   2. After the backfill has been made around the structures, conduits, and pipes as specified above, the remainder of the trench may be backfilled by machine, but the work shall be done in such a way as to prevent dropping of material directly on top of the structure, conduit, or pipe through any great vertical

distance. Material shall be deposited in horizontal layers. In no case shall backfilling material from a bucket be allowed to fall directly on a structure or pipe, and in all cases the bucket must be lowered so that the shock of the falling material will not cause damage.

3. When using various Laying Conditions, Type 1 through 5, to backfill ductile iron pipe, the methods used in backfilling and bedding the pipe shall be in strict conformance to AWWA C 150-76 (ANSI A21.50i), the details shown in the Standard Details or on the plans. The selection of the backfilling method shall be predicated upon the actual trench conditions encountered and shall be determined by the Engineer.

4. Where structures such as pipelines, walks, railroad tracks, and roadways are to be constructed or replaced later on backfilled areas, the Engineer may order the entire backfill in such areas placed in layers, rolled, rammed, or otherwise thoroughly compacted to a minimum of 95 percent density compaction to prevent after-settlement.

C. Selected Fill Material
   1. Selected fill material shall consist of bank-run sand and gravel, or similar material that is approved by the Engineer as suitable for the purpose intended. Selected fill shall be placed in the manner specified under "Backfilling" or as ordered by the Engineer.
   2. Granular materials used in installing pipe with Laying Condition Types 4 and 5 shall not exceed 3/4 inch in diameter and shall be either crushed rock or selected gravel. Graduations of materials used for this Laying Condition shall be approved by the Engineer.
   3. In a rock trench, at least 6 inches of selected fill material shall be placed for pipe bedding.
   4. All excavation done in roadways and along shoulders shall be backfilled with 21B stone and compacted to VDOT specifications.

Section 9

Top Soiling and Seeding

I. General

A. Work included: The work covered by this section consists of furnishing all labor, material, and equipment and the performing of all operations necessary or required to placed topsoil, final grade, fertilize, lime, seed, and mulch all graded and cleared areas, including those areas disturbed in the course of construction, in accordance with the specifications.

B. Quality assurance: Seed shall conform to the formula contained herein and be certified. The supplier shall furnish an affidavit stating that materials used conform to the specification requirements and submit state certification labels to the Engineer.

II. Products

A. Topsoil
   1. Shall be furnished from the on-site stockpile or from some other approved source.
   2. It shall be natural, friable, agricultural soil, possessing characteristics representative of soils in the vicinity that will sustain vigorous plant growth, free from stones larger than two (2) inches in diameter, roots, toxic substances and other foreign matter which might be detrimental to plant growth. Topsoil shall meet the requirements of the VDOT specifications, as amended.

B. Lime
   1. Shall conform to the standards of the Association of Official Agricultural Chemists.
   2. Ground agricultural limestone shall contain not less than 55% of total carbonates and shall be ground to such a fineness that at least 90% will pass a No. 10 mesh screen and at least 50% will pass a No. 100 mesh screen. Coarser material will be accepted provided that the specified rates of application are increased proportionately on the basis of quantities passing the 100 mesh screen. No additional payment will be made for the increased quantity.

C. Fertilizer
   1. Shall be a commercial type-10-10-10 (nitrogen-phosphoric acid-potash) and shall be uniform in composition, free-flowing and suitable for application with approved standard equipment.
   2. The fertilizer shall conform to applicable State fertilizer laws and shall be delivered to the site in bags or other containers each fully labeled and bearing the name, trademark, and warranty of the producer.

D. Seed
1. Shall be labeled or marked per accepted horticulture practice and shall comply with all current State and Federal regulations, and shall be furnished in sealed standard containers. Seed which as become wet, moldy or otherwise damaged in transit or storage will not be acceptable.
2. Seed and mixes shall be furnished with a certification from the seed company stating type of seed; percentages of mixture purity, germination, and weed seed.
3. The seed mix to be applied shall have the following minimum requirements:

	Purity	Germinator	Weed Seed	Lbs. Per 1,000 Sq. Feet
Kentucky-31	90	80	0.75	3.0
Merion or Common Kentucky Bluegrass	95	85	0.75	1.0

E. Mulch – Straw, Hay or Wood Cellulose
1. Straw and hay shall be free from noxious weeds, grain seeds, mold or other objectionable material and shall be in an air-dry condition and suitable for placing with mulch blower equipment. Asphalt binder shall be per AASHTO M-140, Grade SS-1.Wood cellulose shall be natural wood mulch, without toxic substances and foreign matter, packaged in air-dry containers capable of application with power spray equipment, and shall have a maximum pH of 9.0 in distilled water.

III. Execution

A. Preparation
1. The ground surface shall be cleared of stones, roots, cable, wire, grade stakes and any other material that might hinder proper grading and tillage, be harmful to plant growth, or hinder subsequent mowing and other maintenance operations. Sub-grades shall be loosened by dicing to a depth of not less than three (3) inches so that the loosened surface will readily bond with the topsoil.
2. Areas to be planted shall be graded as shown on the drawings and all surfaces shall be left in an even and properly compacted condition to prevent the formation of depressions where water will stand.

B. Application
1. Topsoil, Lime and Fertilizer
   a. Topsoil shall be specified, spread to a compacted depth of four inches for areas to be seeded, shall be raked to a smooth uniform surface and compacted with a lawn rolled weighting not less than 90 pounds per foot of roller width. Any bumps or depressions which develop shall be leveled or filled, as required, and rolled until a satisfactory grade is obtained.
   b. Lime and fertilizer shall be as specified, applied at the rate of 50 pounds per 1,000 square feet of lime, and 20 pounds per 1,000 square feet for

fertilizer. Not more than two (2) days afterward, the area shall be raked or harrowed in such a manner as to well work well the lime and fertilizer into the top two (2) inches of soil, which should then be thoroughly wetted.

2. Seeding and Mulching
   a. All seeding shall be accomplished by Hydroseeding methods. Hydroseeding shall be done by a three-step method using the application rates previously specified. The three steps shall be as follows:
      Step 1 – Apply lime and fertilizer.
      Step 2 – Apply seed mixture.
      Step 3 – Apply hydro mulch.
      Note: All mulching shall be accomplished by means of hydromulching except where slopes are steep and required tied down mulch, a straw or hay mulch as specified herein shall be used. However, under no circumstances shall straw or hay mulch be applied to the berms forming the detention ponds or the aeration lagoons. After slopes have stabilized, the contractor shall gather and removed from the site all straw and/or hay mulch.
   b. Straw or hay mulching shall be spread uniformly over seeded areas at the rate of 115 pounds per 1,000 square feet. It shall be anchored by the specified asphalt binder as follows:
      1. Binder applied as separate operation at 8 gallons per 1,000 square feet on slopes flatter than 3 to 1; 16 gallons per 1,000 square feet on slopes 3 to 1 and steeper.
      2. Binder applied simultaneously with straw or hay at 1.5 gallons per square yard as directed.
   c. The Contractor shall take all necessary precautions to prevent asphalt binder from marking or defecting structures, pavements, utilities, or plant growth. Any disfigurement shall be repaired at the Contractor's expense.
   d. Wood cellulose mulch, as specified, shall be applied evenly at the rate of 50 pounds per 1,000 square feet.

C. Seeding Seasons
   1. The normal seasonal dates for seeding sodding / sodding shall be:
      a. Spring Season – April 15 to May 20
      b. Fall Season – August 15 to September 15
   2. Seeding at other times than specified will be allowed only upon written approval. Seeding shall not be done during windy weather, when the ground is excessively wet, frozen or otherwise untillable.
   3. Temporary seeding, as required for erosion control, is to be applied according to the specifications of the local Soil Conservation District.

D. Seed Establishment Period
   1. The Contractor shall protect, provide proper care and maintain the seeded areas for at least 90 days after seeding is complete.
   2. The Contractor shall repair any damage to seeded areas without additional compensation and shall provide a uniform acceptable stand of grass.

3. The Contractor shall seed as soon as a unit or portion of the project is satisfactorily completed.
4. Maintenance shall consist of repair and replacement of eroded areas, watering, re-fertilizing, re-liming, re-seeding and re-mulching as necessary to provide an even fixed growth of grass.
5. The Contractor will provide protection against traffic and shall erect the necessary barricades and warning signs immediately after planting is completed.

Section 10

Work on State Highways

I. General

A. The Virginia Department of Transportation (VDOT) maintains primary roadways (Business Route 7 and US 340) within the Town of Berryville Corporate Limits.

B. The Contractor shall assume all responsibility for fulfilling any and all requirements specified herein and under the permit(s) obtained from the VDOT for work to be performed on state highways.

C. All applicable provisions as established by the "Land Use Permit Manual, Commonwealth of Virginia - Department of Highways and Transportation, Richmond, Virginia; 1983," and subsequent revisions thereto, shall apply to this work, including provisions for revocation of permit.

D. All work done under this permit within the road right-of-way shall, in all respects including location, alignment, elevation and grade; manner of performing the work; highway crossings; restoration and conditions; etc., be subject to VDOT direction and shall be done to the satisfaction of the Department.

Work on Town Streets

II. General

A. The Town of Berryville maintains public secondary streets within the Corporate Limits.

B. The Contractor shall assume all responsibility for fulfilling any and all requirements specified herein and under the permit(s) obtained from the Town of Berryville for work to be performed on Town street rights-of-way.

C. All applicable provisions as established by the "Land Use Permit Manual, Commonwealth of Virginia - Department of Highways and Transportation, Richmond, Virginia; 1983," and subsequent revisions thereto, shall apply to this work, including provisions for revocation of permit.

D. All work done under this permit within the street right-of-way shall, in all respects including location, alignment, elevation and grade; manner of performing the work; highway crossings; restoration and conditions; etc., be subject to Town of Berryville Department of Public Works direction and shall be done to the satisfaction of the Department.

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Section 11

As-Built Drawings

I. General

A complete set of as-built drawings and corrected key sheets shall be submitted by the developer or owner responsible for the construction upon completion of construction and at least one week prior to the anticipated occupancy of any building within the project. As-built drawings must be determined by actual field survey and sealed by the responsible surveyor or engineer. The following statement, signed by the responsible surveyor or engineer, shall be on each sheet: "I hereby state, to the best of my knowledge and personal belief, that the work shown on these plans was constructed to the direction and grades shown and are either installed within the Public right-of-way or properly recorded easements dedicated to the Town of Berryville". The as-built drawings shall show all revisions, substitutions, variations, omissions, and discrepancies made or discovered during construction concerning location and depth of utilities, piping, manholes, pumps, and other facilities. Revisions shall be made and shown on all drawing views with actual dimensions established to permanent points. The contractor shall keep daily as-built work plans at the construction site and shall furnish them to the design engineer for as-built drawing. In addition to the set of paper drawings, the developer or owner responsible for the construction must also submit a digital file of the as-built drawings that are in an AutoCad format.

The as-built drawings shall show, but not be limited to, the following:

I. Water Line Construction

A. Scale accuracy location plans of the line and all installed valves and fittings, such as elbows, tees, crosses and reducers, and all cradle encasements or special construction.

B. Exact measurements to show positive locations shall be taken from at least two reasonably adjacent and available, fixed and permanent objects, such as fire hydrants, centers of sanitary or storm sewer manhole casting covers, corners or lines extending from buildings, power poles, etc.

C. Type and sizes of all pipes.

II. Sewer Line Construction

A. Scale accuracy location of manhole inverts and top casting elevations and numerical notations of the exact elevations of same as determined by field survey after construction. Elevations shall be in datum of Clarke County.

B. Scale accuracy indication of lengths and grades and direction of lines between manholes and numerical notations of the exact length and grades, as determined after construction.

C. Scale accuracy location of concrete cradles, encasements or special construction.

D. Location of house services by measurement from the manhole immediately downgrade.

E. Type and sizes of all pipes.

III. Wastewater treatment facilities and pumping stations, water pumping stations, all other comparable construction and building structures:

A. As-built plans and specifications shall accurately indicate all approved deviations from or changes in locations or type of equipment installed and material used.

B. Accurate listings of the name of the manufacturer of all operating equipment installed, together with model or style numbers, ratings, capacities and other pertinent information shall be provided as part of the record plans on the project.

C. At least 3 complete sets of operation and maintenance manuals for all operating equipment and all certificates of inspections, warranties and guarantees of equipment, materials and the installation thereof, required by the project specifications which are approved by the Town Director of Utilities, shall be provided as part of the record drawings on the project.

IV. Storm Sewer Construction

A. Scale accuracy location of structures, providing all invert elevations, distances between structures, elevation of structure tops, and diameter of pipes.

V. Stormwater Management Facilities

A. Acceptable as-built drawings for stormwater management facilities utilizing an embankment shall contain:
   1. A profile of the top of the dam.
   2. A cross-section of the emergency spillway at the control section.
   3. A profile along the centerline of the emergency spillway.
   4. A profile along the centerline of the principal spillway, extending at least 100 feet downstream of the fill.
   5. The elevation of the principal spillway crest.
   6. The elevation of the principal spillway conduit invert (inlet and outlet).
   7. The diameter, length, and type of material for the riser.
   8. The diameter, length, and type of material for the conduit.

9. The size and type of anti-vortex and trash rack devices and their elevations in relation to the principal spillway crest.
10. The number, size, and location of the anti-seep collars.
11. The diameter and size of any low-stage orifices or drain pipes.
12. The length, width, and depth or contours of the pool area so that design volume can be verified.
13. A certification statement and seal by a Professional Engineer that the as-built is accurate and complete and that the pond, as constructed, meets the requirements of the standards and specifications for ponds.

When the as-built drawing information differs from the approved construction plans, a design analysis for the existing conditions may be required. After the record drawings are approved in writing by the Department of Public Works and the Town Engineer, a set of three drawings and an electronic copy of all drawings in pdf format shall be submitted. Projects which include water and/or sewer facilities which are located within a VDOT right-of-way will require four additional sets of drawings for the remain-in-place permit.

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STANDARD SPECIFICATION
SECTION 12
CONSTRUCTION RECORD

WATER & WASTEWATER DISTRIBUTION SYSTEM:_____

	Water	**Sewer**
Developer		
Provide 5 copies of preliminary plans to the Planning Department	_____	_____
Pay appropriate fees	_____	_____
Planning Department		
Circulate preliminary plans to:		
Town Engineer	_____	_____
Public Works Department	_____	_____
Town Council Water/Sewer Committee	_____	_____
Other	_____	_____
Public Works Department		
Review Plans	_____	_____
Forward review comments to Planning Department	_____	_____
Town Engineer		
Review Plans	_____	_____
Forward review comments to Planning Department	_____	_____
Planning Department		
Forward comments to Developer	_____	_____
Developer		
Submit revised plans	_____	_____
Submit executed agreement	_____	_____
Planning Department		
Submit revised plans to:		
Town Engineer	_____	_____
Public Works Department	_____	_____
Town Council Water/Sewer Committee	_____	_____
Approving authority	_____	_____
Submit plan to following as necessary:		
Virginia State Department of Health	_____	_____
Department of Environmental Quality	_____	_____

Planning Department:

Upon submission of plans that meet all applicable requirements and address comments received from reviewing authorities:

Submit plans to approving body	_____	_____
APPROVE FINAL PLANS	_____	_____

Developer

Post off-site performance surety	_____	_____
Post on-site performance surety	_____	_____
Provide agreement recordation fees	_____	_____
Submit construction permit request	_____	_____
Schedule preconstruction conference	_____	_____
Submit off-site easement deeds	_____	_____
Record deeds of easement	_____	_____

Public Works and Planning Department

Conduct preconstruction conference	_____	_____
ISSUE CONSTRUCTION PERMIT	_____	_____
Record agreement	_____	_____

Developer

Record off-site easement deeds	_____	_____
Bring roads and ditches to final grade	_____	_____
Disinfect completed system, flush, and submit bacteriological samples	_____	_____
Submit capital cost data and request tentative acceptance in writing	_____	_____

Public Works

Review inspections for tentative acceptance	_____	_____
Require or conduct additional inspections (charged to Developer)	_____	_____

Developer

Correct operational deficiencies	_____	_____

Public Works

GRANT TENTATIVE ACCEPTANCE	_____	_____

Developer

T.V. sewer lines; submit copy of tape(s) to Town	_____	_____
Correct deficiencies	_____	_____

Public Works/Planning Department
Reduce performance bond _____ _____

Developer
Pave roads & adjust valves & manholes _____ _____
Correct remaining deficiencies _____ _____
Submit construction completion certificate to VDH _____ _____
Provide paper and digital record drawings
and paper shop drawings _____ _____
Request final acceptance in writing _____ _____
Submit letter stating system is paid for in full _____ _____
Post 10% defect bond + cost of final T.V. inspection _____ _____
Pay any inspection fees _____ _____

Public Works/Planning Department
GRANT FINAL ACCEPTANCE _____ _____

Release performance bond _____ _____
Inspect for defects (9 months) _____ _____

Developer
Correct defects _____ _____

Public Works
Release performance bond and close record _____ _____
Inspect for defects by T.V. (9 months) _____ _____
Release defect bond and close record _____ _____

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Section 14

Minimum Standards for Wastewater Pumping Stations

I. Design Criteria

A. General

The purpose of this document is to establish minimum technical and design standards for developers and engineers for the design and acceptance of wastewater pumping stations within the service area of the Town of Berryville. The standards are intended to ensure uniformity and quality of construction for wastewater pumping stations throughout the Town. Any deviation from the standards contained herein shall be subject to the approval of the Town Engineer and Superintendent. Plans and specifications shall be prepared and certified by a professional engineer registered in the Commonwealth of Virginia.

Certain equipment manufacturers have been noted herein for the purposes of establishing standards for the level of quality for materials and workmanship, reliability, ease of maintenance, and minimization of spare parts inventory. Other equipment may be used, but must be pre-approved by the Town Engineer and Superintendent. The pumping station and all appurtenant equipment and materials shall be new and unused.

If the property to be served by a pump station is located within the same drainage area as other undeveloped or underdeveloped land situated within the limits of the Berryville Area, the Town may require an increase or modification in sizing or design of the building, wet well, pumps, mains and/or other associated improvements.

After the construction plans and specifications for pumping stations have been completed by the design engineer and have received approval by the Town, the design engineer shall submit the plans to the Virginia Department of Environmental Quality (DEQ), Valley Regional Office along with a stamped and signed application for a Certificate to Construct certifying that the pump station design is in accordance with the Sewage Collection and Treatment Regulations and complies with the reliability requirements as calculated by the DEQ Reliability Requirement Work sheet. A copy of DEQ's approval and issuance of the Certificate to Construct must be provided to the Town prior to final approval by the Town of Berryville.

Upon completion of the construction of the pumping station, the design engineer shall inspect the station; review reports by the equipment manufacturer's field representatives; and request written documentation from the Town that the station is acceptable. The design engineer shall then submit to DEQ a stamped and signed application for a Certificate to Operate (CTO). A Certificate to Operate (CTO)

for each pump station must be issued prior to its acceptance by the Town of Berryville.

B. Design Data
   1. The pump station design shall comply with all Virginia Department of Environmental Quality regulations, and Town Standards.
   2. Pumps shall be capable of handling the maximum peak hourly flow with one unit out of service. A minimum peak factor of 2.5 is required.

C. Site Requirements
   1. The site of any pumping station, where all equipment is not completely enclosed within a building or if the emergency generator is located outside of the main station structure in its own sound attenuating enclosure, shall be protected by a chain link fence at least 6 feet in height. One 3-foot walk-through gate and one 10-foot drive-through gate shall be provided. The grounds within the fenced area shall be covered with a weed barrier and 4 inches of stone (21B) and shall contain no slopes exceeding 15 percent.
   2. Access to the station shall be via a dedicated asphalt or concrete paved road of single lane width. In unusual cases, curbs and gutters may be required by the Town Engineer. In no case shall the profile grade exceed 15 percent.
   3. All grounds are to be landscaped or seeded with grass. Slopes requiring mowing shall not exceed 15 percent.
   4. The pumping station shall be designed to remain fully operational and accessible during a one-hundred (100) year flood event.
   5. The pumping station shall be located within a dedicated easement or fee-simple lot dedicated to the Town of Berryville.
   6. All pump station lots shall have screening with a Town-approved evergreen species of trees and/or tall shrubs along the property lines, and other areas as determined by the Town Director of Public Works.

D. Pumping Station Building
   1. The building shall be precast concrete with a faux brick finish (desert sand), have a minimum 8 foot clear ceiling height, 12 foot overall width and 20 foot overall length. The size may be increased or decreased at the discretion of the Town Engineer or Director of Utilities to provide adequate clearance for equipment operation and maintenance. The building shall have one 6'-0" x 6'-8" fiberglass or aluminum insulated double door with key lock and stainless steel hardware. The building shall have no windows. The interior walls and ceiling to be primed and painted with an alkali resistant primer, and white 100% acrylic industrial enamel finish coat. (Primer: Pittsburgh 6-603, Finish Pittsburgh 90-374 or approved equal.) The roof shall be shingled with thirty year asphalt shingles and have a minimum 5/12 pitch. The roof pitch shall conform to other structures in the area.
   2. Key locksets to the Town of Berryville's existing master-key system. Deliver four (4) master keys to the Town only.

3. A minimum 3'-0" of unobstructed floor space shall be provided in all directions around the pumping equipment or as otherwise accepted by the Town Engineer or Superintendent.
4. A ventilator shall be provided using forced air as opposed to exhaust. Ventilation requirements are 12 air changes/hour for continuous duty or 30 air changes/hour for intermittent duty. A ventilation louver shall be provided on the wall opposite to the ventilation fan.
5. No manholes or wet well entrances shall be located inside the pumping station building.
6. Water service shall be provided by one ¾-inch hose bib and sink located inside the building. This service must have a reduced pressure zone device as its backflow protection.
7. Sufficient electric heat shall be provided so as to prevent freezing inside the building at –10°F ambient temperature.
8. One outside entry light shall be provided near the entrance door. Provide adequate illumination for all areas in the station and the control panel, a minimum of 2 watts illumination per square foot shall be provided. This lighting shall be supplied by the required number of fluorescent type lighting fixtures, each having two (2) 40 watt fluorescent tubes and separate ballasts. A light switch shall be located adjacent to each door opening. Lighting circuit shall be protected by a thermal magnetic circuit breaker. All exterior lighting is to be controlled via a switch located on the inside of the building near the door entrance.
9. A minimum of two 110-volt receptacles shall be provided with ground fault protection and waterproof covers.
10. In general, the building type and architecture should match and compliment adjacent buildings and properties. It shall also meet all applicable building codes.

E. Wet Well
1. All penetrations through the slab to the wet well shall be sealed to prevent sewer gas leakage.
2. An aluminum door shall be provided for access to the wet well sized to provide a minimum 30"x30" clear opening. The door shall have a 300 lbs./square foot load rating with automatic hold open arm.
3. The bottom of the wet well shall be sloped 1:1 toward the pump suction inlet to minimize solids settling. Slope shall begin below pumps off elevation.
4. The wet well shall have a ductile iron 4-inch vent pipe with a 180°turn-down outside of the building. The vent pipe must be screened with stainless steel screen.
5. A ladder or manhole rungs of corrosion-resistant materials shall be provided to provide access to the bottom of the wet well.
6. For 3-inch self-priming pumps or submersibles passing 2.5-inch solids, a strainer basket to remove rags shall be required. The strainer basket bars shall be 2 in. on center and the basket mounted on guide tracks and removable without entering the wet-well. The basket and guide tracks shall be

constructed of welded aluminum and anchored with stainless steel nuts and bolts. Provide aluminum winch stand for removal of basket.

7. The wet-well volume shall be of sufficient capacity to ensure that the time between pump run cycles is within the requirements of the electric motor manufacturer. For duplex pumping stations with alternating pumps, the wet-well cycle time between pump on and pump off levels shall be a minimum of 10 min. for motor sizes less than 15 HP or 15 min. for motor sizes greater than 15 HP when the inflow to the wet well is one-half of the pump rated capacity.
8. Provide adequate distance between the pump off level and the pump suction intake pipe to prevent vortexing.
9. To prevent concrete deterioration from hydrogen sulfide and other sewer gases, the wet well shall be coated with Sherwin Williams Cor-Cote SC Sewer-Cote or an approved equivalent. Surface preparation and coating application shall follow manufacturer's guidelines.

F. Pumps & Associated Controls

Unless performance conditions prohibit their use, all pumps shall be the suction lift type with pumps, motors, valves, and controls located inside a weatherproof above-ground enclosure. Basic details of these suction lift pumps shall include:

1. The pumps shall be located above grade inside the pump station building. Suction lift pumps shall be Super T-Series (or T-Series) as manufactured by the Gorman Rupp Company of Mansfield, Ohio or a Town of Berryville approved equivalent. Discharge piping and controls shall be furnished by Gorman-Rupp or a Town of Berryville approved equivalent. Each pump shall have a large cover plate opening to allow for unclogging and removal of the impeller. Each pump shall be equipped with the following:
   a. Spring-assisted discharge check valve.
   b. Discharge plug valve.
   c. Air release valve, automatic, spring-assisted.
   d. Suction and discharge gauges, glycerin-filled 3-1/2" diameter.
   e. Drain valve with quick connect piping.
   f. High pump temperature thermostat.
   g. Pump controls shall be manufactured by Gorman-Rupp and employ an electronic pressure switch air bubbler wet well level controller with digital readout of wet well level. The pump controller shall be equipped with high wet-well level alarm capability.
   h. All pumps shall be equipped with fixed speed ODP enclosure motors equipped with OSHA-compliant V-belt drive for setting the design pump rpm. Pumps shall be of non-clog design capable of passing a minimum 2-1/2-inch sphere for 3-inch pumps and a minimum 3-inch sphere for larger pumps through all openings within the pump.
   i. For any design flow, a minimum of two fixed speed pumps shall be provided; each capable of pumping in excess of the peak hourly flow.
   j. Pumps, motors, valves, piping and controls shall be tested as a unit at the pump manufacturer's facility prior to shipment. Provide Town Engineer

with a copy of the certified test data. Suction lift pumps must include certified reprime performance tests.

k. All valves shall have ports designed to pass 3-inch spherical solids.
l. Pumps shall be designed to create a low-pressure area within the pump housing to initiate priming. No vacuum-assisted priming systems will be acceptable.
m. The station shall be equipped with an emergency by-pass connection with both suction and discharge connections. Connections shall be a minimum 4 inch aluminum cam and groove connector with a cover plate and required valveing to isolate pumps and connectors. The by-pass connection shall terminate outside the station enclosure.
n. The pump station controls must provide pump alternation and protection from short circuits, overloads, and low voltages on all phases.
o. Provide the following spare parts for each pump:
    i. Mechanical seal
    ii. Cover Plate o-ring
    iii. Shaft sleeve
    iv. Suction flap valve
    v. Sufficient volume of seal lubricant to perform one lubricant change in all pumps with a minimum volume of 2 quarts.
    vi. Impeller
    vii. Wear plate

Where suction lift pumps cannot be used, pumps shall be submersible with all valves and controls located above ground in a weatherproof enclosure. Basic details of submersible pumps shall include:

1. The pumps shall be specifically designed for submersible duty in a sewage environment, and shall be as manufactured by The Gorman-Rupp Company of Mansfield, Ohio or pre-approved equal. All valves, gauges, and controls shall be supplied by the pump manufacturer and shall be located above ground in a weatherproof fiberglass enclosure. Enclosure to be positively sealed from wet well. Each pump shall be equipped with the following:
    a. Discharge check valve
    b. Discharge plug valve
    c. High motor winding temperature thermostat
    d. Motor housing moisture detector
    e. Discharge gauge kit, glycerin-filled, 3½ inch diameter
2. Pump controls shall be manufactured by the pump manufacturer and employ an electronic pressure switch air bubbler wet well level controller with digital readout of wet well level. The pump controller shall be equipped with high wet well level alarm capability.
3. All pumps shall be equipped with a fixed-speed motor with water-proof enclosure. Motors shall conform to NEMA standards, and shall be capable of operating in liquids with a maximum temperature of 40 degrees C. Motors and power cables shall be supplied as an assembly, and all components shall be water-

tight such that the assembly is capable of operating at a continuous submergence of 65 feet without loss of water-tight integrity.

4. For any design flow, a minimum of two fixed speed pumps shall be provided; each capable of pumping in excess of the peak hourly flow.
5. Pumps, valves, motors, piping and controls shall be tested as a unit at the pump manufacturer's facility prior to shipment. Provide Town Engineer with a copy of the certified test data.
6. All valves shall have ports designed to pass 3-inch spherical solids.
7. Provide stainless steel guide rails, sized in accordance with the pump manufacturer's recommendations, for each pump. If desired by the Town Engineer, provide a portable hoist and winch assembly suitable for lifting the pumps. Hoist socket shall be permanently installed on station slab.

G. Electrical

1. Electrical service shall be 3-phase, 60 HZ, 460 volt.
2. Phase conversion equipment to convert single phase power to three phase power shall not be acceptable.
3. Control voltage shall be 110 volt.
4. Electrical components shall be as manufactured by Allen-Bradley, General Electric, or Furnas. Circuit breakers shall have through the door operating mechanisms to prevent the door from opening when the breakers are in the "on" position. Motor starters, relays and selector switches shall be NEMA rated. Enclosure shall be stainless steel.
5. The pump control panel shall be manufactured by the pump manufacturer. Each panel shall be built by a UL panel builder and the assembly shall bear a serialized UL label for "Enclosed Industrial Control Panels". All wiring, workmanship, and schematic wiring diagrams shall be in compliance with the National Electric Code (NEC).
6. Pump stations shall be equipped with the necessary equipment to interface with the Town SCADA system as determined by the Director of Utilities. Provide the following minimum alarm conditions; high water alarm, pump fail to start, high pump temperature, power failure, engine overcrank, battery failure, and high engine temperature. A separate float switch shall be wired directly to the SCADA to serve as an independent high water alarm.
7. All equipment shall be wired for automatic restart capability after restoration of power.
8. Elapsed time meters shall be provided for each pump on the motor control panel.
9. The pump station controls must provide pump alternation and protection from short circuits, overloads, and low voltages on all phases.
10. Pump stations shall be equipped with an emergency generator and automatic load transfer switch. If the generator is installed outside the main station building, it shall be located inside a sound attenuating enclosure and fencing and screening shall be provided per Section 14. C. 1. Units shall be powered by natural gas or LP gas. If LP gas is used, provide calculations on storage tank sizing. Fuel tank is to be sized to allow for five days of continuous operation. Provide a 115 volt battery charger to maintain the charge on the 12 volt DC battery supplied with the engine.

11. LP Fuel tanks shall be designed for underground storage meeting ASME standards and installed following NFPA 58 standards. A minimum of twelve (12) inches of sand shall surround the tank to allow for improved water draining. Tank domes shall be equipped a drain leading to a location lower than the dome and away from the tank. Cathodic protection is to be provided for all LP tanks. Tanks installed in flood plains must be properly anchored to a four (4) inch think slab buried at least seventy (70) inches below grade with four eye bolts installed in the slab at time of pour If underground storage is not possible and a waiver is granted by the Town's Director of Utilities or the Town Engineer, above ground installation following the NFPA 58 standards is required and screening shall be provided as determined by the Town Planner.

H. Force Main
   1. Force main and fittings of diameters 4 inch and larger shall be Polyvinyl Chloride (PVC) manufactured in accordance with ANSI/AWWA C900.
   2. All PVC SDR Series pipe shall be manufactured from a Type I, Grade I Polyvinyl Chloride (PVC) compound with a Cell Classification of 12454 per ASTM D1784. The pipe shall be manufactured in strict compliance to ASTM D2241, consistently meeting and/or exceeding the Quality Assurance test requirements of this standard with regard to pressure rating, material, workmanship, burst pressure, flattening, impact resistance, and extrusion quality.
   3. All force mains shall be pressure tested in accordance with procedures in ANSI/AWWA C 600.
   4. Depth of cover shall be a minimum of 4' - 0".
   5. A by-pass connection with a quick connect coupling and shut-off plug valve shall be installed inside the pump station building on the discharge header to allow for bypass pumping into the force main.
   6. Force main shall be designed to operate at velocities between 2.0 and 5.0 feet per second.
   7. Minimum force main pipe diameter is 4-inch, unless otherwise approved by the Town Engineer, and unless a grinder pump is to be utilized. Force main sizing to be coordinated with pump design for optimum performance.

I. Start-Up
   1. Start-up and equipment check operations shall be performed by an authorized service technician from the original equipment manufacturer.
   2. The Town Engineer shall be notified forty-eight hours prior to start-up and a Town representative shall be present during the period of start-up.
   3. A copy of the technician's start up report showing all field data control, set points and equipment condition shall be furnished to the Township Engineer.
   4. Sufficient water for start-up and equipment check shall be the responsibility of the developer.

J. Submittals
   Prior to beginning work on the station the following data shall be submitted to the Town Engineer for approval:

1. A completed application form.
2. All calculations and assumptions for the system head curve, total dynamic head, flow quantification, wet-well volume, pump duty cycle at average and peak daily flow, force main line velocity, as well as any other design calculations.
3. Site plan showing subject pumping station relative to area under development and the existing sewer system.
4. Building blueprints for the pumping station.
5. All pump curves.

Prior to acceptance of the pumping station, the following shall be submitted to the Town Engineer:

1. Three copies of the equipment submittal drawings.
2. Three copies of the manufacturer's O/M manuals for all mechanical and electrical equipment.
3. Recommended spare parts list from the equipment manufacturer.
4. One copy of manufacturer's certified test data including reprime performance tests.

II Summary of Design Criteria

DESIGN PARAMETER	DESIGN VALUE
1. FLOW DEVELOPMENT	
a. Single family dwellings, GPD/capita	100
b. Others	per accepted text or manuals
2. RATIO OF PEAK HOURLY FLOW/DESIGN AVERAGE FLOW	2.5
3. SITE	
a. Fence	chain link (6' min.)
b. Roadway	asphalt or concrete, single lane, less than 15% grade
c. Maximum landscaped slope, %	15
d. Flood protection, flood event	100 Yr.
4. BUILDING (unless alternate is approved)	
a. Minimum clear ceiling height, ft.	8
b. Unobstructed floor space around pumps, ft.	3
c. Ventilation requirements, air changes/hr	12 continuous, 30 intermittent
d. Potable water service line, in	3/4
e. Interior lighting, 2 bulb, 40W fixtures	2 watts/SF minimum
f. Interior electrical receptacles, 110 volt	2
5. WET-WELL	
a. Minimum wet-well bottom slope	1:1
b. Detention time between pump run cycles, min.	15

6. PUMPS	
a. Maximum pumping rate	2x designed peak pump station influent
b. Minimum number of pumps	2
c. Pump type	suction lift, constant speed unless conditions prohibit
7. ELECTRICAL	
a. Incoming service, volt/phase	460, 3 phase
b. Control voltage, volts	110
8. FORCE MAIN	
a. Pipe material of construction	C 900 PVC
b. Depth of cover, ft.	4
c. Line velocities, fps	2.0-5.0

APPLICATION FORM FOR WASTEWATER PUMPING STATION

All construction plans and specifications for pumping stations must be submitted to the Virginia Department of Environmental Quality, Valley Regional Office, for review and approval. A copy of the DEQ's approval must be provided to the Town, prior to final approval by the Town of Berryville.

A. General Information

1. Name of project served _____
2. Total area served, acres _____
3. Estimated start of construction _____
4. Estimated completion date _____

B. Applicant

I, the undersigned, am fully aware that the statements made in this application for approval of a wastewater pumping station are true, correct and complete to the best of my knowledge.

_____ _____
Mailing Address Signature of Applicant

_____ _____
Telephone No. Name and Title

_____ _____
Date Representing

C. Engineer

This is to certify that this application has been prepared under my direction and the plans and specifications for this wastewater pumping station have been designed by me and are in conformance with sound engineering practices.

_____ _____
Mailing Address Signature of Engineer

_____ _____
Company Name Name

_____ _____
Telephone Number Registration No.

_____
Date

APPLICATION FORM FOR WASTEWATER PUMPING STATION PAGE 2

D. Critical Elevations

1. 100 year flood _____
2. Top of pumping station structure _____
3. Influent line in wet-well _____
4. Bottom of wet-well _____
5. Pump on _____
6. Pump off _____

E. Quantification of Design Flow

	UNITS	@	GAL/UNIT	GPD
1. Single Family Dwellings	_____	@	_____	_____
2. Condominiums, Apartments	_____	@	_____	_____
3. Swimming Pools	_____	@	_____	_____
4. Motels	_____	@	_____	_____
5. School	_____	@	_____	_____
6. Commercial	_____	@	_____	_____
7. Industrial	_____	@	_____	_____
8. Other	_____	@	_____	_____

Average Daily Flow _____ GPD
Minimum Daily Flow _____ GPD
Peak Hourly Flow _____ GPD
Peaking Factor _____

F. Design Information

1. Head
   a. Static head, ft _____
   b. Total dynamic head, ft _____

2. Wet-Well
   a. Volume, CF _____
   b. Detention time at peak hourly flow, min. _____
   c. Time between pump starts _____
   d. Ventilation present _____
   e. Strainer basket present _____

3. Pumps
   a. Pump manufacturer/Model No. _____
   b. Number of pumps _____
   c. Type of pumps _____

APPLICATION FORM FOR WASTEWATER PUMPING STATION PAGE 3

d. Pump capacity
No. 1 _____ GPM @ _____TDH; _____ HP
No. 2 _____ GPM @ _____TDH; _____ HP
e. Pump controller
Manufacturer/Model No. _____

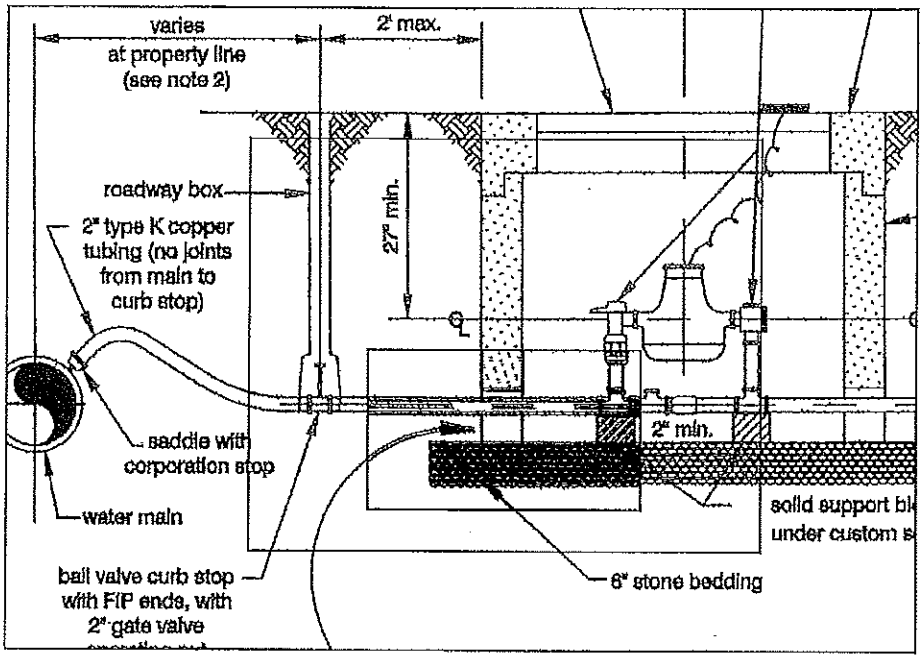
4. Force Main
a. Pipe material of construction _____
b. Pipe diameter, inches _____
c. Line velocity _____
d. Depth of cover, ft. _____

5. Electrical
a. Electrical service manufacturer _____
b. Voltage, Phase _____
c. Automatic restart capability _____
d. Alarm manufacturer/Model No. _____
e. Emergency generator, standby engine or portable engine driven pump _____

6. Building
a. Interior 3/4" hose bib present _____
b. Minimum unobstructed distance around equipment, ft. _____
c. Overhead support beam present _____
d. Ventilator present _____
e. Number of 110 volt electrical receptacles _____
f. Area of building, SF _____

7. Submittals attached with this application
a. Calculations _____
b. Site plan _____
c. Building blueprints _____
d. Pump curves _____

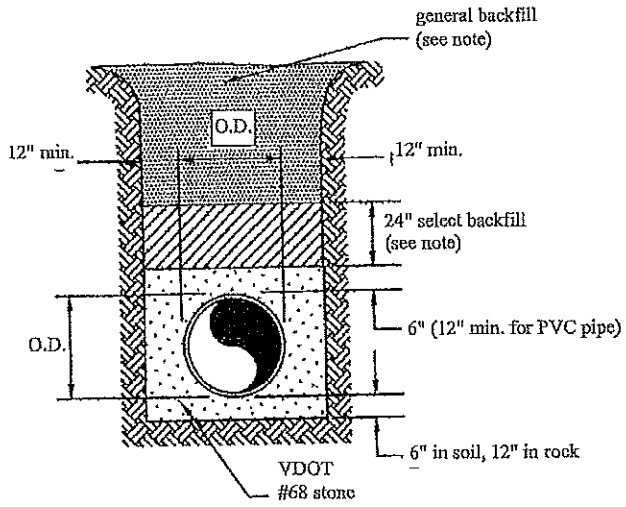
Town of Berryville



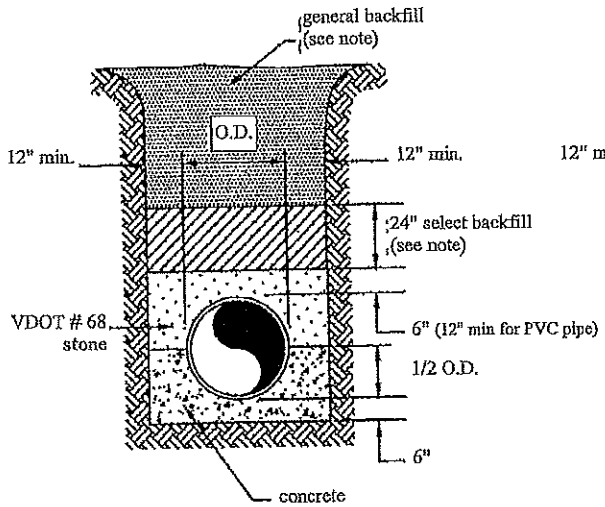
Standard Details

April • 2015

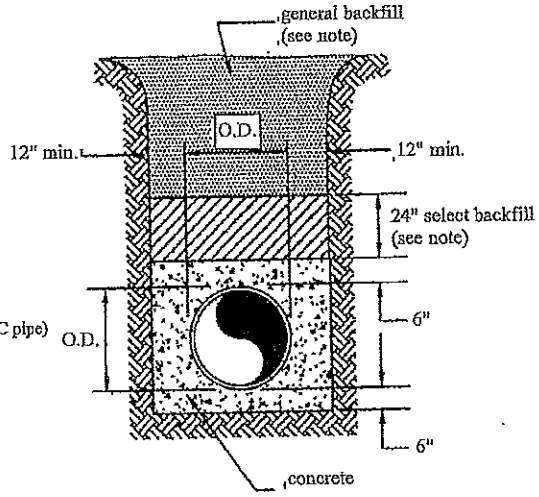
Updated September 2016



STANDARD



CONCRETE CRADLE

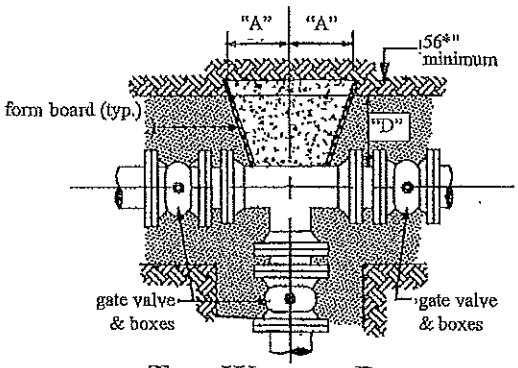


Concrete Encasement

NOTE: Backfill to be compacted to at least 95% of maximum dry density per ASTM D698 placed in maximum eight (8) inch lifts..

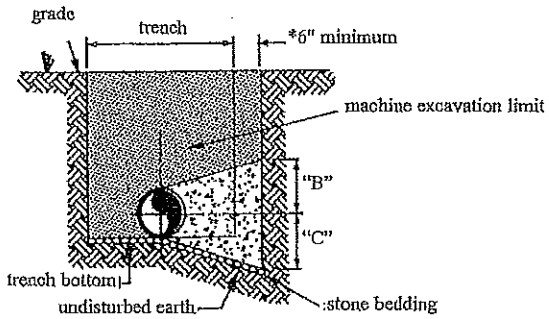
TRENCH & BEDDING

Figure 1



TEE, WYE, OR PLUG

In lieu of wood forming, the fitting may be wrapped with polyethylene and the concrete poured to completely surround the fitting against undisturbed soil. The bearing dimensions against undisturbed soil shall remain as shown.

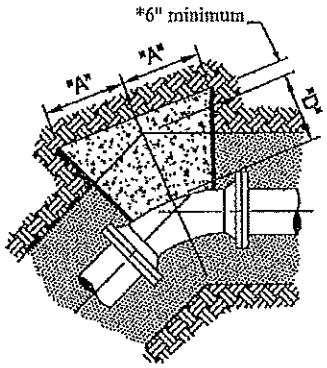


TYPICAL SECTION

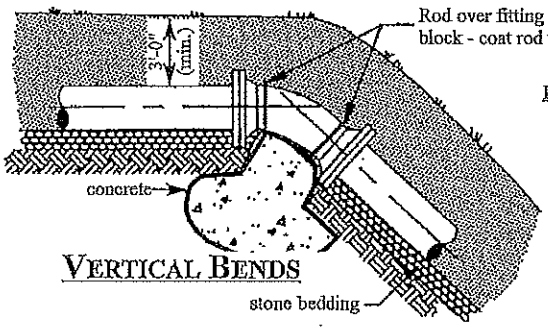
* denotes hand excavation
"D" = 12" min. for 10" and smaller pipe
"D" = 18" min. for 12" thru 20" pipe
see chart below for A, B, C dimensions

CONCRETE DIMENSIONS FOR HORIZONTAL THRUST BLOCKS

PIPE DIA.	PLUGS, WYES & TEES			11¼° AND 22½° BENDS			45° AND 90° BENDS		
-	A	B	C	A	B	C	A	B	C
6"	1'-0"	0'-9"	1'-0"	0'-9"	0'-9"	0'-9"	1'-3"	0'-9"	1'-9"
8"	1'-3"	0'-9"	1'-3"	0'-9"	0'-9"	0'-9"	1'-6"	0'-9"	2'-3"
10"	1'-6"	0'-9"	1'-3"	1'-0"	0'-9"	1'-3"	1'-9"	0'-9"	2'-6"
12"	1'-9"	1'-0"	2'-6"	1'-3"	1'-0"	1'-6"	2'-0"	1'-0"	3'-0"
14"	2'-0"	1'-0"	3'-0"	1'-3"	1'-0"	1'-6"	2'-6"	1'-0"	4'-0"
16"	2'-3"	1'-0"	3'-6"	1'-6"	1'-0"	2'-0"	2'-9"	1'-0"	4'-6"
18"	2'-6"	1'-3"	3'-9"	1'-6"	1'-3"	2'-0"	3'-0'	1'-3"	4'-9"
20"	2'-9"	1'-6"	4'-0"	1'-9"	1'-6"	2'-0"	3'-3"	1'-6"	5'-0"



11¼° THRU 90° BENDS



Rod over fitting and embedded in concrete thrust block - coat rod with foundation coating.

VERTICAL BENDS

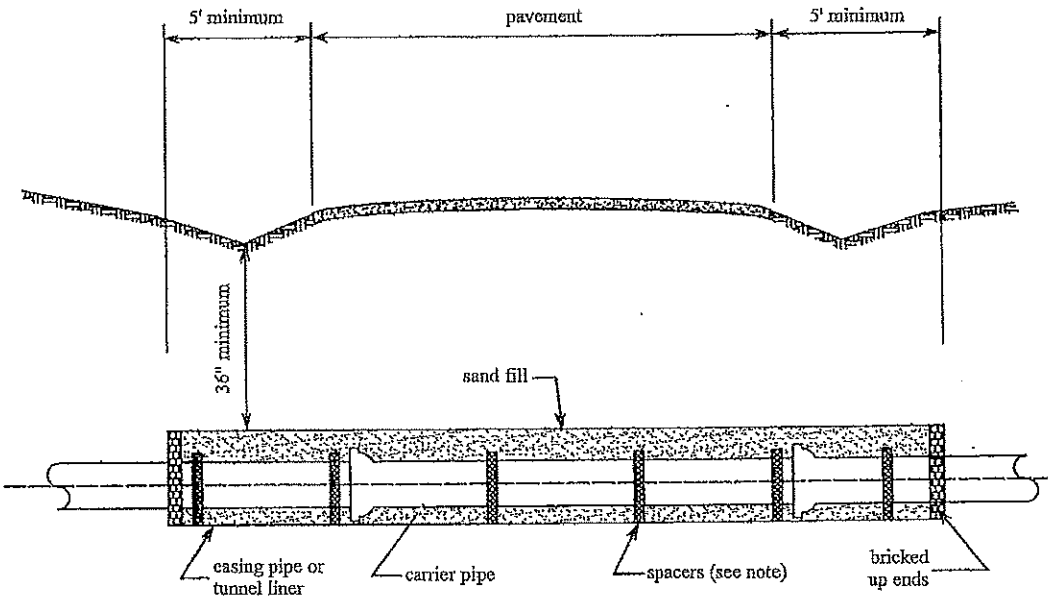
FITTING SIZE	ROD SIZE	NO. RODS	EMBEDMENT
12" & Less	6	2	30"
14" - 20"	8	2	36"

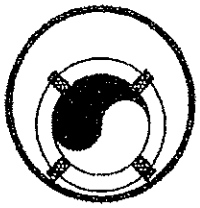
FITTING SIZE	VOLUME OF THRUST BLOCK PER CUBIC YARD			
	11¼°	22½°	45°	90°
6"	-	-	-	1.3
8"	-	-	1.1	2.3
10"	-	-	1.8	3.7
12"	-	1.2	2.8	5.5
14"	0.5	1.7	3.9	7.6
16"	0.9	2.3	5.1	-
18"	1.4	3.2	6.3	-
20"	2.2	4.5	7.8	-

THRUST BLOCKS FOR VERTICAL UP BENDS SHALL BE THE SAME AS FOR HORIZONTAL BENDS.

CONCRETE THRUST BLOCKING

Figure 2





SECTION

NOTE:
1. Separation of carrier pipe shall be by manufactured casing spacers with plastic runners.
2. Spacers shall be placed on spigot end within 6 inches of connection to bell; then 2 spacers evenly placed on length of pipe.

SIZES REQUIRED

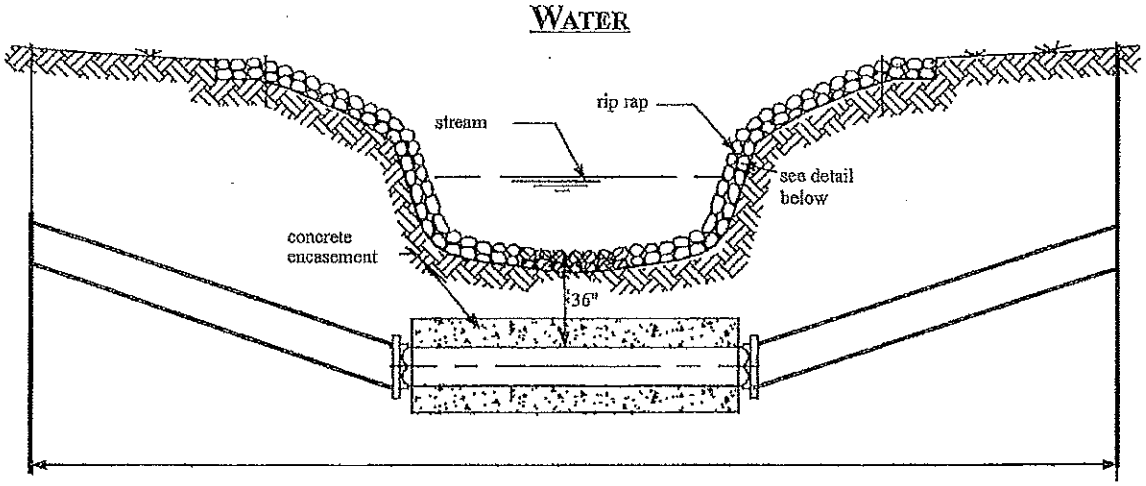
Carrier Pipe Dia. (")	Casing Pipe Dia. (")	Wall Thickness (")
4 or less	12	.250
6	16	.250
8	18	.375
10	20	.375
12	24	.375
14	24	.375
15	24	.375
16	30	.500
18	30	.500
20	36	.500
21	36	.500
24	36	.500

(for larger pipe use tunnel liner)

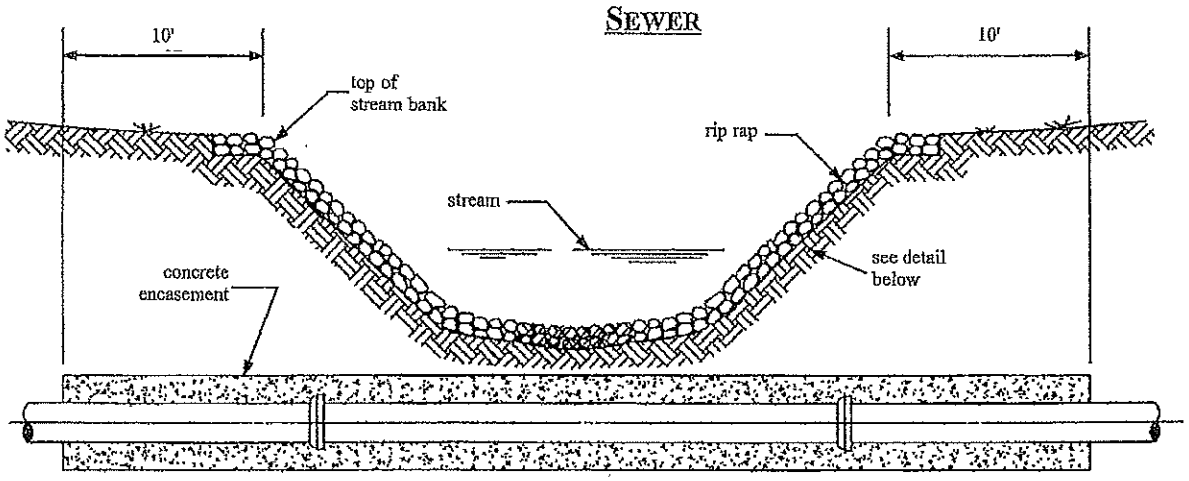
Water Service Laterals
a) Casing pipe shall be SCH 40 PVC or SDR 21
b) 3" diameter pipe for 1" service lines
c) 6" diameter pipe for 2" service lines
d) No spacers or sand fill to be installed

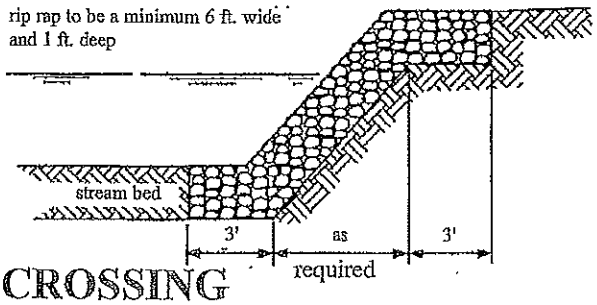
HIGHWAY CROSSING

Figure 3



M.J. FITTINGS AND D.I. PIPE RESTRAINED BY MEGALUG RESTRAINING GLANDS.



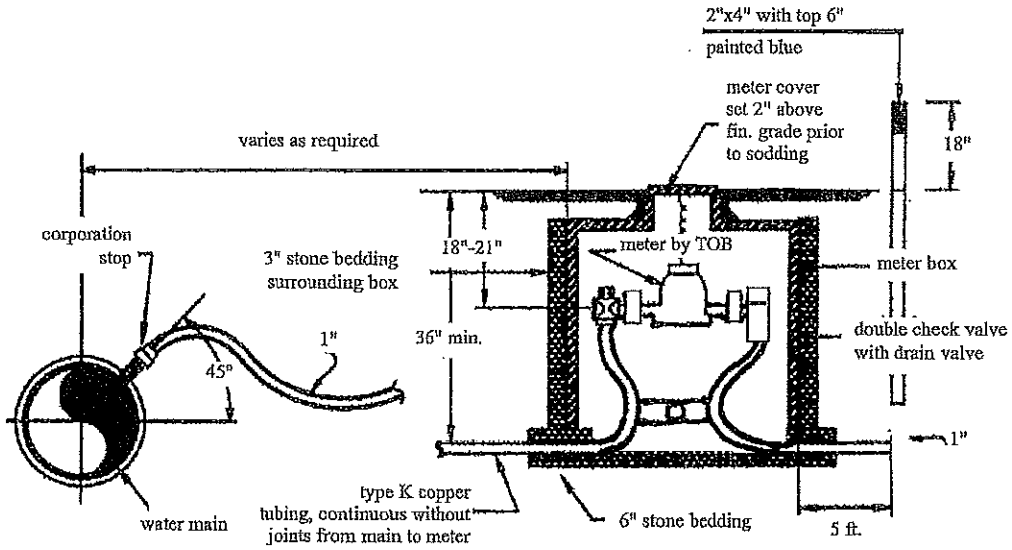


STREAM CROSSING

Figure 4

METER BOX & COVER

Meter Size	Meter Box		Meter Box Cover
5/8"x3/4" or 3/4"	18 in Dia.	Non-Traffic	M32C-PW + FP cast iron plug
		Traffic	A32HH-T
1"	24 in Dia.	Non Traffic	MC-24 (Frame) WITH RML-1-T (Top Lid)
		Traffic	MC-24 (Frame) WITH RML-12-T (Top Lid)



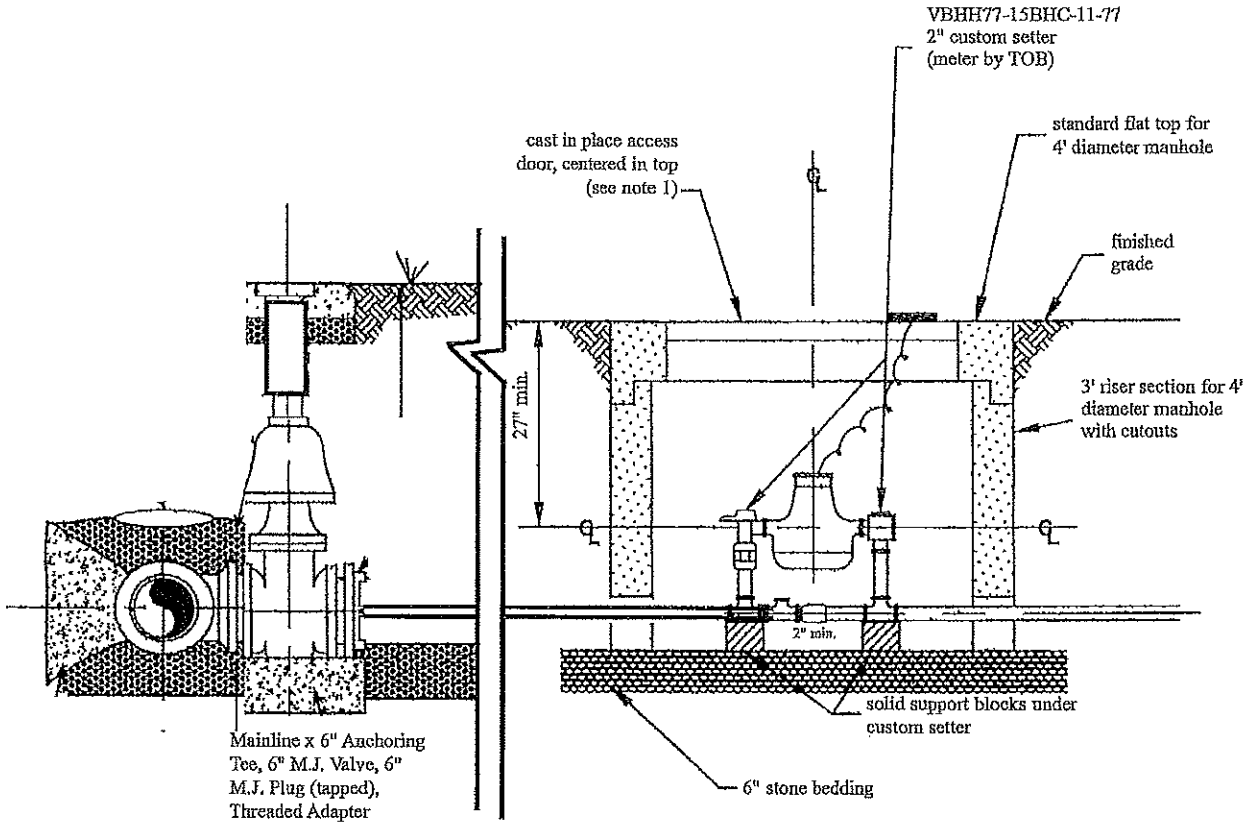
METER SETTING PARTS		
SERVICE PIPING DIA.	METER SIZE	FORD METER SETTER
3/4"	5/8x3/4" (20 GPM)	VBHC 72 12W 4433
1"	5/8"x3/4" (20 GPM)	VBHC 72 15W 44-44B4
1"	3/4" (30 GPM)	VBHC 72 15W 44-44B4
1"	1" (50 GPM)	VBHC 74 15W 4444

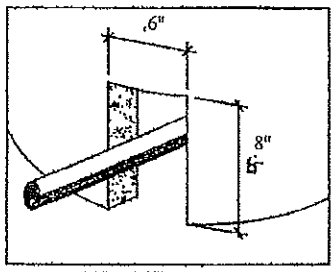
NOTE: Equivalent meter setters by other manufacturers may be installed with prior approval of the Director of Public Works.

INSTALLATION NOTES:
1. Exact location of meter box assembly to be approved prior to installation.

5/8" x 3/4", 3/4" & 1" Meter Installation

Figure 5





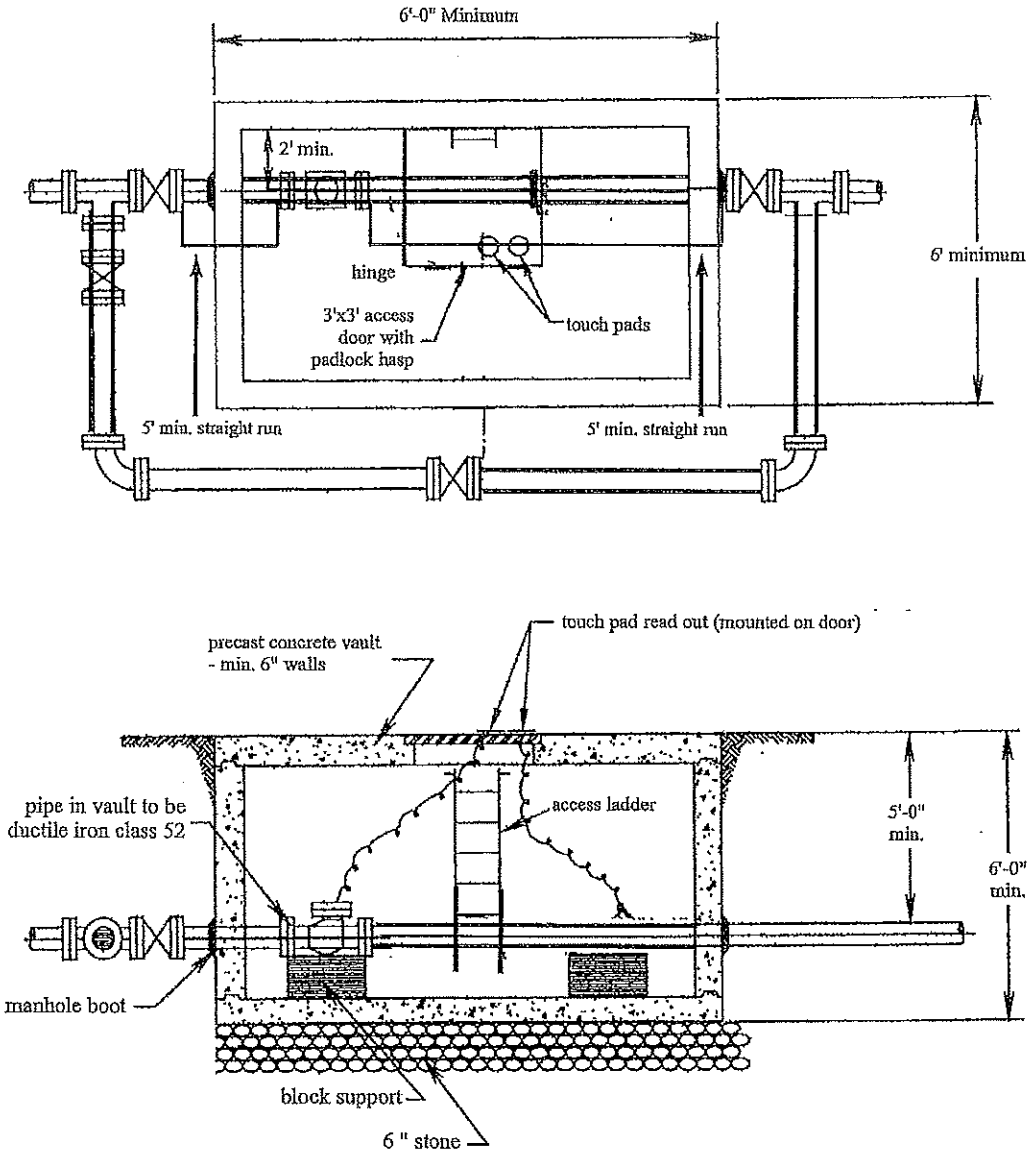
CUTOUT DETAIL
(typical)

NOTES:
1. Access door shall be by Halliday Products or our approved equal:
   a) in non-traffic area - model no. S1R3030
   b) in traffic area - model no. H1R2424

2. Water service crossing street shall be encased in 6" diameter SCH40 PVC or SDR21 piping. The piping shall run from one foot beyond sidewalk, across the street, to one foot beyond sidewalk.

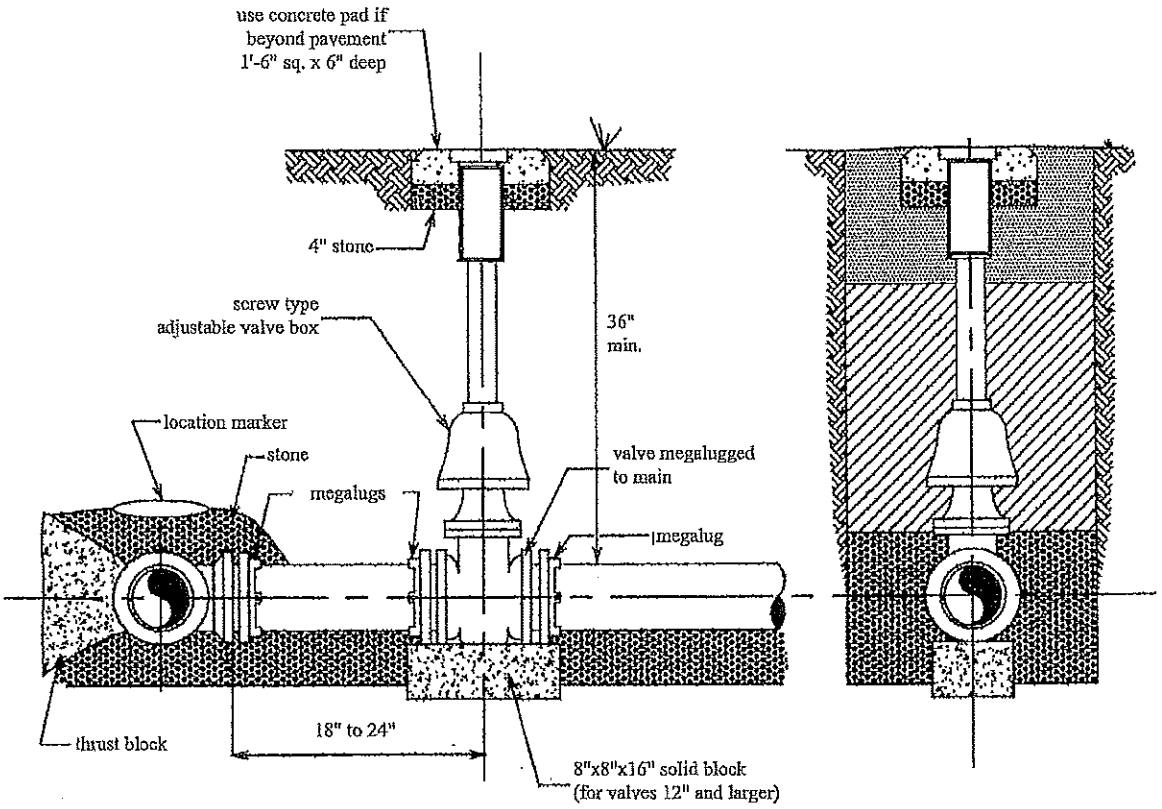
1½" AND 2" METER INSTALLATION

Figure 6



3" THROUGH 8" METER INSTALLATION

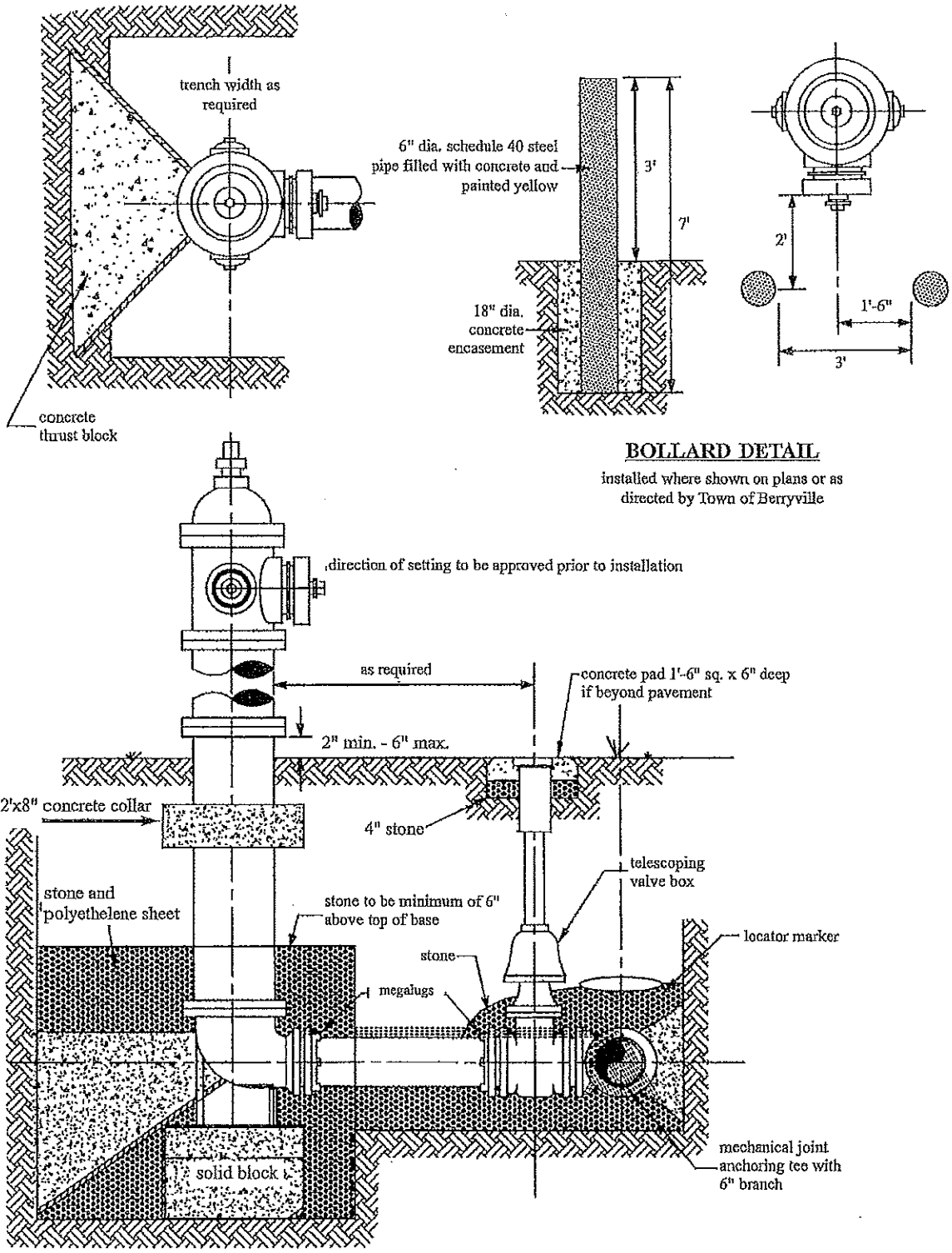
Figure 7



NOTE: this detail is also used for butterfly valves

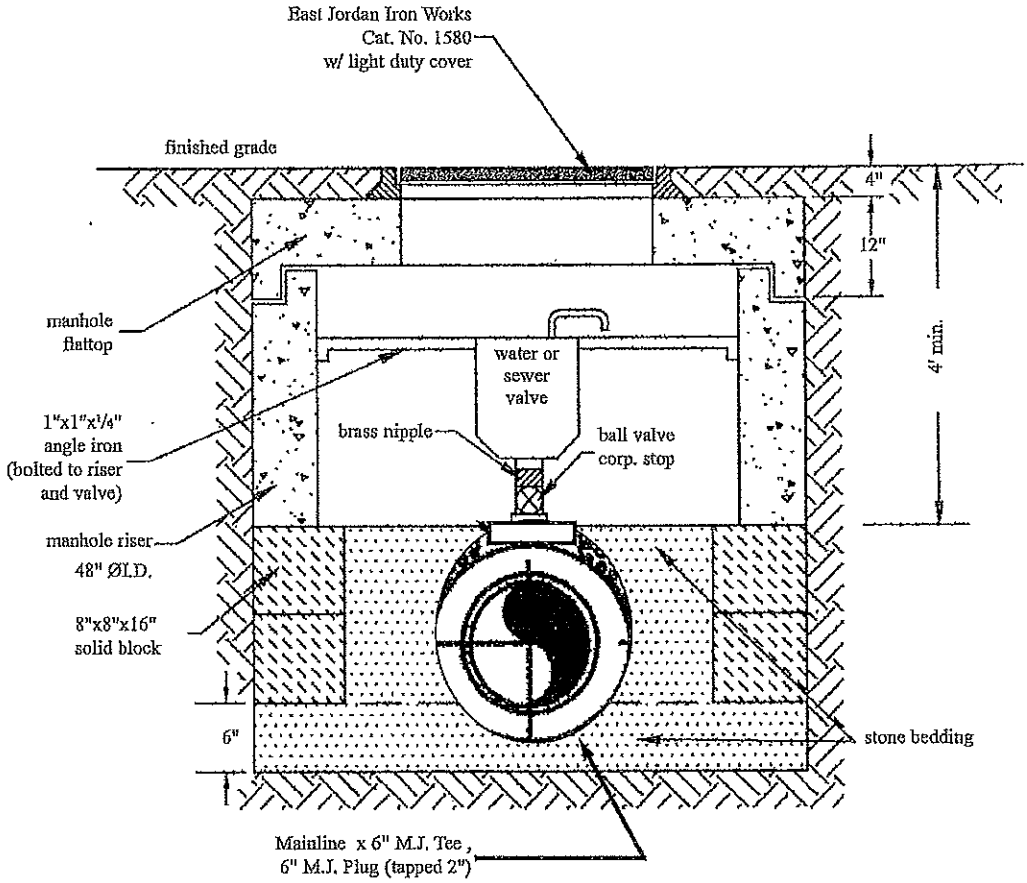
GATE VALVE

Figure 8



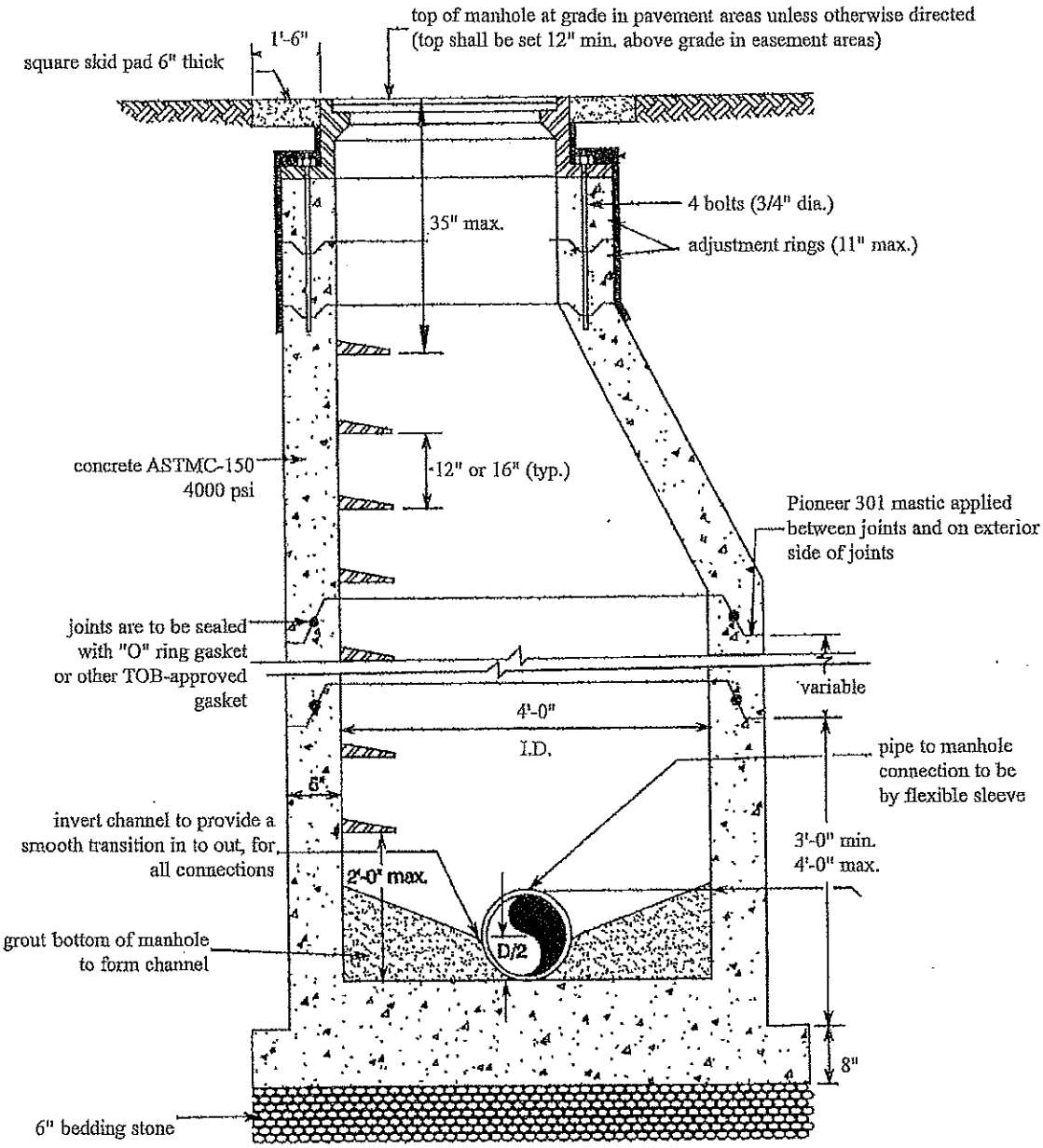
FIRE HYDRANT ASSEMBLY

Figure 9



COMBINATION AIR RELEASE AND AIR VACUUM VALVE

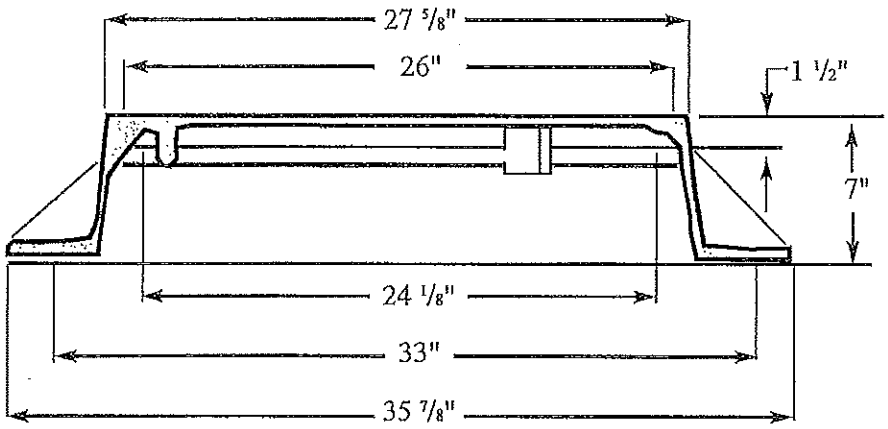
Figure 10



NOTES:
1. Manhole sections shall have an external coating of approved bitumastic water proofing prior to installation.
2. If adjustment elevation exceeds two inches use concrete adjustment rings with a exterior coating of bitumastic water proofing.
3. Final slope adjustment of manhole frame may be by shims and non-shrink grout.
4. Skid pad to be placed around manholes located in shoulders of roads.
5. Flat top casting shall be used on shallow manhole (6 ft. or less) installations.
6. Slope bench at 1":1' toward channel.

STANDARD MANHOLE

Figure 11

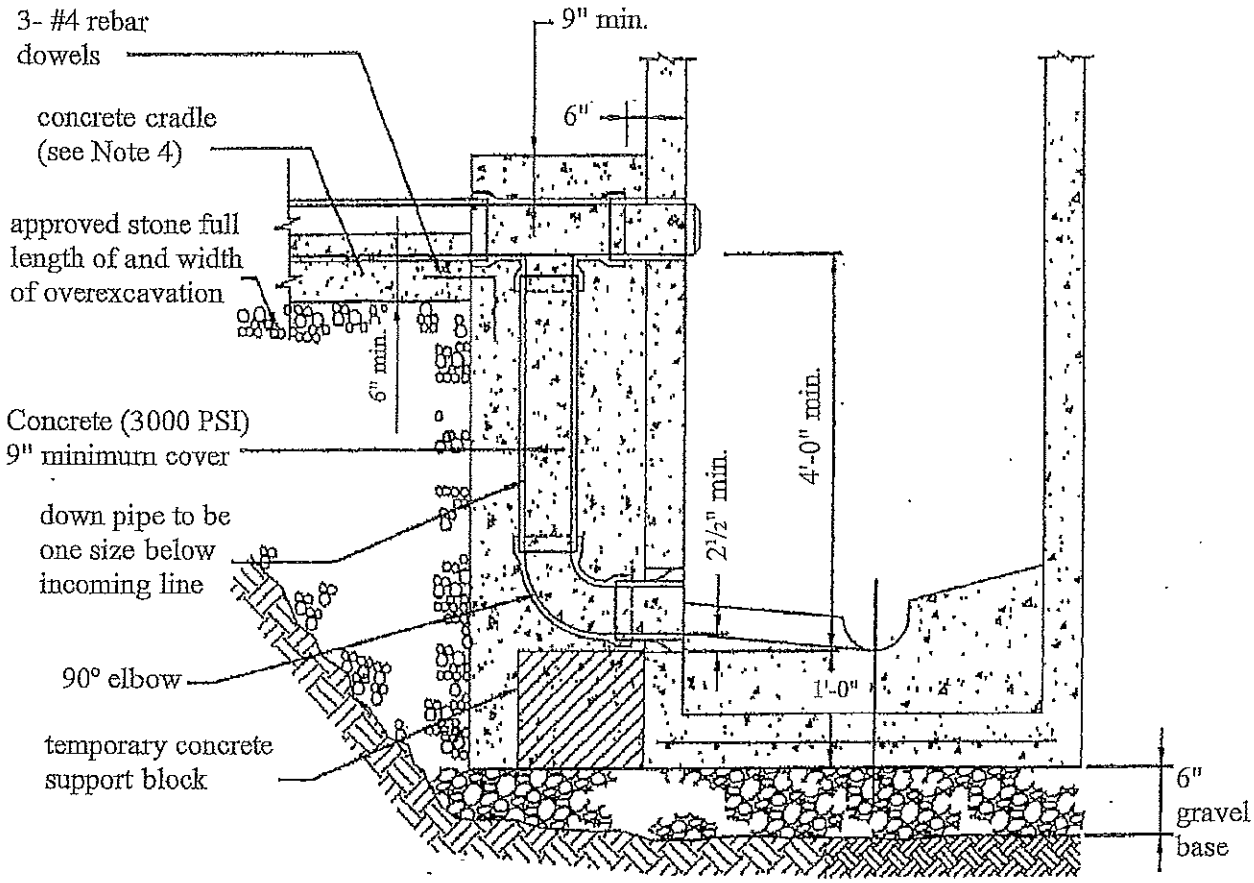


NOTE:

1. Castings shall be manufactured true to pattern. Component parts shall fit together in a satisfactory manner. Castings shall be smooth and well cleaned by shotblasting.
2. Metal shall be ASTM-A-48 Class 35B gray iron minimum, or ASTM-A-536 Grade 80-55-06 for ductile iron.
3. Castings shall have a minimum tensile strength of 35,000 P.S.I,., H20 loading.
4. Watertight castings shall be furnished with a bolt down lid and gasket.
5. Standard castings shall be furnished with a compression sealing gasket.

MANHOLE COVER & FRAME

Figure 12

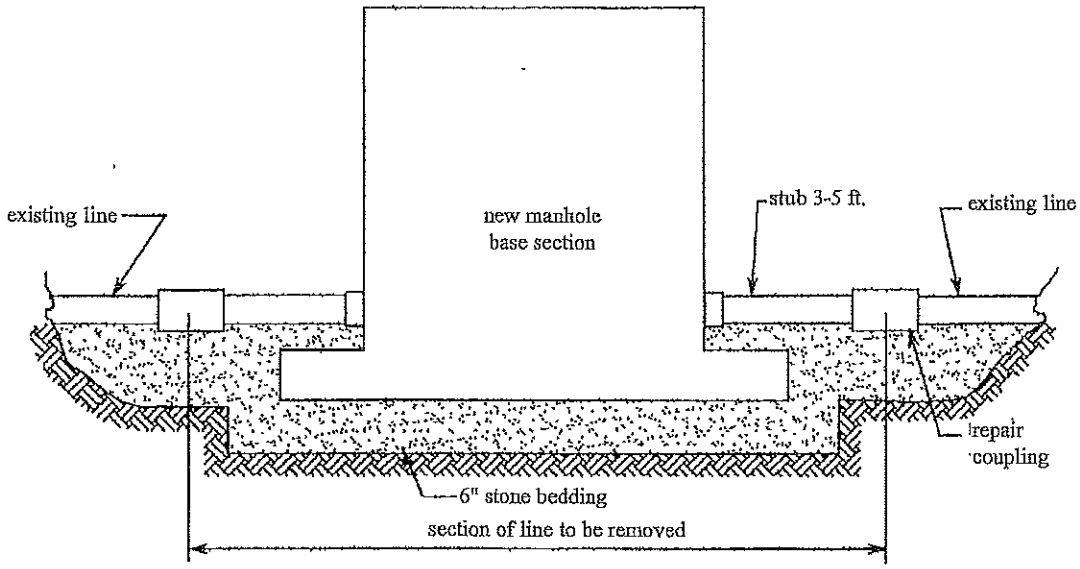


NOTES:

1. See standard details 16 and 17 for manhole requirements.
2. Incoming line to have 2.0% slope maximum.
3. Manhole penetrations to be with core and watertight connector. Core is to be at least 1'-0" clear of horizontal manhole joint.
4. Extend concrete cradle onto undisturbed trench bottom a minimum of 4 feet.
5. Refer to approved products list for additional requirements.
6. The elbow at the bottom of the stack may be either a 45 or 90 degree turned in the direction of flow. Construct channel to conform to the manhole bench.

OUTSIDE DROP MANHOLE

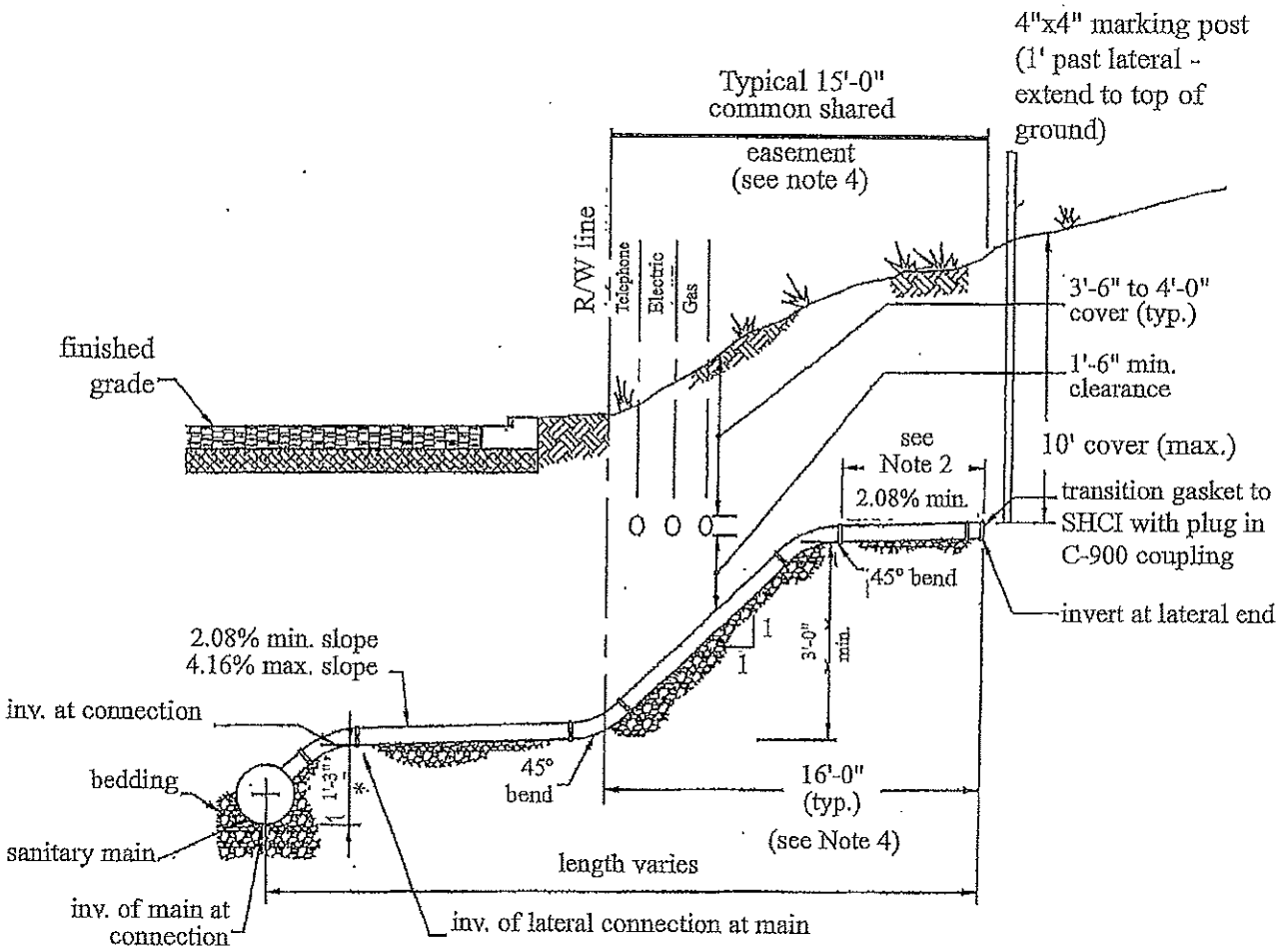
Figure 13



CUT IN

NEW MANHOLE ON EXISTING LINE

Figure 14

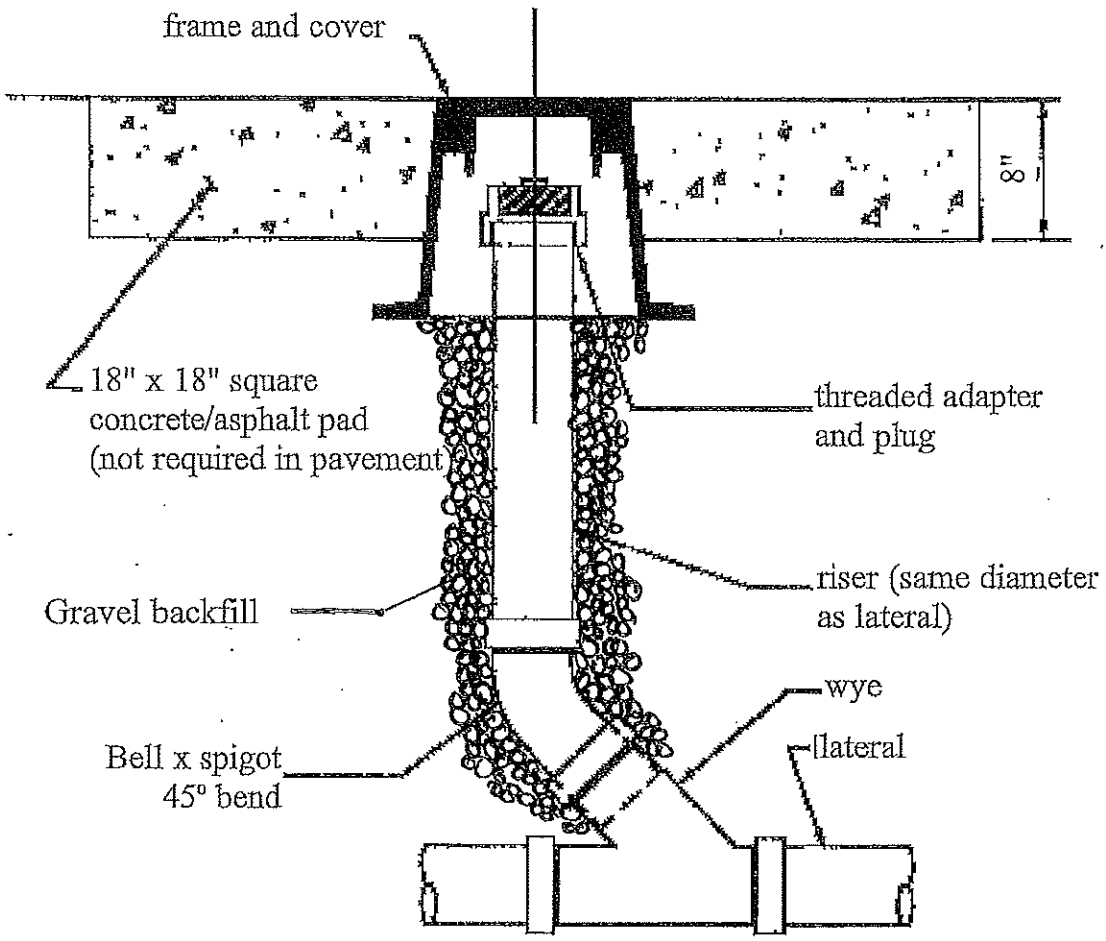


NOTES:

1. *Dimension based on 8" diameter sanitary sewer pipe.
2. Coupling/transition gasket to be minimum of 5' from last pipe joint.
3. Dimensions apply in public rights-of-ways.
4. Refer to approved products list for additional requirements.

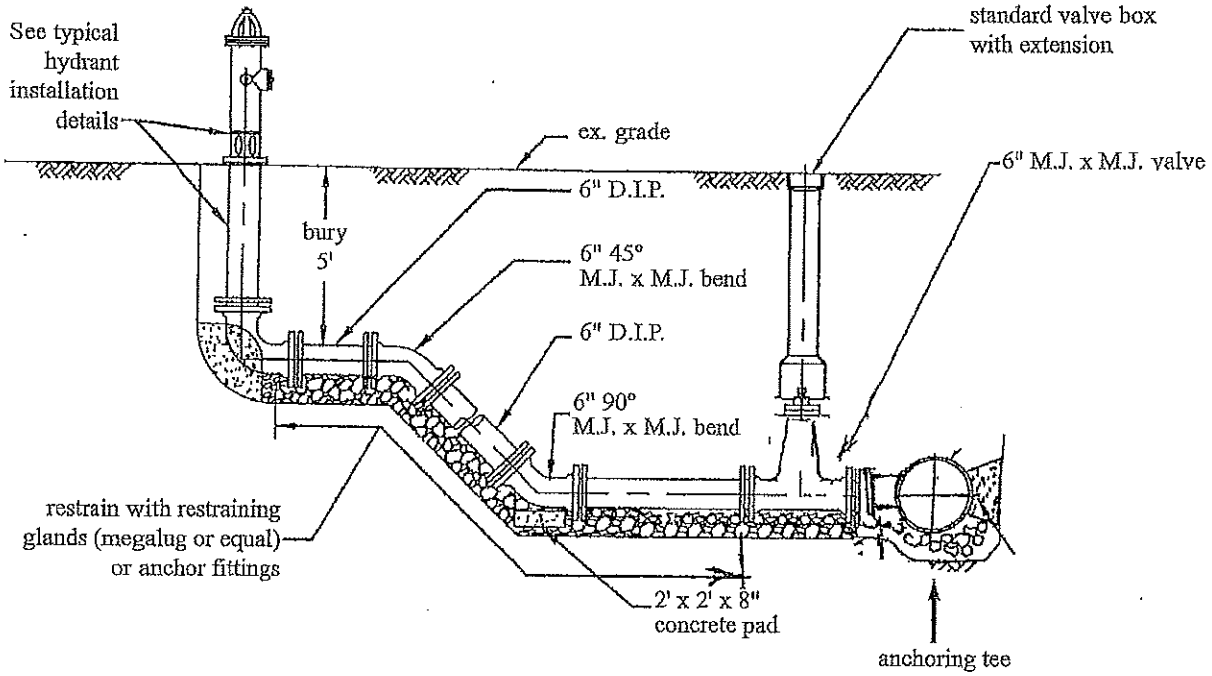
GRAVITY SEWER SERVICE LATERAL

Figure 15



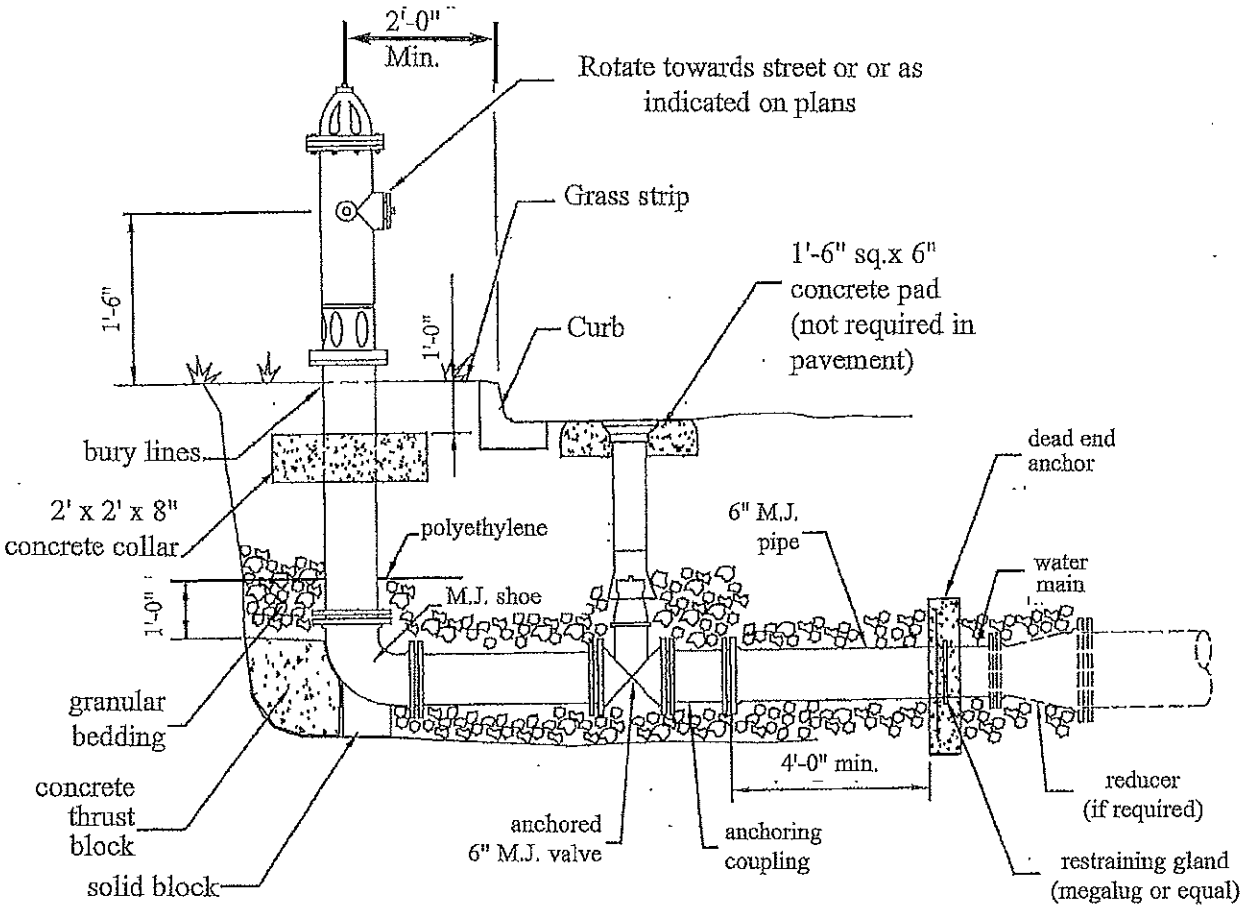
SEWER CLEANOUT

Figure 16



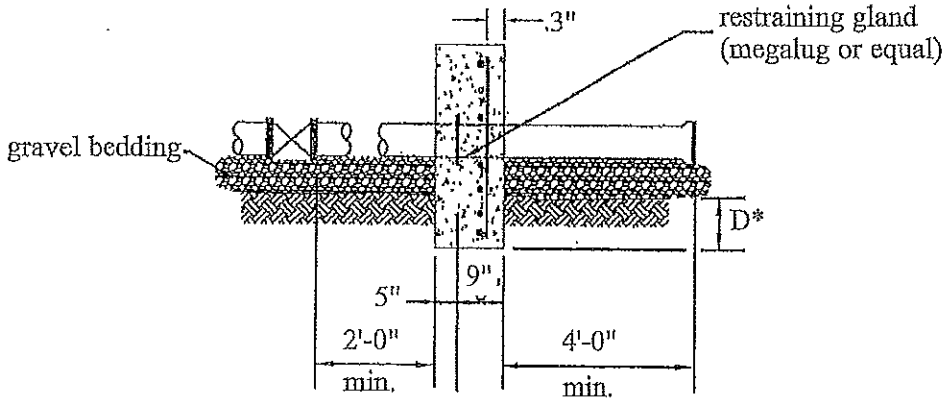
NOTES:
1. Restrain piping from dead end anchor to hydrant barrel.
2. Refer to approved products list for additional requirements.
3. Offset bends to be used where applicable.

DEEP HYDRANT
Perpendicular To Main
Figure 17

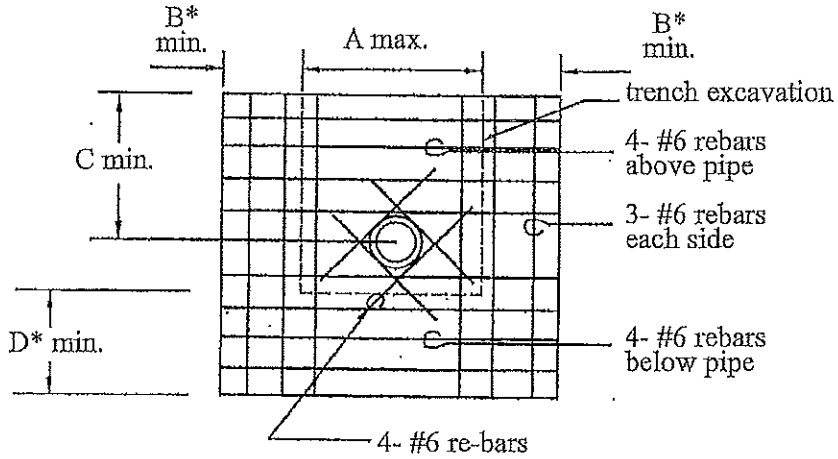


DEAD END HYDRANT ASSEMBLY

Figure 18



SIDE ELEVATION



FRONT ELEVATION

NOTES:

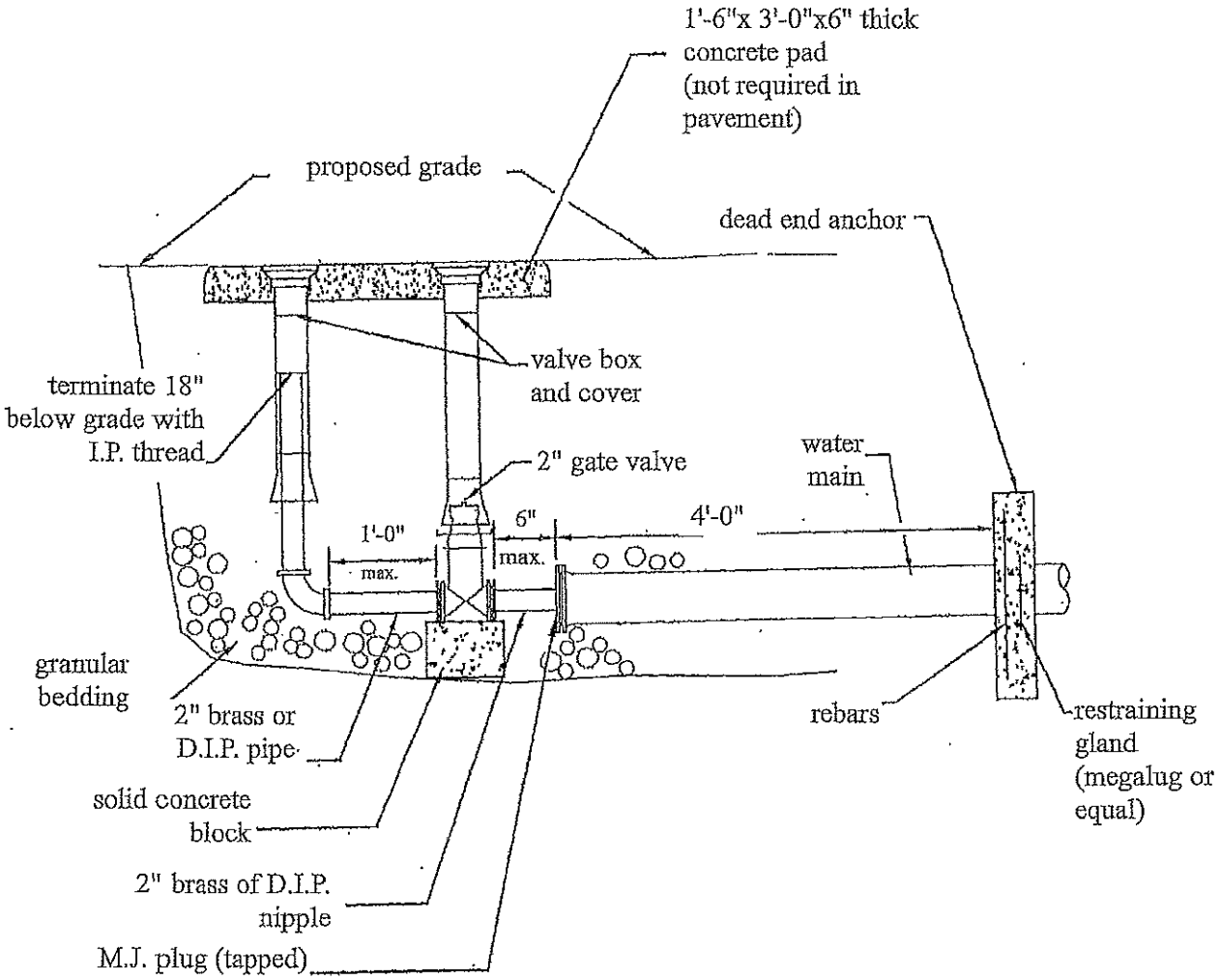
1. Bearing area is based on 200 PSI test pressure and a soil bearing pressure of 2000 pounds per square foot. Increase block dimensions as required for higher test pressures and in soils with lower bearing values.
2. *Dimensions "B" and "D" are minimum values for bearing in undisturbed earth.
3. Refer to approved products list for additional requirements.
4. Concrete strength shall be 3000 PSI.

Dead End Anchor Schedule				
Line Size	A	B*	C	D*
6"	2'-0"	1'-0"	1'-6"	1'-0"
8"	2'-0"	1'-3"	1'-8"	1'-0"
10"	2'-3"	1'-6"	1'-8"	1'-6"
12"	2'-6"	2'-0"	1'-6"	1'-8"

DEAD END ANCHOR

6" to 12" Line Size

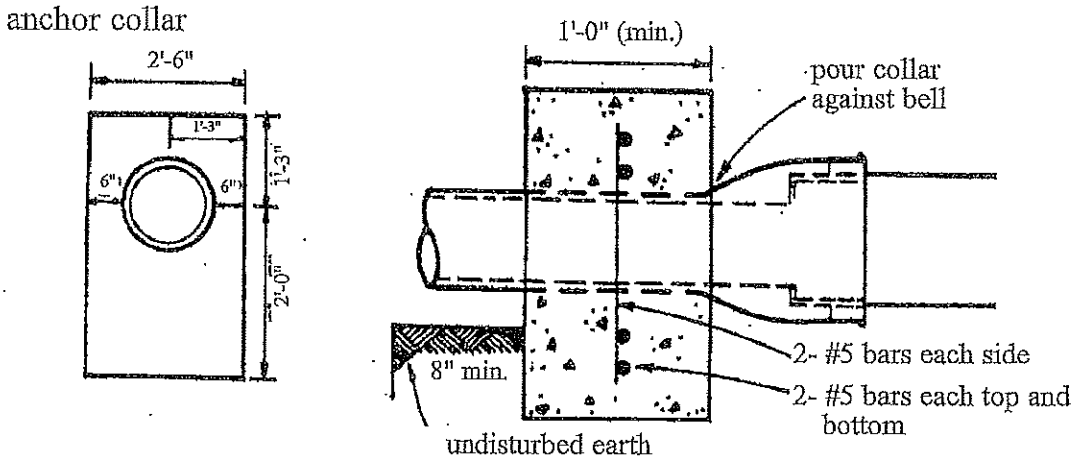
Figure 19



NOTES:
1. All 2" pipe to join with I.P. thread

TEMPORARY BLOW OFF

Figure 20



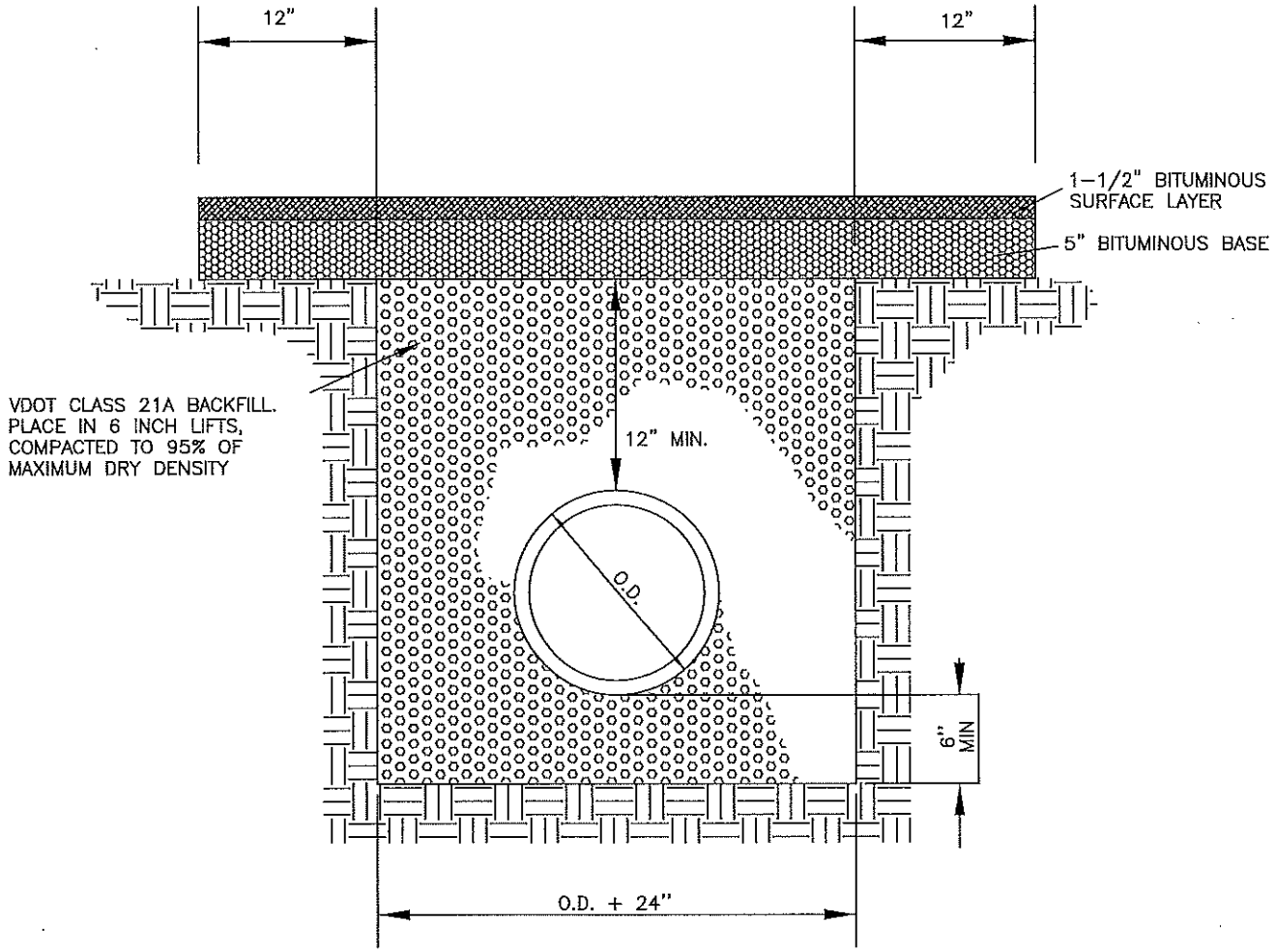
Concrete
Fc=3000 PSI at 28 days

SLOPE ANCHOR

Figure 21

* WHERE THE TRENCH BOTTOM IS ROCK, IT SHALL BE EXCAVATED TO A MINIMUM OF 8" BELOW THE BOTTOM OF THE PIPE AND BACKFILLED WITH BEDDING MATERIAL FREE OF ROOTS, DEBRIS & STONES

* WHERE SUBGRADE IS UNSTABLE, PIPE SHALL BE BEDDED ON A MINIMUM OF 8" BEDDING MATERIAL

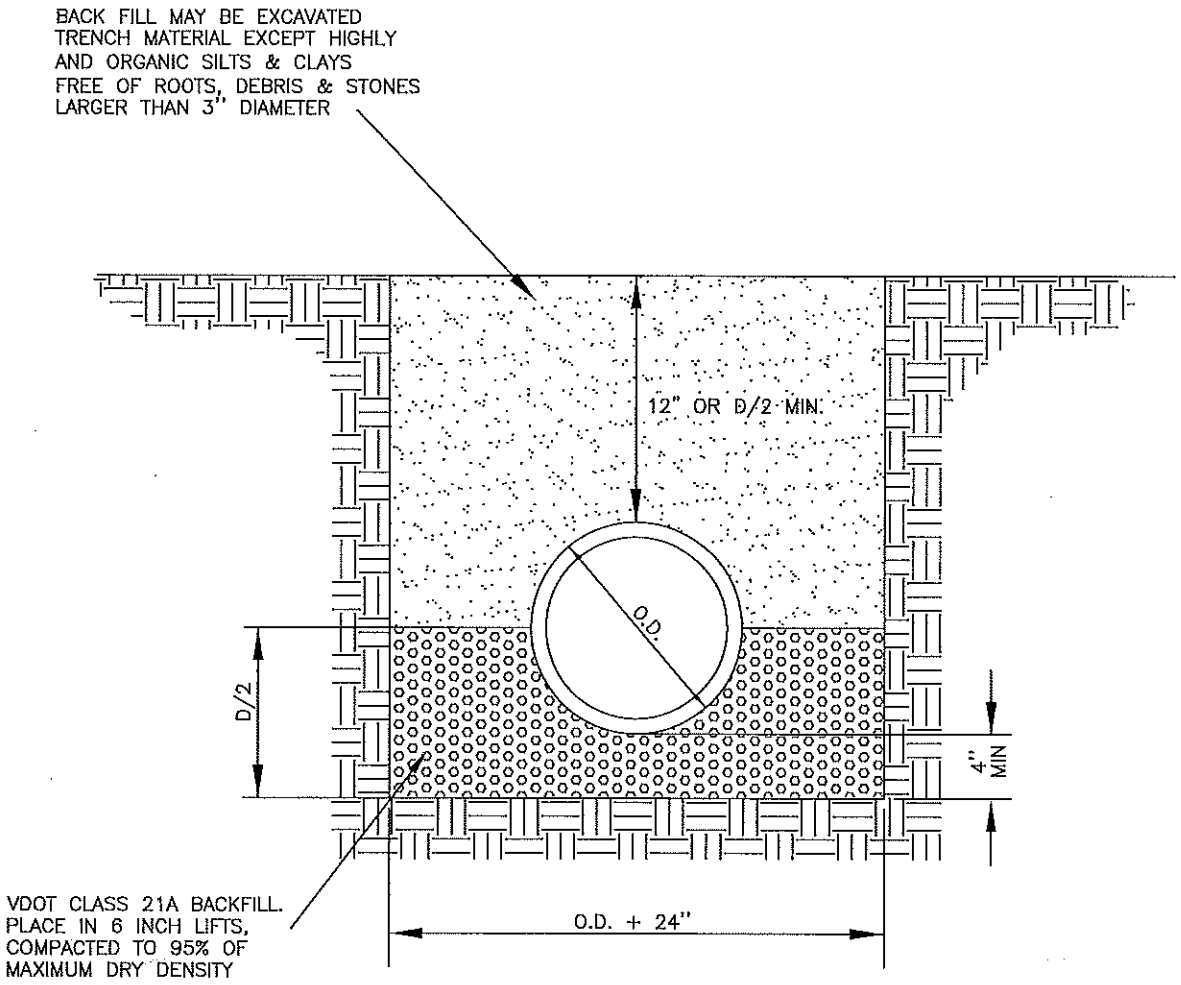


CONCRETE STORM DRAIN BEDDING WITHIN TRAFFIC AREAS (RCP)

Figure 22

* WHERE THE TRENCH BOTTOM IS ROCK, IT SHALL BE EXCAVATED TO A MINIMUM OF 8" BELOW THE BOTTOM OF THE PIPE AND BACKFILLED WITH BEDDING MATERIAL FREE OF ROOTS, DEBRIS & STONES

* WHERE SUBGRADE IS UNSTABLE, PIPE SHALL BE BEDDED ON A MINIMUM OF 8" BEDDING MATERIAL



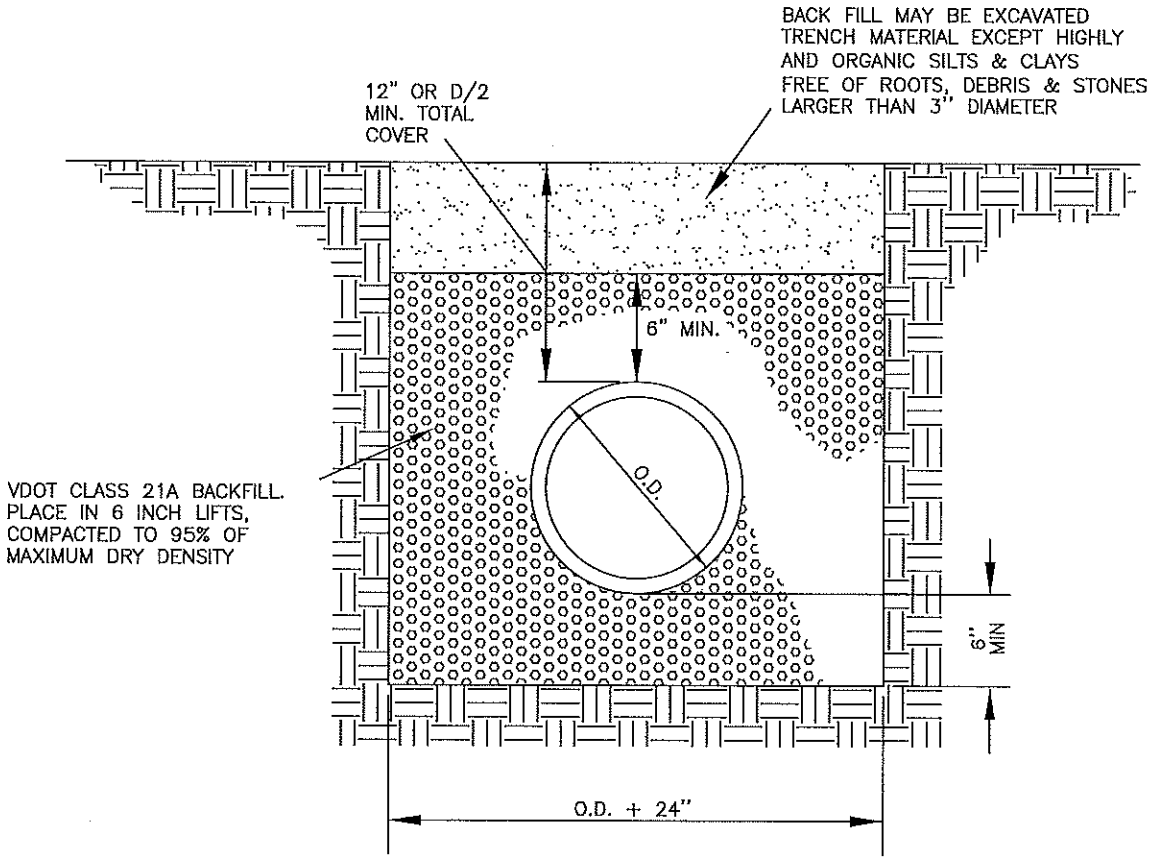
CONCRETE STORM DRAIN BEDDING OUTSIDE TRAFFIC AREAS (RCP)

Figure 23

* WHERE THE TRENCH BOTTOM IS ROCK, IT SHALL BE EXCAVATED TO A MINIMUM OF 8" BELOW THE BOTTOM OF THE PIPE AND BACKFILLED WITH BEDDING MATERIAL FREE OF ROOTS, DEBRIS & STONES

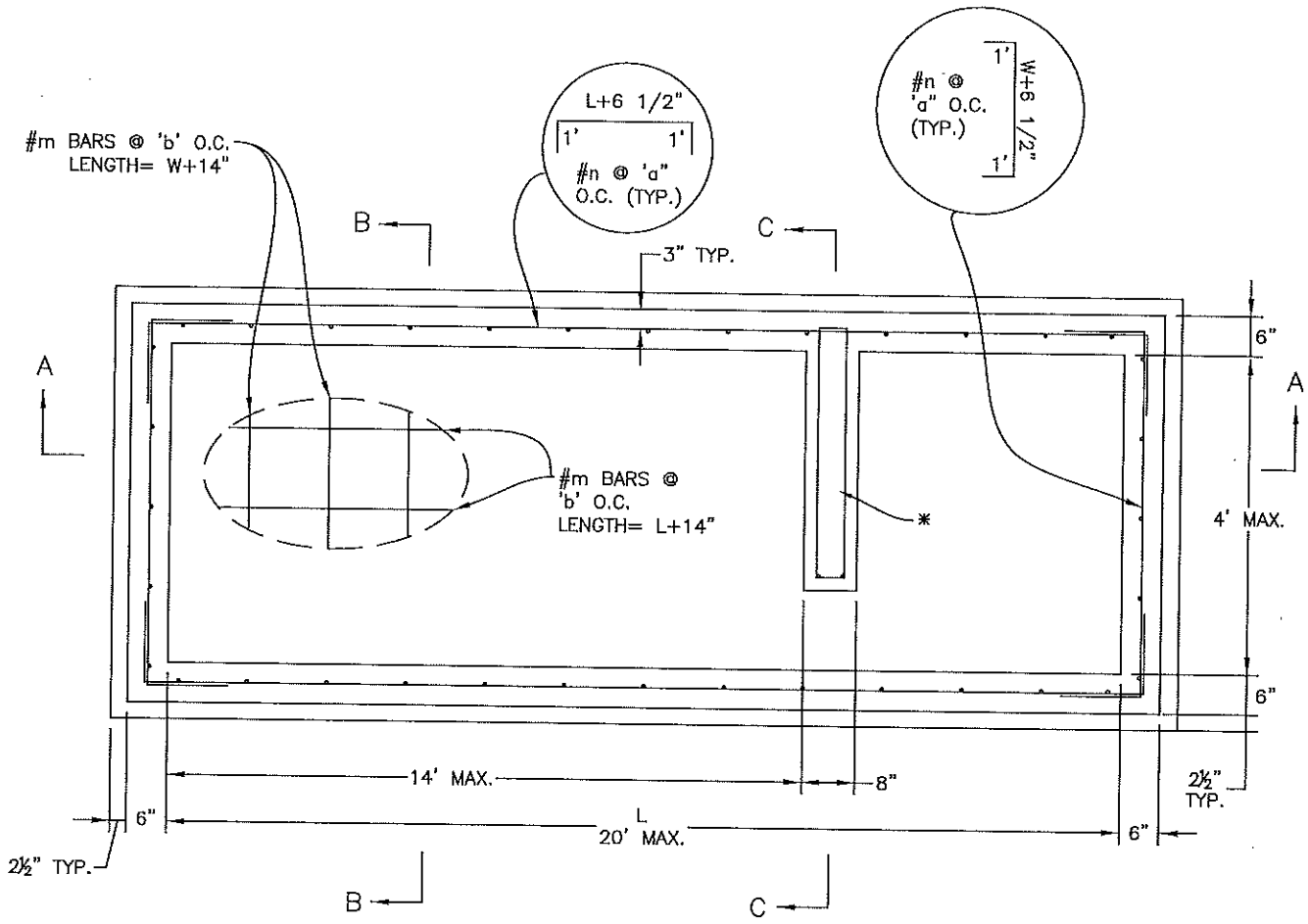
* WHERE SUBGRADE IS UNSTABLE, PIPE SHALL BE BEDDED ON A MINIMUM OF 8" BEDDING MATERIAL

* HDPE PIPE MUST BE INSTALLED PER MANUFACTURERS SPECS



CONCRETE STORM DRAIN BEDDING WITHIN EASEMENT OR NON-TRAFFIC AREAS (CORRUGATED HDPE)

Figure 24



PLAN VIEW

TOP SLAB REMOVED

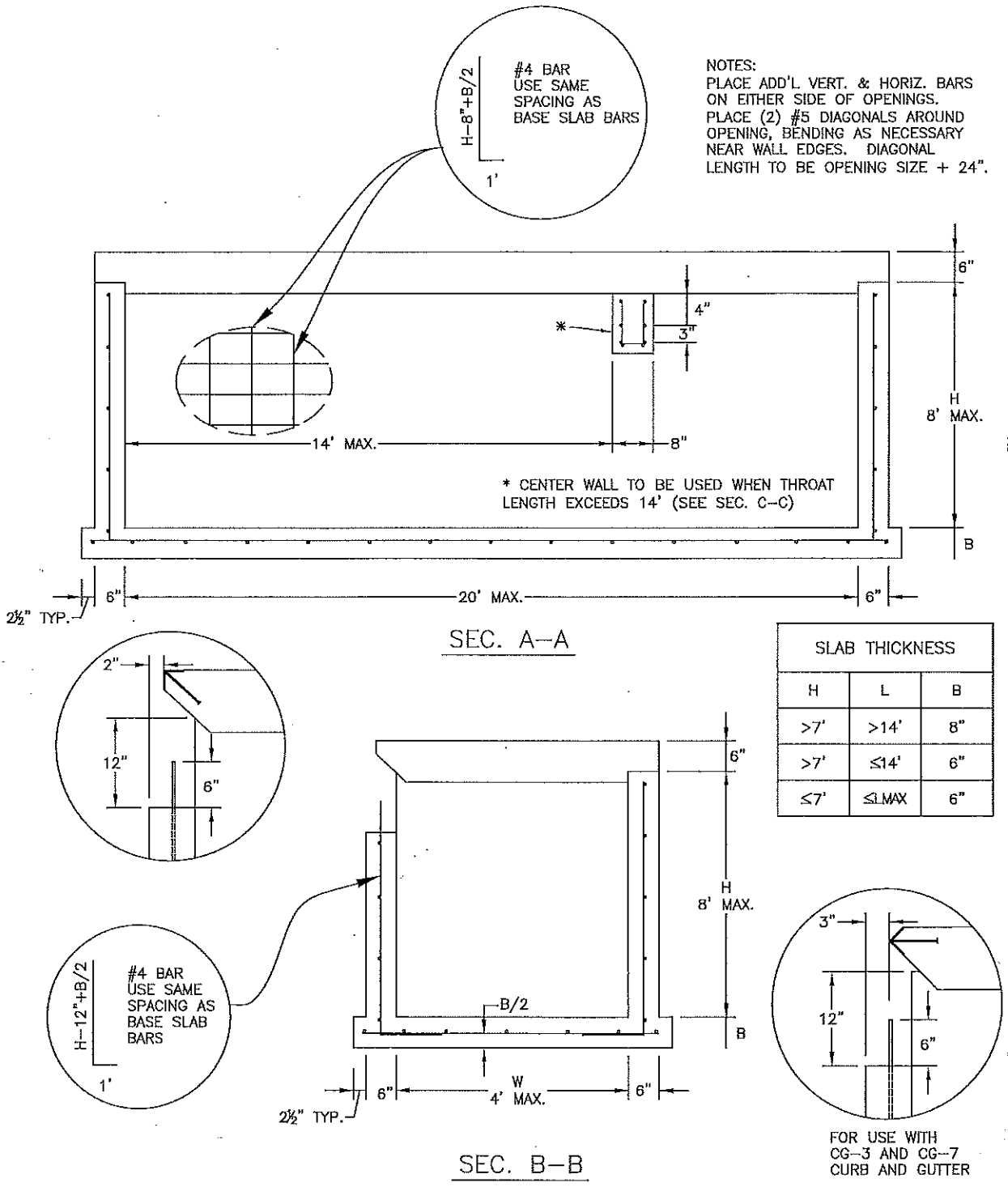
* CENTER WALL TO BE USED WHEN THROAT LENGTH EXCEEDS 14' (SEE SEC. C--C)

NOTES:
1. CONCRETE TO BE 4,000 PSI MIN.
2. STEEL TO BE GRADE 60
3. DOWEL HOLES PROVIDED TO PREVENT SETTLEMENT OF ADJACENT CONCRETE
4. WEEP HOLES PROVIDED
5. STEPS PROVIDED WHEN HEIGHT IS 4' OR GREATER
6. GUTTER PAN/THROAT FACE TO BE POURED IN FIELD

BAR SPACING				
L	HORIZ.		BASE	
—	n	a	m	b
>16'	5	6"	4	12"
>12'	5	9"	4	12"
>8'	4	9"	4	16"
≤8'	4	14"	4	16"

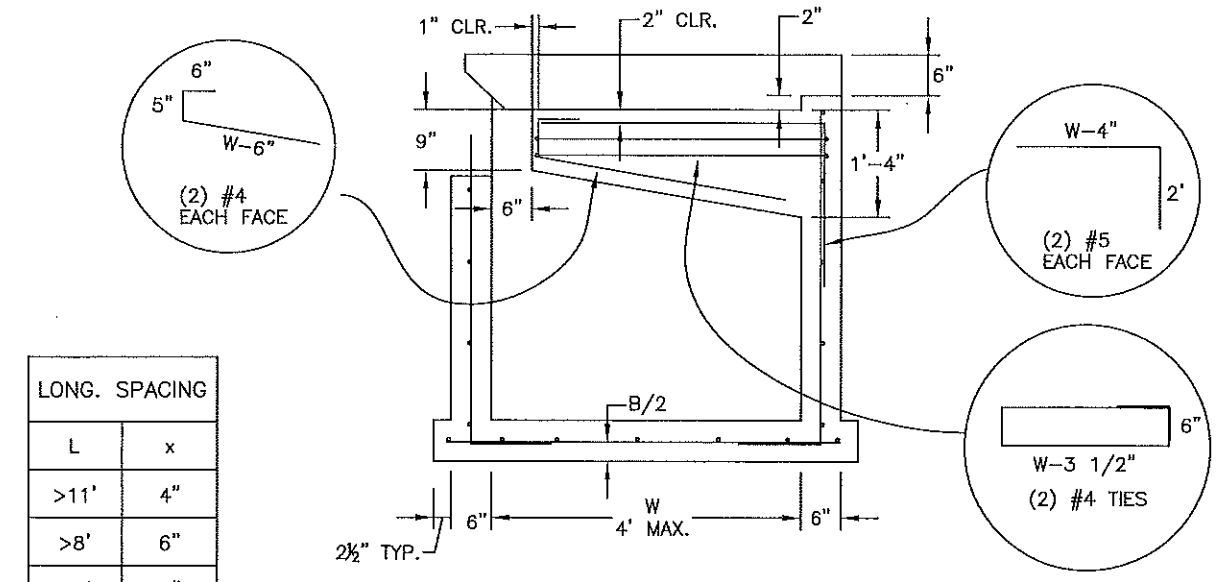
DI-3A, 3B, 3C (SHALLOW)

Figure 25A



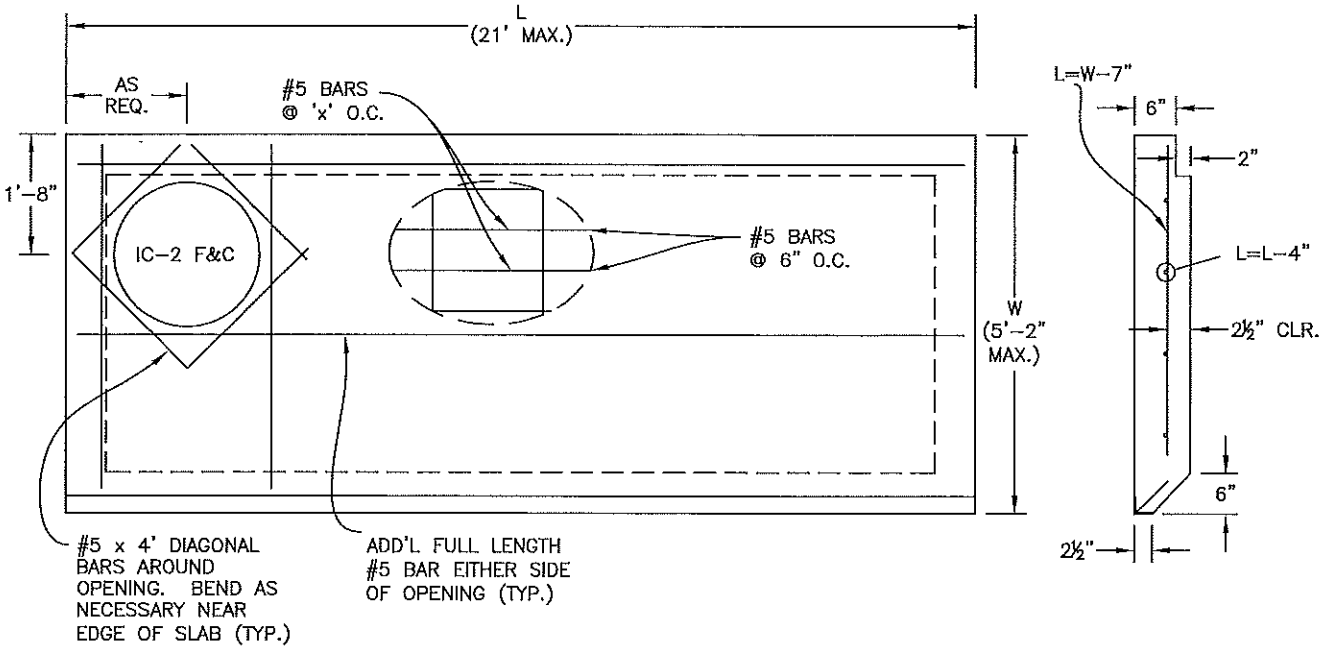
DI-3A, 3B, 3C (SHALLOW)

Figure 25B



LONG. SPACING	
L	x
>11'	4"
>8'	6"
>7'	8"
≤7'	10"

SEC. C-C

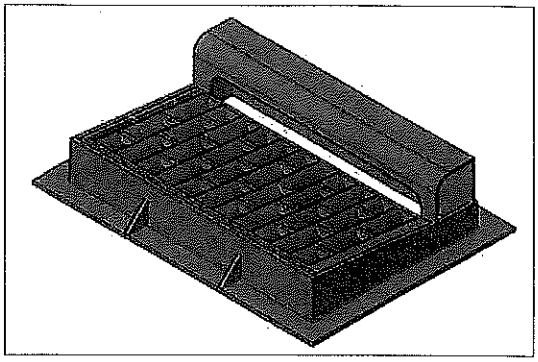


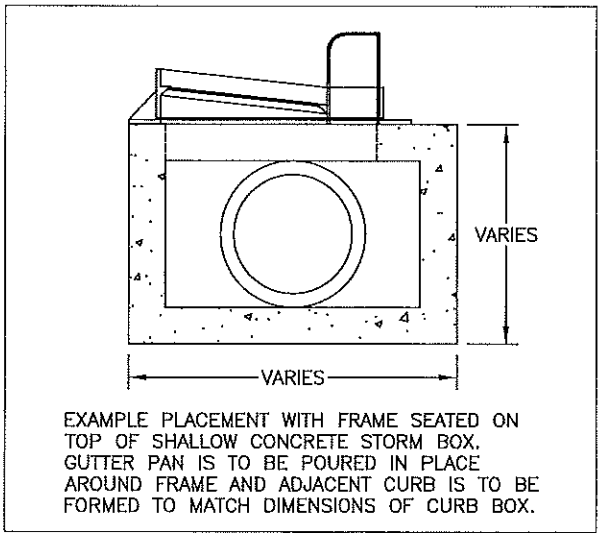
TOP SLAB

DI-3A, 3B, 3C (SHALLOW)

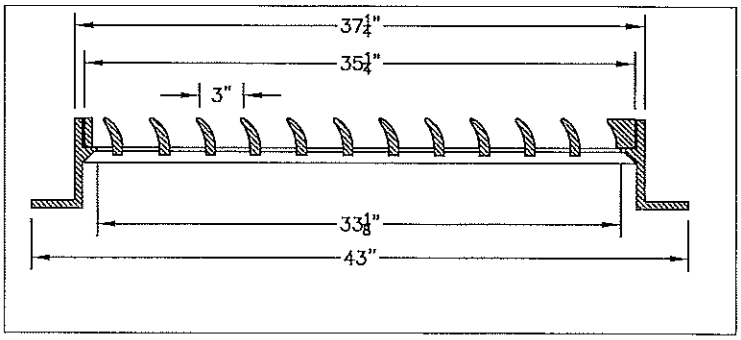
Figure 25C

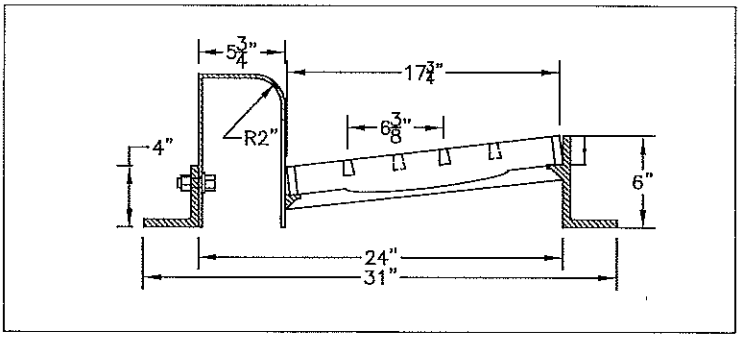
COMBINATION INLET FRAME, GRATE, AND CURB BOX MFG. BY NEENAH FOUNDARY MODEL NUMBER R-3295 TYPE "L" GRATES

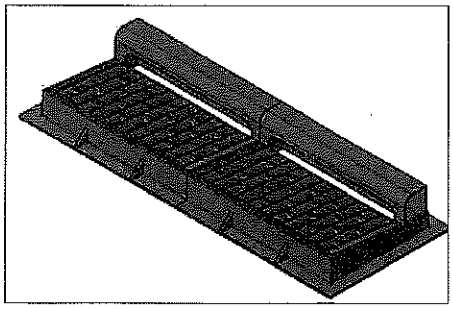




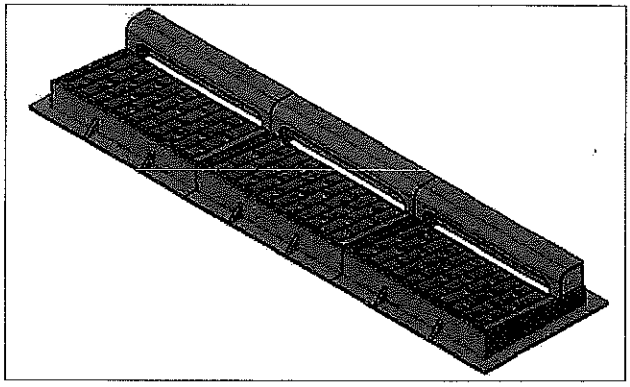
EXAMPLE PLACEMENT WITH FRAME SEATED ON TOP OF SHALLOW CONCRETE STORM BOX. GUTTER PAN IS TO BE POURED IN PLACE AROUND FRAME AND ADJACENT CURB IS TO BE FORMED TO MATCH DIMENSIONS OF CURB BOX.







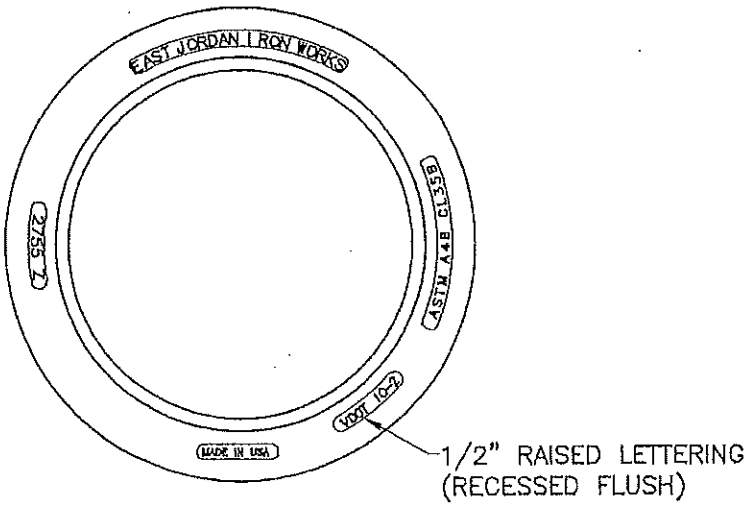
MODEL NUMBER R-3295-2 FOR DUAL INLET SITUATIONS



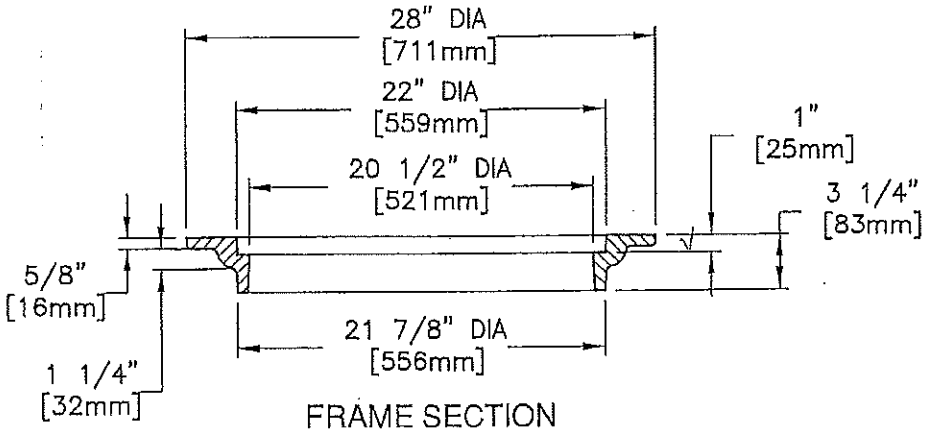
MODEL NUMBER R-3295-3 FOR THREE INLET SITUATIONS. ADD'L MIDDLE UNITS CAN BE ADDED FOR INCREASED LENGTH

MODIFIED DI-1 (SHALLOW)

Figure 26



PLAN VIEW

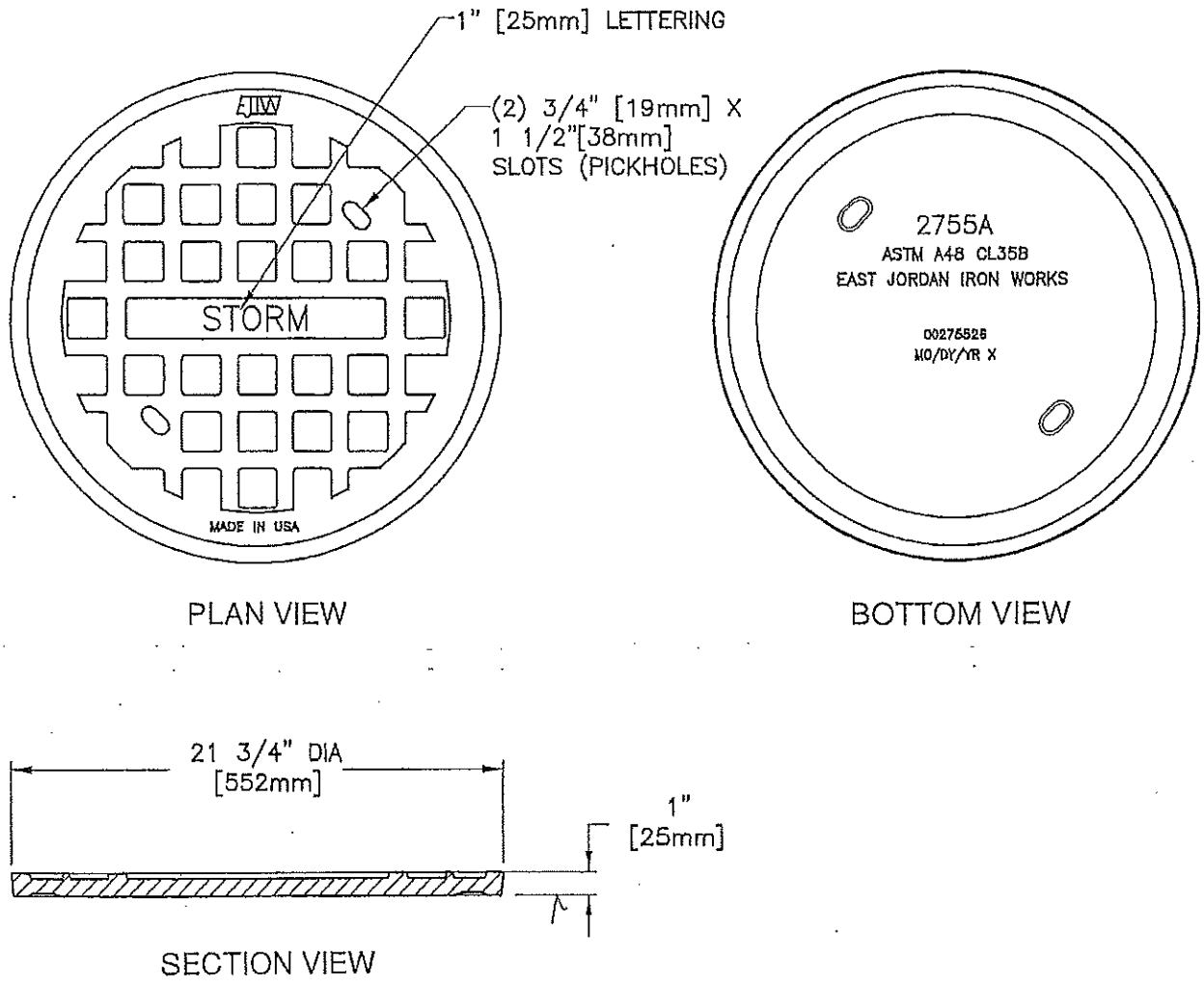


FRAME SECTION

√ MACHINED SURFACE

28" MANHOLE FRAME
HEAVY DUTY RATING

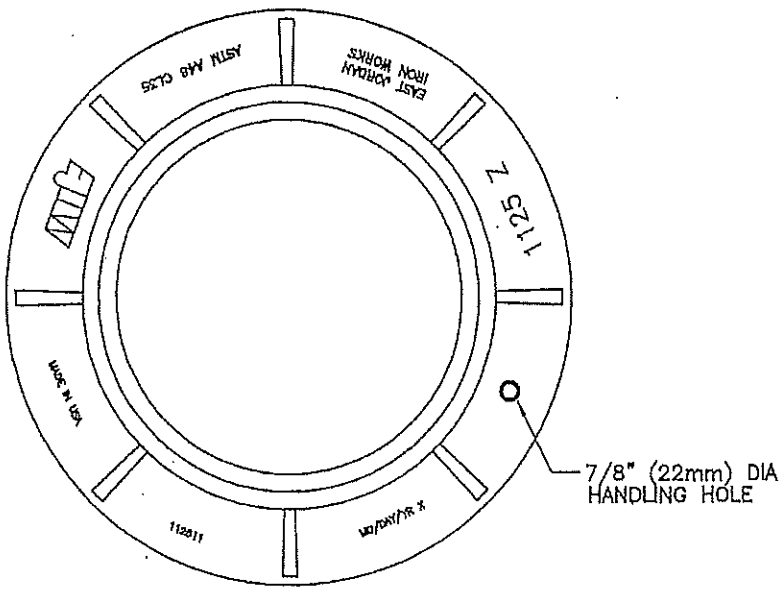
Figure 27A

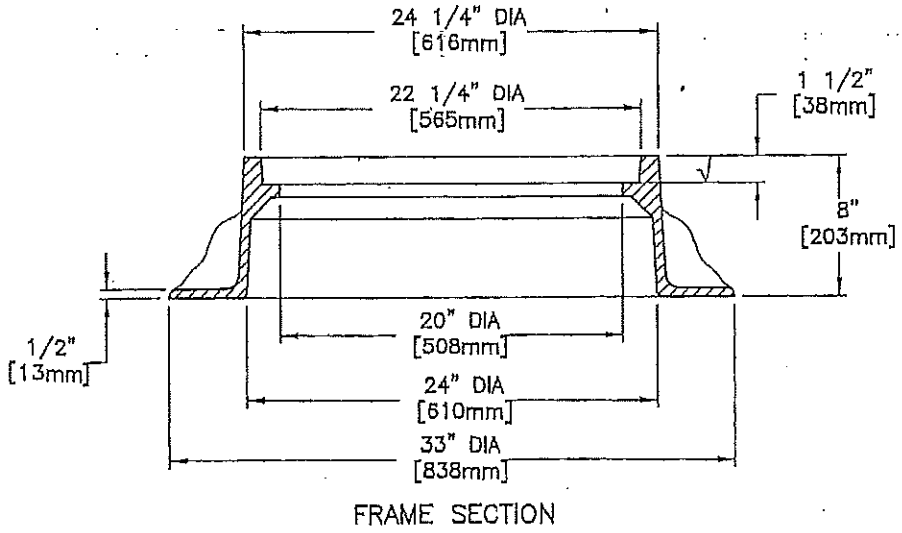


√ MACHINED SURFACE

21 3/4" SPECIAL LETTERED COVER
HEAVY DUTY RATING

Figure 27B

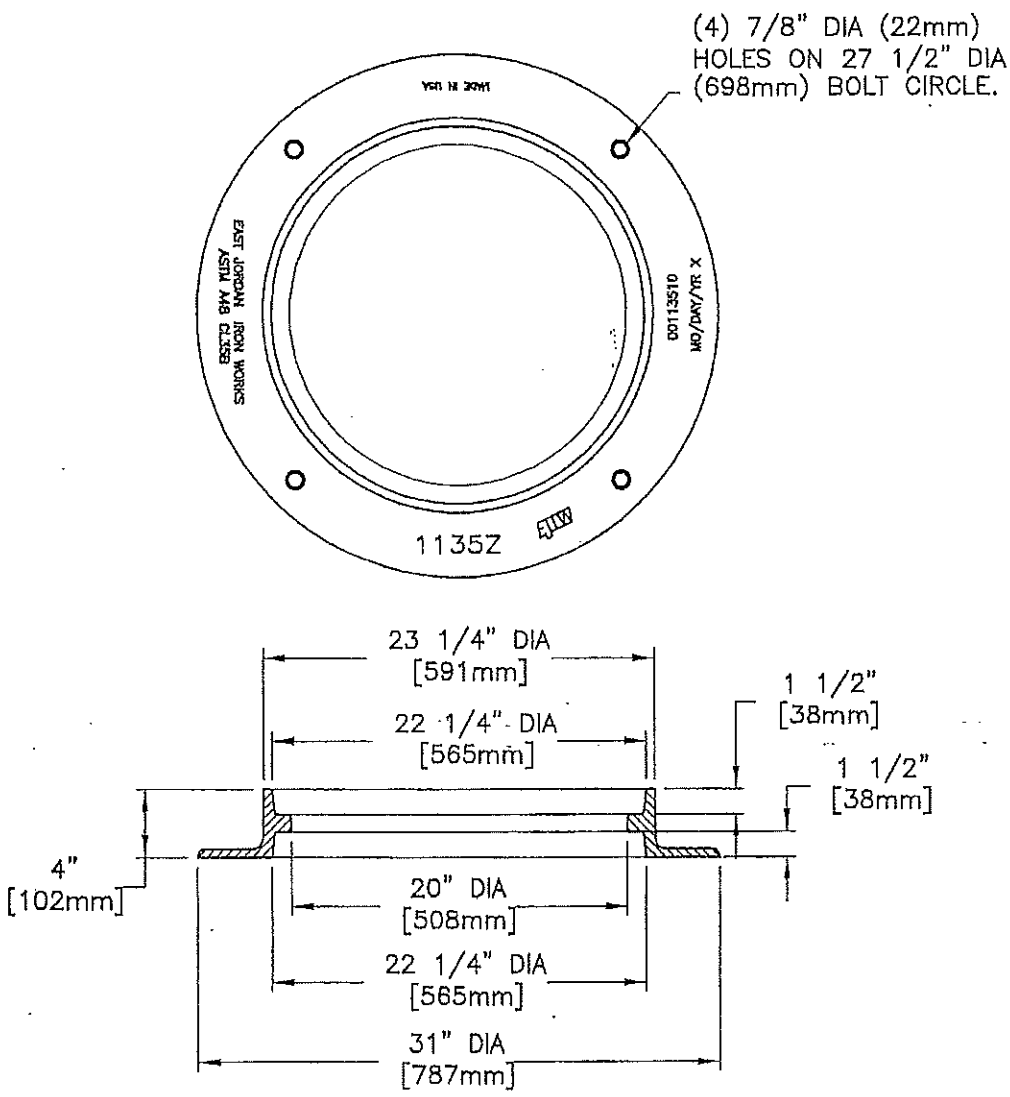




FRAME SECTION

√ MACHINED SURFACE

24¼" MANHOLE FRAME
HEAVY DUTY RATING
Figure 28

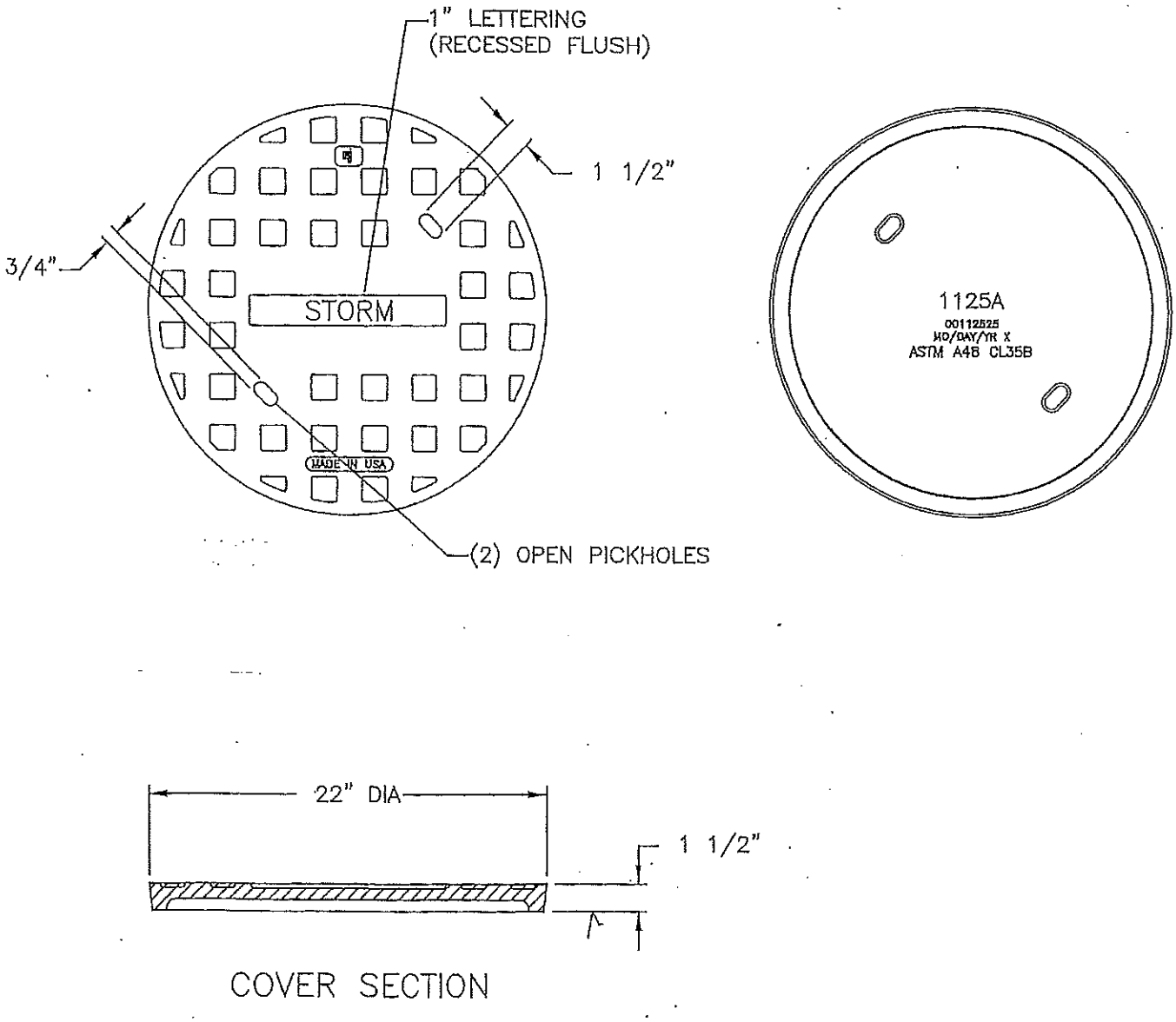


FRAME SECTION

NOTE: FRAME IS REVERSIBLE AND CAN BE INSTALLED AS A TOP FLANGE UNIT.

23 1/4" MANHOLE FRAME
HEAVY DUTY RATING

Figure 29



1125A STORM MANHOLE COVER
FITS 4" AND 8" FRAMES
HEAVY DUTY RATING

Figure 30