TOWN OF BOWLING GREEN COUNTY - STANDAR0S

VOLUME/
DESIGN STANDARDS- WATER AND SEWER FACILITIES

VOLUME II
STANDARD SPECIFICATIONS AND DETAILS FOR
CONSTRUCTION OF WATER AND SEWER
LINES AND RELATED WORK

TOWN OF BOWLING GREEN COUNTY
VOLUME I
DESIGN STANDARDS
WATER AND SEWER FACILITIES

ADOPTED_____

TABLE OF CONTENTS

FORWARD

These Standards have been developed for use by consultants working on water and sewer utility projects within the Town of Bowling Green and for the Town of Bowling Green personnel who review those projects. The standards are not intendedas a regulation but should be used as a guide which will establish a degree of uniformity for drawings and specifications for all water and sewer utility projects.

The Standards consist of two volumes as follows:

- Volume I - contains the design standard for water mains, pump stations and sewer lines, force mains and pump stations.

- Volume II - contains specifications for construction and materials for water and sewer lines.

Consultants working on water and sewer utility projects should recognize the fact that State and Federal regulations must be satisfied on all projects. In the event that the Town Standards differ from State or Federal Requirements, the more restrictive standard shall be utilized.

It is very difficult to generalize when addressing matters of engineering design without endangering the final product; therefore, consultants should strive for designs which show consideration of details presented herein. However, these details are secondary to good engineering judgment. The design of water mains, pump stations, force mains and gravity sewers is a matter which requires special consideration for each specific project and can not be generalized for all jobs. Therefore, the design engineer is responsible for checking the specific requirements of each project against these standards and making any additions, deletions or changes necessary for the project being designed.

The work described herein is under the jurisdiction of the Town of Bowling Green hereinafter referred to as the Town.

The Town will review all plans and specifications, ho ever, all such documents for new construction must be submitted to the appropriate office of the State Health Department for review and a certificate of construction must be issued before construction can begin.

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SECTION 1

1.1 General Requirements

l.1.01 General

A. The design of all utility systems and extensions or modifications thereto shall be performed under the direction of a registered professional engineer with a current registration in the Commonwealth of Virginia in accordance with Title 54, Chapter 3 of the Code of Virginia, 1950, as amended. Where applicable, design may be performed W1der the direction of a certified land surveyor in accordance with Sec. 54-17.l(3)(b) of the above cited code.

B. All design shall conform to the Commonwealth of Virginia "Sewerage Regulations", the "Waterworks Regulations" and to the requirements of other State and Federal Agencies having jurisdiction.

C. Additionally, all design shall conform to the requirements of the Town of Bowling Green (hereinafter referred to as "Town"). Where the requirements of the State and the Town, hereafter referred to as the Town, are in conflict, the more restrictive requirements shall govern.

1.1.02 Engineering Report

A. An engineering report shall be submitted to and approved by the Town before preparing drawings and specifications except for minor sewer extensions. The report shall contain an overall plan which shall incorporate all of the proposed constmction together with a sufficient amount of the surrounding area in order to clearly outline the interrelationship of the two. Existing and proposed development shall be shown as well as existing and proposed utilities. Where phase development is contemplated, the extent of each phase shall be clearly delineated. Additional requirements shall be imposed as detailed in other divisions of these standards and as required by the Town.

1.1.03 System Layout

A. Layout map shall be prepared which delineates sewer shed area boundaries or pressure zone boundaries for sewer projects and water projects respectively. The map shall clearly de.fining the areas pertinent to interim and ultimate development of the area proposed to be served. The Layout Map shall show present and future development, proposed interim and future utilities as well as those existing utilities that will be affected by or have an effect on the proposed utilities.

1.1.04 System Design

A. An analysis shall be prepared that will tabulate the numbers of people served or proposed to be served as determined from the Town Land Use Map or existing Zoning. The tabulation shall be incremental areas for evaluation purposes.

B. Minimum, average and maximum flows shall be developed for areas and sub-areas and tabulated in the report as deemed necessary or appropriate.

C. The design shall address overall present and future flows and system capacities of existing and proposed utilities as they may be affected by or may affect the facilities involved and shall develop proposed water main and sewer line sizes.

D. The design shall be based on ultimate development and shall present such factors as deemed necessary for a sound evaluation of the several factors used in development of the report.

E. Where an alternate design is proposed that would incorporate interim or staged construction, the report shall develop the alternate design and shall present a thorough investigation and justification for consideration of the alternate.

1.2. Drawing Organization and Format

1.2.01 Drawing Organization

A. Drawings shall consist of the following types of sheets arranged in the order listed:

(1) Cover Sheet

(2) IndexSheet (if necessary)

(3) Plan Sheets

(4) Plan and Profile Sheets

(5) Standard Sheets and Special Details

(6) Erosion and Sediment Control Details

B. Projects consisting of only structures may not require plan and profile sheets and projects for construction of gravity sewers, force mains or water lines may not require the use of plan sheets except for special details.

1.2.02 Sheet Format

A. All construction drawings shall be on sheets 24 inch x 36 inch.

B. The cover sheet shall contain the Owner's name and project description in large, distinctive letters, a vicinity map with a minimum area of 144 square inch drawn where possible on a scale or 1 inch equals 2,000 feet to indicate the general vicinity of the contemplated construction, an index to the plan sheets and the signed stamp of the Owner or principal of the engineering firm.

C. An Index Map shall be prepared for sewer line, sewage force main and water line projects. The Index Map shall be to a scale of not less than 1 inch equals 600 feet and shall show all proposed utility construction with ties to existing utilities. The lines of proposed construction together with proposed utility structures shall be indexed to the drawings to indicate the extent of coverage on each drawing, or, in the case of structures, to the group of drawings involved.

D. All elevations will be based on USC&G datum.

E. Plan sheets as well as Plan and Profile Sheets shall show horizontal, vertical and topographic data as outlined in Section 1.2. of these Standards.

F. Drafting Conventions

(1) Follow the symbols shown on the Standard Symbols Sheet at the end of this Tab No. I.

Line weight for existing facilities shall be no heavier than 0.021 inch.

(2) Standard Symbols - Proposed Facilities

Symbols shall be as shown above except that solid lines shall be used for pipes, line weight shall be no lighter than 0.026 inches and no heavier than 0.035 inches.

(3) Drafting Standards For Good Reproduction

Letters will be no smaller than ½ inch and care will be exercised to keep the lettering open so that it will be legible in the event drawings are reduced to half size. All drawings must be capable of producing legible second generation prints after being reduced to half size.

G. Additional Information

(1) Drawings for minor utility extensions shall include estimated materials quantities and current Town standard notes.

(2) Horizontal scale in Plan and Profile Sheets shall be no smaller than l inch eq uals 100 feet.

(3) Vertical profile scale shall be no smaller than 1 inch equals 10 feet.

(4) All existing and proposed underground utilities shall be shown in plan and profile.

(5) Bench Marks shall be set no more than 500 feet apart along the lines of construction outside the limits of construction. Datum for elevation shown shall be USGS (Mean Sea Level).

1.3. Easement Requirements

1.3.01 All sewer and water lines to be under the jurisdiction of the Town of Bowling Green shall be located either in public right of way or easements.

A. Private owners developing water and sewer facilities which will be under the control of the Town of Bowling Green shall prepare plots and convey easements to the Town of Bowling Green.

B. Water and sewer facilities prepared for the Town of Bowling Green shall be prepared for all construction outside of public right of way.

1.3.02 Permanent easements shall be a minimum of 16 feet in width with consideration for wider easeme nts where more than one facility may occupy an easement, or where, because of line size or access requirements, wider easements are desirable. Where lines have cover in excess of 10 feet, the minimum easement width shall be 20 feet between manholes.

1.3.03 Construction easements shall be acquired for all Town contracts. Developers constructing facilities are not required to have construction easements where work is on the developer's property. Construction easements shall provide a minimum working width of 50 feet, including the 16 foot permanent easement. Generally it is desirable to provide more construction easement on one side than the other. This allows room for construction traffic and material storage.

1.3.04 Easement plats shall be on sheets 8½ inch x 13 inch or 8½ inch x 26 inch where longer easements are required, multiple sheets may be utilized. A sample plat sheet is shown on Form No. F-3.

A center line for the easement shall be shown together with the limits of both the proposed permanent and construction easement widths referenced to the center line of the easement. Bearings and distances shall be shown on the center line of the easement and on the right-of-

fixed points on both the center line and the property lines to the intersection of the two. way or property lines where they intersect the center line. Distances shall be sho'vvn from

Bearings, distances and closures shall be to the degree of accuracy of 1 in 8,000 except that approximations will be permitted where it is considered impractical to delineate existing property lines. The body of the plat shall show the name of the property owner and the Deed or Will Book reference for the source of title. The names of all adjacent property owners and a north arrow shall also be shown. Street names or highway route numbers shall also be shown where applicable.

1.4. Review Procedure

1.4.01 General

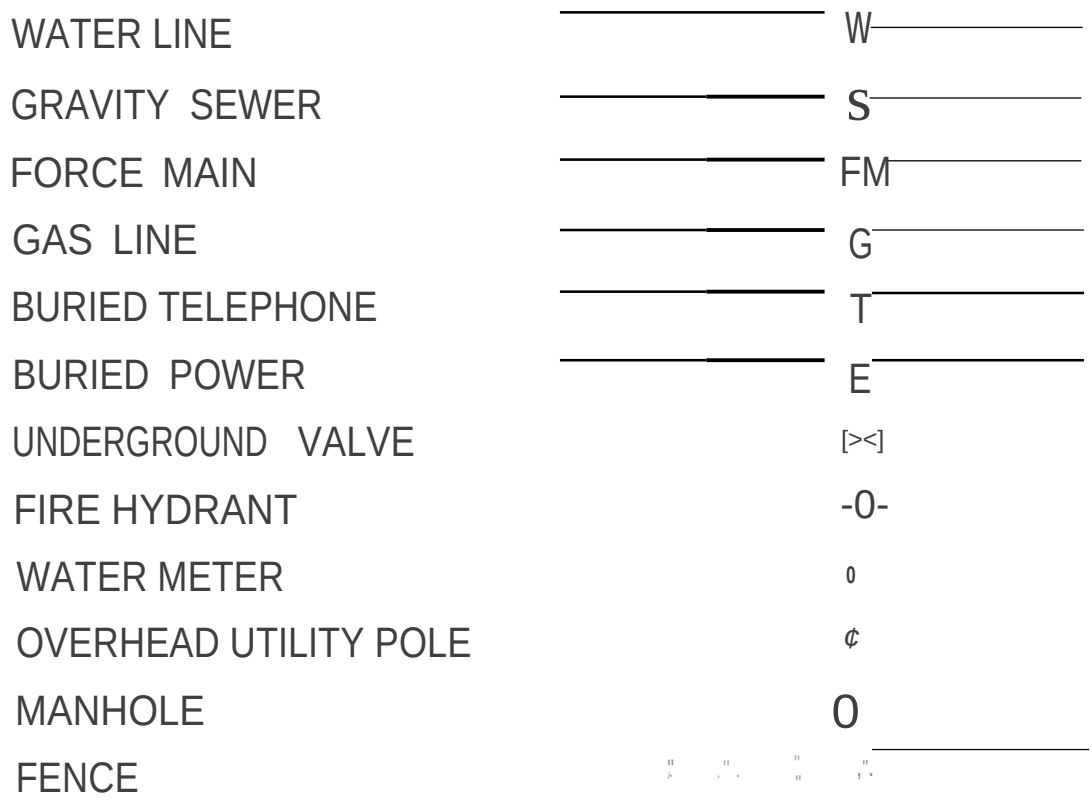
A. The engineer shall be responsible for obtaining the review and necessary approvals of all drawings and specifications by applicable Town, Caroline County, State and Federal agencies having jurisdiction. Copies of such approvals shall be submitted to the Town at the time of final review by the Town.

1.4.02 Town Review

A. Six sets of plans shall be submitted with the current Utility Checklist (Forum F-6 and F-7) and Information Sheet to the Town for review and if found acceptable shall be marked "Approved" by the Town.

B. Additional sets of plans shall be required when backflow conditions are considered as a potential source of contamination of public watersupply.

END OF SECTION



REVISIONS	STANDARD SYMBOLS	DRAWING N

SECTION 2

SECTION 2 DESIGN STANDARDS FOR GRAVITY SANITARY SEWERS

2.1. General Requirements

2.1.01 Sanitary sewers are to be provided solely for the removal of sanitary waste. Under no circumstances shall any roof drains, foundation drains, surface of subsurface drains be either directly or indirectly connected to sanitary sewers. The following design parameters include an adequate allowance for normal infiltration but will not accommodate the above forbidden connections.

2.2 Technical Design

2.2.01 System Layout

A. The overall layout and general design shall conform to the parameters set forth in the approved Engineering Report.

B. All sanitary sewers shall be located in:

(1) Legally established road rights-of-way.

(2) Legally established permanent easements for such purpose, either existing or as proposed by the designer in accord with 1.3. "Easement Requirements" of these Standards.

C. Construction shall be along the center line of rights-of-way or easements except when this location has been previously used by another utility, or when the width of a road right-of-way justified the use of two sewer lines. Exception to this specified location will be allowed only when it can be established that it is not practical to adhere to the standard location.

D. All sewers shall be on continuous grade between manholes.

E. Sewers should intersect in manholes at angles not greater than 90 degrees. In the event that this is impractical the designer must satisfy the Town that adequate losses have been provided in the hydraulicanalysis.

F. Sewer mains and manholes shall be a minimum of 10 feet horizontally from any part of a building or structure.

G. Sewers shall not be located within 50 feet of an existing well.

2.2.02 System Design

A. The overall design shall be in accordance with the provisions of the approved Engineering Report in accordance with 1.1.02 "Engineering Report" of these Standards.

(1) Design carrying capacities of lateral, trunk and interceptor sewers shall be based upon the total drainage area served by the line or lines in question. The design flow shall be based on acreage density, using the Town of Bowing Green Land Use Map or approved zoning, whichever allows higher densities.

(2) Equivalent flows from motels, schools, hospitals, etc. shall be based upon that of the Commonwealth of Virginia "Sewerage Regulations".

(3) In the absence of information on densities or equivalent flow, the designer shall supply sufficient information, substantiated by sound engineering judgement to verify the design. This information shall be subject to approval by the Town.

2.2.03 Capacity Design

A. Laterals shall be designed to carry ultimate tributary population with a 50 year projection as an upper limit. Properallowance for peak flow, as shown on Peak Flow Chart, in Section 5, Form F-2 shall be included.

B. Tmnks and interceptors shall be designed on the same basis as laterals except in cases where capacities of system or parts thereof can be readily increased by future relief, allowing for shorter capacity design life of initial or subsequent lines.

C. Computations of all lines shall be shown on form similar to the sewer design form in Section 5, Form F-1, including anticipated future relief lines that may be required.

(1) Computations shall be accompanied by a Drainage Area Map, conforming basically to requirements oflndex Map, 1.2.02 C. Map(s) shall show entire drainage area involved, location(s) ofline(s) in system and points of entry of flows, including any flows being received from other areas. Drainage Area Map shall be keyed to computation sheet (hydraulic analysis, Form F-1). Computations and maps shall be submitted to the Town for approval.

2.2.04 Hydraulic Design - Sewers

A. Minimum grades shall not be less than those required to produce a velocity of approximately two and one quarter (2.25) feet per second when the sewer size selected is flowing full or half full. Pipe sizes shall not be arbitrarily increased in order to take advantage of a flatter grade.

B. The minimum size pipe to be used in systems shall be eight (8) inches.

C. Allowable minimum grades shall be as follows:

Sewer Size (Inches)	Minimum Slope in Feet/100 Feet
8	0.40
10	0.32
12	0.24
14	0.20
15	0.16
16	0.16
18	0.12
21	0.10
24	0.08
27	0.07
30	0.06
33	0.06
36	0.05

D. Computations for velocity of flows shall be based upon the following values of "N" as used in the Kutter or Manning formula for velocity of flow.

(1) Sizes 8 inch through 21 inch: N equals 0.013

(2) Sizes 24 inch and above: N equals 0.012

E. In cases where the calculated depth of flow is less than pipe flowing full, the velocity at actual depth of flow shall be computed.

F. For sewage flow depth less than ¼ full, an allowance shall be made for increased value of "N" and in no case shall velocities of less than 2.0 feet per second be permitted. The improved velocities shall be accomplished by steeper grades and not by changing pipe diameter.

G. Generally the sizes of pipe shall be continually increasing with increase of tributary areas. However, when steep grades are available and length is such that a significant cost savings will result without jeopardizing the system, the size of pipe may be reduced a maximum of two (2) normal diameters, but not below twelve (12) inches. Proper hydraulic allowances must be made for resulting head losses.

H. Miscellaneous head losses at manholes and curves shall be computed as follows.

Junctions of more than two (2) pipes will require special consideration.

(1) Manholes where radius in turn is less than 2 pipe diameters:

$$H_L = 0.5\frac{V^2}{2g}\frac{\Delta}{90°}$$

(2) Manholes were radius of turn is greater than 2 pipe diameters.

$$H_L = 0.25\frac{V^2}{2g}\frac{\Delta}{90°}$$

Where:

g = acceleration due to gravity.
Δ = is horizontal deflection angle.
HL = head loss.
V = is ve locity in infl uent pipe.

(3) Loss for straight run manhole shall be 0.05 feet. In no case shall loss less than 0.05 feet be allowed.

I. \Vhere pipe diameters increase at manholes, in direction of flow, effluent invert shall be lowered below effluent elevation as follows:

Change equals 0.8 (D^1 . D^2)Ft.:

D^1 equa ls downstream diameter
D^2 equals upstream diameter

This adjustment shall be in addition to computer miscellaneous head loss.

J. Special consideration shall be given to cases where pipe diameters decrease in direction of flow.

2.2.05 Structural Design

A. Structural requirements must be considered m the design of all sewers and appurtenances.

B. The proper strengths shall be determined and indicated for sewer pipe materials being specified . Strength shall be based upon pipe size, proposed depth, width of trench,

bedding conditions, existing ground conditions, tic. This is a matter of detail design

not subject to simple generalizations. Minimum bedding shall be Class C.

C. In deep cuts, it is generally preferable to change pipe strengths to obtain proper design rather than vary bedding conditions. However pipe strength or class shall be shown on plans with stations to indicate the location.

D. No change in pipe strength or material shall be made between manholes unless it can be substantiated that a considerable cost savings would result and integrity of system would not be jeopardized. Proper precautions shall be taken regarding correct location(s) of varying strength of pipe.

E. The thickness of precast concrete manhole walls shall be increased when total depth of manhole exceeds thirty (30) feet. Brick manholes shall conform to Standard Drawings. The minimum manhole diameter shall be increased to 60" when the total depth exceeds 24 feet.

F. Gravity systems receiving pumped flows shall be protected against sulfide attack for a distance of 1200 feet downstream from point of pumped flow entry.

(1) This shall be accomplished by the use of acid-resistant pipe and manholes. The Town shall approve the materials and design for the conditions at each individual location.

G. Ductile iron pipe shall be used for all stream, or estuary crossings.

H. Anchor sewers on slopes of20 percent or greater with concrete anchors or equal. The following minimum requirements shall be used:

(1) Not over 36 feet center to center no grades 20 percent and up to 35 percent;

(2) Not over 24 feet center to center on grades 35 percent and up to SO percent;

(3) Not over 16 feet center to center on grades SO percent and over.

I. Steel casing pipe shall be sized in accordance with Paragraph 3.2.0IS.

J. When velocity of the sewage will exceed 15 feet per second, special protection will be afforded to the pipe to prevent internal erosion. Erosion protection measures must be in accordance with ASTM, AWWA, ANSI, or other appropriate standards.

2.2.06 Sewer Appurtenances

A. Standard and drop manholes, service connections and other appurtenances shall be

constructed in accordance with Standard Drawings.

B. Manholes shall be installed at the end of each line, at all grade, size or alignment changes, and at all sewer line intersections.

C. Sewer connections serving more than one building shall be made by construction of a manhole on the Town sewer and an 8" sewer line terminating in another manhole at the uppermost building connection. Such construction shall be in accordance with Town Standards.

D. Manholes shall be spaced at distances no greater than 400 feet for sewer sizes up to 15 inches and 500 feet for sewer sizes 16 inch through 30 inch.

E. Greater spacing than above may be permitted in sewers larger than 30 inches of up to 600 feet.

F. Sewer lines shall be protected from a 100 year flood by either raising manhole tops above flood plain or by the use of watertight frames and covers. Where watertight frames and covers are used, unventilated length of sewer cannot exceed 1000 feet. Manhole covers shall be no more than 30 inches above ground level.

G. Vandal proof manhole frames and covers shall be used on all manholes not in paved streets unless watertight covers are required.

H. All new food preparation facilities, such as restaurants and bakeries, shall be required to construct an outside grease trap for the retention of grease, fats, and oils generated by that business. The design of the grease trap shall be approved by the Director. The grease trap shall be operated and maintained properly by the discharger.

I. A monitoring manhole shall be required on all new construction or renovations or modifications to existing facilities, where the discharge originating in the new, renovated, or modified facility is, or will have the potential to be non-domestic in nature.

J. Where possible in unpaved areas, manhole castings shall be approximately 12 inches above final grade.

K. Sewer laterals for non-residential connections shall be a minimum of 6-inches. Sewer laterals for residential connections shall be a minimum of 4-inches. Connections shall be made at an angle of 90° to the main.

L. Where a sewer enters a manhole at an elevation greater than 24" above the exit invert, a drop manhole is required.

M. No manhole shall be constructed within 10' of an existing waterline.

2.2.07 Depth of Sewers

A. Generally, all sewers shall be of sufficient depth to provide service to lowest sewer elevation of structure in question, allowing proper service connection grade. However, a greater depth may be required due to future extension or possible future lowering of existing road grade or utilities, minimum depth of cover over sewers shall be 5.5 feet in rights-of-way and 3.5 feet in easements.

B. Where a roadside ditch is used instead of curb and gutter, the engineer shall profile each sewer service connection from the sewer main in the street to the property line being served and must show the service connection material, grade and cover at the ditch line.

C. Exceptions to the above requirements will be considered only if impractical to provide required depths, in which case, special approval must be secured, in writing, from the Town. In the special case of less than minimal cover, ductile iron pipe of adequate thickness shall be provided.

D. Sewers over 18 feet deep shall be of ductile iron.

E. Sewers over 24 feet deep shall be polylined ductile iron with a minimum film thickness of 40 mils.

F. Sewer service connections shall be per Standard Details and shall have clean-outs at the discretion of the Director.

G. Sewers crossing streams must have one foot of cover minimum if stream bead is rock and three feet of cover minimum if stream bed is other material.

2.3. Drawings

2.3.01 In addition to requirements in Section 1.2. "Drawing Organization and Format" of these Standards, drawings shall also have:

A. Stationing, pipe size, material, bearings, direction of flow, deflection angles, grade and distance between center lines of manholes.

B. All manholes numbered, with drop manholes identified and top, influent and effluent elevations clearly shown.

C. The plans shall indicate the following information to provide for service to elevation of the connection as follows:

(1) Lowest sewer structure elevation.

(2) Low ground corner of structure with first floor service only.

Ground level at building line on unoccupied parcel.

(4) The elevation and location of any existing structure to be sewered shall be
(3) clearly shown.

D. Existing water lines and water mains shall be shown and profiles shall indicate points where crossings occur, clearly indicating vertical clearance between utilities.

E. Consultants shall show the location of erosion control devices on the plans. These devices shall be in conformance with the Virginia County Erosion and Sedimentation Control Handbook. Consultants shall include approved erosion control details from the Town.

F. Any other pertinent details.

(1) Consultants designing facilities for developers shall show the appropriate Sewer or Water Notes on the drawings (see Section 5, F-4).

END OF SECTION

SECTION 3

SECTION 3- DESIGN STANDARDS FOR SEWAGE PUMPING STATIONS AND FORCE MAINS

3.1. General Requirements

3.1.01 The design of sewage pumping stations and force mains is an engineering matter and is not subject to detailed recommendations or requirements.

3.1.02 Sewage pumping stations and force mains are to be provided solely for the conveyance of sanitary wastes. Under no circumstances shall any roof, foundation, surface or sub-surface or any other form of storm drainage be allowed to pass through the proposed facility.

3.1.03 A detailed engineering report shall be submitted to and approved by the Town prior to design. The report shall fully evaluate the proposed sanitary drainage area and the overall effect upon present and future Town facilities.

3.1.04 The design must conform to the minimum standards set forth in the Commonwealth of Virginia "Sewerage Regulations". Town of Bowling Green requirements for specific equipment and submittals will be detailed during engineering review.

3.2 Technical Design

3.2.01 System Layout

A. The sizing and configuration of the pumping station and the sizing of the attendant force main shall be within the parameters set forth in the engineering report. The facilities to be provided sha ll be based on ultimate flows unless an interim flow design shall have been incorporated in the approved engineering report.

B. The type of equipment to be installed in the pumping station will be influenced by the inte rim and ultimate capacity of the station and an evaluation of the period of time that the service of the station will be required.

C. Pumping equipment shall be in general conform to the following types:

Pump Type	Flow Range
Grinder Pumps	Up to 30 gpm
Wet Pit or Submersible	30 to 250 gpm
Dry Pit or Suction Lift	250 gpm and over

D. An ample, all-weather road, including surface treatment, storm drainage and parking, shall be provided for easy access to the pumping station.

E. The architecture of the pumping station shall be considered. Site grading, seeding or sodding, trees or shrubs shall be provided to present a finished appearance, as approved by the Town, consistent with the zoning and general appearances of the surrounding area. Approved fencing with gates shall be provided as deemed necessary to properly protect the facility.

F. The Design Engineer shall determine the "Reliability Class" in accordance with the State "Sewerage Regulations" and shall comply with the requirements thereof. Each pumping station shall have an emergency generator or alternate source feed.

G. The Design Engineer shall consider the need for protection of the pumping station and force main against hydrogen sulfide attack and shall provide the proper equipment if such protection is found necessary.

H. All motors, motor control and other electrical equipment shall be housed in a weatherproof, above-ground structure. Adequate provisions shall be incorporated for the proper ventilation, drainage and flood protection in order to insure maximum reliability, electrical and personnel safety.

I. All pumping station wet well shall be considered explosion hazardous. All electrical equipment installed therein shall be approved for NEMA 7, Class I, Group D. In accordance with Article 500 of the National Electric Code (NFPA No. 70). The use of intrinsically safe controls in accordance with NFPA No. 493 is satisfactory and their use is encouraged.

J. Where structurally separate wet well and dry wells are provided, adequate provision for differential settlement shall be incorporated by means of flexible pipe joints consisting of a minimum of at least two standardized mechanical joint bell connections or their approved equivalent.

K. All pumping stations shall be of sufficient size and contain adequate clearances to provide ample room for maintenance and equipment replacement.

L. Consideration shall be given to the need for a water supply well in locations where a public water supply is not available.

M. Force main locations shall generally conform to Section 2.2.01 - "System Layout" of these Standards. Force mains shall have a positive slope from the pumping station to the point of discharge unless unusual conditions make it impractical. Extra depth of bury shall be provided in lieu of air or air/vacuum relief valves wherever feasible. Every effort shall be expended to maintain the force main below the hydraulic gradient. Where a relief valve is required, an automatic valve shall be provided and

N. Every effort shall be made to maintain a full force main under operating conditions. installed inside a standard manhole with adequate means of drainage.

0. Sizing of main shall be such that velocity shall not be below 2 F.P.S. flushing facilities.

P. All force mains shall be ductile iron, or polyvinylchloride (PVC).

Q. Design Engineer shall consider ground conditions in the case of metallic conduits and provide suitable cathodic protection where necessary.

R. Steel casing pipe shall have a minimum yield strength of 35,000 p.s.i. and a minimum internal diameter of 4" greater the largest external diameter of the carrier pipe. The wall thickness of casing pipe shall be sufficient to resist loads to which it will be subjected, but in no case less than 0.250 inches.

S. Conduits of non-ferrous material buried underground shall have a detectable tracer buried in the trench approximately **18"** above the conduit, but no less than 24" below grade and 12 ga. solid copper wire taped on top of pipe.

3.2.02 Capacity Design

A. Capacity design for the pumping station and force main shall be based on Section 2.2.02 - "System Design" of these Standards, and shall take into consideration such parameters as minimum, average and peak station inflows as well as minimum, average and maximum pumping rates.

B. Pump selection and force main sizing shall be based on a hydraulic analysis of the required flows, pipeline velocities and receiving gravity sewer capacities.

C. Calculations shall be prepared and a system friction chart prepared that will show static head and total dynamic head for both single and multiple pump operation. The chart shall also show the pump performance curve for both single and multiple pump operation. Where variable speed pumping is contemplated, pump performance curves shall show performance at maximum speed, minimum speed just above static head and several intermediate speeds that will clearly indicate pump operation. The system friction curves shall illustrate the effect of wet well level on system friction. Particular attention shall be given to the available versus required net positive suction head (NPSH).

D. Consideration must be given to designs which produce minimum power requirements to accomplish the functions required. If requested, supporting data shall be furnished to the Town.

3.2.03 Structural Design

A. In addition to conventional design procedures, there are several specific areas that must be considered.

(1) The effect of hydraulic thrust must be countered by the use of thrust blocking, pipe anchorage or other suitable means to prevent movement of pumping equipment and pipelines.

(2) Structural requirements for force mains include the proper selection of materials and strengths of pipe and pipe accessories. This will involve a study of anticipated trench conditions and bedding methods. The minimum depth of cover shall be governed by depths of other utilities and hydraulic gradient; however, not less than 3.5 feet of cover shall be provided.

3.2.04 Drawings

A. Drawings for pumping stations and plan and profiles for force mains shall be prepared in accordance with Section 1.2. - "Drawing Organization and Format."

B. Drawings and specifications shall be of such quality and contain sufficient details so that no misunderstanding may reasonably arise as to the extent of the work to be performed, the materials to be used, the equipment to be installed or the quality of the workmanship. Manufacturers of major items of equipment shall be specifically approved. No deviation from the approved manufacturers will be permitted.

C. Drawings for pumping stations shall include a site plan drawn to scale of not less than 1" equals 20' and shall contain existing and proposed contours on a 2' contour interval. The boundaries of the site shall be clearly shown on the site plan and shall be permanently mounted in the field prior to completion of construction.

D. Drawings for pumping stations shall be drawn on a scale of not less than ¼" equals l'-0". Drawings required to clarify construction details shall be drawn on an appropriately larger scale.

E. Drawings for forcemains shall show stationing, pipe size, bedding, direction of flow, deflection angles and curve data.

F. Profiles for force mains shall show the ground line, force main profile, underground utility lines and structures that might affect force main depth. It shall also show areas where additional depth will be required, any required vertical curve data and locations of all relief valves and appurtenances. All crossing of existing and proposed water mains shall be shown to clearly indicate vertical clearance between utilities.

G. Details shall be shown for all blocking, pipe restraints, and for relief valves.

H. Consultants shall show the location of erosion control devices on the plans. These devices shall be in conformance with the Virginia / County Erosion an Sedimentation Control Handbook.

END OF SECTION

SECTION 4

SECTION 4 - DESIGN STANDARDS FOR WATER DISTRIBUTION FACILITIES

4.1. General Requirements

4.1.0I Water and fire protection distribution facilities are to be provided solely for the purpose of supplying potable water and fire protection. Under no circumstances shall cross-connections be allowed to unapproved water facilities. The following design parameters should be used in the design of water distribu tion facilities. Water transmission facility design parameters are not included herein and such criteria will be established on a case by case basis.

4.1.02 Prior to submitting plans for new water distribution facilities or extensions to existing facilities, the designer shall coordinate with the Town and determine the available flow and pressure from the existing system.

4.2 Technical Design

4.2.01 System Layout

A. The overall layout and generaldesign shall conform to the parameters set forth in the approved Engineering Report.

B. Generally, all water mains shall be located, where practical ,in:

(1) Legally established road rights-of-way.

(2) Legally established permanent easements for such purpose and immediately adjacent to legally established road rights-of-way or paved areas, either existing or as proposed by the designer in accordance with Section 1.3. - "Easement Requirements" of these Standards.

(3) Paved areas.

C. Construction shall generally be parallel to the center line of roads or easements. The same offset shall be used throughout except when existing utilities dictate a change in offset along the proposed line.

D. Water mains shall be installed a minimum of 10 feet from any part of any structure.

E. In general, main line valves are required at intervals of 500 feet and at tees and crosses to allow adequate control of the system without major system shutdowns.

4.2.02 System Design

A. The proposed facilities together with the pertinent ex1stmg facilities shall be evaluated based on the hydraulic design, demand design and fire protection design requirements contained herein.

B. The Design Engineer shall submit to the Town a neat and orderly set of design calculations to illustrate normal and fire flows, pipe size selection and fire protection requirements.

C. Non-Ferrous mains shall have a detectable tracer buried in the trench 18" above the main but no less than 24" below grade and 12 ga. solid copper wire taped to pipe.

D. Dead end lines shall be minimized by looping mains. Where looping is required the minimum size pipe shall be 6".

E. All dead ends shall be provided with a fire hydrant, flushing hydrant, or blow-off.

4.2.03 Hydraulic Design

A. Hydraulic design shall be accomplished by use of the Hardy-Cross Network Analysis Method or similar method acceptable to the Town. A Hazen-Williams coefficient of friction equal to 120 shall be used for purposes of design unless the Town hasdata to indicate a lesser coefficient should be used for existing lines.

4.2.04 Demand Design

A. Maximum rates of water consumption shall be calculated and used as a basis of hydraulic design. Average daily water consumption rate values for the number and type of consumers anticipated to be served shall be based on those contained in the State of Virginia "Waterworks Regulations." Any such rates not given or any deviations from tabulated rates shall be estimated and justified by the Design Engineer and approved by the Town. The average annual daily water consumption rates shall be adjusted by a multiplier to arrive at the maximum daily water consumption rate by the application of a multiplier, expressed as follows:

$$0_{111} = 0a \times C$$

0_{111} is maximum daily water consumption rate.

$O.$ is average annual daily water consumption rate.

C is constant varying from 1.5 to 1.75

0_{111} shall be used as the basis for hydraulic design.

4.2.05 Fire Protection

A. Rates of flow for fire protection shall be estimated based on the 1980 I.S.O. Fire Suppression Rating Schedule, Section I, Public Fire Suppression, Subsection 300, Needed Fire Flow, including ~~Definitions Extracted From the CFRS~~ and including ~~Occupancy Classifications, Non-Manufacturing and~~ allowance of 50% reduction in needed fue flow may be allowed for buildings with automatic sprinkler systems that provide full protection.

B. The minimum fire flow from any individual fire hydrant shall be 500 gpm. The minimum flowing pressure at maximum flow shall be 20 psi.

C. During maximum rated fire flow conditions, the residual pressure in the system shall not be less than 20 psi.

D. The minimum size water line used for fire protection to properties zoned agricultural or single family residential shall be 6" in size. The minimum size water line used for fire protection to properties zoned multi-family residential, commercial or industrial shall be 8" in size.

E. The minimum sized fire service lines above shall be looped to provide feed from at least two directions. The sizing of minimum-sized fire service lines and larger than minimum fire service lines shall be determined by Sections 4.2.03 and 4.2.05 - "Hydraulic Design" and "Fire Protection." Not more than one fire hydrant shall be installed on a 6" dead end line.

F. Dead end lines shall not contain more than 600 feet of the minimum sized line. Additional lengths required shall be provided by increasing the line size.

G. Fire hydrants shall be located no further from edge of roadway shoulder than 10'-0".

H. Fire hydrants shall be placed on legal rights-of-way and shall generally be placed in line with street intersections. This shall be deemed to be the P.T. of the returns on the rights-of-way. Where long block lengths require the use of intermediate fire hydrants, they shall be placed in line with the property boundary between adjacent lots or parcels of land.

I. Fire hydrant spacing for prope1ties zoned agricultural or single family residential shall not exceed 500 feet or require a hose lay of over 650 feet from the hydrant to any part of any structure to be protected.

J. Fire hydrant spacing for properties zoned multi-family residential, commercial or industrial shall not exceed 500 feet or require a hose lay of over 350 feet from the hydrant to any part of any structure to be protected. Where multiple fire hydrants are needed to supply the required fire flow, all necessary hydrants must be located within the specified hose lay.

K. No fire hydrant shall be placed closer than 50 feet from the face or overhang of any building to be protected.

L. The above criteria for spacing fire hydrants may be modified by the Town to improve fire hydrant accessibility for fire fighting purposes.

M. Structures protected by automatic sprinkler systems require installation of a detector check, dedicated fire hydrant, and a siamese connection. The detector hydrant is not credited towards external protection requirements. Siamese connections must be located within 50 feet of the dedicated hydrant.

4.2.06 Structural Design

A. Structural requirements must be considered in the design of all water mains and appurtenances.

B. The proper strengths shall be specified for the pipe material being specified. Strength shall be based on operating pressures, depth of bury, trench width and foundation conditions. This is an engineering matter and not subject to generalization.

C. Proper blocking and/or restraints must be provided and shown on the drawings. Where blocking is not detailed on the drawings, restrained joints shall be used.

D. Proper support shall be provided for aerial or suspended lines.

E. Any potable waterline crossing above surface water must be:

(1) Adequately supported.

(2) Protected from freeze damage.

(3) Accessible for repair or replacement.

(4) Above the 100-year flood plain elevation.

F. Any potable waterline crossing under surface water must meet the following requirements:

(1) The pipe shall be of special construction having flexible watertight joints.

(2) Valves shall be provided at both ends of the water crossing so that the section can be isolated for test or repair; the valves shall be easily accessible and not subject to flooding.

(3) Permanent sample taps shall be available at each end of the crossing and at a reasonable distance from each side of the crossing, for the purpose of testing the section of line crossing the surface water, and for locating leaks in that section.

(4) Minimum cover over the pipe during crossing shall be 3 feet.

4.2.07 Miscellaneous Considerations

A. The minimum size water line pipe to be used for normal domestic water shall be 6 and be capable of supplying 3 gpm per residential connection at 20 p.s.i. except where fire protection lines are to be provided.

B. Air, air/vacuum or pressure reducing valves, blow-off tees and related fittings shall be provided. The type, size, etc., shall be specified by the Design Engineer, subject to approval by the Town.

C. The minimum depth of cover for water mains shall be 3½ feet. Additional depth shall be provided where required for thrust restraint or to clear underground obstructions.

D. The profile of water services at ditch lines shall be shown on plans and have a minimum of 24" cover at the ditch invert.

E. Service lines larger than ¾", with meters larger than ½" shall be sized in accordance with AWWA Manual M-22 "Sizing Water Service Lines and Meters" except as follows:

(l) Useconstant pressure factor of 1.

(2) Include all outside hose bibs in combined fixture value total.

(3) Irrigation System shall be excluded from domestic meter sizing criteria except as follows:

(a) Exclusion meters shall be at least one (1) size smaller than the domestic meter.

(b) If metered separately, the irrigation meter shall be sized based on demand criteria furnished by the Engineer.

(4) For non-residential facilities with flush-valve fixtures, the meter will be sized as follows:

METER SIZE - INCHES	COMBINED FIXTURE VALUE TOTAL
1	41-100
l½	101-400
2	401-1200

(5) For residential facilities and office buildings with tank type water closets, the meter will be sized as follows:

METER SIZE - INCHES	COMBINED FIXTURE VALUE TOTAL
½	0-40
1	41-400
l½	40 l-5500

(6) Plumbing Fixtures Values shall be shown in AWWA No. M-22 for 35 PSI.

(7) Meter installations requiring a flow of greater than 160 gpm or greater than the total fixture values indicated above shall be reviewed and/or approved on a case by case basis in accordance with AWWA Manual M-22.

(8) Steel casing pipe shall be sized in accordance with Paragraph 3.2.01S.

(9) A ½" meter may be used for non-residential facilities with tank type water closets and a combined fixture value total of 0-40. A 1" meter will be the minimum size used for any facility with flush valve fixtures.

F. Where water lines are subject to extreme variations in temperature (i.e., attached to bridges or box culverts) consideration shall be given to expansion and contraction of pipe materials and the freezing of the line contents.

G. Cathodic Protection - Design Engineer shall consider ground conditions in the case of metallic conduits and provide suitable cathodic protection where necessary.

H. No flushing device shall be directly connected to a sewer.

4.3. Drawings

4.3.01 In addi tion to the requirements of Section 1.2. - "Drawings Organization and Format" of these Standards, the drawings shall incorporate the following features:

A. Drawings for water lines shall show stationing, pipe size, bearings, deflection angles and curve data.

B. The drawings shall also show all fire hydrant and water service connections. Fire hydrants and water services over¾" in size shall be shown in plan and profile views which are labeled by stations.

C. Profiles shall be provided for all water lines excluding service connections. Grades shall be calculated and shown on the profiles. Profiles shall also show all air, air/vacuum relief valves, fire hydrants, and blow off locations.

D. Water lines shall be referenced by distances from right-of-way lines, buildings and other utilities.

E. The Drawings shall show blocking and/or restraint details.

F. Current Town of Bowling Green Sewer and Water Notes, where applicable, see Section 5, F-4.

G. All drawings for water mains, crossing sewers, force mains or other utilities, shall show points where crossings occur. Crossings shall be shown in both Plan and Profile. The Profile shall clearly indicate vertical clearance between utilities.

H. Meter sizing form, backilow prevention details and ISO calculations shall be shown on the plans.

I. All fittings to include valves, bends, tees, etc. shall be shown on the plan and profile.

END OF SECTION

SECTION 5

SECTION 5 - DESIGN STANDARDS FOR WATER PUMPING STATIONS AND WELLS

5.1. General Requirements

5.1.01 The design of water pumping stations and wells is and engineering matter and is not subject to detailed recommendations and requirements.

5.1.02 A detailed engineering report shall be submitted to and approved by the Town prior to design. The report shall fully evaluate the proposed sanitary drainage area and the overall effect upon present and future Town facilities.

5.1.03 The design must conform to the minimum standards set forth in the Commonwealth of Virginia. Town of Bowling Green requirements for specific equipment and submittals will be detailed during engineering review

5.2 Technical Design

5.2.01 System Layout

A. The sizing and configuration of the pumping station and the sizing of the attendant force main shall be within the parameters set forth in the engineering report. The facilities to be provided shall be based on ultimate flows unless an interim flow design shall have been incorporated in the approved engineering report.

B. The type of equipment to be installed in the pumping station will be influenced by the interim and ulfimate capacity of the station and an evaluation of the period of time that the service of the station will be required.

C. An ample, all-weather road, including surface treatment, storm drainage and parking, shall be provided for easy access to the pumping station.

D. The architecture of the structure shall be considered. Site grading, seeding or sodding, trees or shrubs shall be provided to present a finished appearance, as approved by the Town, consistent with the zoning and general appearances of the surrounding area. Approved fencing with gates shall be provided as deemed necessary to properly protect the facility.

E. The Design Engineer shall determine the availability of electric service and coordinate the available electrical service with that required for the facility. The engineer shall also determine the need for primary service extension and advise the Town if an extension is necessary.

F. The Design Engineer shall determine need for standby electric service. If necessary,

the facility shall have a permanently installed emergency generator or alternate

source feed.

G. Adequate provisions shall be incorporated for the proper ventilation, drainage and flood protection in order to insure maximum reliability, electrical and personnel safety.

H. All water pumping stations and well building shall be of sufficient size and contain adequate clearances to provide ample room for maintenance and equipment replacement.

5.2.02 Capacity Design

A. Hydraulic design for water pumping stations shall be based on Sections 4.2.04 and 4.2.05 - "System Design" of these Standards, and shall take into consideration such parameters average and maximum pumping rates, and fire flow.

B. Pump selection shall be based on a hydraulic analysis of the required flows.

C. The hydraulic analysis shall show static head and total dynamic head for both single and multiple pump operation. It shall also show the pump performance curve for both single and multiple pump operation. Where variable speed pumping is contemplated, pump performance curves shall show performance at maximum speed, minimum speed just above static head and several intermediate speeds that will clearly indicate pump operation.

D. Consideration must be given to designs which produce minimum power requirements to accomplish the functions required. If requested, supporting data shall be furnished to the Town.

5.2.03 Drawings

A. Drawings for pumping stations and plan and profiles for force mains shall be prepared in accordance with Section 1.2. - "Drawing Organization and Format."

B. Drawings and specifications shall be of such quality and contain sufficient details so that no misunderstanding may reasonably arise as to the extent of the work to be performed, the materials to be used, the equipment to be installed or the quality of the workmanship. Manufacturers of major items of equipment shall be specifically approved. No deviation from the approved manufacturers will be permitted.

C. Drawings for water pumping stations and wells shall include a site plan drawn to a scale of not less than 1" equals 20' and shall contain existing and proposed contours on no greater than a 2' contour interval. The boundaries of the site shall be clearly shown on the site plan and shall be permanently marked in the field prior to completion of construction.

D. Drawings for pumping stations shall be drawn on a scale of not less than ¼" equals 1'-0". Drawings required to clarify construction details shall be drawn on an appropriately larger scale.

E. Consultants shall show the location of erosion control devices on the plans. These devices shall be in conformance with the Virginia / County / Town Erosion and Sedimentation Control Handbook.

END OF SECTION

SECTION 6

STANDARD FORMS AND NOTES

INDEX TO FORMS

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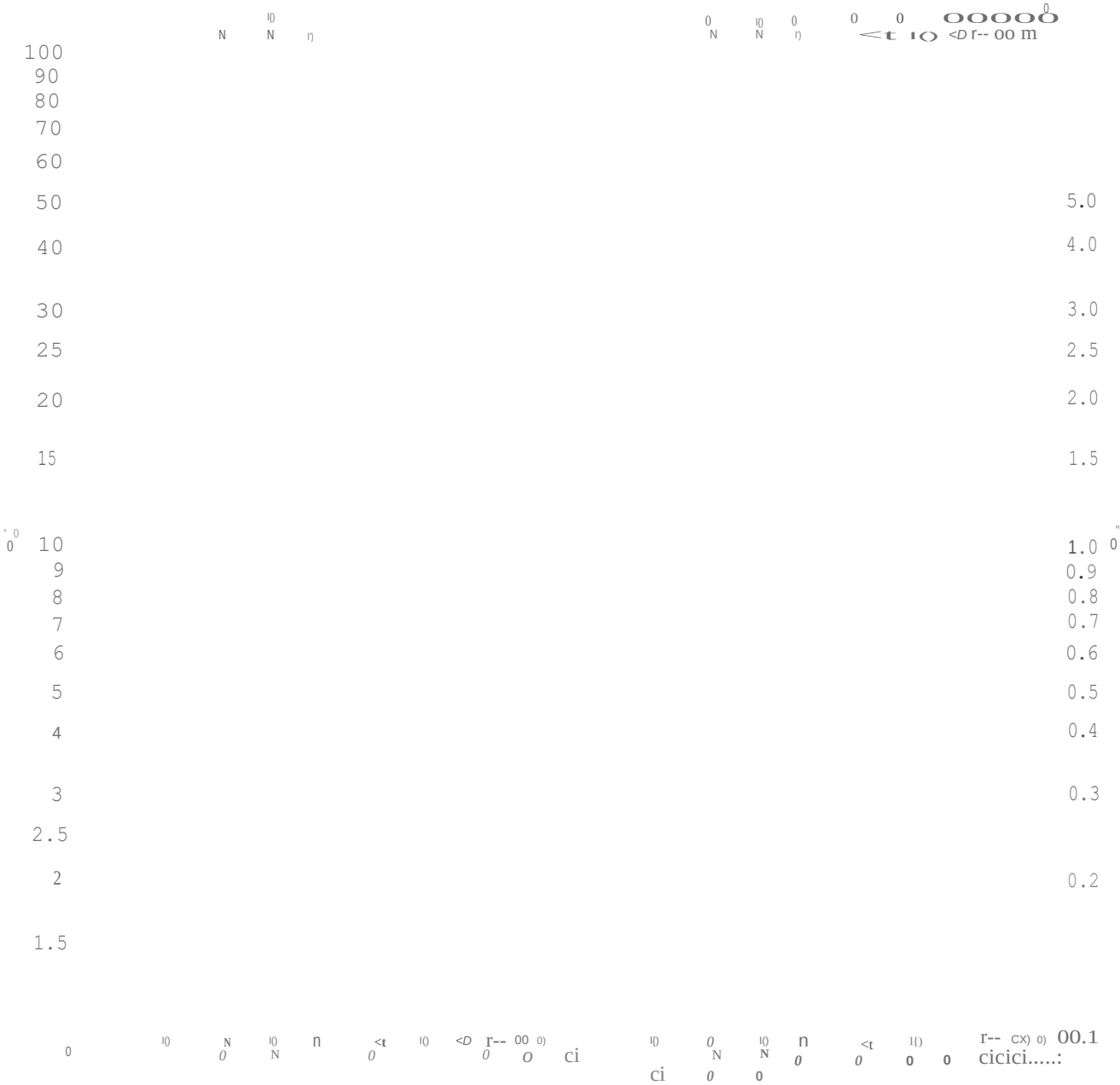
LOCATION	0 :z:	MANHOLE NUMBER		AREA C = >	ELEVATION OF INVERT		REMARKS
		FROM	TO	tlOIOIEIIT	TI UPPER ENO	LOWER ENO	
1	2	3	4	f>	J O	31	

TOWN OF BOWLING GREEN

VALUES OF Qo FROM 1.0 TO 100 MGD



VALUES OF Qo FROM 1.0 TO 100 MGD

0-20 MGD : Qd = (3.03700)$^{0.8606}$

20-50 MGD : Od = (20a)

REVISIONS	CHART SHOWING RELATION OF AVERAGE FLOW TO DESIGN FLOW FOR SANITARY SEWER DESIGN	DRAWING NO. FORM F-2

WATER AND SEWER NOTES

1. All materials and installation shall conform to the latest edition of Standards, Town of Bowling Green.

2. Contractor shall be responsible for notifying the Town Public Works Department and scheduling a pre-construction meeting at least 48 hours prior to starting any work on this project. All work shall be subject to inspection by Town inspectors. The Contractor shall obtain all necessary permits.

3. The Contractor shall include in applicable bid price, the cost of locating and uncovering all sewer manholes and all valve boxes after completion of all paving and adjust them to the final road grades.

4. The location of existing utilities across or along the line of the proposed work is not necessarily shown on the plans and where shown is only approximately correct. The Contractor shall, on his own initiative and at no extra cost, locate all underground lines and structures as necessary. The Contractor shall be responsible for any damage to underground structures.

5. Minimum cover over top of water pipe shall be 3.50 feet.

6. Datum for all elevations shown in USC&G.

7. Engineer shall certify that unpaved streets area to subgrade prior to Contractor installing water system. Curb and gutter, if required, shall be installed prior to acceptance of water system by the Town.

8. Contractor shall call "Miss Utility" toll free at 1-800-552-7001 prior to construction.

9. No structures or planting of trees shall be permitted in utility easements.

10. Service saddles must be used on water connections to PVC mains less than 6" rn diameter.

11. Fire hydrants shall be installed in accordance with Standard Drawing D-160.

12. Vandalproof covers shall be used on all manholes in easements. Watertight covers shall be used in flood plains. The manhole covers shall be in accordance with Standard Drawings D-465, D-466, or D-467 and D-468.

13. Final Acceptance by the TO'\,vn shall not be made until all work shown on approved utility plans is completed including paving, grading, and all required adjustments.

14. A Wetlands Permit may be required from the U.S. Army Corps of Engineers for this development. For information concerning such a requirement, contact of Corps at (804) 462-5382.

EROSION CONTROL NOTES

1. It shall be the developer's responsibility to inspect all erosion control devices periodically and after every erodible rainfall. Any necessary repairs or cleanup to maintain the effectiveness of the erosion control devicesshall be made immediately.

2. No disturbed area will be denuded for more than 30 calendar days.

3. All erosion and siltation measures are to be placed prior to or as the first step in grading.

4. All storm and sanitary sewer lines not in streets are to be mulched and seeded within fifteen days after backfill. No more than five hundred feet are to be open at one time.

5. Electric power, telephone, and gas supply trenches are to be compacted, seeded and mulched within fifteen days afterbackfill.

6. All temporary earth berms, diversions, and silt dams are to be mulched and seeded for vegetative cover within ten days after grading. Straw or hay mulch is required. The same applies to all soil stockpiles.

7. During construction, all storm sewer inlets will be protected by silt traps, maintained and modified as required by construction progress.

8. Any disturbed are not paved, sodded, or build upon by November S1 i, is to be seeded on that date with oats, abruzzi, rye, or equivalent and mulched with hay or straw mulch. Modify as applicable depending on proposed time of construction.

TOWN OF BOWLING GREEN

REVIEW ~~CHECKLIST FOR WATER AND SEWER~~ PLANS
Project Title

Existing utilities to be extended to service this project are shown on Sheet No._ orApproved Utility Plan No.___ .

1 Virginia registered engineer's stamp & signature.

2 Plan and profile sheets are on 24" x 36" paper.

3 Project vicinity map.

4 Owner/ Developer name and address shown on plans.

5 l.S.O. Fire Flow computations shown on plans (where applicable).

6 Domestic water meter calculations shown on plans in accord with AWWA Manual M-22 (where applicable).

7 Water System designed to provide adequate domestic service and fire protection to Owner's property. _" diameter line required to adequately serve this project in accord with County standards.

8 Sanitary Sewer Service area map submitted with plans. (Calculations shown thereon) ___ " diameter line required to adeq uate ly serve this project in accord with the Town Standards.

9 Overall water, and sanitary sewe r plans submitted for phased projects. Fire hydrants and valve locations shown on wate r overall plan.

10 Deflect ion ang les shown on all manholes.

11 Standard water and sewer notes shown on plans.

12 Benchmarks shown every 500 feet.

13 Direction of flow arrows shown on sanitary sewer.

14 All underground utility conflicts profiled and resolved.

15 This project has been designed in accord with the latest Town Standard and State Regulations (whichever is more restrictive).

16 All proposed water and sewer lines connect to existing facilities which have been previously accepted by the Town for operations and maintenance.

17. All off-site easements necessary for the completion of this project have been acquired, recorded and their Deed Book and Page references are shown on the plans.

I& A list of the approximate material quantities to be used and the following material notes on the plans:

Sanjtar:y Sewer

PVC plastic shall be ASTM D-3034 PSM SOR 35 min; Class "B" bedding (min.)

PVC plastic pipe shall be AWWA C-900 Table 2 Glass 150 (min.)

Non-reinforced concrete pipe shall be ASTM C-14 Class 2; Class "C" bedding.

Ductile Iron Pipe shall be ANSJ/AWWA C15 I Class 52 for 12" and smaller and Class 51 for 16" and larger.

19. A thrust restraint shown on the plan as per Design Standards.

2) Backflow Prevention Plan submitted in accordance with Section 6 of the Commonwealth of Virginia, State Board of Health Waterworks Regulations.

21. Design calculations that illustrate normal and fire flows, pipe size selection, and fire protection requirements.

I hereby certify that I have complied with the above and do herewith submit these plans for approval.

_____	_____
Signature	Certificate Number
_____	_____
Name Typed or Printed	Date

TOWN OF BOWLING GREEN
REVIEW SHEET FOR SEWAGE PUMPING STATION

SUBJECT: _____
SEWERAGE: _____
PROJECTNO.: _____
EPA NO.: _____

REVIEWED BY _____
DATE _____
CONSULTING ENGINEERS _____
REFERENCES AND CORRESPONDENCE _____

LOCATION OF PROJECT _____

TYPE OF PUMPS PROVIDED _____
NUMBER OF UNITS _____

PUMP NO.	SIZE (CNCHES)	FRICTION HEAD (FT)	STATIC HEAD (FT)	RATED CAPACITY (GPM)	RATED TOH (FT)	COMPUTED TOH (FT)	OPERATCNG CAPACITY (GPM)	VARIABLE OR CONSTANT SPEED

IS CAPACITY OF PUMP STATION ADEQUATE? _____
CAN PEAK FLOW BE PUMPED WITH LARGEST UNIT OUT OF SERVICE? _____
CAPACITY OF RECEIVING SEWER LINE _____ MGO ADEQUATE CAPACITY AVAILABLE

CAPACITY OF ULTIMATE TREATMENT _____ MOD AVERAGE FLOW (I YR.) _____

BAR SCREENS & COMM INUTOR

ARE BAR SCREENS OR COMMINUTOR PROVIDED? _____
SPACE BETWEEN BARS _____ INCHES EFFECTIVE AREA _____ SQ.IN.
VELOCITY THROUGH BAR SCREEN _____ FT./SEC.
MECHANICALLY CLEANED? _____
COMM!NUTOR PROVIDED? SIZE _____ CAPACITY _____ GDM.
IS AUTOMATIC BYPASS TO BAR SCREEN PROVIDED?

REVISIONS	REVIEW SHEET FOR SEWAGE PUMPING STATION	FORM F-6 I OF 3

TOWN OF BOWLING GREEN

CHLORINATION

IS CHLORINATION PROVIDED? _____

LIQUID OR GAS? _____ CAPACITY _____ PPD

SEPARATE CHLORINATION ROOM PROVIDED? _____

VIEWING WINDOW TO CHLORINATOR ROOM? _____

VOLUME OF CHLORINATOR ROOM? _____

VENTILATION FAN CAPACITY _____ CFM TURNOVER TIME _____ MIN.

IS POTABLE WATER SUPPLY ADEQUATELY PROTECTED? _____

PUMPS

POSITIVE SUCTION HEAD? _____ ALTERNATING CONTROL? _____

TYPE OF CONTROL MECHANISM? _____

SUCTION LINE SIZE _____ INCHES DISCHARGE LINE SIZE _____ INCHES

IS GATE VALVE PROVIDED ON SUCTION LINE? _____

GATE VALVE AND CHECK VALVE ON DISCHARGE LINE? _____

SIZE OF SPHERES THAT PASS THROUGH PUMP _____

VE LOCITY OF DISCHARGE Ll i'i c _____

VELOCITY OF SUCTION LINE _____

WET WELL

LLET SLOPE _____ VOLUME BETWEEN HWL AND LWL _____ GAL

rs VOLUME SUFFICIENT TO CAUSE ONE PUMP TO RUN CONTINUOUSLy FOR FIVE MINUTES OF EVERY 30 MINUTE PERIOD AT MINIMUM FLOW? _____

VOLUME ABOVE LWL _____ CU.FT. VENTILATION FAN CAPACITY _____ CFM

CONTINUOUS OR INTERMITTENT VENTILATION? _____

AIR CHANGES PER HOUR _____ ADEQUATE ACCESS PROVIDED? _____

ADEQUATE VENTILATION? _____

DRY WELL

PROVISIONS FOR REMOVING EQUIPMENT ? _____

ADEQUATE ACCESS PROVIDED? _____ SUMP PUMP PROVIDED? _____

ADEQUATE DISCHARGE POINT FOR SUMP PUMP _____

VOLUME OF DRY WELL _____ CU.FT. VENTILATION FAN CAPACITY _____ CFM

CONTINUOUS OR INTERMITTENT VENTILATION? _____

AIR CHANGES PER HOUR _____

ADEQUATE PROTECTION OF WATER SUPPLY? _____

REVISIONS	REVIEW SHEET FOR SEWAGE PUMPING STATION	FORM F-6 2 OF3

TOWN OF BOWLING GREEN

FLOW MEASUREMENT

DOES PUMPING STATION HAVE A CAPACITY OF I0% OF ULTTMATE TREATMENT CAPACITY? _____

IS ADEQUATE FLOW MEASURING DEVICE PROVIDED?_

RELIABILITY

RELIABILITY CLASS _____ ADEQUATE ALTERNATIVE MOTIVE FORCE PROVIDED? _____

PROVISION FOR CONTINUOUS OPERABILITY PROVIDED? _____

TYPE OF PROVISION _____

IS ADEQUATE POWER DISTRIBUTION PROVIDED? _____

BREAKER SETTINGS OR FUSE RATINGS ADEQUATE? _____

ELECTRICAL CONTROL CENTERS LOCATIONS ADEQUATE? _____

ARE MOTORS ADEQUATELY PROTECTED? _____

EMERGENCY POWER EQUIPMENT ADEQUATELY LOCATED? _____

DOES ELECTRICAL EQUIPMENT COMPLY WITH NATIONAL BOARD OF FIRE UNDERWRITERS SPECIFICATIONS? _____

ARE THREE PHASE MOTORS ADEQUATELY PROTECTED FROM SHORT CIRCUITS AND OVERLOADS? _____

LOW VOLTAGE PROTECTION FOR LARGE MOTORS? _____

UNDERGROUND CONDUITS HAVE MOISTURE RESISTANT INSULATION? _____

CONCRETE, METAL AND SAFETY DEVICES ADEQUATELY PROTECTED AGAINST CORROSION? _____

ADEQUATE ELECTRICAL EQUIPMENT TESTING PROVISIONS? _____

ADEQUATE ALARM SYSTEM PROVIDED? _____

FORCE MAIN

PIPE DIAMETER _____ CHES DISCHARGE VELOCITY _____ FPS

ADEQUATE AIR RELIEF VALVES PROVIDED? _____

ADEQUATE TERMINATION? _____ PIPE MATERIAL SPECIFIED _____

JOINT SPECIFICATIONS _____ DEQUATE LEAKAGE TESTING? _____

ALLOWABLE LEAKAGE _____ GALLONS/HR ADEQUATE? _____

ADEQUATE BEDDING? _____ THRUST BLOCKS PROVIDED? _____

REVISIONS	REVIEW SHEET FOR SEWAGE PUMPING STATION	FORM F-6 3 OF 3 .

TOWN OF BOWLING GREEN, VIRGINIA
STANDARDS
VOLUME II
STANDARD SPECIFICATIONS
AND DETAILS FOR
CONSTRUCTION OF WATER AND SEWER
LINES AND RELATED WORK

ADOPTED_____

TABLE OF CONTENTS

FORWARD

These Standards have been developed for use by consultants working on water and sewer utility projects within The Town Of Bowling Green and for the Town Of Bowling Green personnel who review those projects. The standards are not intended as a regulation but should be used as a guide which will establish a degree of uniformity for drawings and specifications for all water and sewer utility projects.

The Standards consist of two volumes as follows:

- Volume I - contains the design standard for water mains, pump stations and sewer lines, force mains and pump stations.

- Volume II - contains specifications for construction and materials for water and sewer lines.

Consultants working on water and sewer utility projects should recognize the fact that State and Federal regulations must be satisfied on all projects. In the event that the Town Standards differ from State or Federal Requirements, the more restrictive standard shall be utilized.

It is very difficult to generalize when addressing matters of engineering design without endangering the final product; therefore, consultants should strive for designs which show consideration of details presented herein. However, these details are secondary to good engineering judgment. The design of water mains, pump stations, force mains and gravity sewers is a matter which requires special consideration for each specific project and can not be generalized for all jobs. Therefore, the design engineer is responsible for checking the specific requirements of each project against these standards and making any additions, deletions or changes necessary for the project being designed.

The work described herein is under the jurisdiction of the Town Of Bowling Green hereinafter referred to as the Town.

The Town will review all plans and specifications, however, all such documents for new construction must be submitted to the appropriate office of the State Health Department for review and a certificate of construction must be issued before construction can begin.

PROCEDURAL SECTION

1. These specifications will be provided by the Town Of Bowling Green upon request for the cost of reproduction and handling.

2. Design notes and calculations must be submitted by the design professional to the Virginia Department of Health, Division of Water Supply Engineering along with the plans for the project.

3. Any deviations to these specifications and standards must have prior approval from the Virginia Department of Health, Division of Water Supply Engineering before installation.

4. These specifications may be used for projects to be built within the Town Of Bowling Green. Use of these specifications is limited to projects with 12" and smaller water lines and gravity sewers 12", 10", and 8" in diameter on NQN EPA funded projects. Project plans will be required for each project and will be prepared and submitted in accordance with the Commonwealth of Virginia Department of Health, Division of Water Resources.

5. All requests for deviation from these standard specifications will be set forth in writing and directed to the Town Of Bowling Green. Permission for same will be issued by the Town Of Bowling Green in the form of a letter. A copy of the letter of permission will also be sent to the Commonwealth of Virginia, State Department of Health.

6. The purpose of these specifications is to standardize the construction of water lines and sewer lines in the Town Of Bowling Green.

7. The design professional who is responsible for the project must prepare project plans and has the responsibility of determining that all standard details and standard specifications are appropriate for the intended use. He also has the responsibility of stating upon completion of project construction that all specified tests were performed with results within specified limits and that the project was built in accordance with the plans and specifications.

8. The specifications have been developed using Construction Specification Institute (CSI) format. Additional sections or modifications to the enclosed should be incorporated as needed for specific projects.

SECTION 02110 - SITE CLEARING

1.0 GENERAL

1.1 Description

A. Work under this Section of the Specifications includes general site clearing operations, including trees and vegetation removal, protection of existing trees to be left standing, and clearing and grubbing.

1.2 Provide barricades, coverings, or other types of protection necessary to prevent damage to existing improvements not indicated to be removed, and improvements on adjoining properties.

A. Restore all improvements damaged by this Work to their original condition, and acceptable to the Owner or other parties or authorities having jurisdiction.

1.3 Protect existing trees and other vegetation indicated to remain in place against cutting, breaking, or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary fences, barricades or guards as required to protect trees and vegetation to be left standing.

1.4 Burning where allowed by local ordinances will be permitted.

2.0 PRODUCTS

2.1 Not Applicable.

3.0 EXECUTION

3.1 Clearing

A. Remove from the site trees, brush, shrubs, down timber, rotten wood, rubbish, other vegetation as well as fences, and incidental structures necessary to allow for new construction.

(1) Remove all trees, stumps and roots within 10' of any structure or pipeline.

(2) Stumps of trees, other than the above, to be left in place shall be cut off and shall be left not more than 6" above original grade. Remove all stumps when such stumps will be less than 5' below finished grade.

B. Clearing work shall be restricted to area within rights-of-way or easements or within "Construction Limits" indicated on Contract Drawings.

3.2 Existing Trees and Shrubs

A. Trees and shrubs that are to remain within "Construction Limits" will be indicated on Contract Drawings or conspicuously marked on site.

B. Ownership to Trees: Unless otherwise noted, trees within the "Construction Limits" shall become the property of the Contractor and shall be removed from the site.

3.3 Grubbing

A. Grub areas within and to a point IO' outside of all structures and pipe lines, areas to receive fill where finished grade will be less than 3' above existing grade, cut areas where finished grade will be less than 2' below existing grade, transitional areas between cut and fill, and any areato receive control fill.

B. Remove from the ground to a depth of 18", all stumps, roots½" and larger, organic material and debris.

C. Use only hand methods for grubbings inside the drip lines of trees which are to remain.

3.4 Clean up debris resulting from site clearing operations continuously with the progress of the work.

3.5 Remove all waste material fromsite.

3.6 Remove debris from site in such a manner as to prevent spillage. Keep pavement and area adjacent to site clean and free from mud, dirt and debris at all times.

END OF SECTION

SECTION 02225 - TRENCHING & BACKFILLING

1.0 GENERAL

1.1 Work included in this Section includes trenching and backfilling for underground pipelines and related structures only.

1.2 Reference Specifications are referred to by abbreviation as follows:

A. American Society for Testing and Materials ..... ASTM

B. American Association of State Highway and Transportation Officials ..... AASHTO

C. Virginia Department of Transportation ..... VDOT

1.3 The Contractor shall perform all construction operations in accordance with the U.S. "Occupational Safety and Health Act of 1970", the Standards of the U.S. Department of Labor, Occupational Safety and Health Administration and the latest amendments thereto.

1.4 The Contractor shall perform all construction operations in accordance with the "Rules and Regulations Governing the Safety and Health of Employees Engaged in Construction" as adopted by the Safety and Health Codes Commission of the Commonwealth of Virginia and all latest revisions thereto and issued by the Department of Labor and Industry.

1.5 Store and use explosives in accordance with Federal, State and Local regulations. The Contractor shall be responsible for and shall satisfactorily correct all damage resulting from use of explosives.

1.6 Owner will provide compaction testing, if in his opinion it is required.

1.7 Locate existing utilities, culverts and structures, above and/or below ground, before any excavation starts. Coordinate work with utility companies through **MISS UTILITY.** Protect, maintain in service, and prevent damage to utilities not designated to be removed. When utilities are encountered and are not shown on Drawings or when locations differ from those shown on Drawings, notify the Town for instructions before proceeding.

1.8 All excavation is unclassified and no additional payment will be allowed regardless of materials encountered.

2.0 PRODUCTS

2.1 Pipe Bedding Fill

A. Granular fill shall meet requirements for coarse aggregates, ASTM C3, Size No. 57.

2.2 Select Backfill

A. Aggregate fill shall meet requirements for coarse aggregates, Section 203, VDOT Specification, size No. 57.

B. Clean earth fill shall be an approved material free of debris, roots, frozen materials, organic matter, rock or gravel larger than l" in any dimension or other harmful matter.

2.3 Rip-rap, where shown on the Drawings shall conform to VDOT Specification Sec. 414 "Dry Rip-rap - Class I."

3.0 EXECUTION

3.1 Strip existing topsoil, leaf mold and organic materials, meeting topsoil requirements of Section 02935 - Seeding. Deposit in storage piles separate from other excavated material.

3.2 Where the trench width exceeds the allowable width, the Contractor at his own expense shall provide for increased loads on pipe as directed by the Town.

3.3 Unauthorized excavation consists of the removal of material beyond indicated subgrade elevations or side dimensions without specific approval of the Town. Where unauthorized excavations occur, restore these areas to the elevations and dimensions shown on the Drawings with granular fill.

3.4 Where removal of unsatisfactory material is due to fault or negligence of the Contractor, by inadequate shoring or bracing, dewatering, material storage or other failure to meet specified requirements, any work deemed necessary by the Town to correct the faulty condition shall be performed at no additional cost to the Owner.

3.5 Trenches in public roadways

A. Refer to Virginia Department of Transportation's "Road and Bridge Specifications" for design and construction considerations.

B. Adequate protection of sewer lines shall include the following:

(1) Minimum 5 feet of cover over PVC pipe.

(2) Minimum 3 feet of cover over ductile iron.

(3) Concrete caps shall be used where minimum covers cannot be attained.

3.6 Excavation.

A. Open trenches only so far in advance of pipe laying as permitted by Town. In no case will more than 500 ft. of trench may be open at one time. Trenches shall be backfilled at the end of each working day except where otherwise permitted.

B. The width of the trench at and below the top of the pipe shall not exceed the outside diameter of the pipe plus 18 inches except that for pipe 12 inches or less in diameter, the trench width shall not exceed 36 inches. Where this width is exceeded, Contractor shall provide for increased pipe loading as directed by the Town.

C. The trench walls above the top of the pipe may be sloped or the trench, above the top of the pipe, may be widened as necessary for bracing, sheeting and shoring. Construction methods shall be subject to review and approval by the Town.

D. Excavate trenches for gravity lines to elevations shown on Contract Drawings. Excavate trenches for pressure lines to elevations shown on Contract Drawings or to depths specified in other sections of this Division.

E. The bottom of the trench for gravity lines shall be as specified herein under "Pipe Bedding".

F. The bottom of the trench for pressure lines shall be shaped to fit the bottom of the pipe as specified herein under "Pipe Bedding".

(1) Excavate for bell holes at each joint.

(2) Where rock is encountered, excavate a minimum of 6 inches below the bottom of the pipe for bedding.

G. Dewater excavation as necessary to provide proper protection. If deemed necessary, the Town may require continuous dewatering 24 hours per day by adequate pumpage or well-points until backfilling is completed. The method, and equipment used for dewatering shall be subject to the approval of the Town.

H. Where unsuitable soil is encountered, excavate to depth determined by the Town and replace with select backfill thoroughly and uniformly compacted.

I. Where underground streams or springs are found, provide temporary drainage and notify the Town.

J. Remove from project site and dispose of material unsatisfactory for backfill, trash, and all excess material continuously with the progress of the work.

K. Remove shoring and all form materials, unless ordered to remain.

L. Where rock is encountered so that a manhole, vault, or other stmcture will bear

entirely on rock, it shall be used to support the foundation. Where only a part of the foundation would bear on rock, excavate to an even depth of 8 inches below the entire structure and backfill with aggregate fill and thoroughly compact.

M. Provide a minimum of 8 inches between rock excavation and sides of structures.

3.7 Sheeting

A. Maintain trench walls in a safe condition at all times. Provide sheeting, shoring, and bracing as necessary to prevent cave-in of excavation or damage to existing structures on or adjoining the site.

B. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.

C. Maintain sheeting, shoring and bracing in excavations regardless of time period excavations will be open. Carry down sheeting, shoring and bracing as excavation progresses in accordance with the proper Authority.

D. Sheeting, shoring and bracing left in place shall be cut off to a depth of not less than 18 inches below grade.

3.8 Pipe Bedding

A. Bed all sewer pipe in accordance with bedding details as shown in Section 00870 - Standard Details.

B. Except where otherwise shown on the Drawings, all gravity lines using rigid pipe such as concrete, etc. shall be Class C bedding as a minimum.

C. Except where otherwise shown on the Drawings, all gravity lines using flexible pipe such as PVC, etc. shall be Class B-1 bedding as a minimum.

D. Except where otherwise shown on the Drawings, all pressure lines using rigid pipe such as ductile iron, etc. shall be Class C-1 bedding as a minimum.

E. Except where otherwise shown on the Drawings, all pressure lines using flexible pipe such as PVC, etc. shall be Class B-1 bedding as a minimum.

F. Compact pipe bedding by tamping or rodding to prevent settlement.

3.9 Backfill

A. Backfill trench to a compacted depth of l foot over the pipe with select backfill in accordance with the details shown in Section 00870 - Standard Details. Backfill shall

be placed by hand, uniformly on each side of the pipe and compacted in layers not exceeding 5". Do not backfill on muddy or frozen soil, or with muddy or frozen soil.

B. Backfill trench from 1 foot above the pipe to grade with clean earth fill free of stones not larger than 5" or 1/2 the layer thickness, whichever is smaller. Layers shall not exceed 12", except that under road shoulders and under existing or future paved areas, layers shall not exceed 8 inches. Backfill shall be compacted to the density specified for the areas in which it is located except that minimum compaction in any area shall be to the density of the adjacent soil.

C. Excavation depressions caused by removal of stumps or other clearing operations to firm subgrade, fill with clean earth fill and compact as specified.

D. Place backfill materials evenly adjacent to structures. Take care to prevent wedging action of the backfill against structures by carrying the material uniformly around the structure to approximately the same elevation in each lift.

E. Compact soil materials using equipment suitable for materials to be compacted and work area locations. Use power-driven hand tampers for compacting materials adjacent to structures.

F. Compact aggregate fill placed around manholes or other structures to required density.

3.10 Compaction

A. Percentage of maximum density requirements.

(1) Compact each layer of fill or backfill to not less than the following percentages of the maximum density at optimum moisture content as determined by ASTM D 1557 (AASHTO T-180).

95% beneath and within 25 ft. of buildings and structures, including those shown for future construction.

90% beneath pavements, walks, and road shoulders, including those shown for future construction.

85% in other unpaved areas.

3.11 Grading

A. Uniformly grade all areas within the limits designated on the Contract Drawings, including adjacent transition areas. Finish surfaces within specified tolerances with uniform levels or slopes between points where elevations are shown and existing

grades.

B. Finish all surfaces free from irregular changes.

C. Finish subgrade areas to receive topsoil to within 0.10 foot of required subgrade elevations.

D. Shape subgrade under walks to line, grade, and cross-section to within 0.10 ft. of required subgrade elevations.

E. Shape subgrade under pavement to line, grade, and cross-section to within ½" of required subgrade elevations.

F. Protect newly graded areas from traffic and erosion. Repair and reestablish grade in settled, eroded, or rutted areas to the specified tolerances.

G. Where compacted areas are disturbed by subsequent construction or adverse weather scarify the surface, reshape and compact to the required density. Use hand tamper for reco mpaction over underground utilities.

3.12 Utilities to be Abandoned or Removed

A. When underground utilities are to be abandoned in place, plug, cap, or seal with concrete at the "construction limits" or at points shown.

B. Remove underground utilities indicated on the Drawings to be removed and backfill resul ting excavation with suitable material, compacted as specified. Plug, cap or seal utilities with concrete, at the construction limits or at points shown.

3.13 Erosion Control

A. Comply with local erosion control ordinance and with the "Virginia Erosion and Sediment Control Handbook" by the Virginia Soil and Water Conservation Commission to control erosion and sedimentation.

B. Submit erosion control plan to Caroline County for review and approval prior to commencing any grading operations.

C. Install all applicable erosion and siltation control measures in accordance with approved plan prior to grading.

0. No more than 500 feet of trench shall be open at any one time.

E. All utility lines, not in streets, shall be mulched with hay or straw and seeded within 15 days after backfill

F. Any disturbed area, not paved, sodded or built upon by November 15 is to be seeded on that date with oats, abruzzi rye, or equivalent and mulched with hay or straw.

0. Protect graded areas from the action of the elements. Settlement or other damage that occurs prior to acceptance of the work shall be repaired and grades satisfactorily reestablished.

H. Repair after cleanup: Upon completion of construction work and after spoils and debris have been removed, regrade any areas disturbed by operations.

3.14 CleanUp

A. Keep area of Work cleaned up at all times and promptly remove all materials and debris not intended for incorporation in the Work. Broom clean the surfaces of all paved areas immediately after backfilling operations.

B. Maintain backfilled trenches from the nuisance of dust, mud or settling during the entire length of the Contract and for a period of one year following Final Acceptance of the Work.

C. 1nthe event the Contractor fails to satisfy these requirements to the satisfaction of the Town, or otherwise prosecute the Work in a reasonable or proper manner, and after a reasonable period of time has elapsed after notification by the Town of unsatisfactory conditions, the Owner reserves the right to employ outside services to take such corrective action as deemed necessary by the Town. The cost incurred in taking corrective actions will be deducted from any monies due the Contractor by the Owner or such other means of collection as may be available to the Owner.

3.15 Preparation for Final Inspection

A. Locate and adjust all manholes, valve boxes, etc. to final grade and flush out all gravity pipe lines as necessary prior to final inspection by the Town. The costs of this work shall be included in the applicable bid prices.

3.16 Existing Driveways, Fences, Culverts, etc.

The Contractor shall return all driveways, fences, culverts, lawn areas, paved areas, etc. to the same condition existing prior to construction. Any culverts damaged during construction shall be replaced with new culverts at no cost to the Owner.

END OF SECTION

SECTION 02665 - WATER DISTRIBUTION SYSTEM

1.0 GENERAL

1.1 Work in this Section includes all exterior potable water distribution system piping and appurtenances.

1.2 Reference Specifications are referred to by abbreviation as follows:

A. American National Standards Institute ..... ANSI

B. American Society for Testing and Materials ..... ASTM

C. American Water Works Association ..... AWWA

D. Commercial Standard (National Bureau of Standards) ..... CS

E. Federal Standards ..... FS

F. Virginia Department of Transportation ..... VDOT

1.3 Separation of water lines and sanitary and/or combined sewers.

A. Follow State Health Department "Waterworks Regulations" for separation of water mains and sewer lines.

B. Parallel Installation

(1) Nannal Conditions - Water lines shall be constmcted at least 10' horizontally from a sewer or sewer manhole whenever possible. The distance shall be measured edge-to-edge.

(2) Unusual Conditions - When local conditions prevent a horizontal separation of at least 10', the water line may be laid closer to a sewer or sewer manhole provided that:

(a) The bottom of the water line is at least 18" above the top of the sewer.

(b) Where this vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved water pipe pressure-tested in place to 50 psi without leakage prior to backfilling. The sewer manhole shall be of watertight construction and tested in place.

C. Crossing

(1) Normal Conditions - Water lines crossing over sewers shall be laid to provide a separation of at least 18" between the bottom of the water line and the top of the sewer whenever possible.

(1) Unusual Conditions - When local conditions prevent a vertical separation described in crossing, normal conditions, paragraph above the following construction shall be used.

(a) Sewers passing over or under water lines shall be constructed of the materials described in parallel installation, unusual conditions - Paragraph (B) above.

(b) Water lines passing under sewers shall, in addition, be protected by providing:

1. A vertical separatio of at least 18" between the bottom of the sewer and the top of the water lines.

2. Water lines passing under sewers shall, m addition, be protected by providing:

3. That the length of the water line shall be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sewer.

D. Sewers or sewer manholes - No water pipes shall pass through or come in contact with any part of sewer or sewer manhole.

2.0 PRODUCTS

A. Submit shop drawings on all products as required by The Town of Bowling Green.

B. Provide certified test results of pipe testing.

2.1 Ducti le iron pipe shall meet requirements of AWWA/ANSI C151/A21.51 for Class 150, thickness Class 5 I unless otherwise indicatedon the Drawings. Thickness classes shall meet requirement of AWWA CI 50. All pipe shall have a cement mortar lining on the interior and a bitwninous coating on the exterior.

2.2 Flanged cast iron and ductile iron pipe shall meet the requirements of AWW*Al* AJ.'.J.SI C115/A.21.15 for Class 150, thickness Class 53, unless otherwise shown on Contract Drawings. Thickness class shall meet requirements of AWWA/ANSI Cl50/A21.50. All

pipe shall have a cement mortar lining on the interior and a bituminous seal coat on the exterior.

2.3 Polyvinylchloride (PVC) pipe and fittings in sizes 4" through 12" shall meet the requirements of AWWA C900, C.I.P. O.D. Class 200 except that all connections shall be made using elastomeric gasket joints.

2.4 Polyethylene pipe shall meet the requirements of AWWA C901, Standard Code Designation PE3408, Pressure Class 200 psi.

2.5 Copper tubing shall meet requirements of ASTM B88 for Type "L" copper, hard drawn, for above ground and Type "K" hard drawn for below ground.

2.6 Gray iron and ductile iron fittings shall meet requirements of AWWA/ANSI Cl 10/A2l. l 0. Pressure ratings shall be a minimum of 250 psi for fittings 12" and smaller and at least 150 psi for fittings 14" and larger, or pressure specified for adjacent piping, whichever is greater. All fittings shall be all bell, mechanical joint, or mechanical joint plain end unless otherwise approved by the Town. All fittings shall have a cement mortar 11.ning on the interior and a bituminous coating on the exterior.

2.7 Compact ductile iron fittings shall meet requirements of AWW A/ANSI C153/A21.53 in sizes 4" through 12". 14" and l6" sizes shall conform to manufacturer's standard. All fittings shall be all bell, mechanical joint, or mechanical joint plain end unless otherwise approved by the Town. All fittings shall have a cement mortar lining on the interior and a bituminous coating on the exterior.

2.8 Mechanical joints and jointing materials shall meet requirements of AWW A/ANSI C111/A2l . l 1.

A. Mechanical JOmt retainer glands shall meet requirements of AWWA/ANSI Clll/A21.ll. Glands for ductile iron pipe shall be Megalug Series 1100 as manufactured by EBAA Iron Sales Inc. or approved equal. Glands for PVC pipe shall be Megalug Series 1600, 6500 or 2000 as manufactured by EBAA Iron Sales Inc. or approved equal.

B. Locked type mechanical joints may be used where restrained joints are required.

2.9 Push-on joint and rubber gasket shall meet requirements of AWWA/ANSI Cl l l/A21.l1.

A. Locked type restrained push-on joints may be used where restrained joints are required.

2.10 Flanged joints for ductile iron pipe shall meet requirements of ANSI B16.1.

2.11 Flanged joint gaskets shall be full-face, made of rubber, and shall meet requirements of

ANSI B16.21.

2.12 Cement mortar lining with bituminous seal coat for ductile iron pipe and fittings or for cast iron fittings shall meet requirements of AWWA C104.

A. Cement mortar lining shall be standard thickness.

2.13 Exterior, bituminous coating for ductile iron pipe and fittings and cast iron fittings shall meet requirements of AWWA C106 or AWWA C151 as applicable.

2.14 Metal harness shall be galvanized rods and clamps as detailed on Drawings.

2.15 Fittings for copper piping shall meet requirements of ANSI B16.22 for wrought copper, sweat joint. Soldering joints shall be made using ASTM B32 alloy Grade SN96 or Sb5 solder having a maximum lead content of 0.2%.

2.16 Screwed fittings for galvanized steel pipe shall be 150 lb. standard, malleable iron meeting the following requirements: dimensions, ANSI B16.3; threads, ANSI B2.1; material, ASTM A47; galvanizing, ASTM Al53.

A. Exterior, coal tar enamel coatings for steel pipe shall be materials and applications as specified in AWWA C203. Finish coat shall be single wrap kraft paper. Affidavit of compliance will not be required. Conditions of service shall be as indicated on Contract Drawings.

2.17 Gate Valves

A. Gate valves, 3" thru 16", shall be iron body, bronze mounted, non-rising stem with O-ring seals and parallel double-disc gates meeting the requirements of AWWA C500. Valves ends shall be mechanical joint or bell joint for underground service or flanged for meter vaults and above ground service. Valves shall open counter-clockwise and shall be equipped with a 2" square AWWA operating nut. Valves shall be factory tested in accordance with AWWA C500 and upon request the manufacturer shall furnish certified copies of test reports.

B. Horizontally installed gate valves 16" and larger in a horizontal line shall be fitted with tracks, scrapers and rollers to carry the weight of the disc and ease operations.

C. Square bottom gate valves designed for throttling service shall be installed at location indicated on Contract Drawings.

D. Valves 16" and larger shall have geared operation.

E. Bypass valves shall be provided on all gate valves 16" and larger where indicated on the Contract Drawings.

F. Operators

(1) Buried valves shall be equipped with 2" sq. operating nuts unless otherwise shown on the Drawings. Where nuts will be more than 48" below finished grade, extension stems shall be pin connected to valve stem. Extension stem shall raise operating nut to within 24" of finished grade.

(2) Interior valves shall be handwheel operated except where otherwise shown on the Drawings.

(3) Interior valves in inaccessible locations shall be provided with chain operators as shown on the Drawings.

G. Valves shall be American Flow Control, Clow, Dresser (M&H), Kennedy, Mueller or approved equal meeting this Specification.

H. Gate valves smaller than 3" shall be bronze, solid wedge, rising stem, at least 200 psig working pressure, Jenkins 49-U threaded ends or Jenkins 1242 solder ends.

I. Tapping valves shall meet requirements of gate valves specified above except that seat opening shall be larger than nominal size and valve outlet end shall have mechanical joint.

2.18 Butterfly Valves

A. Butterfly valves 3" and larger shall be of the rubber seated, tight closing type meeting requirements of AWWA C504 and shall be Class 150B unless otherwise indicated. Wafer-type valves shall not be used.

B. Valve ends shall be mechanical joint or bell joint in accordance with AWWA Cl l l. Accessories (bolts, glands, and gaskets) shall be supplied by the valve manufacturer.

C. Valve operator shall be of the traveling-nut type, sealed, gasketed and lubricated for underground service. Valve operator shall be capable of withstanding an input torque of 450' lb. at full open or closed position, without damage to the valve and valve operator. Valve operator shall be AWWA standard 2" square operating nut.

D. Rubber seal may be applied to the body or to the disc.

E. Valves shall open counter-clockwise.

F. Valves shall be factory tested in accordance with Section 5.2 of AWWA Specification C504. Upon request the manufacturer shall furnish certified copies of test reports.

G. Valves shall be American-Darling, Dresser "450", Pratt Groundhog or approved equal.

2.19 Check Valves

A. Check valves 3" and larger shall be iron body, bronze mounted, swing check valves, meeting requirements of **AWWA** C508. Check valves 3 through 12" shall be for 175 psi non-shock cold water working pressure. Valves 14 through 24" shall be for 150 psi non-shock cold water. Valves shall have outside weight and lever.

B. Manufacturer shall be American Darling Valve and Manufacturing Company, Eddy-Iowa Division of Clow Corporation, Kennedy Valve Manufacturing Company, M&H Division of Dresser Industries, or G-A Industries, Inc.

2.20 Pressure Reducing Valve

A. Valves shall be hydraulically operated and of the self-contained, differential piston type. The valves shaJl function to reduce high upstream pressure to a predetermined lower downstream pressure without shock or hammer.

B. The valve shall be air and water cushioned and when required, provide tight valve closure. When required, the valve shall open wide to permit full pipe line opening. An indicator shall be furnished as an integral part of the valve to show piston position within the body.

C. The valves shall be cast iron body. The piston shall be of cast bronze provided with renewable leather or composition cup and seat. The valve liner shall be of cast bronze provided with a leather or composition cup. The valve shall be provided with "V" shaped ports for flow passage downstream of the seat opening. The valve assembly shall be so constructed as to permit removal of the piston or liner from the valve body without removing the valve body from the line.

D. The pilot valve shall be of the single seated, globe body pattern, diaphragm operated and spring loaded with convenient discharge pressure setting over a range no less than 30 psi.

E. Valves in sizes 3-12" shall have a working pressure of 175 psi. Valves in sizes 14" and up shall have a working pressure of 150 psi. Valves shall be provided with 125 lb. ANSI flanges and shall be similar to G-A Industries, Inc., Fig. No.

4500-D.

2.21 Altitude Valve

A. Function

(1) The altitude control valve shall be of the double acting type, functioning to close off at maximum pre-set level in tank or reservoir; and opening when the system pressure drops below the static head, for the purpose of returning the storage water back through the valve for distribution.

(2) A hand operated valve in the power water line to the top of the piston shall permit adjustment of the speed of valve closing. The tank water level control shall be by means of a diaphragm operated, spring loaded, three way pilot which directs power water to or from the top of the main valve piston. The three way pilot shall be of bronze or stainless steel construction. The diaphragm surface exposed to the tank head shall be not less than 57 sq. inches. It shall be possible to adjust the spring above the diaphragm for water level control approximately 20% above or below the factory setting.

(3) The valve shall be completely piped ready for installation.

B. Description

(1) The main valve shall operate on the differential piston principle such that the area on the underside of the piston is no less than the pipe area, and the area on the upper surface of the piston is of a greater area than the underside of the piston.

(2) The valve piston shall be guided on its outside diameter by long stroke stationary Vee ports which shall be downstream of the seating surface to minimize the consequences of throttling. Throttling shall be done by the valve Vee ports and not the valve seating surfaces.

(3) The valve shall be capable of operating in any position and shall incorporate only one flanged cover at the valve top from which all internal parts shall be accessible. There shall be no stems, stem guides, or spokes within the waterway. There shall be no springs to assist the valve operation.

C. Construction

(1) The valve body shall be of cast iron ASTM A-126 with flanges conforming to the latest ANSI Standards. The valve shall be extra heavy

construction throughout. The valve interior trim shall be bronze B-62 as well as the main valve operation.

(2) The valve seals shall be easily renewable while no diaphragm shall be permitted within the main valve body.

(3) All controls and pipingshall be of non-corrosive construction.

(4) A visual valve position indicator shall be provided for observing the valve piston position at any time.

D. Manufacturer

(1) The valve shall be as manufactured by GA Industries of Mars, Pennsylvania, Fig. 3300-DR or approved equal.

2.22 Valve boxes shall be adjustable cast iron valve boxes of the three-piece type, consisting of lid, two-piece sliding extension and base. Base shall be proper type and size for the valve with whichit is used. The worQ_ "water" shall _!:>e cast or ef!1bo s_ed_on t_he -yalv o ___ lid in letters not less than 1" high. Valve box shall be manufactured by Mueller Company, Richard Foundry, or Tyler.

2.23 Tapping sleeves shall meet requirements of AWWA C110 for pressure ratings shown on the Drawings. Sleeves shall be built in two sections and shall be mechanical joint type with flanged outlet. The tapping sleeve shall be for the size and type of pipe shown on the Drawings.

2.24 Flexib le coupling shall be of gasketed, sleeve type. Each coupling shall consist of a steel middle ring, two steel followers, two rubber compounded wedge section gaskets and sufficient galvanized track, head steel bolts to properly compress the gaskets. Couplings shall be of the type to match piping in which installed. Couplings shall be manufactured by Dresser Manufacturing Division of Dresser Industries or Smith-Blair.

2.25 Flanged adapters for joining ductile iron plain-end pipe to flanged ductile iron items shall be Style 128 or 127 as manufactured by Dresser Manufacturing Division of Dresser Industries. Flanged adaptors for joining plain end PVC Pipe to flanged ductile iron items shall be Uni-Flange Series 900. Adapter shall be rated for a water working pressure of the pipe connected and shall have a 2:1 factor of safety.

2.26 Fire hydrants shall conform to the requirements of AWWA Standard CS02, latest revision for "Dry Barrel Fire Hydrants" and shall comply in full with the following requirements.

A. Hydrants shall be of the three post type of dry top design rated 150 psi with compression main valve opening counterclockwise against pressure. Each hydrant shall have a 6" standardized, mechanical joint inlet connection with

accessories. The internal valve shall provide a minimum of 4½" unobstructed flow area. Each hydrant shall be designed to allow the removal of all operating parts through the standpipe without excavation. Each hydrant shall be constructed with an oil lubricated dry type bonnet with "O" ring seals above and below operating threads.

B. The standpipe sections shall be connected at the ground line by a two-part safety flange that prevents damage to the barrel sections when the hydrant is struck by a vehicle. The standpipe and safety flange design shall permit rotation of the hydrant nozzles to any desired position without excavation or disassembly of the operating components. Threaded joints, above or below ground, or breakable bolts will not be allowed for the barrel assembly.

C. The main valve operating rod shall be designed with a travel stop so that the rod cannot be placed in compression. Travel stops located at the bottom of the hydrant will not be acceptable. The operating rod threads top and bottom shall be isolated from contact with water in the bonnet or in the inlet shoe. A safety stem coupling on the operating rod shall be placed at the ground line.

D. The drain mechanism shall be co-related with the operation of the main valve to provide a momentary flushing of the drain ports each time the hydrant is opened. The drain ports shall be fully closed when the hydrant valve is more than 2½ turns open. The drain ports shall be fully open when the hydrant is in the closed position.

E. The nozzle outlets shall consist of two (2) 2½" hose nozzles 180° apart and one (1) 4½" pumper connection. The nozzle threads shall conform to ANSI Standard B26. The nozzle caps shall be individually attached to the standpipe with heavy duty non-kinking chains that permit free turning of the cap. The operating nut and cap nuts shall be National Standard pentagon with 1½" from point to flat.

F. The exterior of the hydrants above the ground line shall be shop painted red.

G. Fire hydrants shall be Mueller Model A-421 "Centurion", Kennedy K-81-A "Guardian", or an approved equal.

2.27 Pressure gages shall be open front case type with bronze bourdon tube soldered to socket and tip, stainless steel movement, and a 4½" white coated dial graduated from Oto 100 psi. Gages shall be similar to Ashcroft No. 1279.

2.28 Compound gages shall be open front case type with bronze bourdon tube soldered to socket and tip, stainless steel movement, and a 4½" white coated dial graduated from 0 to 100 psi and 0 to 30" vacuum.

2.29 Air release and combination valves shall be constructed with cast iron bodies, type 302

stainless steel floats, bronze trim and Buna-N seats. Valves shall be of the size and at the locations indicated on the Drawings. Combination valves shall relieve large volumes of air as the lines are filled or emptied and also release small quantities of entrained air under pressure. Valves shall be for working pressures indicated on Drawings. Manufacturers shall be Valve & Primer Corp., American Darling Valve and Manufacturing, Val-Matic Valve & Manufacturing Company, or Clow Corporation.

2.30 Water service connection accessories shall consist of corporation stop, meter box and meter yoke in accordance with Standard Drawing D-175.

2.31 Manholes

A. Manholes shall be constructed of pre-cast reinforced concrete manhole sections in accordance with the requirements of ASTM C478 and detailed in Section 00870 - Standard Details.

B. A maximum of two lift holes per manhole section may be provided.

C. Provide tongue and groove joints in manhole sec tions \.vith a preformed groove in the tongue for placement of an O-ring type round, rubber gasket.

(1) Gasket shall comply with requirements of ASTM C361.

(2) Gasket shall provide the sole element in sealing the joint from either internal or external hydrostatic pressure.

D. Joint sealant shall be a one-component polyurethane sealant similar to Sika "Sikaflex" Series 430.

E. Manhole steps shall be corrosion-resistant and shall be l" square cast iron, rubber-covered steel or alumin um. The steps shall conform to the dimensions shown in Section 00870 - Standard Details.

F. Manhole frames and covers shall be molded of gray cast iron conforming to ASTM A48, Class 30. Castings shall be coated with a coal tar pitch varnish, to which sufficient oil has been added to make a smooth coating, tough and tenacious when cold, but not tacky or brittle. Seating surfaces between frame and cover shall be machined. The dimensions and weights shall conform to the requirements shown in Section 00870 - Standard Details.

(l) Standard Manhole Frame and Cover shall be similar to Richards Foundry Corporation No. D-1125.

(2) Vandal-proof Manhole Frame and Cover shall be similar to Neenah

Foundry Co., Cat. No. R-1926-Cwith 4 - 1" diameter vent holes.

2.32 Globe valves smaller than 3" shall be of bronze construction with bronze plug type discs and solder joint ends.

2.33 Thrust blocking shall be as shown in Contract Documents or as directed by Project Representative based upon field conditions. Conc rete shall have 3000 psi strength at 28 days in accordance with Section 03300 - Cast-in-Place Concrete and shall meet requirements of ASTM C94.

2.34 Detectable Marking Tape

A. Plastic marking tape consisting of one layer of aluminum foil laminated between two layers of inert plastic film. Tape shall be resistant to alkalis, acids and other destructive agents commonly found in the soil. The laminate shall be strong enough that the layers cannot be separated by hand.

B. Tape shall be a minimum of 4½ mils thick with a minimum tensile strength of 60 lbs. in the machine direction and 58 lbs. in the transverse direction per 3" wide strip. Tape color shall be APWA Color Coded for marking the particular utility line and shall be imprinted with a continuous warning message to indicate the type of utility being marked, the message normally being repeated every 16 to 36". Tape shall be inductively locatable and conductively traceable using a standard pipe and cable locating device. Tape shall be 3" wide Terra Tape "Sentry Line Detectable 620".

2.35 Detector Check Valves shall be epoxy coated UL and FM approved, hot dipped galvanized cast iron with brass bypass meter trim. Valves shall be ITT Grinnel / Kennedy Model 1371g, or 13690 Hersey Model EDC, Mueller #A-2133-6 or Viking Model E-1.

3.0 EXECUTION

3l l Pipe Laying, General

A. Take all precautions necessary to insure that pipe, valves, fittings, and other accessories are not damaged in unloading, hand ling, and placing in trench. Examine each piece of material just prior to installation to determine that no damage has occurred. Remove any damaged material from the site and replace with undamaged material.

B. Exercise care to keep foreign material and dirt from entering pipe during storage, hand ling, and placing in trench. Close ends of in-place pipe at the end of any work period to preclude the entry of animals and foreignmaterial.

C. Bedding of pipe shall be as specified in Section 02225 - Trenching & Backfilling.

D. Do not lay pipe when trench bottom is muddy or frozen, or has standing water.

E. Use only those tools specifically intended for cutting the size and material and type pipe involved. Make cut to prevent damage to pipe or lining and to leave a smooth end at right angles to the axis of the pipe.

F. Lay pipe with bell ends facing the direction of laying. Where grade is 10% or greater, lay pipe uphill with bell ends upgrade.

3.2 Install pressure line with a minimum depth of cover of 42" over the top of the pipe, where no grades are shown on the Contract Drawings.

A. Where grades on the pressure line conflict with existing pipes or structures, lay pressure line to additional depth with a uniform vertical curve to provide proper clearance without the use of fittings. No additional payment will be allowed for additional excavation. Provide allowance for expansion as directed by Engineer.

B. Lay pressure line pipe with bell ends facing the direction of laying. Where grade is 10% or greater, pipe shall be laid uphill with bell ends upgrade.

3.3 Joining Mechanical Joint Pipe

A. Thoroughly clean inside of the bell and 8" of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating and other foreign matter. Paint the bell and the spigot with soap solution (half cup granulated soap dissolved in 1 gallon water). Slip cast-iron gland on spigot end with lip extension of gland toward end of pipe. Paint rubber gasket with or dip into the soap solution and place on the spigot end with thick edge toward the gland.

B. Push the spigot end forward to seat in the bell. Then, press the gasket into the bell so that it is located evenly around the joint. Move the gland into position, insert bolts and screw nuts up finger tight. Then tighten all nuts to torque listed below:

Bolt Size - Inches	Torque Ft. - Lbs.
½	40 - 60
¾	60 - 90
	70 - 100
1¼	90 - 120

(l) Tighten nuts on alternate side of the gland until pressure on the gland is equally distributed.

C. Join lock-type mechanical joint pipe according to manufacturer's recommendations.

D. Permissible deflection in mechanical joint pipe shall not be greater than ½ of that listed in AWWA C600.

E. Permissible deflection in lock-type mechanical joint pipe shall be as recommended by manufacturer.

3.4 Joining Push-On Joint Pipe

A. Thoroughly clean inside of the bell and 8" of the outside of spigot end of the joining pipe to remove oil, grit, excess coating, and other foreign matter. Flex rubber gasket and insert in the gasket recess of the bell socket. Apply a thin film of gasket lubricant supplied by pipe manufacturer, to either the gasket or the spigot end of the joining pipe. Start the spigot end of the pipe into the socket with care. Then complete the joint by forcing the plain end of the bottom of the socket with a forked tool or jack-type device. File the end of field cut pipe to match the manufactured spigot end.

B. Join restrained push-on joints according to manufacturer's recommendations.

C. Permissible deflection in push-on joint pipe shall not be greater than 2/3 of that listed in AWWA C600.

D. Permissible deflection in restrained push-on joint pipe shall be as recommended by manufacturer.

3.5 Joining Fabricated Steel Pipe

A. Join steel pipe by field welding in accordance with AWWA C206.

B. Repair cement lining in welded steel water pipe in accordance with AWWA C205.

C. Join steel pipe by use of flexible coupling. Install flexible couplings as recommended by the manufacturer.

D. Coat flexible coupling installed on steel pipe in accordance with AWWA C203.

3.6 Join reinforced concrete water pipe with rubber gaskets installed as recommended by manufacturer.

3.7 Join PVC pipe and fittings in accordance with manufacturers' instructions and install in

accordance with ASTM D232 l.

3.8 Join copper pipe using 95-5 solder and suitable flux. Do not use acid core solder.

3.9 Setting Valves and Valve Boxes

A. Install valves with operator stems in the vertical plane through the pipe axis and perpendicular to the pipe axis. Locate valves where shown on Contract Drawings. Thoroughly clean before installation. Check valves for satisfactory operation.

B. Equip all underground valves with valve boxes where shown on the Contract Drawings. Set valve boxes in accordance with Section 00870 - Standard Details. Set box in alignment with valve stem centered on valve nut. Set the valve box to prevent transmitting shock or stress to the valve. Set the box cover flush with the finished ground surface or pavement.

C. Construct manholes for all underground valves where shown on the Contract Drawings. Construct manholes so as to prevent transmitting any load or shock to the valve or pipe. Locate manholes and valve relative to each other in order that packing, operator and other parts of the valve are readily accessible for minor repairs.

3.10 Manhole shall be constructed to the elevations shown on the Contract Drawings m accordance with the provisions of Section 00870 - Standard Details.

A. Set manhole base section on bed of VDOT #57 stone to a minimum depth of 6". Stone shall be thoroughly compacted and carefully leveled.

B. Join all manhole riser and cone or flat slab top sections by the use of rubber gaskets.

C. Plug lift holes and repair any defects in manhole.

D. Set adjusting rings in portland cement mortar bed.

(1) Rings will not be required outside of paved roadways or walkways unless called for on the Drawings.

(2) Rings in paved roadways or walkways shall permit upward or downward adjustment of manhole frame by 6".

E. Set manhole frame in bed of sealant. Bed shall consist of one, ¾" bead laid flush with the inside edge of the frame base and another ¾" bead laid flush with the outside edge of the frame base.

F. Bolt watertight manhole frames to manhole cone or flat slab top section as shown on the Standard Details.

3.11 Locate fire hydrants as shown on Contract Drawings and in accordance with Section 00870 - Standard Details.

3.12 Provide air and vacuum valve at locations shown on Contract Drawings. Install gate valve between water main and relief valves. Construct manholes for air and vacuum relief valve as shown on Drawings.

3.13 Provide reaction anchors of concrete blocking, metal harness, retainer gland type or restrained joint type pipe at all changes in direction of pressure pipelines and as shown on Contract Drawings.

A. Concrete reaction anchors shall bear against undisturbed earth and shall be of the size and shape shown on the Contract Drawings.

B. Use metal harness restraints as shown on Contract Drawings.

C. Where retainer glands are used, extreme care shall be taken so that each set screw is tightened as recommended by the manufacturer before the pipe is backfilled and tested.

3.14 Installation of Tapping Sleeves and Tapping Valves

A. All tapping sleeves shall be set to avoid interference with existing pipe joints.

B. After all tapping sleeves and valves have been set in place, a pressure test of 150 psi shall be made to insure that there are no leaks around the sleeve or through the valve. All leakage shall be corrected.

C. The actual tap shall be made in presence of a representative of the Town. The Town shall be notified 48 hours in advance of making the tap.

3.15 Detectable Tape

A. Install marking tape in all trenches containing buried pipe lines. Tape shall be installed in all trenches with a cover of 18 to 54" and a minimum clearance over the pipe lines of 18". Place tape on edge of trench toward the center of the pavement in roadways. In other locations, place tape to the north or east of the utility line. Wrap tape around all valves, corporation stops and meter setters. Wrap tape three turns around base of fire hydrants and extend tape up above ground against fire hydrants. Tape shall be made electrically conductive throughout the entire system through the use of splices of a type recommended by

the manufacturer. In addition to detectable tape, 12 gauge solid copper wire shall be placed along pipe and wrapped around valves.

3.16 Disinfection of Water Lines

A. Disinfect and test water mains and accessories in accordance with AWWA Standard C 651 and the following:

B. All water lines shall be disinfected prior to being placed in operation.

C. Prior to disinfection all water lines shall be flushed unless the tablet method disinfection is used. All valves and hydrants shall be operated during this operation. Flushing velocities should not be less than 2.5 ft./sec. Adequate provisions shall be made for drainage of flushing water.

D. Methods of Chlorine Application

(1) Continuous feed method - Potable water shall be introduced into the pipe line at a constant flow rate. Chlorine shall be added to a constant rate to this flow so that the chlorine concentration in the water in the pipe is at least 50 mg/L. The chlorinated water shall remain in the pipe line at least 24 hours, after which, the chlorine concentration in the water shall be at least 10 mg/L. All valves and appurtenances shall be operated while the chlorinated water remains in the pipe line.

(2) Slug Method - Potable water shall be introduced into the pipe line at a constant flow rate. This water shall receive a chlorine dosage which will result in a chlorine concentration of 100 mg/L in a "slug" of the water. The chlorine shall be added long enough to insure that all portions of the pipe are exposed to the 100 mg/L chlorine solution for at least 3 hours. The chlorine residual shall be checked at regular intervals not to exceed 2000' to insure that adequate disinfection is occurring. As the chlorinated water passes valves and appurtenances, they shall be operated to insure disinfection of these appurtenances.

(3) Tablet Method - This method shall not be used if non-potable water or foreign materials have entered the lines or if the water temperature is below 50°C (41°F).

(4) The tablets shall be placed in each pipe section and in all appurtenances. Enough tablets shall be used to insure that a chlorine concentration of 25 mg/L is provided in the water. They shall be attached by an adhesive to the top of the pipe sections and cmshed or rubbed in all appurtenances. The adhesive shall be acceptable to the State Health Department. The filling velocity of the potable water in the pipe line shall be less than 1

ft/sec. The water chlorine solution shall remain in contact with the pipe for 24 hours. All valves and appurtenances shall be operated while the chlorinated water is in the pipeline.

E. Final Flushing - After the required retention period, the heavily chlorinated water shall be flushed from the pipeline using potable water.

F. Testing - After the lines have been flushed, the water lines shall be tested. Samples shall be collected at regular intervals, not exceeding 2000' throughout the length of pipeline.

(1) All chlorine residual determinations shall be made using only those methods approved by the Bureau.

(2) Two water samples for bacteriological analysis must be collected at least 24 hours apart and analyzed by a certified laboratory. The results of these samples must indicate no coliform contamination before the pipe, tanks, or equipment can be utilized as part of the waterworks. If contamination is indicated, then the disinfection procedures must be repeated.

G. Maintain a copy of AWWA Standard C601 on Project site during all disinfecting operations.

3.17 Acceptance Tests

A. Supply the pumps, calibrated gages and meters, and all the necessary apparatus. Notify the Town of Bowling Green at least 48 hours in advance of the test date and perform tests in presence of The Town of Bowling Green's representative.

B. The Town will supply water at no cost for one test of potable water lines only; all other water will be supplied by the Contractor at his own cost.

C. After the line has been backfilled and at least seven days after the last concrete reaction anchor has been poured, subject the line or any valved section of the line to a hydrostatic pressure test in accordance with AWWA C600, except as modified herein. Fill the system with water at a velocity of approximately 1' per sec. while necessary measures are taken to eliminate all air. After the system has been filled, raise the pressure by pump to 1.5 x the working pressure. Test pressures shall: (1) Not be less than 1.25 x the working pressure at the highest point along the test section, (2) not exceed thrust restraint pressure, (3) not vary by more than+ or -5 psi, (4) not exceed twice the rated pressure of the valves or hydrants when test includes closed gate valves, (5) not exceed rated pressure of valves if resilient-seated butterfly valves are used, (6) shall be at least 100 psig. Measure pressure at the low point on the system compensating for gage elevation. Maintain this pressure for two hours. If pressure cannot be maintained,

determine cause, repair and repeat the test until successful.

D. A leak.age test shall be conducted concu rrently with the pressure test in accordance with AWWA C600, except as modified herein. Leakage shall be determined with a calibrated test meter, furnished by the Contractor. Leakage is defined as the quantity of water required to maintain a pressure within 5 psi of the specified test pressure, after air has been expelled and the pipe filled with water. Leakage shall not exceed 10 gallons per day per mile per inch of diameter. If leakage exceeds that specified, find and repair the leaks and repeat the test until successful.

E. All visible leaks shall be repaired regardless of the amount of leakage.

F. No leakage will be allowed for welded steel pipe. If leaks are revealed by test, repair by rewelding. Peening of leaks will not be allowed.

END OF SECTION

SECTION 02730 - SANITARY SEWER SYSTEM

1.0 GENERAL

1.1 Work in this Section includes all exterior sanitary sewer system and force main work on th.is Project.

1.2 Reference Specificationsare referred to by abbreviat ion as follows:

A. American National Standards Institute ..... ANSI

B. American Society for Testingand Materials .....ASTM

C. American Water Works Association..... AWWA

D. Virginia Department ofTransportation.....VDOT

1.3 Definitions

A. Outside or exterior shall ;mean 5 feet beyond the perimeter of buildings, except that footing drains areincluded.

B. Inside or interior shall mean inside buildings and within 5 feet of the perimeter of buildings, except that footing drains are excluded.

2.0 PRODUCTS

2.1 Non-reinforced concrete pipe, fittings and specials in sizes 6 in. through 10 in. shall meet requirements of ASTM CI 4 Class 2. Pipe ends shall have O-ring gasket groove provided during manufacturing process.

A. Rubber gaskets and joints of concrete pipe shall meet requirements of ASTM C361.

B. Pipe and joints shall be tested in accordance with Section 9 of ASTM C14 and ASTM C443 with test reports submitted to the Town.

2.2 Reinforced concrete pipe in sizes 12 in. and larger shall meet requirements of ASTM C76. All pipe shall be Class III unless otherwise shown on Contract Drawings. Pipe end shall have O-ring gasket groove provided during manufacturing process.

A. Rubber gaskets and joints of concrete pipe shall meet requirements of ASTM C361.

B. Pipe and joints shall be tested in accordance with Section 9 of ASTM C76 and ASTM C443 with test reports submitted to Town.

2.3 Polyvinyl-Chloride (PVC) pressure pipe and fittings for other than waterworks service shall meet the requirements of ASTM D2241. The long term pressure rating (PR) shall be 160 psi with a sustained test pressure of 340 psi. Pipe joints shall conform to ASTM DJ 139.

2.4 Polyvinyl-Chloride (PVC) pipe and fittings in sizes 4" through 15" shall meet the requirements of ASTM Standard D3034 SOR 35, Type PSM with flexible elastomeric gasket seals confo1ming to ASTM Standard F477.

2.5 Polyvinylchloride (PVC) sewer pipe and fittings in sizes 18 in. through 27 in. shall meet the requirements of ASTM F679 wall thickness T-1, PS 46 with flexible elastomeric seals conforming to ASTM Standard F477.

2.6 Ductile iron pipe shall meet requirement of AWWA/ANSI Cl51/A21.51 for Class 150, thickness Class 51 unless otherwise indicated on the Drawings. Thickness class shall meet requirements of AWWA Cl50. Pipe shall have cement-mortar lining and a bituminous seal coat onthe exterior.

2.7 Flanged cast iron and ductile iron pipe shall meet the requirements of AWWA/ANSI Cl 15/A21.15 for Class 150, thickness Class 53, unless otherwise shown on Contract Drawings. Thickness class shall meet requiremen ts of AWWA/ANSI C I50 /A21.50. All pipe shall have a cement mortar lining on the interior and a bituminous seal coat on the exterior.

2.8 Gray cast iron fittings shall meet requirements of AWWA/ANSI Cl 10/A21.10. Thickness class shall be Class 53 unless otherwise shown on Contract Drawings. Thickness class shall meet requirements of AWWA/ANSI C150/A21.50. Fittings shall have cement-mortar lining and a bituminous seal coat on the exterior.

2.9 Compact ductile iron fittings shall meet requirements of AWWA/ANSI C153/A21.53 in sizes 4" through 12". 14" and 16" sizes shall conform to manufacturer's standard. Fittings shall have cement-mortar lining and a bituminous seal coat on the exterior.

2.10 Mechanical joints and jointing materials shall meet requirements of AWWA/ANSI Cl 11/A2l. l 1.

A. Mechanical JOmt retainer glands shall meet requirements of AWWA/ANSI C111/A2l. l 1. Glands for ductile iron pipe shall be Megalug Series 1100 as manufactured by EBAA Iron Sales Inc. or approved equal. Glands per PVC pipe shall be Megalug Series 1600, 6500 or 2000 as manufactured by EBAA Iron Sales Inc. or approved equal.

B. Locked type mechanical joints may be used where restrained joints are required.

2.11 Metal harnesses shall be bituminous coated galvanized rods and clamps as detailed on Drawings.

2.12 Push-on joint and rubber gasket shall meet requirements of AWWA ANSI C111/A21.11.

A. Locked type restrained push-on joints may be used where restrained joints are required.

2.13 Flanged joints for ductile iron pipe shall meet requirements of ANSI B16.1.

2.14 Flanged joint gaskets shall be full face, made of 1/16 in. thick rubber, and shall meet requirements of ANSI B16.21.

2.15 Cement mortar lining with bituminous seal coat for cast iron pipe and fittings or ductile iron pipe shall meet requirements of AWWA/ANSI C104/A21.4.

A. Cement mortar lining shall be standard thickness.

2.16 Exterior, bituminous coating for cast iron fittings and ductile iron pipe shall meet requirements of AWWA/ANSI C106/A21.6 or Cl 51/A21.51 as applicable.

2.17 Reinforced concrete pipe, steel cylinder type, not prestressed and prestressed, rubber gaskets for joints, fittings and specials shall meet requirements of AWWA C300, and AWWA C301. Design pressure as defined in these standards shall be as indicated on Contract Drawings. Design limits of pipe shall be such that they shall not be exceeded by the combined requirements of design pressure plus 40 percent of design pressure for water hammer, plus earth dead load.

2.18 Gate Valves

A. Valves shall be for at least 250 psi working pressure in sizes 3" through 12" and for at least 150 psi working pressure in sizes larger than 12" or pressure rating specified for adjacent piping whichever is greater. Valve ends shall be compatible with piping systems in which valves are installed.

B. Outside screw and yoke valves, 3" and larger shall meet requirements of AWWA C500. Valves shall have at least 250 psi working pressure in sizes 3" through 12" and for at least 150 psi working pressure in sizes larger that 12" or pressure rating specified for adjacent piping whichever is greater. Valve ends shall be compatible with piping systems in which they are installed. Valve shall have cast iron body, bronze mounted with double parallel disc and bronze stem and shall open counter clockwise.

2.19 Valve boxes shall be adjustable cast iron valve boxes of the three piece type, consisting of lid, two piece sliding extension and base. Base shall be proper type and size for the valve with which it is used. The word "Sewer" shall be cast or embossed on the valve box lid in letters not less than 1 inch high. Valve box shall be manufactured by Mueller Company, Richard Foundry, or Tyler.

2.20 Check valves 3 inches and larger shall be iron body, bronze mounted, swing check valves, meeting requirements of AWWA C508. Check valves 3 through 12 inches shall be for 175 psi non-shock cold water working pressure. Valves 14 through 24 inches shall be for 150 psi non-shock cold water. Valves shall have outside weight and lever.

A. Manufacturer shall be American Darling Valve and Manufacturing Company, Eddy-Iowa Division of Clow Corporation, Kennedy Valve Manufacturing Company, M & H Division of Dresser Industries, or G-A Industries, Inc.

2.21 Plug Valves

A. General

(1) Valves shall be of the non-lubricated type. Valves in sizes 12" and smaller shall be designed for a minimum working pressure of 175 psi. Valves in sizes 14" through 36" shall be designed for a minimum working pressure of 150 psi. Valves 42" and larger shall be designed for a minimum working pressure of 125 psi. Valves shall provide tight shutoff with rated pressure from either direction.

(2) Ports in valves shall be round or rectangular style. Where rectangular port valves are furnished, valves shall have a minimum flow area of 100% of corresponding port area.

(3) Valve bodies shall be of ASTM A-126, Class B cast iron. Valve body shall be furnished with a welded-in overlay of 90% nickel alloy content on all surfaces contacting the plug face. Sprayed, plated or screwed in seats are not acceptable.

(4) Plugs shall be of cast iron complying with ASTM A-126, Class B or ductile iron complying with ASTM A-126, Grade 65-45-12. Plugs shall be of one piece construction.

(5) Valves shall be furnished with replaceable, pe rmanently-lubricated, sleeve-type 18-8 stainless steel bearings in the upper and lower journals. Shaft seals shall be in accordance with AWWA C-504-87.

(6) Valves shall be tested in accordance with AWWA C504-87, Section 5.

Each valve shall be performance tested in accordance with Section 5.2 and shall be given a leakage test and a hydrostatic test as described in Paragraphs 5.3 and 5.4. The leakage test shall be applied to the face of the plug tending to unseat the valve. Certified copies of test results and Proof-of-Design testing as described in Section 5.5 shall be furnished upon request.

B. Two-Way Valves: Two-way valves shall be of the eccentric type. Threaded ends shall meet NPT standard. Mechanical joint ends shall comply with AWWA C111-64.

C. Three-Way Valves: Three-way valves shall be of the tapered plug type. Flanged valves shall meet ANSI B16.1 including facing, drilling and flange thickness. Valves shall be furnished with a plug to shut off one port at a *time* unless other arrangement is shown on the Drawings.

D. Operators

(1) Buried valves shall be equip ped wit h 2" sq. opera ting n uts unless otherwise shown on the Drawings. Where nuts will be more than 48" below finished grade, extension stems shall be pin connected to valve stem. Extension stem shall raise operating nut to within 24" of finished grade.

(2) Interior valves 6" and smaller in size shall be wrench operated, except where otherwise shown on the Drawings. Valves shall be capable of being converted to worm gear or automated operation without removing the bonnet or plug from the valve. Valves shall be equipped with a 2" sq. nut for use with removable levers or extended "T" handles. A wrench shall be furnished with each valve.

(3) Valves 8" and larger shall be right-angle, worm-gear operated and equipped with hand-wheels except where otherwise shown on the Drawings. Gear operators shall be totally enclosed, permanently lubricated. Manual operator components shall withstand, without damage, a pull of 200 lbs. on the handwheel, with buried service gear units capable of withstanding an input torque of 300 lbs. on the operating nut as required by AWWA C 504-87, Sec. 3.8.3 and AWWA C507-85, Sec. 11 Paragraph 11.9. Gear segment shall be of ductile iron, ASTM A536, Grade 65-45-12, supported on bronze bushings.

(4) Interior valves in inaccessible locations shall be provided with valve floor-stands or chain operators as shown on the drawings.

(5) Hydraulic, pneumatic or electric operators shall be provided, where shown

on drawings.

E. Manufacturer

(1) The valves shall be as manufactured by Keystone, DeZurik or Milliken, or approved equal.

2.22 Flexible couplings shall be of a gasketed, sleeve type. Each coupling shall consist of a steel middle ring, two steel followers, two mbber compounded wedge section gaskets and sufficient galvanized track head steel bolts to properly compress the gaskets. Couplings shall be of the type to match piping in which installed. Couplings shall be manufactured by Dresser Manufacturing Company or Smith-Blair.

2.23 Flanged adapters for joining plain-end pipe to flanged items shall be 128 or 127 as manufactured by Dresser Manufacturing Division of Dresser Industries or Smith-Blair type 912 or 913.

2.24 Pressure gages shall be open front case type with bronze bourdon tube soldered to socket and tip, stainless steel movement, and a *41/:2* inch white coated dial graduated from O to 100 psi. Gages shall be Ashcroft No. 1279.

2.25 Compound gages shall be open front case type with bronze bourdon tube soldered to socket and tip, stainless steel movement, and a 4½ inch white coated dial graduated from 0 to l 00 psi and O to 30 inch vacuum.

2.26 Air release valves and air and vacuum valves, located where indicated on Contract Drawings, shall have cast iron body and cover, bronze mechanism and seat, Buna-N needle and stainless steel float and lever pins. Valves shall have valved quick coupling back flushing connection. Valves shall be APCO Model 400 and 401 sewage valves as manufactured by Valve and Primer Co. or Model 48 and 301 by Val-Matic Corporation.

2.27 Manholes

A. Manholes shall be constructed of pre-cast reinforced concrete manhole sections in accordance with the requirements of ASTM C478 and detailed in Section 00870 - Standard Details.

B. A maximum of two lift holes per manhole section may be provided.

C. Provide tongue and groove joints in manhole sections with a preformed groove in the tongue for placement of an O-ring type round, mbber gasket.

(1) Gasket shall comply with requirements of ASTM C361.

(2) Gasket shall provide the sole element in sealing the joint from either

D. Provide flexible pipe connections to manholes, other than acid-resistant manholes, for pipes 15 in. d smaller in size.

internal or external hydrostatic pressure.

(1) Materials shall be resistant to water, sewage, acids, ozone, weathering and aging. Use neoprene conforming to ASTM C923 and stainless steel, Series 300.

(2) Cast or core drill openings in manholes to receive connectors. Connectors shall be suitable for field repair or replacement. Connectors not suitable for field replacement are unacceptable.

(3) The assembled connectors shall allow at least an 1I° angular deflection of the pipe and at least one inch of lateral misalignment in any direction and be suitable for a normal variation *in* diameter or roundness for the pipe mat::rial used.

(4) Connectors shall be similar to Kor-n-Seal as manufactured by National Pollution Control Systems, Inc.

E. Liners for acid-resistant manholes shall be of fiberglass reinforced polyester or polyvinylchloride construction and shall be installed to protect the pre-cast manhole sections from the inside base of the manhole to the base of the manhole frame.

(1) FRP liners shall consist of a *7'(6* in. thick fiberglass reinforced polyester with a 15 mil gel coat interior surface. The polyester resin shall be similar to Dion No. 6694. Joints between sections of the liner shall be sealed in accordance with the manufacturer's instructions.

(2) PVC liners shall consist of polyvinylchloride plates, not less than 0.060 in. thick, with integral bonding ribs and shall be similar to Arnercoat "T-Lock Amer-Plate". Joints between sections of liner shall be welded in accordance with the manufacturer's instructions.

F. Sealant for manhole frames shall be a one-component polyurethane sealant similar to Sika "Sikaflex" Type 1a.

G. Sealant for flexible pipe connections shall be a two-component polyurethane sealant similar to Sika "Sikaflex" Type 2c with primer Type 429.

H. Manhole steps shall be corrosion-resistant and shall be one inch square cast iron, rubber-covered steel or aluminum. The steps shall conform to the dimensions

shown in Section 00870 - Standard Details.

I. Manhole frames and covers shall be molded of gray cast iron conforming to ASTM A48, Class 30. Castings shall be coated with a coal tar pitch varnish, to which sufficient oil has been added to make a smooth coating, tough and tenacious when cold, but not tacky or brittle. Seating surfaces between frame and cover shall be machined. The dimensions and weights shall conform to the requirements shown in Section 00870 -Standard Details.

(1) Standard Manhole Frame and Cover shall be similar to Richards Foundry Corporation No. D 1125.

(2) Vandal-proof Manhole Frame and Cover shall be similar to Neenah Foundry Co., Cat. No. R-1926-C with four (4) - 1 in. diameter vent holes.

(3) Watertight Manhole Frame and Cover shall be similar to Richards Foundry Corporation No. B-9960.

3.0 EXECUTION

3I I Take all precautions necessary to insure that pipe, valves, fittings, and related items are not damaged in unloading, handling and placing in trench. Examine each piece of material just prior to installation to determine that no damage has occurred. Remove any damaged material from the site and replace with undamaged material.

A. Keep pipe clean. Exercise care to keep foreign material and dirt from entering pipe during storage, handling and placing in trench. Close ends of in-placepipe at the end of any work period to prevent entry of animals and foreign material.

B. Bed pipe as specified in Section 02225 - Trenching & Backfilling.

C. Do not lay pipe when weather or trench conditions are unsuitable.

D. Separation of sewer and water in accord with State requirements.

3.2 Lay gravity sewers so as to maintain a true alignment and grade as indicated on Contract Drawings. After completion, the pipe shall exhibit a full circle of light when lighted at one manhole and viewed from the next.

A. Commence laying gravity sewers at the lowest point on a section of line and lay pipe with the bell ends uphill.

B. Pipe Joint. Preparatory to making pipe joints on gravity sewer lines, clean and dry all surfaces of joint pipe and jointing material. Use lubricants, primers, adhesives and similar materials as recommended by the manufacturer. Place, fit,

join and adjust the jointing materials or factory fabricated joints as recommended by the manufacturer to obtain the degree of watertightness required. As soon as possible after the joint is made, place sufficient backfill material, as specified under Section 02225 -Trenching & Backfilling, along each side of the pipe to resist forces that might tend to move the pipe off line and grade.

C. Complete backfilling as specified under Section 02225 -Trenching & Backfilling. Place backfill over the pipe immediately after the pipe has been laid.

3.3 Install force main with a minimum depth of cover of 42 in. over the top of the pipe, where no grades are shown on the Drawings.

A. Where grades on the force main conflict with existing pipes or structures, lay force main to additional depth with a uniform vertical curve to provide proper clearance without the use of fittings. No additional payment will be allowed for additional excavation. Provide allowance for expansion as directed by Engineer.

B. Lay force main pipe with bell ends facing the direction of laying. Where grade is 10 percent or greater, pipe shall be laid uphill with bell ends upgrade.

3.4 Joining Pipe

A. Join mechanical joint pipe as follows:

(1) Thoroughly clean inside of the bell and 8 inches of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating and other foreign matter from the joint. Paint the bell and spigot with soap solution (half cup granulated soap dissolved in 1 gallon water). Slip cast-iron gland on spigot end with lip extension of gland toward end of pipe. Paint rubber gasket with or dip into the soap solution and place on the spigot end with thick edge toward the gland.

(2) Push the spigot end forward to seat in the bell. Then carefully press the gasket into the bell so that is located evenly around the joint. The gland is moved into position, bolts inserted and nuts screwed up finger tight, then tighten all nuts to torque listed below. Contractor shall provide a calibrated torque wrench for verification of torque.

Bolts Size - Inches	Torque Ft. -Lbs.
½	40-60
¾	60 -90
1	70 -100
1¼	90 -120

(3) Tighten nuts on alternate sides of the gland until pressure on the gland is equally distributed.

(4) Permissible deflection in mechanical joint pipe shall not be greater than listed in **AWWA** C600.

B. Join push-on joint Ductile Iron pipe as follows.

(1) Thoroughly clean inside of the bell and 8 inches of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating, and other foreign matter. Flex rubber gasket and insert in the gasket recess of the bell socket. Apply a thin film of gasket lubricant supplied by pipe manufacturer, to either the gasket or the spigot end of the joining pipe.

(2) Start spigot end of pipe into socket with care. The joint shall then be completed by forcing the plain end to the bottom of the socket with a forked tool or jack type device. Field cut pipe shall have the end filed to match the manufactured spigot end.

(3) Permissible deflection in push-on joint pipe shall not be greater than ½ of that listed in AWWA C600.

C. Join reinforced concrete pipe with rubber gaskets installed as recommended by the manufacturer.

D. Install PVC pipe in accordance with ASTM D-2321.

E. Set valves and valve boxes as follows.

(1) Set vertically installed valves with stems in the vertical plane through the pipe axis and perpendicular to the pipe in the plane 90° to the pipe axis. Locate valves where indicated on Drawings. Thoroughly clean valves before installation. Check valves for satisfactory operation.

(2) Equip all underground valves without gearing or operators with valve boxes. The box shall be in alignment with valve stem centered on valve nut. The valve box shall be so as not to transmit shock or stress to the valve. Set box cover flush with the finished ground surface or pavement.

(3) House all operators or gearing of underground valves, equipped with gearing or operators, in manholes. Construct manhole to prevent transmitting any load or shock to the valve or pipe. Locate manholes and valves relative to each other in order that packing, operator, and other parts

of the valve are readily accessible for minor repairs.

3.5 Provide force main air vent valves at locations indicated on Drawings and at all high points of the mains. Install gate valve between main and air valves. Construct manholes for air and vacuum relief valves.

3.6 Use sleeves where pipes, valves stem extensions or equipment parts pass through concrete or masonry walls or slabs. Sleeves shall be either cast iron or schedule 40 steel of sufficient size to allow sealing around pipes and clearance for valve stems or equipment. Extend vertical sleeves through slabs 1 inch above top surface.

A. Use cast iron sleeves with intermediate collars to anchor and provide a water stop on outside of sleeves that pass through exterior walls below grade. Seal pipes using oakum and leadite.

3.7 Provide reaction anchors, metal harness or retainer gland type at all changes in direction of pressure pipelines and as shown on Drawings.

A. Use metal harness restraints as indicated on Drawings.

3.8 Construct service connections for sewer main to property line as follows:

A. Place a tee fitting with 4-inch or 6-inch outlet in the sewer where service connection is to be constructed. Lay 6 inch pipe from the tee to the property line on a grade of not less than ¼ in. per foot or lay ductile iron pipe on a grade of not less than ½ in. per foot. Close service connection at the property line with a water-tight plug. See Section 00870 -Standard Details.

B. Install service connections on existing sewer mains with a compression type cast iron saddle as manufactured by Pioneer or approved equal. Secure saddle to the pipe with a 24 gage stainless steel strap and two nickel-bronze T bolts. Make connections of this type by machine tapping or cutting the pipe. Use mastic sealer type gasket to insme a water-tight connection.

C. Determine the depth of service connections by the deepest of the following:

(1) Provide 5 foot cover at the edge of the road paving or 15 feet from the center line of the street.

(2) Provide 18 inch cover at the bottom of highway ditches unless protected by concrete ditch apron.

(3) Provide 30 inch cover at the property line when property is above street.

(4) Provide depth necessary for a 1% grade if required to provide service to a property.

D. Place a 2 in. x 4 in. solid piece of lumber at the end of each service connection. The 2 in. x 4 in. marker shall be set vertically and extend from invert to 6 in. above grade.

E. Construct concrete pedestals where shown on the Contract Drawings and/or as directed by Engineer, in accordance with Section 00870 - Standard Detail.

F. Provide ductile iron pipe or concrete encasement where cover over sewer is less than 3.5 feet in public roads or right-of-way.

3.9 Stream crossings shall adhere to the following:

A. Watertight manhole covers shall be provided when the top of the manhole is below the 25-year flood/wave elevation.

B. Either concrete encasement shall be provided around the sewer at the crossing, or adequate cover (1 foot [minimum) in rock; 3 feet [minimum] in other material) shall be provided over the sewer at the crossing.

C. Infiltration tests shall be conducted and will exhibit a level of "O" infiltration.

3.10 Manholes shall be constructed to the elevations shown on the Contract Drawings in accordance with the provisions of Section 00870 - Standard Details.

A. Set manhole base section on bed of VDOT #57 stone to a minimum depth of 6 in. Stone shall be thoroughly compacted and carefully leveled.

B. Join all manhole riser and cone or flat slab top sections by the use of rubber gaskets.

C. Pack and brush joints in FRP lining in acid-resistant manholes with sealant to provide a watertight and acid-resistant seal. Field weld joints in PVC lining of acid-resistant manholes in accordance with manufacturer's instructions.

D. Install pipe stubs in manholes where called for on the Contract Drawings. All stubs shall extend 12" -18" beyond the manhole and shall be sealed watertight with a plug or cap.

E. Install flexible manhole connections for all pipes sizes 8 in. to 15 in., inclusive and apply sealant to completely fill joint between manhole barrel and flexible connection for the full thickness of the manhole barrel.

G. Set adjusting rings in portland cement mortar bed.

F. Plug lift holes and repair any defects in manhole.

(1) Rings will not be required outside of paved roadways or walkways unless called for on the Contract Drawings.

(2) Rings in paved roadways or walkways shall permit upward or downward adjustment of manhole frame by six inches.

H. Set manhole frame in bed of sealant. Bed shall consist of one, 3/8 in. bead laid flush with the inside edge of the frame base and another 3/8 in. bead laid flush with the outside edge of the frame base.

I. Bolt watertight manhole frames to manhole cone or flat slab top section as shown on the Standard Details.

J. Constrnct drop connections where called for on the Contract Drawings.

(1) Drop connection may be constructed of the same pipe material as used on the sewer line or may be constructed of ductile iron pipe and fittings.

(2) Drop connections shall be encased in concrete except where ductile iron pipe and fittings are used.

K. Construct bench of concrete or brick and mortar.

(1) Lowest elevation of bench shall be at the spring line of the outgoing pipe.

(2) Slope bench three inches toward channel for drainage.

(3) Where stubs or knockouts are provided for future pipe connections, bench shall be so formed.

(4) Use sulfate resistant cement for concrete or mortar on all acid-resistant manholes.

(5) Where sealant is used, bench shall not be in contact with pipe or flexible pipe connection.

3.11 Install detectable marking tape in all trenches containing buried pipe lines. Tape shall be installed in all trenches with a cover of 18 to 54" and a minimum clearance over the pipe lines of 18". Place tape on edge of trench toward the center of the pavement in roadways. In other locations, place tape to the north or east of the utility line. Wrap tape around all valves, corporation stops and meter setters. Wrap tape three turns around base of fire

hydrants and extend tape up above ground against fire hydrants. Tape shall be made electrically conductive throughout the entire system through the use of splices of a type recommended by the manufacturer. In addition to the tape, a 12 gauge solid copper tracing wire shall be installedalong pipe.

3.12 Testing gravity sewer lines and manholes:

A. Testing of gravity sewer lines shall be conducted on short sections of sewer line, i.e., between manholes, or at the end of each day's work. Provide all labor, materials, tools, and equipment necessary to make the tests. All equipment and methods used shall be acceptable to the Town. All monitoring gages shall be subject to calibration, if deemed necessary.

B. Sanitary sewer lines 24 in. diameter and smaller shall be tested after backfill using a low-pressure air test in accordance with appropriate ASTM Standard Test Method.

C. Low-pressure air test:

(1) Summary of Method: Plug the section of the sewer line to be tested. Introduce low-pressure air into the plugged line. Use the quantity and rate of air loss to determine the acceptability of the section being tested.

(2) Preparation of the sewer line: Flush and clean the sewer line prior to testing, thus serving to wet the pipe surface as well as clean out any debris. A wetted interior pipe surface will produce more consistent results. Plug all pipe outlets using approved pneumatic plugs with a sealing length equal to or greater than the diameter of the line being tested to resist the test pressure. Give special attention to laterals.

(3) Ground Water Determination: Install a ½ inch capped galvanized pipe nipple, approximately 12 inches long, through the manhole on top of the lowest sewer line in the manhole. Immediately prior to the line acceptance test, the ground water elevation shall be determined by removing the pipe cap and blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic hose to the pipe nipple. The hose shall be held vertically and a measurement of the height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in the plastic hose.

(4) Procedures: Determine the test duration for the section under test by computation from the applicable formulas shown in appropriate (test method) ASTM. The pressure-holding time is based on an average holding pressure of 3 psi gage or a drop from 3.5 psi to 2.5 psi gage.

(a) Add air until the internal air pressure of the sewer line is raised to approximately 4.0 psi gage. After an internal pressure of approximately 4.0 psig is obtained, allow time for the air pressure to stabilize. The pressure will normally show some drop until the temperature of the air in the test section stabilizes.

(b) When the pressure has stabilized and is at or above the starting test pressure of 3.5 psi gage, commence the test. Before starting the test, the pressure may be allowed to drop to 3.5 psig. Record the drop in pressure for the test period. If the pressure has dropped more than 1.0 psi gage during the test period, the line shall be presumed to have failed. The test may be discontinued when the prescribed test time has been completed even though the 1.0 psig drop has not occurred.

(c) The test procedure may be used as a presumptive test which enables the installer to determine the acceptability of the line prior to backfill and subsequent construction activities.

(d) If the pipe to be tested is submerged in ground water, the test pressure shall be increased to 1.0 psi for every 2.31 feet the ground water level is above the invert of the sewer.

(5) Safety: The air test may be dangerous if, because of lack of understanding or carelessness, a line is improperly prepared.

(a) It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. In as much as a force of 250 lb. is exerted on an 8 inch plug by a internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or of a plug that is partially deflated before the pipe pressure is released can be dangerous.

(b) As a safety precaution, pressurized equipment shall include a regulator or relief valve set at perhaps 10 psi to avoid over-pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.

D. Sanitary sewer lines larger than 24" in diameter shall be tested by infiltration or exfiltration as hereinafter detailed. Manholes may likewise be tested by infiltration or exfiltration as an alternative to vacuum testing.

(1) Use infiltration test when ground water is at least 4 feet above pipe crown along entire length of line to be tested. Plug the pipe at the upper manhole. Install suitable measuring device at the next lowest manhole.

Measure the amount of water flowing through the outlet after flow has been stabilized.

(2) Ground water determination: Use same procedure as "low pressure air test" above.

(3) Use exfiltration test when ground water is less than 4 feet above the pipe crown. Conduct exfiltration test of lower manhole as detailed below. After acceptable test of lower manhole, plug the pipeline to be tested at the lower manhole. Fill the line and manhole to 4 feet above pipe crown or top of manhole whichever is less. Let the water stand until pipe has reached maximum absorption and until all trapped air has escaped, 4 hour mmunum. After maximum absorption is reached, refill manhole to original level. After 30 minutes, record difference in level and convert to gallons.

(4) Allowable leakage of the sewer shall be 100 gallons per inch of pipe diameter per mile per 24 hours up to a maximum of 2,400 gallons per mile per 24 hours.

E. Manhole Exfiltration Test: All pipes leading to and from manhole shall be plugged. Plugs shall be inserted into the pipes a distance greater than the length of the plugs used to air test each respective section of sewer line, so as to insure the manhole and sewer line tests overlap. Plugs shall be secured to the manhole structure. The manholes shall be filled with water to the top of frame and allowed to soak for a minimum of four hours to permit the manhole to absorb water. The cover shall be on the manhole during the soaking period. At the end of the soaking period, water shall be added until the manhole overflows. No loss of water will be permitted over a four-hour period. Upon completion of the test, the water shall be removed from the manhole.

F. Vacuum testing of manholes: Vacuum tests shall be conducted on newly constructed manholes following construction & after all connections have been made but before any backfilling around the manhole. Successful testing shall be accomplished before any backfilling operations.

(1) Provide necessary vacuum pump, pneumatic plugs and accessories required for proper performance of the test. Plugs shall have a sealing strength equal to or greater than the diameter of the connecting pipe to be sealed.

(2) Follow all local, state and federal safety precautions. Brace inverts if lines entering the manhole have not been backfilled or otherwise restrained to prevent pipe from being dislodged and pulled into the manhole.

(3) Install vacuum tester head assembly at the top access of the manhole. Adjust the cross brace to insure that the inflatable sealing element inflates and seals against the straight top section of the manhole if possible.

(4) Attach the vacuum pump assembly to the proper connection on the test head assembly. Make sure the vacuum inlet/outlet valve is in the closed position.

(5) Following safety precautions and testing equipment manufacturer's instructions, inflate sealing element to the recommended maximum inflation pressure. Do not overinflate.

(6) Start the vacuum pump assembly engine and allow preset pump to stabilize. Open the inlet/outlet ball valve and evacuate the manhole to 1O" H g (approximately -5psig). Pressurizing the manhole may result in damage to manhole or to test equipment.

(7) Close vacuum inlet/outlet ball valve and monitor vacuum for specified test period (see table). If vacuum does not drop in excess of l" Hg., manhole is considered acceptable and the manhole passes the test. If manhole fails the test, complete necessary repairs and repeat test procedures until satisfactory results are obtained.

Depth of Manhole (Feet)	Manhole Diameter (inches) Time (seconds)		
			n:..
8	14	18	23
10	17	23	28
12	21	28	34
14	25	32	40
16	28	37	45
18	32	41	51
20	35	46	57
22	39	51	62
24	42	55	68
26	46	60	74
28	49	64	80
30	53	69	85

(8) Repeat the above test procedure after backfilling manhole for final acceptance test.

3.13 Deflection testing of flexible pipe gravity sewer

A. Conduct deflection tests on all flexible pipe gravity sewer lines in order to verify the roundness and proper installation of the pipelines. When tests are conducted within 30 days after backfilling has been completed and compacted, 95% of the pipe must have a deflection on less than 5%. When tests are conducted more than 30 days after backfilling has been completed and compacted, 92½% of the pipe must have a deflection of less than 7½%. Mandrel diameter shall be in accordance with ANSI/ASTM D-3034 & F-679.

B. Mandrels shall be approved by the Town with proving rings prior to use and shall meet the following requirements:

(1) Mandrel Sizing shall be the base pipeline diameter times the percent of deflection limit.

(2) The mandrel shall be of open design to prevent debris build-up from occurring between the channels of adjacent fins which in-turn causes erratic test results. The fin sets shall number at least nine (9) and shall be removable from the mandrel core by unscrewing the wing-nut and loosening the end caps which secure the fins in position. The contact area of the fins shall be equal to the nominal inside diameter of the pipe. Gauges of various diamete_rs shall be assembled by substituting fin sets of appropriate dimension.

C. After the pipeline has been installed and backfill materials have been compacted to their required standard densities, as set out in ASTM D 2321 or other applicable standard, the mandrel shall be pulled by hand through the pipeline with a suitable rope or cable that is connected to an eye-bolt at one end of the gauge. A similar rope or cable shall be attached to the eye-bolt at the opposite end of the mandrel and tension shall be applied to it to insure that the mandrel maintains its correct position during testing and also to remove the mandrel if it should become lodged in an excessively deflected pipeline. Winching or other means of forcing the mandrel through the pipeline are unacceptable.

D. A permanent record of all testing with locations where excessive pipeline deflections occur shall be kept by the Contractor and forwarded to the Town after completion of testing and acceptance of each line.

E. The Contractor shall immediately rep lace all sections of pipe which deflect more than the acceptable limits set out above.

F. All materials and labor required for testing and replacement of pipelines shall be furnished by the Contractor and the cost thereof included in the price bid for furnishing and installing pipelines.

3.14 Force Main tests shall be as follows:

A. Supply the pumps, water, calibrated gages and meters, and all the necessary apparatus. Notify the Town at least 48 hours in advance of the test date and perform tests in presence of Town.

B. Hydrostatic pressure test. After the line has been backfilled, a hydrostatic pressure test shall be performed. Carefully fill the system with water at a velocity of approximately 1 ft. per second while necessary measures are taken to eliminate all air. After the system has been filled, raise the pressure by pump to 50 psi as measured at end of force main closest to sewage pump discharge. Measure pressure at lowest point in system with gage compensated for elevation. Maintain this pressure for at least two hours. No leakage will be allowed and if pressure cannot be maintained determine the cause, repair and repeat the test until successful.

C. All visible leaks shall be repaired regardless of the amount of leakage.

D. A leakage test shall be conducted concurrently with the pressure test. Leakage shall be determined with a calibration test meter, furnished by the Contractor. Leakage is defined as the quantity of water required to maintain a pressure within 5 psi of the specified test pressure, after air has been expelled and the pipe filled with water. Leakage shall not exceed 10 gallons per day per mile per inch of diameter. If leakage exceeds that specified limit, find and repair the leaks and repeat the test until successful.

END OF SECTION

SECTION 02935 - SEEDING

1.0 GENERAL

1.1 Description

A. Furnish and install all items of seeding as specified herein and shown on the Contract Drawings.

1.2 Reference Specifications are referred to by abbreviation as follows:

A. American Society for Testing and Materials ..... ASTM

B. Federal Specifications .....FS

1.3 Submit three copies of following:

A. Seed Test Report

B. Fertilizer Analysis

1.4 Materials shall be delivered in unbroken containers, clearly marked by the manufacturer as to contents . Seed, limestone, and fertilizer shall be labeled as to proportions, analysis and quality. Store all materials in a manner affording protection from damage by weather or vandalism.

2.0 PRODUCTS

2.1 Topsoil shall be the top 6" of original soil from the site, unless otherwise noted on the Drawings. Topsoil obtained off-site shall be fertile, friable loam, containing not less than 2 pct., by weight, of finely divided, decomposed vegetable matter. Topsoil shall be free of subsoil, clay lumps, brush, weeds, roots larger than ½" diameter, stones larger than ½" diameter and other material toxic or harmful to growth.

2.2 Fertilizer shall meet requirements of Federal Specification 0-F-241. Provide fertilizer that is complete, inorganic, uniform in composition and suitable for application with approved equipment.

A. Proportions of fertilizer nutrients shall be as follows:

Mixed grasses and legumes: 1000 lbs./acre 10-20-10 or equivalent nutrients (23 lbs./1000 ft').

Legwne stands only:	1000 lbs./acre 5-20-10 (23 Jbs./1000 ft^2. is preferred; however, 1000 lbs./acre of 10-20-10 or equivalent may be used.
Grass stands only:	1000 lbs./acre 10-20-10 or equivalent nutrients, (23 lbs.II000 ft^2).

B. Other fertilizer formulations, including slow-release sources of nitrogen (preferred from a water quality standpoint), may be used provided they can supply the same amounts and proportions of plant nutrients.

2.3 Certified seed will be used for all permanent seeding. The seed must meet published state standards and bear an official "Certified Seed" label. Grass seed, tested within 6 months of sowing, shall have the following characteristics.

A. Permanent Seeding

1. General Slope (3:1 or less)

	Total Lbs. Per Acres
Kentucky 31 fescue	128 lbs.
Red Top Grass	2 lbs.
Seasonal Nurse Crop*	20 lbs.
	150 lbs.

2. Low-Maintenance Slope (Steeper than 3:1)

Kentucky 31 Fescue	108 lbs.
Red Top Grass	2 lbs.
Seasonal Nurse Crop*	20 lbs.
Crownvetch**	20 lbs.
	150 lbs.

* Use seasonal nurse crop in accordance with seeding dates as stated below:

Feb.16-April ..... Annual Rye
May l-Aug.15 ..... Foxtail Millet
Aug.16-Oct. ..... Annual Rye
Nov.-Feb.15 ..... Winter Rye

** Substitute Sericea lespedeza for Crownvetch east of Farmville, VA (May through September use hulled Sericea, all other periods, use unhulled Sericea). If Flatpea is used in lieu of Crownvetch, increase rate to 30 lbs./acre. All legume seed must be properly inoculated. Weeping Lovegrass may be added to any slop or low-maintenance mix during warmer seeding periods; add 10-20 lbs.Iacre in mixes.

B. Temporary Seeding

Planting Dates	Species	Rate (lbs./acre)
Sept.l-Feb.15	50/50 Mix of Annual Ryegrass (Lolium multi-florum) & Cereal (Winter) Rye (Secale cereale)	50 - 100
Feb.16-Apr.30	Annual Ryegrass (Lolium multi-florum)	60 - 100
May l-Aug.31	German Millet (Setaria Italica)	50

2.4 Lime shall be ground agriculturalgrade limestone containing not less than 85% calcium and magnesium carbonates. Fineness shall be such that 100% will pass a No. 20 sieve, not less than 50% will pass a No. 100 sieve. Burnt lime or hydrated lime may be substituted in equivalent carbonates, if requested.

2.5 Type I mulch shall be "Hold/Gro"erosion control fabric manufactured by Gulf States Paper Corporation, P. 0. Box 3199, Tuscaloosa, Alabama 35401 or equivalent. The fabric shall be manufactured of materials which degrade in 6 to 8 months under outdoor exposure. Type I mulch shall be used on slopes greater than or equal to 3:l.

2.6 Type II mulch composed of straw or hay, fiber mulch or com stalks shall be free of objectionable weed seeds or other harmful materials. Type II much may be used on slopes less than 3 to l .

2.7 Type II mulch shall be anchored by means of a mulch anchoring tool, fiber mulch application or a synthetic mulch binder which is organically formulated.

2.8 Fiber mulch shall not be used during the dry summer months or used for a late fall mulch cover. Straw, hay or corn stalk mulch shall be used.

2.9 Asphalt, petroleum based or chemical binders sha ll not be used.

2.l 0 Sod shall be composed of at least 70% of Kentucky 31 tall fescue and be cut to provide a minimum thickness of2". Vegetation more than 5" in height shall be cut to 3" or less before sod is lifted.

3.0 EXECUTION

3.1 Seed all areas within "Limits of Construction" and all areas disturbed during construction.

3.2 Apply seeding products only when wind velocity is less than 15 miles per hours.

3.3 Temporary Seeding

A. Use to reduce erosion and sedimentation in disturbed areas that will not be brought to final grade for a period of more than 30 days. Use to reduce damage from sediment and runoff to downstream or off-site areas, and to provide protection to bare soils exposed during construction until permanent vegetation or other erosion control measures are established.

B. Apply fertilizer at a rate of 600 lbs./acre of 10-20-10 (14 lbs./1,000 sq.ft.) or equivalent nutrients.

C. For loose soil, work lime and fertilizer into soil and then seed. For packed or hard soil, loosen top layer while working lime and fertilizer into soil and then seed at the rate required for the temporary seeding species.

D. Seed shall be evenly applied with a broadcast seeder, drill, culti-packer seeder or hydroseeder. Small grains shall be planted no more than l" deep. Grasses and legumes shall be planted with no less than 1/4" soil cover.

E. Seeding made in the fall for winter cover and during hot and dry summer months shall be mulched with straw. Fiber mulch will not be considered adequate during these periods.

F. Areas which fail to establish vegetation cover, adequate to prevent rill erosion, shall be reseeded as soon as such areas are identified.

3.4 Permanent Seeding

A. Prepare soil for permanent seeding by tillage of topsoil in place to loosen thoroughly and break up all clods to a depth of 6". Remove all stumps and roots, coarse vegetation, stones larger than 1½" and all construction debris. Soil shall be worked by suitable agricultural equipment to a depth of not less than 4". Rake to a uniform, smooth and drainable surface.

B. Apply lime and fertilizer uniformly and mix well into top 4" of seed bed. Apply lime at the rate of 90 lbs. per 1,000 sq. ft. Apply fertilizer at the rate of l00 lbs. of l0-20-10 per acre or 23 lbs. of l0-20-10 per 1,000sq. ft. Rates should be adjusted for other grades of fertilizer.

C. Seeding in Lawn Areas: After final grading, a finely pulverized seed bed shall be prepared using a minimum of 3" of topsoil over the entire area to be seeded. Topsoil, previously placed, may be used to the extent available. Cost of any additional topsoil shall be included in the cost of seeding. Mulch shall be Type II. Type I may be required depending on the slope of area to be seeded.

D. Seeding in Easements: After final grading and site preparation, grass seed shall be applied at the rate of 60 lbs. per acre and followed immediately by mulching and protection as provided. Mulch shall be Type II.

3.5 Use seasonal nurse crop in accordance with dates as specified in this Section part 2.3.

3.6 Sow permanent seed by mechanical seeder as follows:

A. Apply seed uniformly with a broadcast seeder, drill, culti-packer seeder, or hydroseeder on a firm, friable seedbed. Seeding depth should be ¼ to ½". Apply in cross directions to ensure uniform distribution.

B. Mulch shall be applied as follows:

(1) Straw or hay mulch shall be applied at the rate of 1.5-2 tons per acre or 70-90 lbs. per 1,000 sq. ft. with a mulch blower or by hand. It shall be anchored after application.

(2) Fiber mulch shall be applied at the rate of a minimum of 1,500 lbs. per acre or 35 lbs. per 1,000 sq. ft. It shall be applied as a slurry.

(3) When fiber mulch is the only available mulch during periods when straw should be used, apply at a minimum rate of 2,000 lbs. per acre or 45 lbs. per 1,000 sq. ft.

(4) Corn stalk mulch shall be applied at the rate of 4-6 tone per acre or 185-275 lbs. per 1,000 sq. ft. It shall be applied with a mulch blower or by hand. Stalks shall be cut or shredded in 4-6" lengths and air dried. It shall not be used in fine turf areas.

C. Anchor mulch to the following standards:

(1) Straw mulch shall be anchored immediately after spreading to prevent displacement.

(2) Use of a mulch anchoring tool (i.e. Krimper Tool) shall be limited to grades less than 3 to 1. Machinery shall be operated on the contour.

(3) Use a fiber mulch, shall be applied by means of a hydroseeder at a rate of

500-750 lbs. per acre over top of straw mulch or hay.

(4) If a synthetic mulch binder is used, apply at the rate recommended by manufacturer.

(5) On slopes steeper than 3 to 1 fasten Type I mulch as recommended by the manufacture.

3.7 Remove all soiling or staining of finished walks, drives and parking areas resulting from seeding work. Maintain paved areas in clean condition.

3.8 Turfgrass Maintenance

A. Water as required to keep soil moist during germination period.

B. Mowing

(1) When grass reaches height of 3W' to 4", mow to height of 2½".

(2) Maintain grass height between 2½" and 4".

(3) Do not remove more than 33% of total height of grass in one mowing.

C. Reseed and mulch spots larger than 1 sq. ft. without uniform stand of grass.

D. Mow and maintain all seeded areas until uniform stand of grass is acceptable to the County and/or Town.

E. In the event that gro-wth is not established by final project inspection, continue the specified attention until stand is accepted by the County and/or Town.

F. Correct or ;epair all undue settling as evidenced by complaints received within one year after final inspection.

END OF SECTION

SECTION 15151 - DISPLACEMENT TYPE COLD WATER METERS ½" T HR U 2"

1.0 GENERAL

1.1 Fumish and install cold water meters as specified herein where shown on drawings.

1.2 Reference Specifications are referred to by abbreviation as follows:

A. American Water Works Association .....AWWA

1.3 Submit three (3) copies of shop drawings for meters.

2.0 PRODUCTS

A. All meters shall be constructed in accordance with AWWA C?00 latest revision "Standard Specification for Cold Water Meters - Displacement Type." Meters may be oscillating-piston or mutating-disc.

B. All meters shall be Rockwell as shown below:

Meter Size - Inches	Model
½	SR-11, Touch Read
¾	SR-11, Touch Read
1"	Sealed Register, Touch Read
l½-2"	Sealed Register, Touch Read

C. Registers:

(1) Registers shall be straight reading *in* gallons and have a center sweep test hand and a separate flow detector device. Numeral wheels for units and tens shall be different color from other numeral wheels.

D. Guarantee And Maintenance Program:

(1) Manufacturer must provide a meter maintenance plan in writing which includes the price of repairing meters to meet AWWA new meter accuracy standards after the expiration of the performance guarantee.

3.0 EXECUTION

3. I Install meters in accordance with manufacturers instructions .

END OF SECTION

SECTION 00870 - STANDARD DETAILS

Standard Details have been adopted in order to produce uniformity of facilities to be operated by the Town. These details are a guide to the normal procedure. However, where it is necessary due to specific job requirements to deviate from the standards, the designer shall prepare the appropriate detail and show it on the drawings.

TABLE OF CONTENTS

DRAWING NO.	TITLE
D-428	60", 72", 84", and 96" I.D. Manhole - III
D-430	Tee Manhole
D-435	Standard Drop Manhole
D-440	Acid-Resistant Lining Manhole
D-445	Manhole Vent Detail
D-455	Standard Invert Details
D-460	Standard Manhole Step
D-465	Standard Manhole Frame & Cover
D-466	VandalproofManhole Frame & Cover
D-467	Alternate Vandalproof Manhole Frame & Cover
D-468	Watertight Manhole Frame & Cover
D-471	House Connection Details with Clean-Out
D-700	Sewer and Force Main in Sarne Trench
D-705	Force Main Termination at Manhole
D-706	Force Main Termination at Manhole
D-710	Sewage Air Relief Valve Installation

END OF SECTION

CARRIER PIPE DIA.	CASING PIPE DIAMETER	MINIMUM WALL THICKNESS			
		CRITERIA WITHIN RAILROAD RIGHT OF WAY		CRITERIA WITHIN VOOT RIGHT OF WAY	
		R.C.P. WITH PROTECTIVE COATING	STEEL WITH PROTECTIVE COATING	R.C.P.	STEEL
6"	16"	3.0"	0.250"	3.0"	0.250"
8"	20"	3.0"	0.375"	3.0"	0.250"
10"	20"	3.0"	0.375"	3.0"	0.250"
12"	24"	3.5"	0.375"	3.5"	0.250"
15"	24"	3.5"	0.375"	3.5"	0.250"
16"	24"	3.5"	0.375"	3.5"	0.250"
18"	30"	4.0"	0.500"	4.0"	0.375"
20"	30"	4.0"	0.500"	4.0"	0.375"
21"	30"	4.0"	0.500"	4.0"	0.375"
24"	36[11]	4.5"	0.563"	4.5"	0.375"
30"	42"	5.0"	0.625"	5.0"	0.500[11]
33"	42"	5.0"	0.625"	5.0"	0.500"
36"	48"	5.5"	0.688"	5.5"	0.500"
42"	54"	6.0"	0.750"	6.0"	0.500"

REINFORCED CONCRETE CASING PIPE SHALL BE ASTM C- 76, CLASS III.

STEEL CASING PIPE SHALL BE ASTM 1-139, GRADE 8.

NOTES:

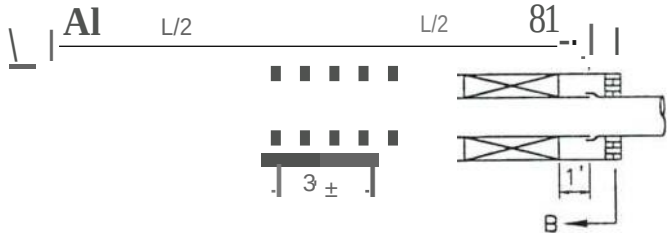
A. Slopes through bores shall not be based on minimum grade unless it is the only slope available.

8. Increasing thickness of cosing must be considered where bore lengths exceed 125'.

C. Use minimum of .3125" thickness where ground cover over pipe exceeds 15'.

D. Contractor shall make an effort to bore in the appropriate direction based on existing soil conditions. Engineer must take into consideration where bore pit is to be placed in order that proper space is available, where possible.

REVISIONS	CASING PIPE REQUIREMENTS	DRAWNG NO. 100



CASING DETAIL

CASING PIPE

CARRIER PIPE

STAINLESS STEEL STRAP

WOOD BLOCKING

CASING PIPE

CARRER PIPE

4" THICK BRICK ANO MORTAR PLUG

1" WEEP HOLE

SECTION A- A

SECTION B-8

1. DUCTILE IRON PIPE REQUIRES THREE (3) POINT BLOCKING. PLASTIC CARRIER PIPE REQUIRES FOUR (4) POINT BLOCKING.
2. CENTER BLOCKING SHALL BE AT MID-SPAN OF PIPE LENGTH AND OUTSIDE BLOCKING NOT LESS THAN 1' FROM ANY JOINT. ALL SUPPORT BLOCKS SHALL BE AT LEAST 3' IN LENGTH, CONTRACTING A MINIMUM 30% CARRIER PIPE CIRCUMFERENCE.
3. BLOCKING SHALL BE CONSTRUCTED OF LOCUST, CYPRESS, CRESOTE TREATED HARDWOOD, OR OTHER MATERIAL APPROVED BY TOWN.
4. STAINLESS STEEL STRAPS AND CLIPS HOLDING BLOCKING TO CARRIER PIPE SHALL HAVE A MINIMUM CROSSECTION OF 0.014 IN. SQ. STRAP SPACING SHALL BE AT 2' INTERVALS, WITH A MINIMUM TWO (2) BANDS PER BLOCK LENGTH.
5. STEEL CASING SHALL HAVE A MINIMUM YIELD STRENGTH OF 35.000 PSI AND SUFFICIETN CORROSION PROTECTION.
6. CASING SHALL HAVE A MINIMUM SLOPE OF 1/2%.
7. ENDS OF CASING SHALL HAVE A 4" THICK BRICK AND MORTAR PLUG IN THE ANNULAR SPACE WITH A 1 " WEEP HOLE.
8. VALVES OR OTHER CONTROL/ MAINTENANCE EQUIPMENT ATTACHED TO WATERLINE SHALL BE LOCATED A MINIMUM FOUR PIPE LENGTHS FROM THE END OF THE CASING, OR AS APPROVED BY THE TOWN.
9. WATERLINES TO BE ENCASED UNDER RAILROADS WILL COMPLY WITH COUNTY AND/OR TOWN AND AMERICAN RAILROAD ENGINEERING SPECIFICATIONS FOR PIPELINES, WHICHEVER IS THE HIGHER.
10. WATERLINES TO BE ENCASED UNDER STATE ROADS WILL COMPLY WITH COUNTY .t-NO/OR TOWN AND ANY APPLICABLE VDOT SPECIFICATIONS, WHICHEVER IS THE HIGHER.
11. WHEN INSTALLING CARRIER PIPE, CONTRACTOR SHALL PUSH SO THAT PIPE JOINTS ARE ALWAYS BEING COMPRESSED.
12. CARRIER PIPE SHALL BE WRAPPED 'iilTH TAR PAPER AT MASONRY PLUG.

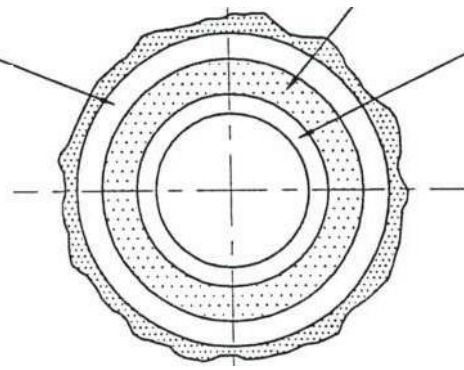
REVISIONS	CASING DETAIL WATER NOT TO SCALE	DRAWING NO. 105

LENGTH OF CASING
AS SHOWN IN PLANS

CEMENT GROUT Fill

CASING PIPE BLACK METAL

CARRIER PIPE



CASING PIPE SHALL BE CAPABLE OF MEETING H-20 LIVE LOAD BASED ON 1 20 LB. SOIL AND SHALL PROVIDE A MINIMUM 4" CLEARANCE FOR PIPE BELLS.

CASING PIPE MAY BE FOUR (4) FLANGE OR LAP JOINT LINER PLATES OR SMOOTH STEEL BORED.

TYPICAL SECTION

1. CARRIER PIPE REQUIRES THREE (3) POINT BLOCKING.
2. CENTER BLOCKING SHALL BE AT MIO- SPAN OF PIPE LENGTH AND OUTSIDE BLOCKING NOT LESS THAN 1' FROM ANY JOINT. All SUPPORT BLOCKS SHALL BE AT LEAST 3' IN LENGTH, CONTACTING A MINIMUM 30% CARRIER PIPE CIRCUMFERENCE.
3. BLOCKING SHALL BE CONSTRUCTED OF LOCUST, CYPRESS, CREOSOTE TREATED HARDWOOD, OR OTHER MATERIAL APPROVED BY COUNTY.
4. STEEL STRAPS AND CLIPS HOLDING BLOCKING TO CARRIER PIPE SHALL HAVE A MINIMUM CROSS SECTION OF 0.014 IN. STRAP SPACING SHALL BE AT 2' INTERVALS, WITH A MINIMUM TWO (2) BANDS PER BLOCK LENGlli.

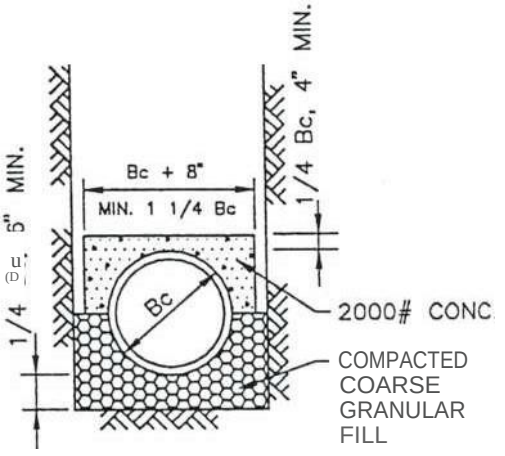
REVISIONS

CASING PIPE DETAIL

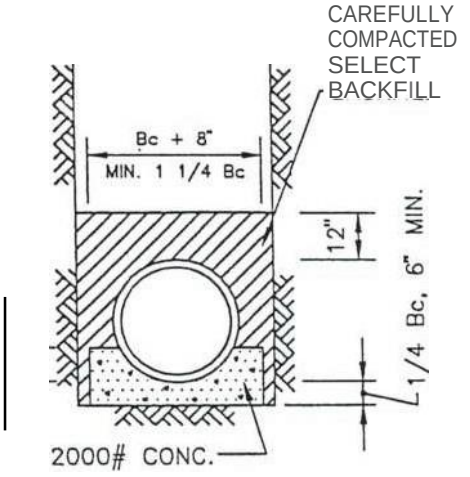
DRAWING NO.

107

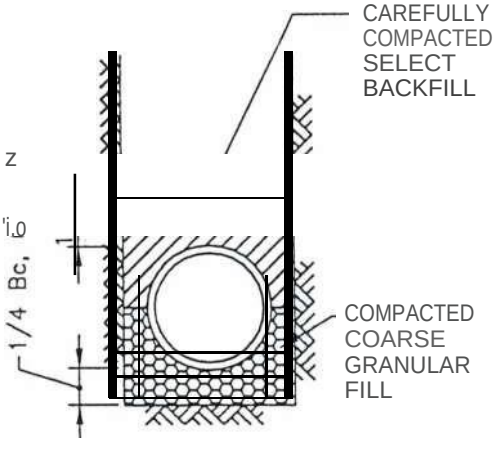
Be = 0.0. OF PIPE



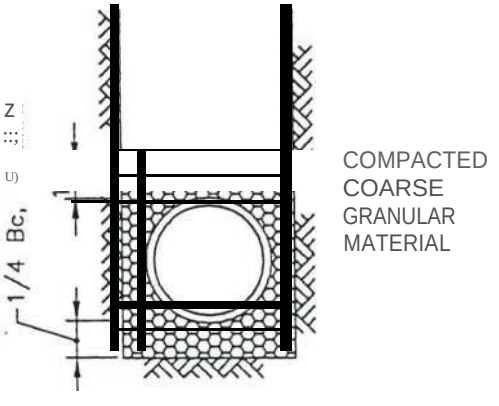
CLASS "A' BEDDING
LOAD FACTOR = 2.8



CLASS "A...:.1" BEDDING
LOAD FACTOR = 2.8



CLASS "8" BEDDING
LOAD FACTOR = 1.9



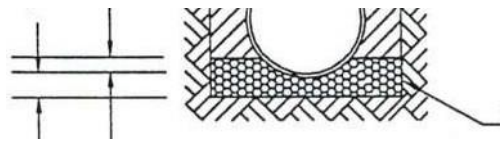
CLASS "8-1" BEDDING
LOAD FACTOR = 1.9

NOTE: IN ROCK TRENCH, EXCAVATE AT LEAST
6" BELOW THE BOTTOM OF THE PIPE.

REVISIONS	TRENCH BEDDING - I	DRAWING NO.
		110

Be = 0.0. OF PIPE

CAREFULLY COMPACTED
SELECT BACKFILL

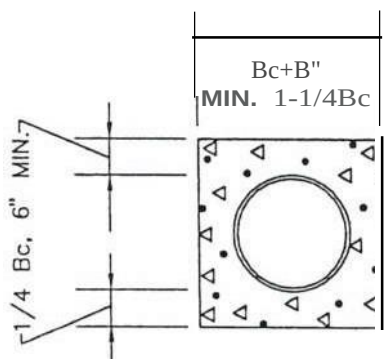


COMPACTED COARSE
GRANULAR FILL

=4

CLASS "C" BEDDING
LOAD FACTOR = 1.5

CLASS "C-1" BEDDING
LOAD FACTOR = 1.5

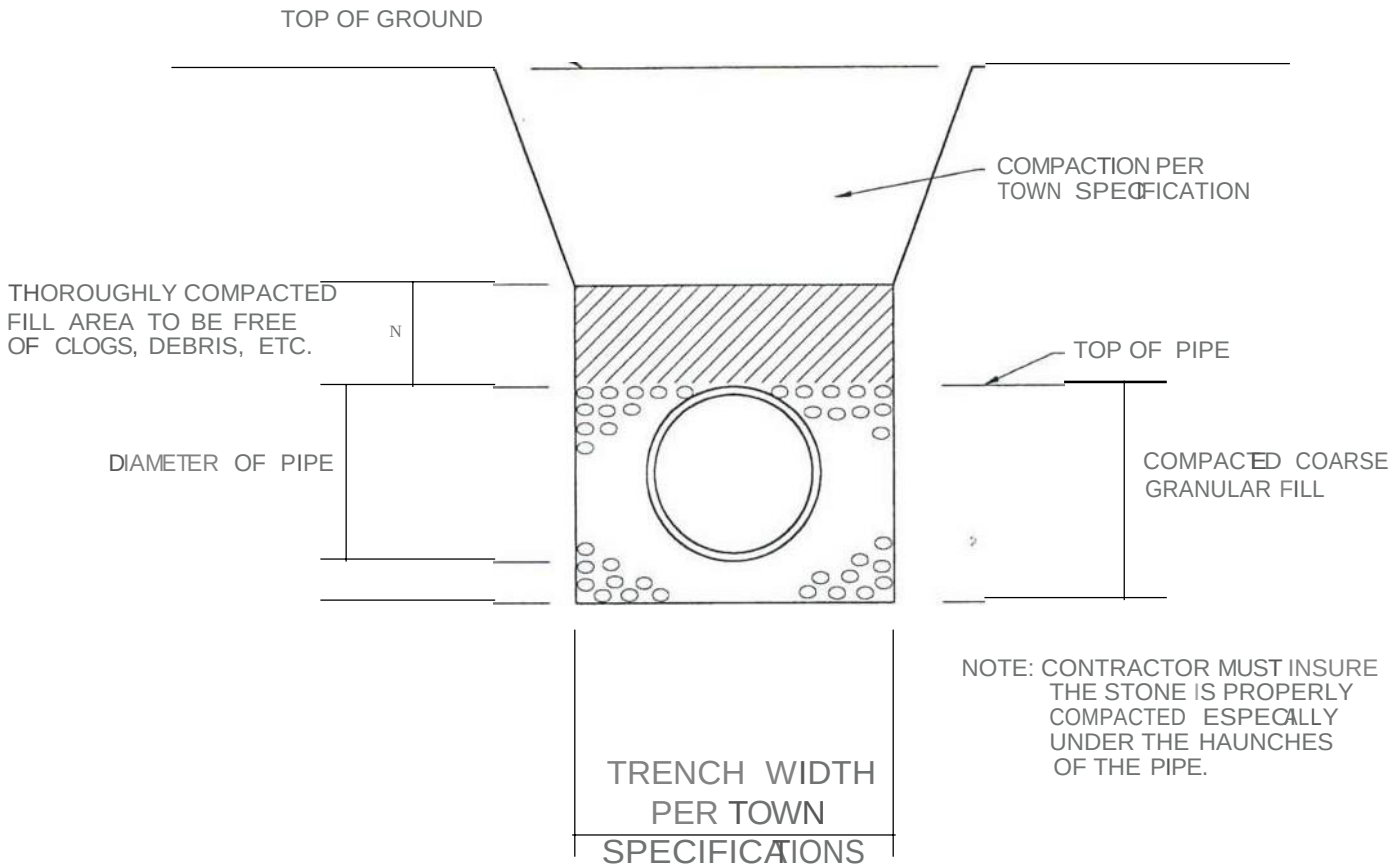


2000# CONC.

CONCRETE ENCASEMENT
LOAD FACTOR = 4.5

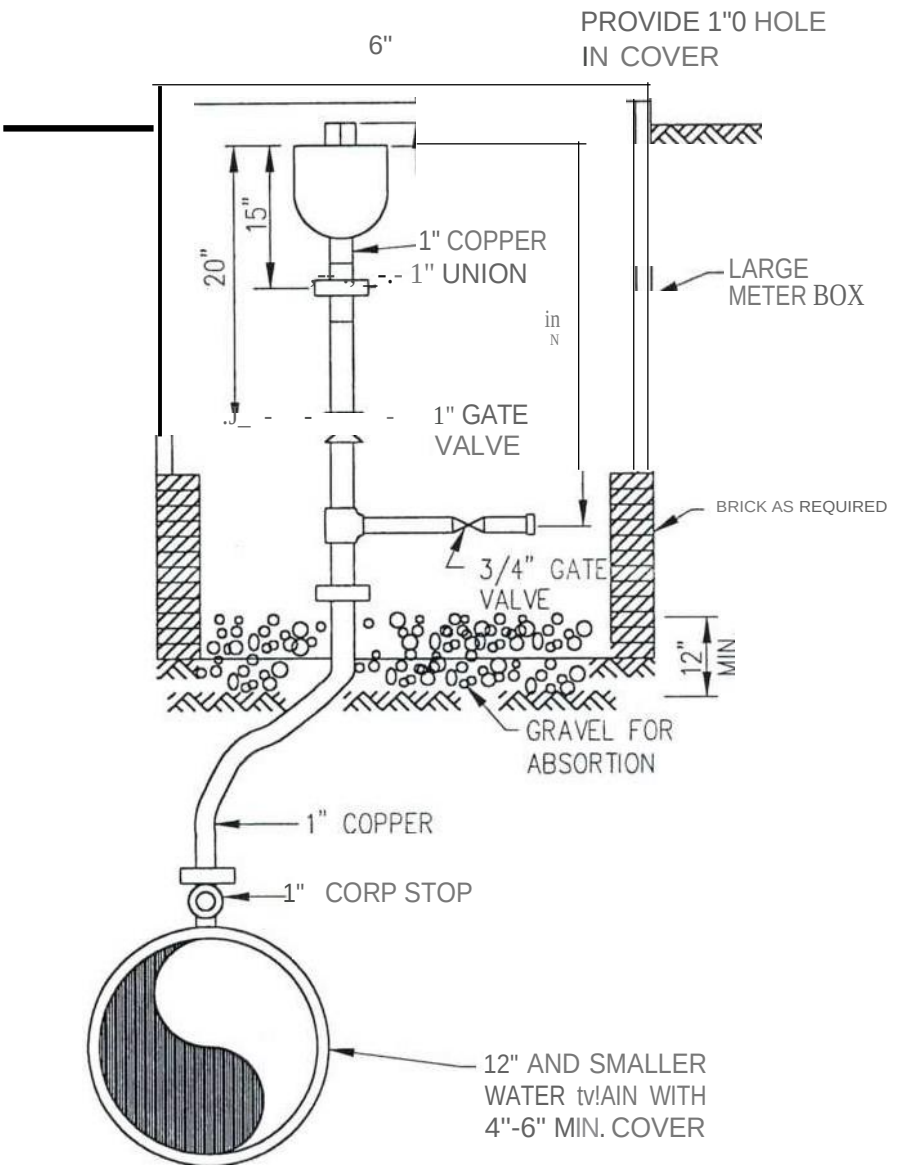
NOTE: IN ROCK TRENCH, EXCAVATE AT LEAST
6" BELOW THE BOTTOM OF THE PIPE.

REVISIONS	TRENCH BEDDING IT	DRAWING NO.
		111



NOTE: CONTRACTOR MUST INSURE THE STONE IS PROPERLY COMPACTED ESPECIALLY UNDER THE HAUNCHES OF THE PIPE.

BEDDING AND BACKFILL DETAIL FOR PLASTIC PIPE

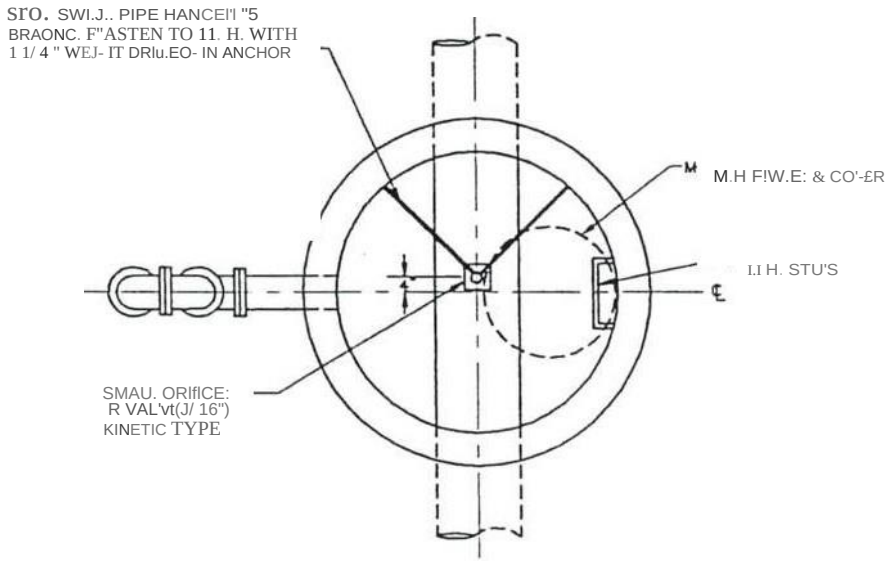


REVISIONS

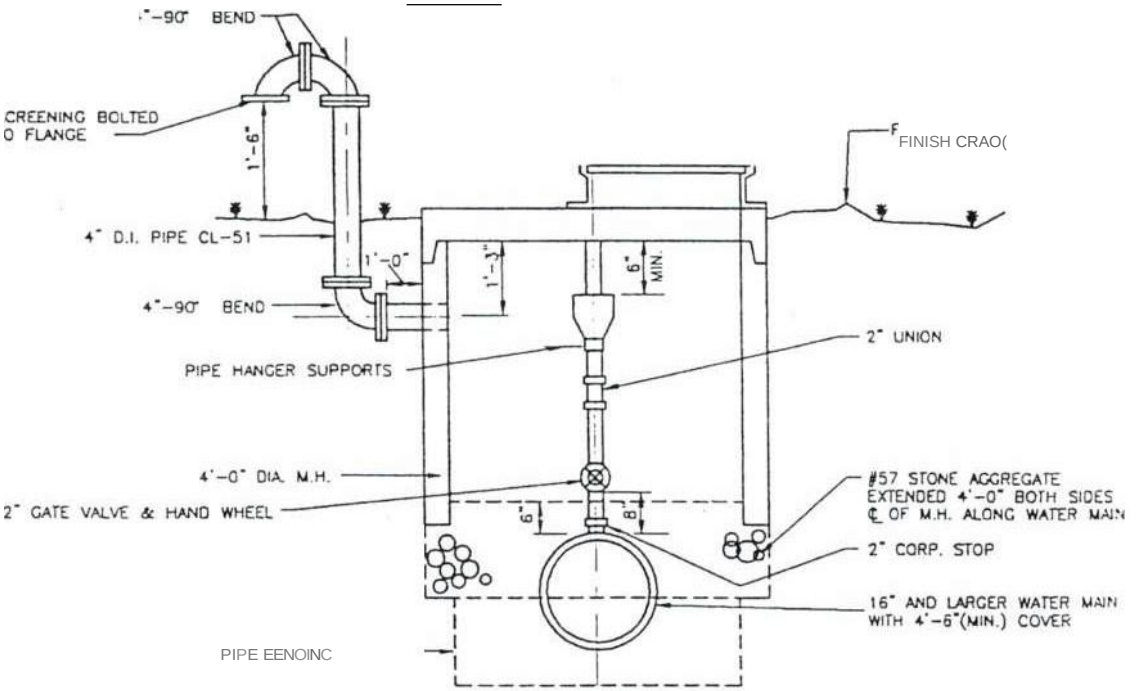
1" AIR RELEASE VALVE

DRAWING NO.

115



PLAN



ELEVATION

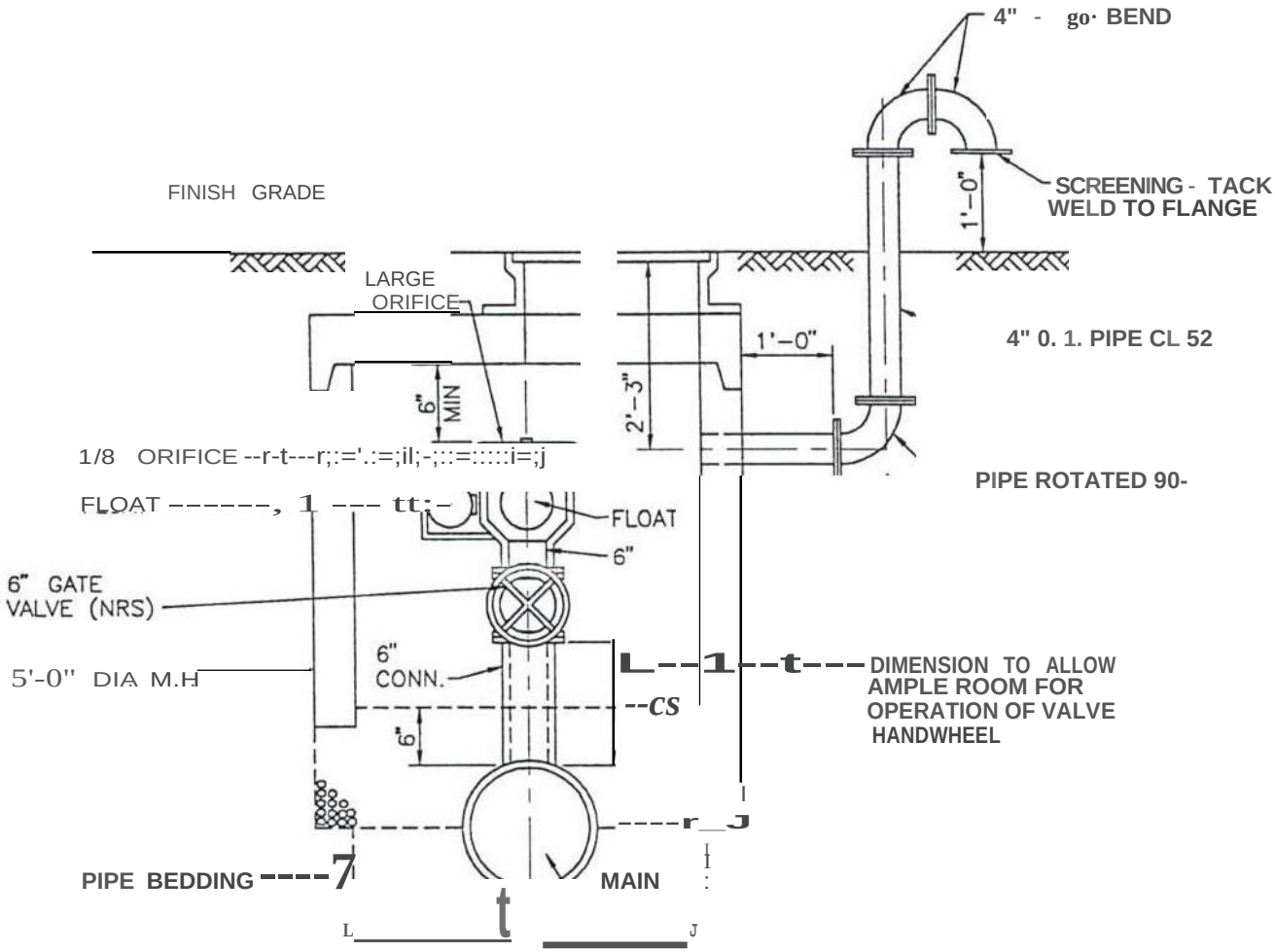
2" AIR RELEASE VALVE ASSEMBLY

ORAWIN': '' .

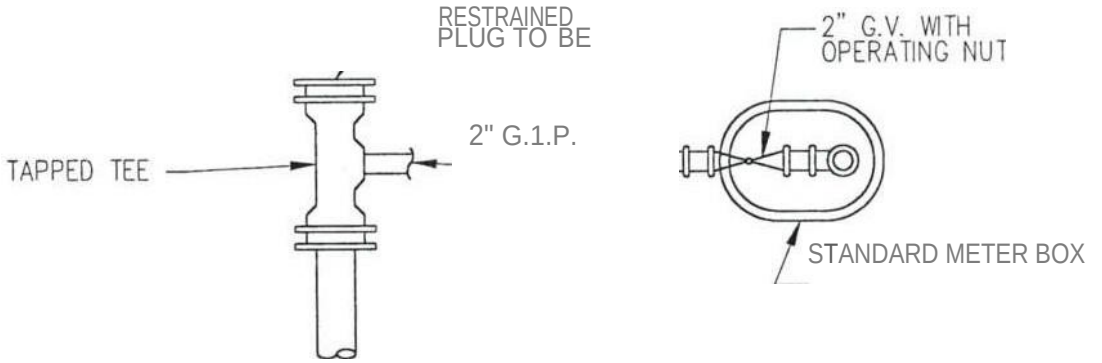
116

REVISIONS

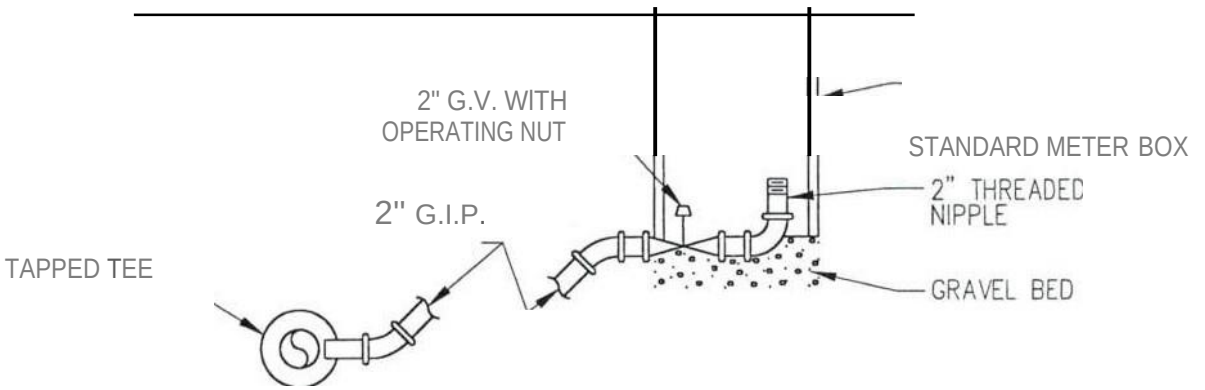
L



REVISIONS	TYPE 3 DETAIL DUAL ORIFICE AIR VALVE	DRAWING NO. 120



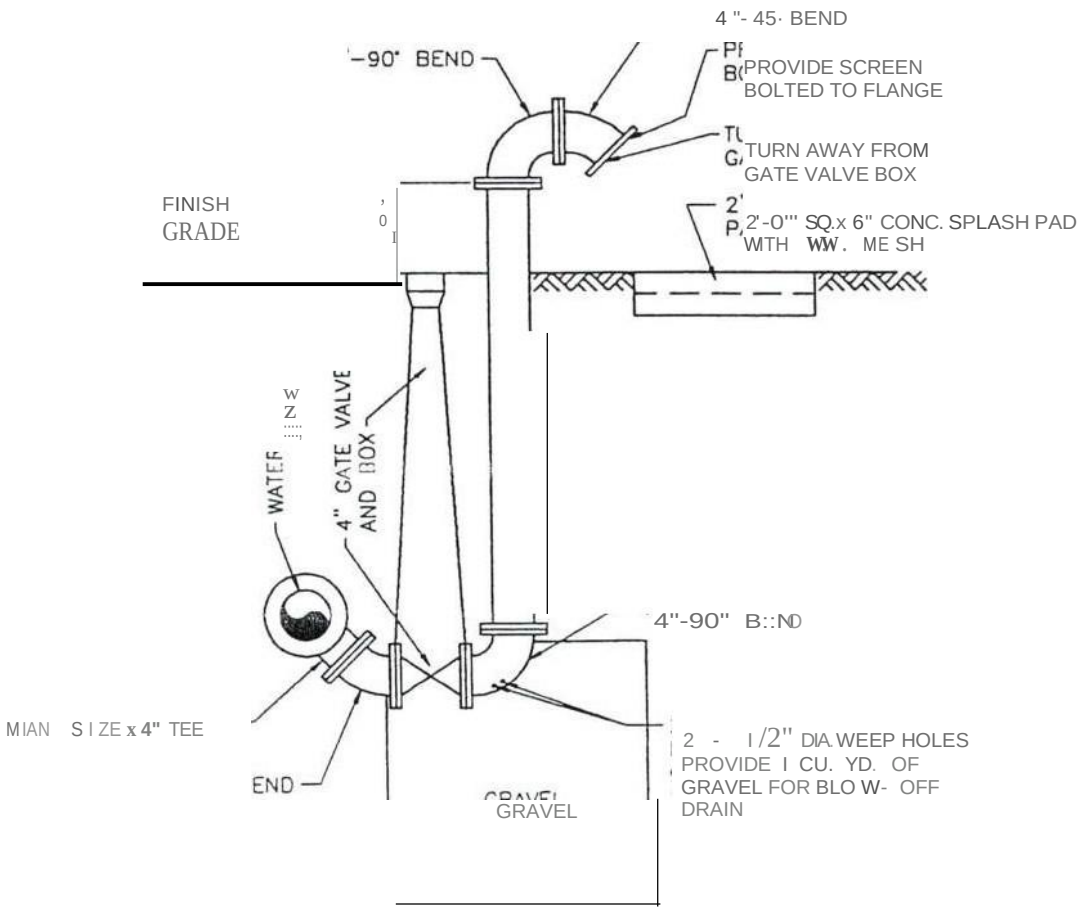
NOTE: THRUST RESTRAINT SHALL BE BY RESTRAINED JOINTS. CALCULATIONS ON LENGTH OF RESTRAINT SHALL BE SUBMITTED.



REVIS IONS

DRAWING NO.

DETAILS - 2" BLOW-OFF



ELEVATION

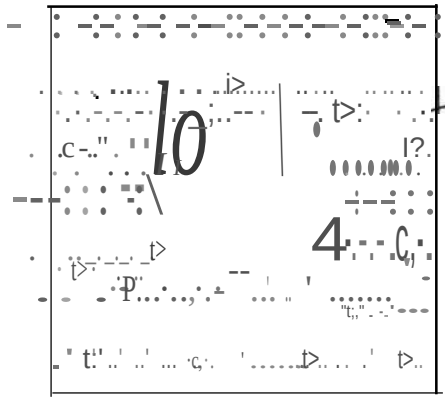
NOTE: ALL FITTINGS FOR BLOW-OFF SHALL SE FLANGED.

4" BLOW-OFF

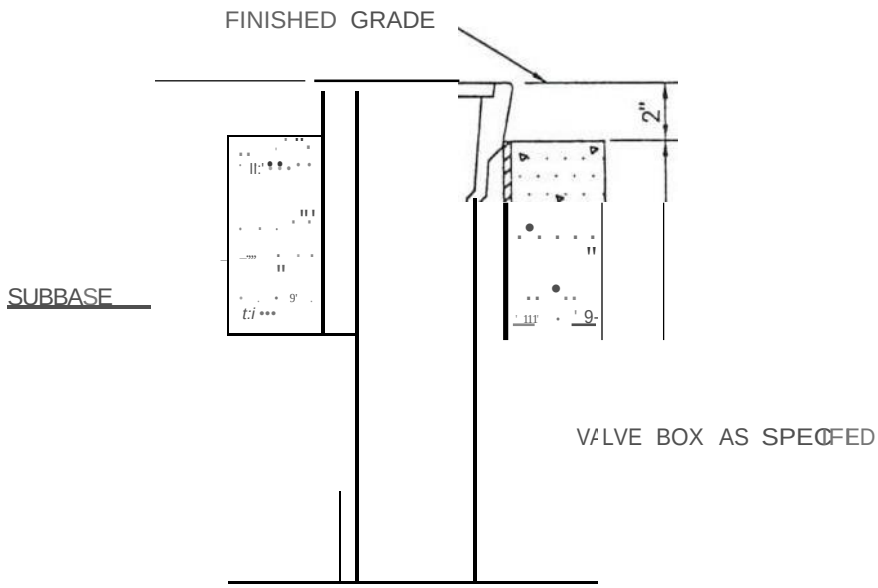
DRAWING :--.

132

REVISIONS



CONCRETE POURED AROUND
SLEEVE SO THAT VALVE BOX
IS FREE FOR ADJUSTMENTS

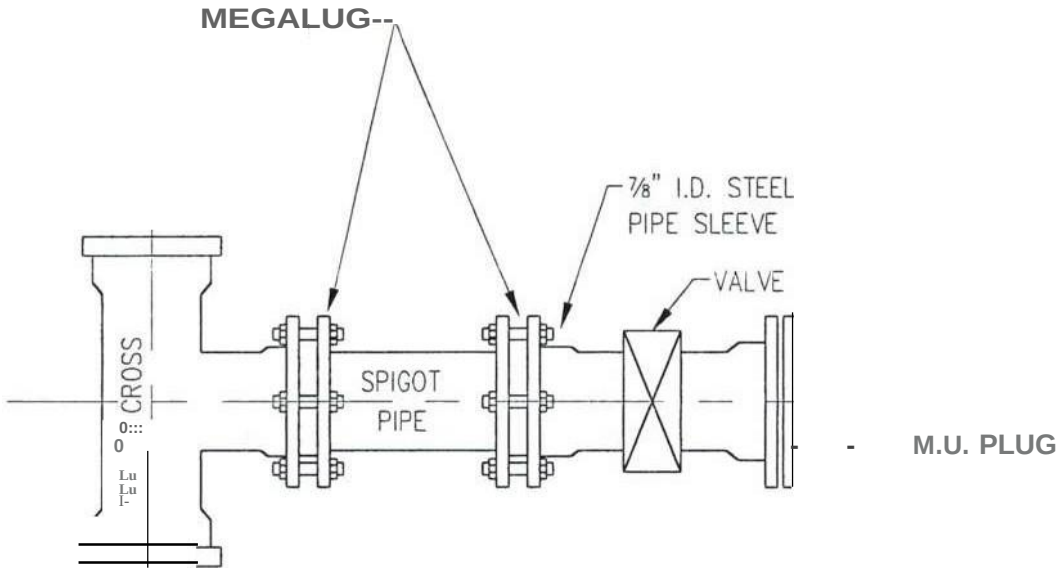


REVISIONS

VALVE BOX INSTALLATION DETAIL

DRAWING NO.

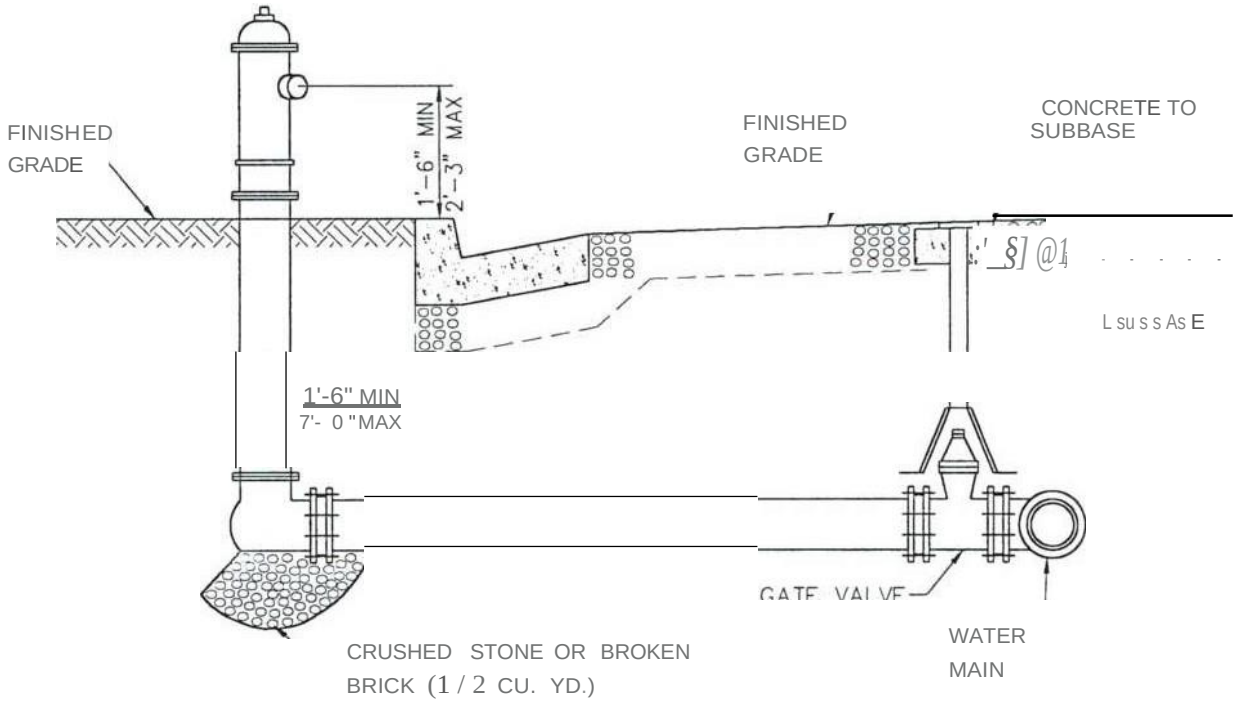
145



PLAN

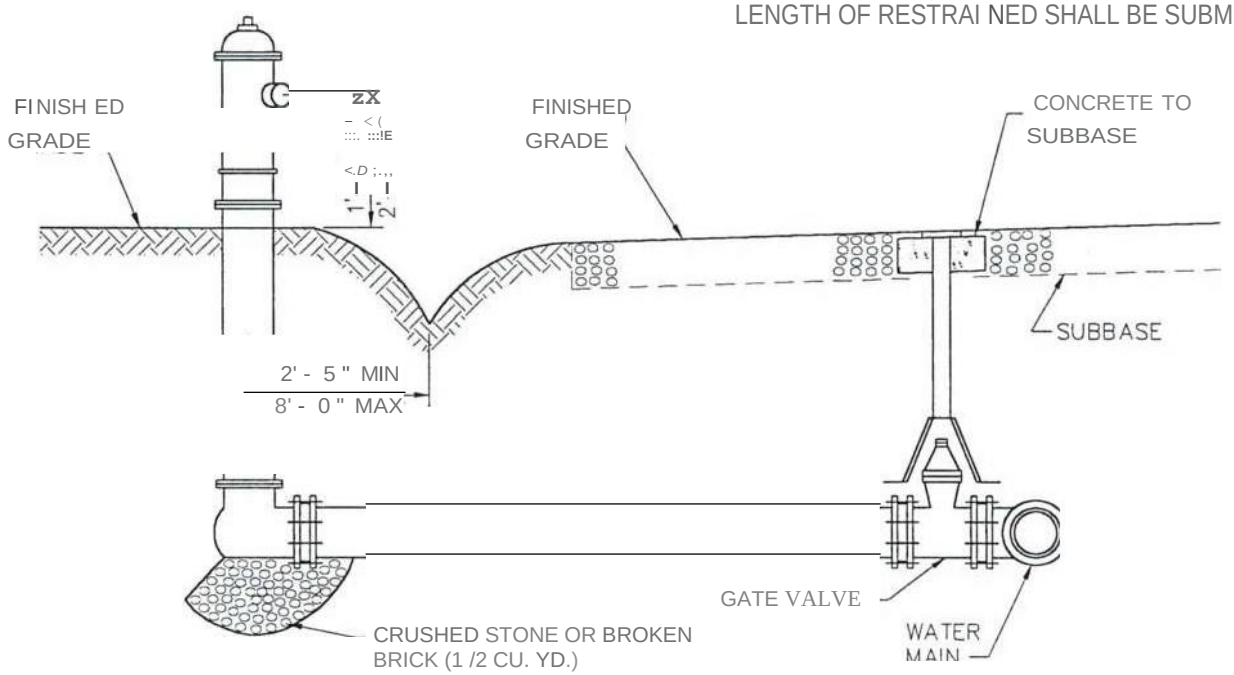
NOT TO SCALE

REVISIONS	STRAPPING VALVE TO MAIN	DRAWING NO.
		146



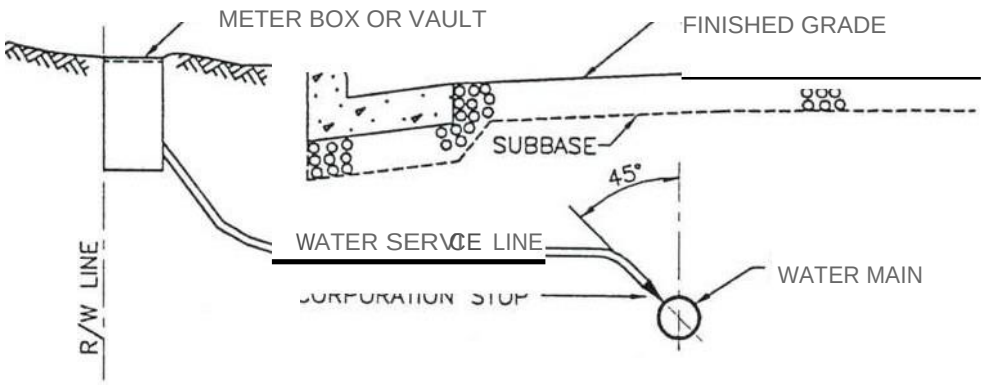
CURB & GUTTER

NOTE: THRUST RESTRAINT SHALL BE BY RESTRAINED JOINTS. CALCULATIONS ON LENGTH OF RESTRAI NED SHALL BE SUBMITTED.

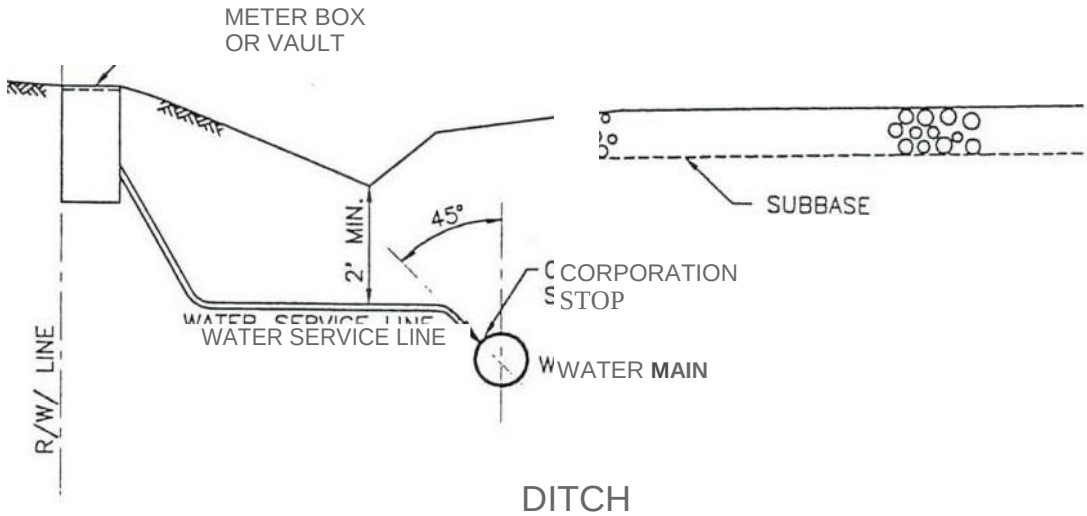


DITCH

REVISIONS	TYPICAL FIRE HYDRANT DETAIL	DRAWING NO. 160

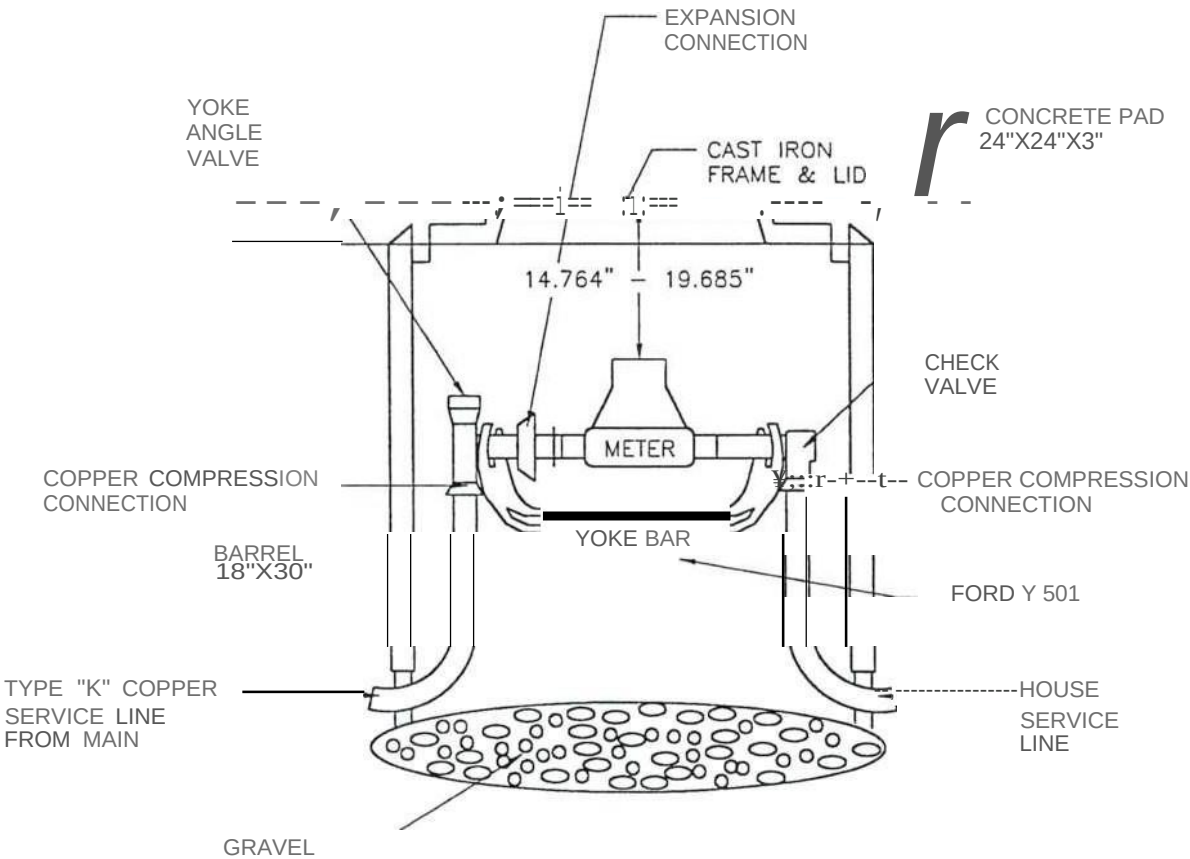


CURB & GUTTER



DITCH

REVISIONS	METER INSTALLATION DETAIL	DRAWING NO
		170



WATER METER SETTING FOR UP TO 25 MM

WATER SERVICE LINES SHALL BE TYPE "K" COPPER, AND SHALL BE INSTALLED IN ACCORDANCE WITH AWWA C800. CORPORATION STOPS SHALL BE BRONZE. HAVE COMPRESSION FITTINGS AND CONFORM WITH AWWA C800.

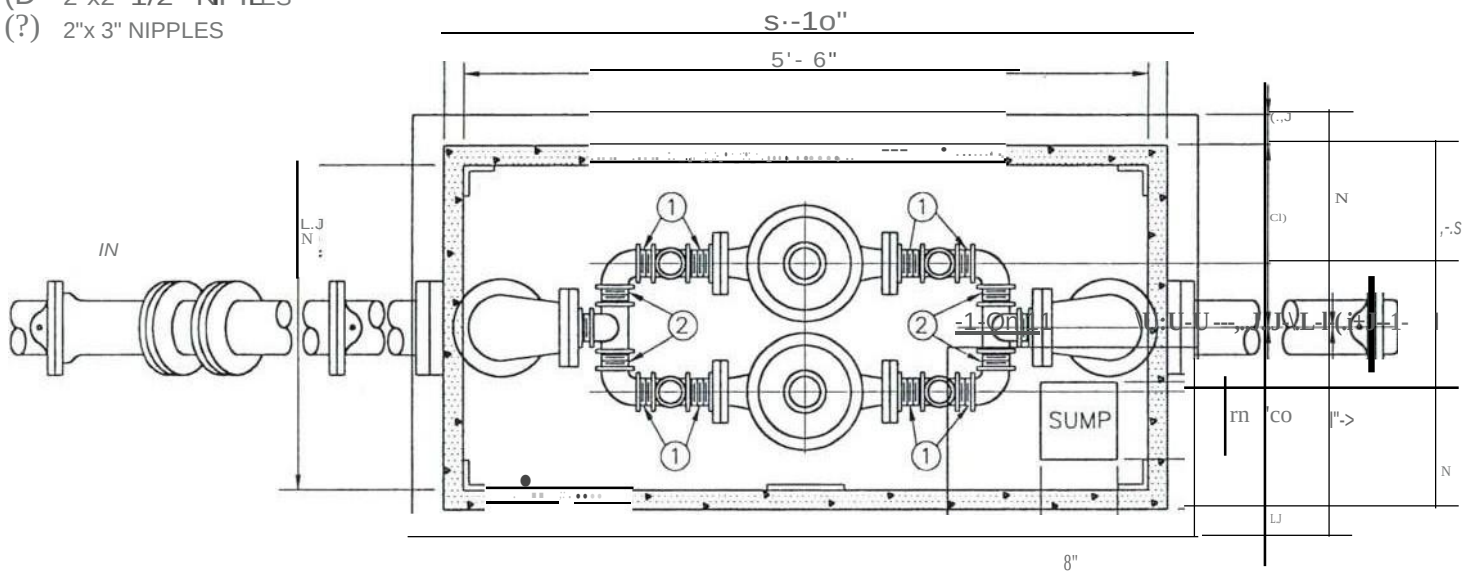
P.. TAPS FOR PROPOSED WATER MAIN SHALL INCLUDE:

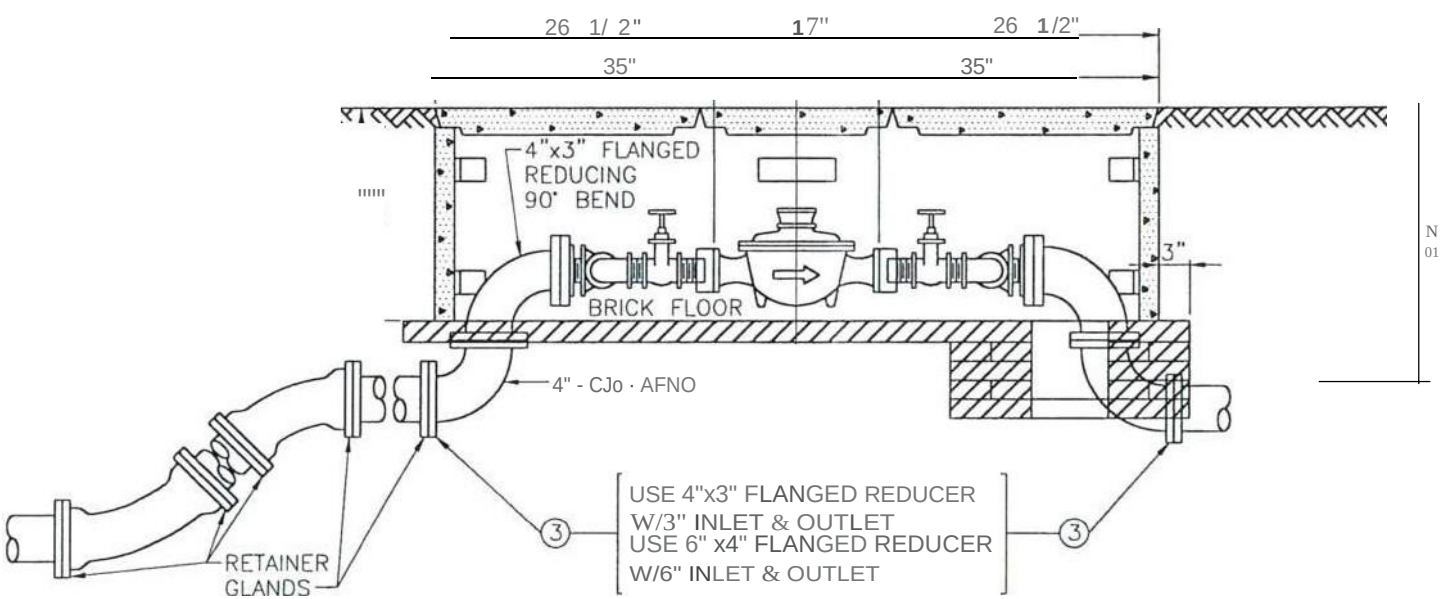
i. LESS THAT 25 M DIAMETER - CORPORATION STOP WITH NO SADDLE REQUIRED.

2. GREATER THAN OR EQUAL TO 25 MM DIAMETER AND LESS THAN 50 MM DIAMETER - CORPORATION STOP WITH SADDLE REQUIRED.

REVISIONS	TOWN OF BOWLING GREEN METER	DRAWING .: 02650 176

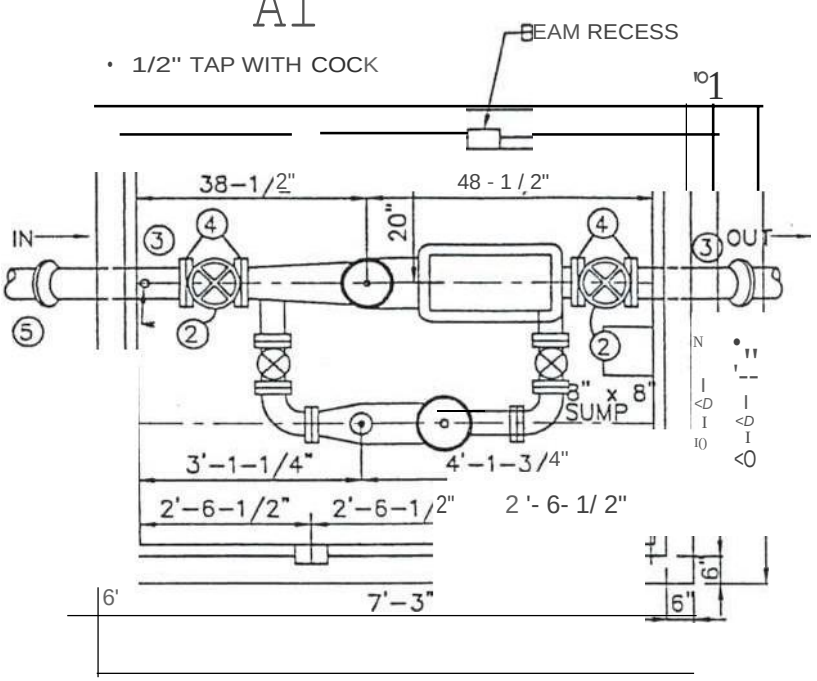
(D 2"x2 1/2" NIPPLES
(?) 2"x 3" NIPPLES



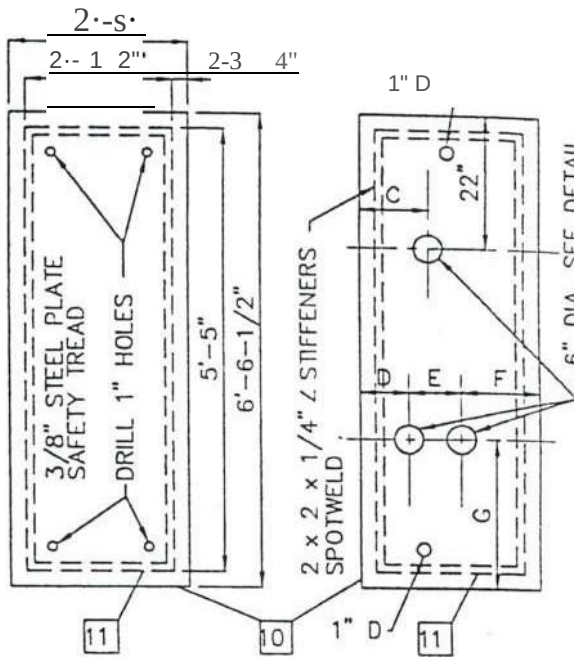


G!G

COVER DETAIL



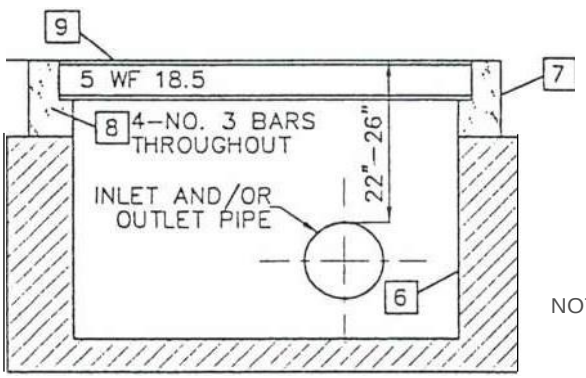
PLAN
SCALE 3 / 8" = 1 '- 0"



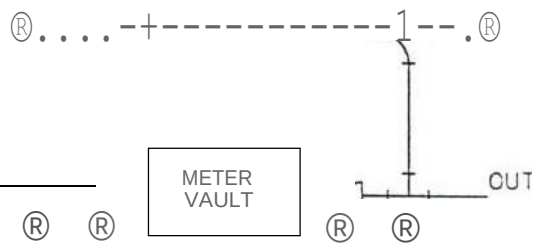
COVER PLATE 1,3
2 ENDS REQ'D
SCALE 3 / 8 " = 1'- 0"

COVER PLATE 2
1 CENTER REQ'O
SCALE 3/ 8 " = 1'-0"

NO TE: SET NO. 3 BARS 12" LONG
6" BELOW TOP OF BRICK 12" O.C.
AS DOWELS FOR CONCRETE CAP.



SECTION A-A
SCALE 3/8" = 1'-0"



METER BY- PASS DETAIL

NOTE: IN STALL BY-PASS ON ALL F.M. METERS 6" W/ 4 " METC
6" W/6" METE
8 " W/8" METEF

@ - 2- 90' BENDS
® - 2- TEES
© - 1 VALVE & VALVE BOX
@ -2-6" x 4" REDUCERS

SIZE	A	B	C	D	E	F	G
4"	17 - ¥,"	28 - }', "	10·	8-¥,'	7-:},s"	14-Vts"	JO-¥,'
6"	21-:;-11"	24--7/i.	9 - ¼'	7-¼"	1O·	12-!Ya"	25-1/a"
8"	26- ¹/i "	20"	9- 7h'	8-¼"	,r	9- :Ya"	22"

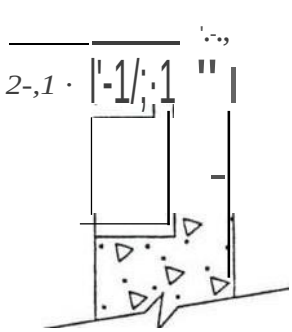
NOTE: DIMENSIONS IN TABLES ARE TO BE USED ONLY WHEN CT METER IS ON THE RIGHT OF FLOW.

1 Or Z

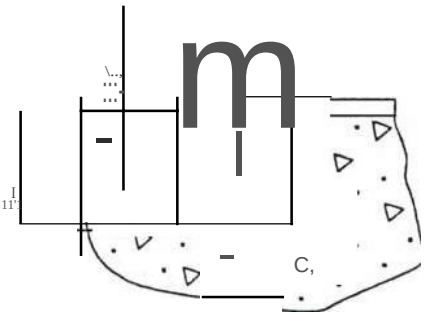
REVISIONS

4", 6", & 8" F.M. METER SETTING

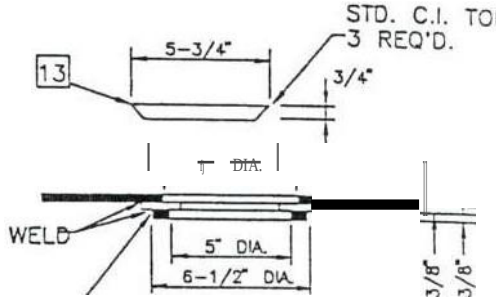
ORAW1N8



SECTION



ELEVATION

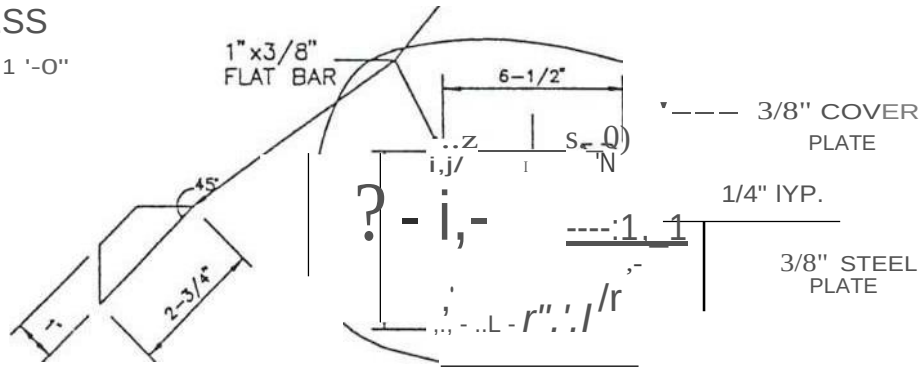


SECTION

SCALE: 1-1 /2" =1'-0"

BEAM RECESS

SCALE: 1- 1/2" = 1 '-0"



SPACER

SC ALE: 3" = 1'-0"
12REQ'D.

OPENING IN COVER *rt*
& C.I. TOP SUPPORT

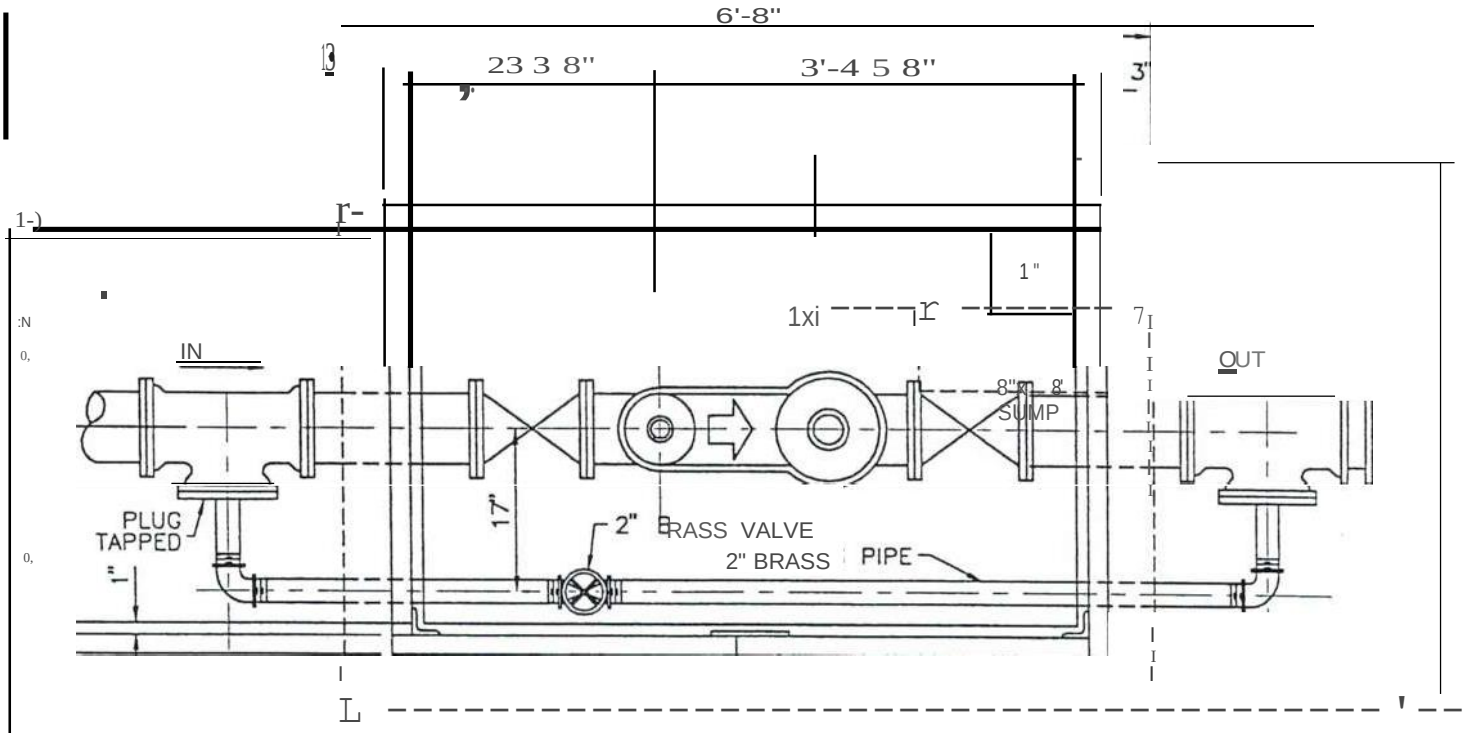
SCALE: 1-1/2" = 1'-0"
3 REQ'D.

MATERIALS LIST

(D	1 - 4",6" OR 8" F.M. METER
Q)	2 - 4",6" OR 8" FLANGED GATE VALVES
G)	2 - 4" ,6" OR 8" FLANGED BY PLAIN NIPPLES
@	4 - 4" ,6" OR 8" GASKETS
@	2 - 4" ,6" OR 8" - 45· M.J. BENDS W/ RETAINER GLANDS
(i]	1000 BRICKS & MORTAR
(!]	1/ 4 CUBIC YARD CLASS 2000 PSI CONCRETE
0	150 NO. 3 REINFORCING BARS
W	2 - 5" WF BEAMS @ 18.5 lbs. x 6'-0 1/4"
S)	3 - 2'- 6" x 5'-10 1/ 2"x 3 / 8" SAFTEY TREAD COVER PLATES
G2j	42'-6" - 2"x2"xl/4" STE€L *L*
@J	2'-6" - 1'x .3/8" STEEL ST I?
	3 - 5 3/ 4" x 3/ 4" CAST IR::JN TOPS

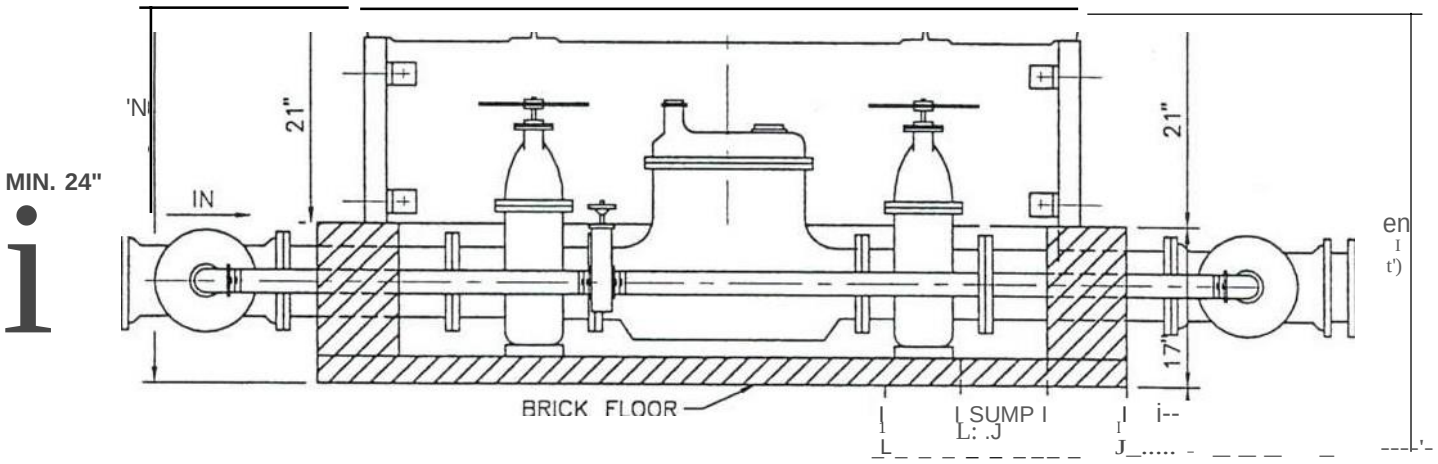
2 Or :Z

REVISIONS	4", 6" & 8,, F.M. METER SETTING	DRAW ING NO
		19s·



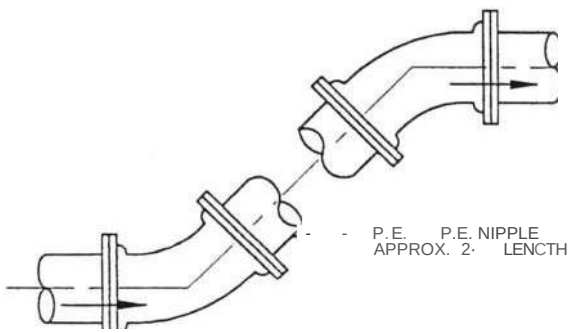
PLAN

NO SCALE



ELEVATION

NO SCALE



ELEVATION

NO SCALE

NOTE: SEE "STANDARD METER VAULT PARTS" 0WG.(02650 - 225 & 226) FOR METER VAULT DETAILS.

#7	#e 00	#7

COVER DETAIL

NO SCALE

REVISIONS	4" COMPOUND METER SETTING	DRAWING NO. 200

TYPE I (4" INLET & 4" OUTLET)

QTY.	DESCRIPTION
1	4" CT meter
2	4" flanged wheel valves
2	4" flanged x PE nipples 30" long
	4" PE x PE nipple approx. 24" long
2	4" x 3" MJ tees
2	3" MJ plug tapped 2"
2	4" 45· MJ bends
7	4" retainer glands
1	4" MJ plug
10	2" brass pipe cut & threaded by contractor
1	2" brass gate valve
2	2" go· brass elbows
4	4" flanged gaskets
•8	4" MJ gaskets
1	4" PE x PE nipple 24" min. length
2	#7 Covers
1	#8 Cover
4	A sides
2	C sides
8	Angles
4	Plates
24	Bolts, nuts & wa she rs, 1/ 2" x 3 - 1/ 2"
*32	3/ 4" x 3-1 /2" MJ nuts & bolts
575	bricks
32	5/8" x 3" flanged nuts & bolts
*8	5/8" x 3" MJ nuts & bolts
•2	3" MJ gaskets
*28	5/8" x 1- 1/2" set screws for retainer glands

TYPE II (6" INLET AND 6" OUTLET)

ELIMINATE FROM TYPE I

QTY.	
2	4" flanged x PE nipples 30" long
1	4" PE x PE nipple to reach elev. of water main
2	4" x 3" MJ tees
2	4" 45" MJ bends
7	4" retainer glands
1	4" MJ plug
•8	4" MJ gaskets
1	4" PE x PE nipple 24" min. length
	5/8" x 1-1 /2" set screws for retainer gkmds

ADD

2	6" x 4" flanged reducers
2	6" flanged x PE nipples 30" long
2	6" x 3" MJ tees
2	6" 45· MJ tees
2	6" flanged gaskets
7	6" retainer glands
1	6" MJ plug
•8	6" MJ gaskets
*16	3/ 4" x 3-1 /2" MJ nuts & bolts
16	3/ 4" x 3-1 /2" flanged nuts & bolts
1	6" PE x PE nipple 24" min. length
1	6" PE x PE nipple approx. 24" long
•42	5/ 8" x 2" set screws for retain er glands

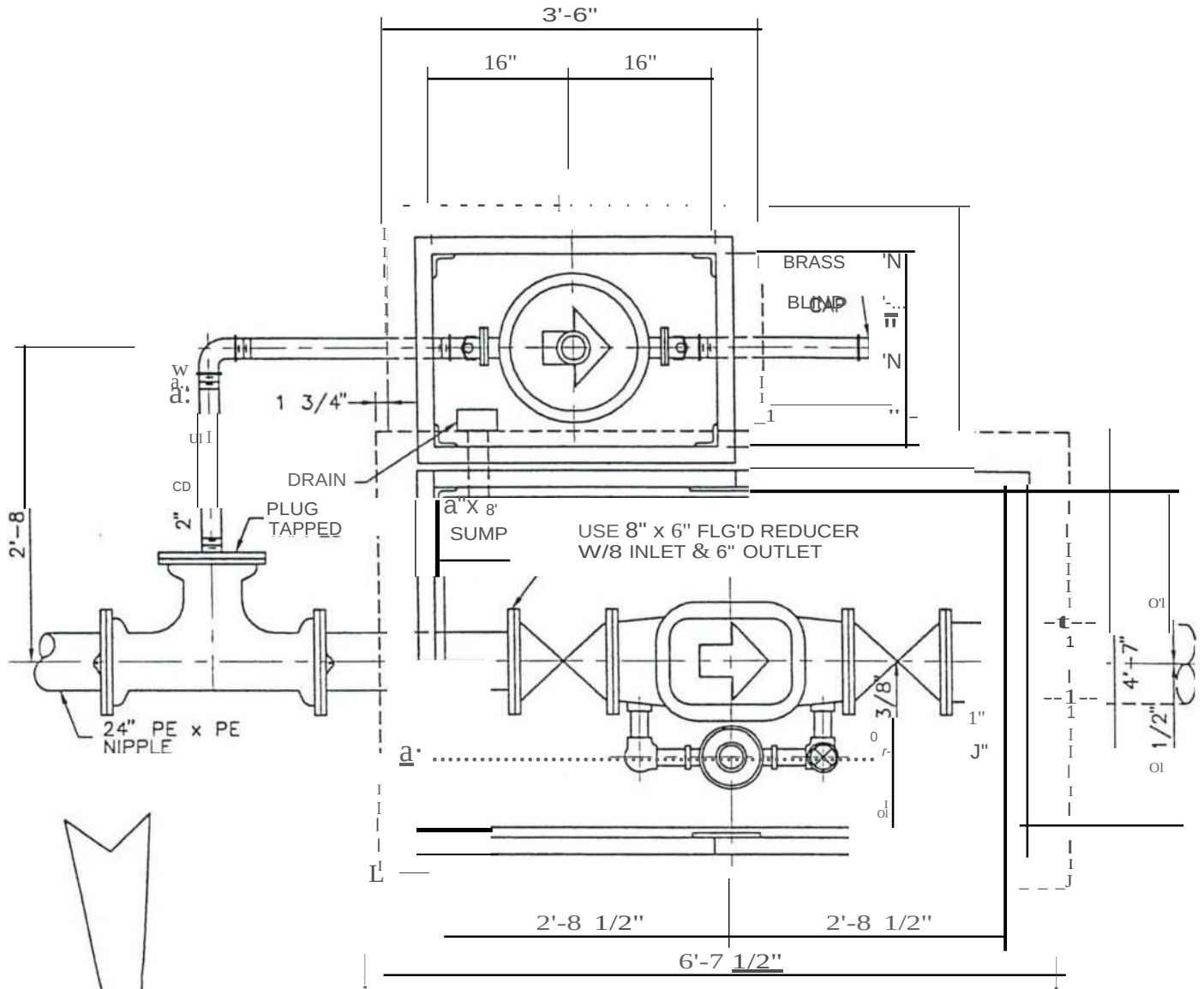
• Above MJ gaskets, set screws, & MJ nuts & bolts are supplied with respective fittings.

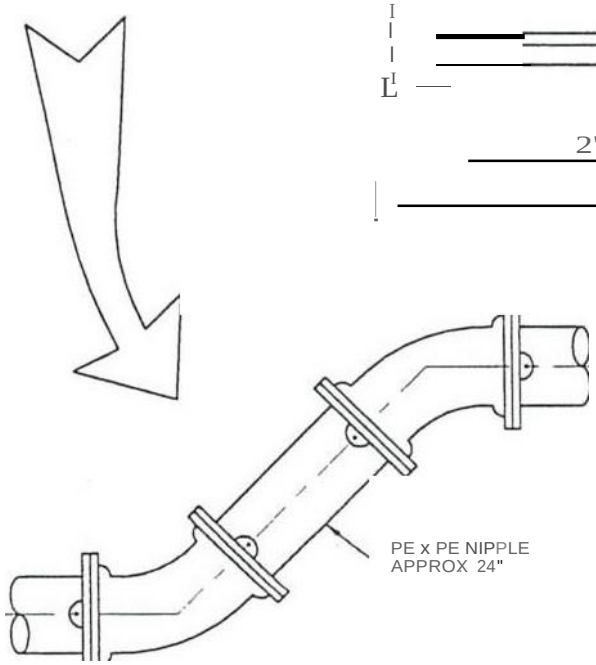
REVISIONS

MATERIALS LIST FOR 4" COMPOUND METER SETTING

DRAWING NO

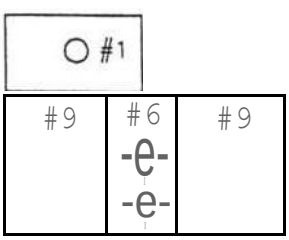
201





ELEVATION

NO SCALE



COVER DETAIL

NOTE: SEE "STANDARD METER VAULT PARTS" DWG.(02650-225 & 226) FOR METER VAULT DETAILS.

REVISIONS

1-1 /2" OR 2" METER 6" DETECTOR CHECK SETTING

DRAWING NO

205

1YPE I 1 1/2" DISC METER. 6" DC (8" INLET) (6" OUTLET)
2" BRASS INLET & OUTLET)

Q1Y.	- DESCRIPTION
1	1-1 /2" Disc Meter with gaskets, bolts, and nuts
2	1-1 /2" flanged angle valves
3	2" brass elbows
10	2" brass pipe to be cut & threaded by contractor
1	8 x 3 MJ tee
1	3" MJ plug tapped 2"
2	6" flanged x plain end nipples 30" long
2	6" 45· MJ bends
	6" plain end x plain end nipple· approx. 24" long.
	6" plain end x plain end nipple 24" min. length
7	6" MJ retainer glands
1	6" MJ cap
•7	6" MJ gaskets
4	6" flanged gaskets
2	6" flanged gate valves
	6" DC meter
•42	3/ 4" x 3-1 /2" nuts & bolts for MJ connections
*4	5/8" x 3" nuts & bolts for MJ connections
•42	5/8" x 2" set screws for retainer glands
32	3/ 4" x 3-1 / 4" nuts & bolts for flange connections
1	#1 cover
1	#6 cover
2	#9 cover
6	A sides
2	B sides
2	C sides
16	Angles
4	Plates
40	Bolts, nuts & washers, 1/2" x 3-1 /2"
625	bricks

1YPE II 1-1 /2"" DISC METER (8" INLET) (6" OUTLET)
2" BRASS INLET & OUTLET)

Q1Y.	ELIMINATE FROM TY
	6" x 3" MJ tee
	6" flanged x plain end nipple 30" long
2	6" 45· bends
1	6" plain end x plain end ni approx. 24" long
6	6" MJ retainer glands
	6" plain end x plain end ni 24" min. length
	6" MJ gaskets
	3/4" x 3-1/2" nuts & bo MJ connections

ADD

	8" x 3" MJ tee
	8" flanged x plain end nipple 30" long
2	8" 45· MJ bends
1	8" plain end x plain end nipple approx. 24" long
6	8" MJ retainer glands
	8" plain end x plain end nipple 24" min. length
	8" MJ gaskets
	3/ 4" x 4" nuts & bolts fo MJ conn ections
	8" x 6" flanged reducer
8	3/4 x 3-1 /2" nuts & bo for flanged connections
	8" flanged gasket

* Above MJ gaskets, set screws, & MJ nuts & bolts are supplied with respective fitt ings.

REVISIONS

MATERIALS LIST FOR 1-1 /2" or 2" METER 6" DETECTOR CHECK SETTING

TYPE III 2" DISC METER, 6" DC (6" INLET) (6"OUTLET) 2" BRASS INLET & OUTLET)

QTY.	FROM TYPE I ELIMINATE
	1-1 / 2" Disc Meter with gaskets, bolts, and nuts
	ADD
	2" Oise Meter with gaskets bolts, and nuts

QTY.	FROM TYPE I ELIMINATE
2	1-1/2" flanged angle valves
	ADD
2	2" FLANGED ANGLE VALVES

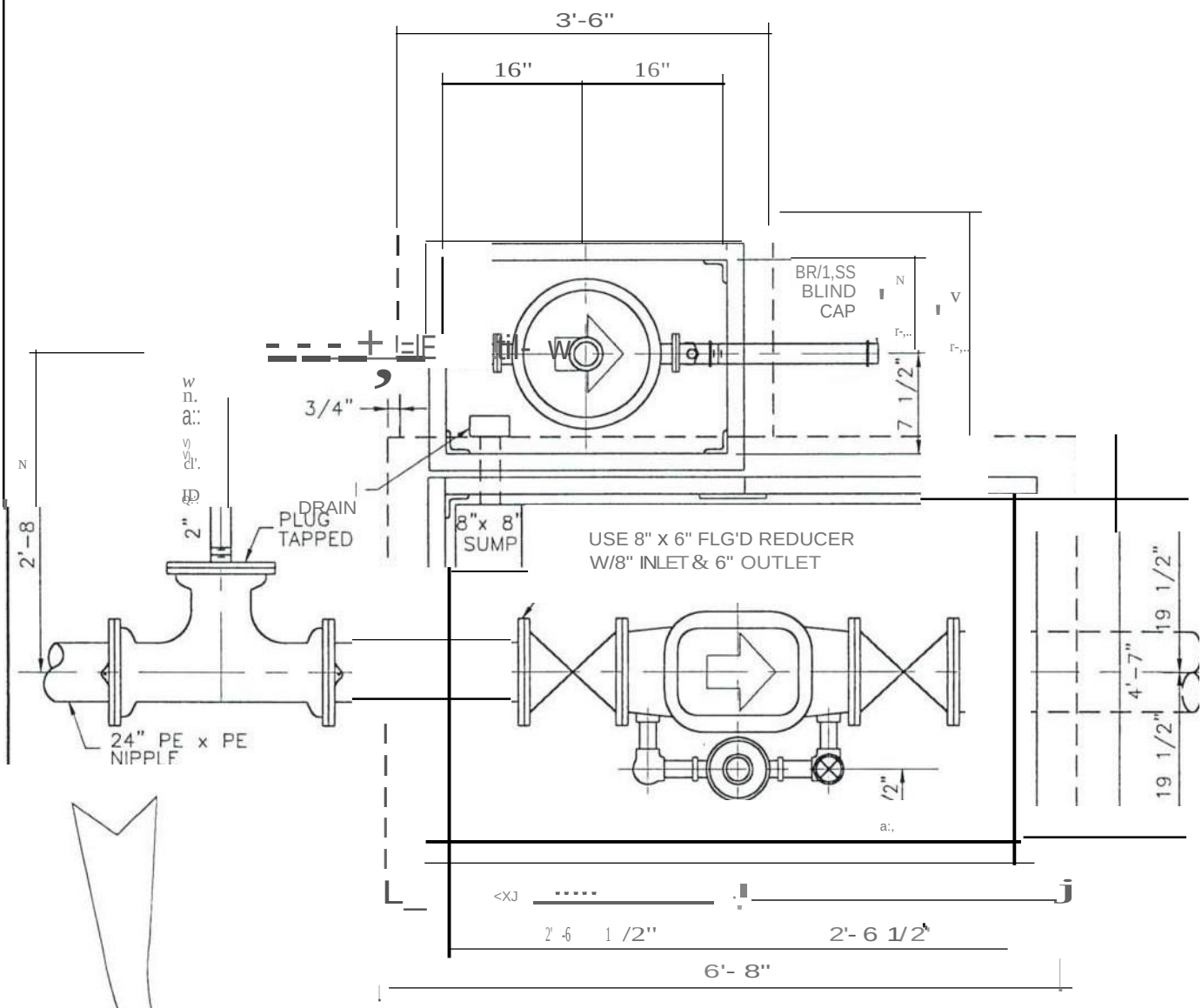
TYPE IV 2" DISC METER, 6" DC (6" INLET) (6" OUTLET) 2" BRASS INLET & OUTLET)

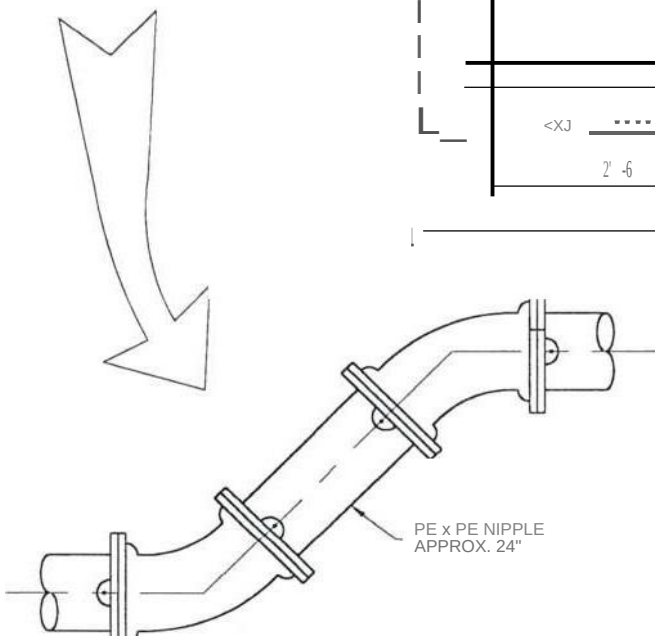
QTY.	FROM TYPE II ELIMINATE
1	1-1 /2" Disc Meter with gaskets, bolts, and nuts
	ADD
	2" Disc Meter with gaskets bolts, and nuts

QTY.	FROM TYPE II ELIMINATE
2	1-1 /2" flanged angle valves
	ADD
2	2" FLANGED ANGLE VALVES

* Above MJ gaskets, set scr ews, & MJ nuts & bolts ore supplied with respec tive fittings.

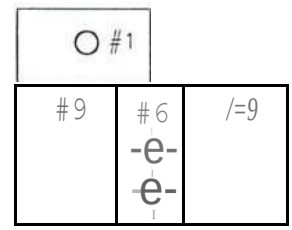
REVISIONS	MATERIALS LIST FOR 1-1 /2" or 2" METER 6" DETECTOR CHECK SETTING	DRAWING NO. 207





ELEVATION

NO SCALE



COVER DETAIL

NOTE: SEE "STANDARD METER VAULT PARTS" DWG.(02550-225 & 226) FOR METER VAULT DETAILS .

REVISIONS	1-1 /2" OR 2" METER 8" DETECTOR CHECK SETTING	DRAWING NO. 210

TYPE I 1 1/2" DISC METER, 8" DC (8" INLET) (8" OUTLET) 2" BRASS INLET & OUTLET)

QTY.	DESCRIPTION
	1-1 /2" Disc Meter with gaskets, bolts, and nuts
2	1-1 /2" flanged angle valves
3	2" brass elbows
10	2" brass pipe to be cut & threaded by contractor
1	8 x 3 MJ tee
1	3" MJ plug tapped 2"
1	8" DC meter
2	8" flanged gate valves
2	8" flanged x plain end nipples 30" long
2	8" 45· MJ bends
1	8" plain end x plain end nipple approx. 24" long.
1	8" plain end x plain end nipple 24" min. length
1	8" MJ cap
7	8" retainer glands
• 7	8" MJ gaskets
4	8" flange gaskets
32	3/ 4" x 3-1 /2" nuts & bolts for flange connections
	5/8" x 2" set screws for retainer glands
	5/8" x 3" nuts & bolts for MJ connections
	3/ 4" x 4" nuts & bolts for MJ connections
1	#1 cover
1	#6 cover
2	#9 cover
6	A sides
2	8 sides
2	C sides
16	Angles
4	Plates
40	Bolts, nuts & washers, 1/2" x 3-1 /2"
625	bricks

TYPE II 2" DISC METER 8" DC (8" INLET) (8" OUTLET) 2" BRASS INLET & OUTLET)

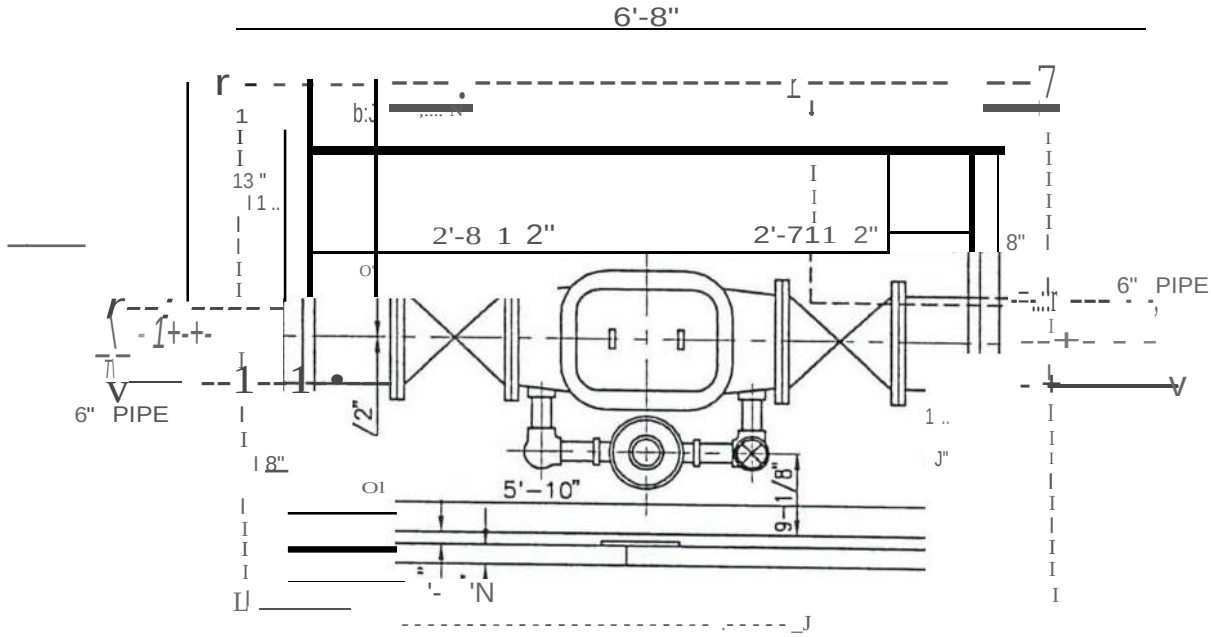
QTY.	,ELIMINATE FROM TYPE I
	1-1 /2" Disc Meter with gaskets, bolts, and nuts
2	**1-1 /2"** flanged angle valves

ADD

	2" Disc Meter with gaskets bolts, and nuts
2	2" flanged angle valves

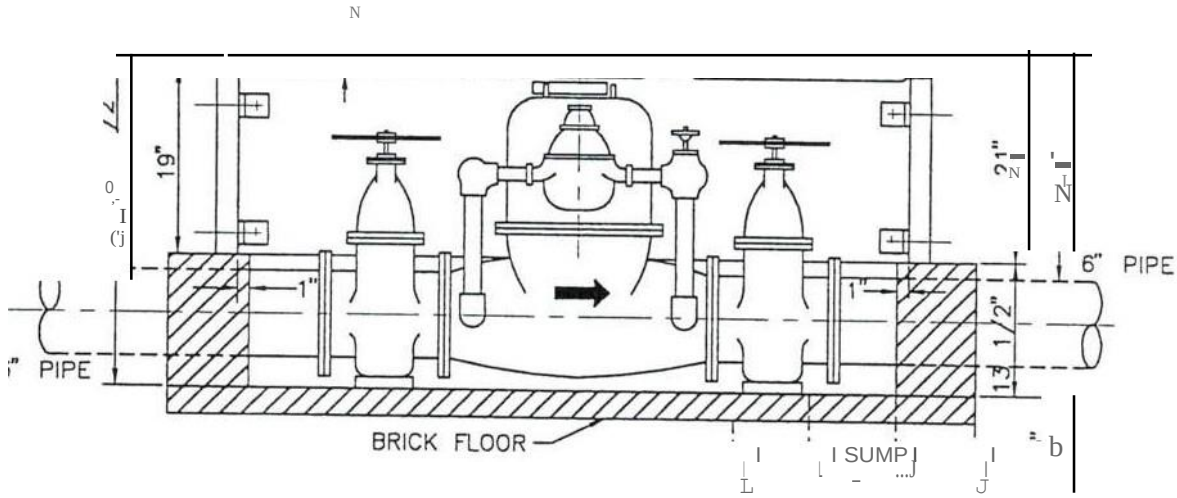
* Above MJ gaskets, set screws, & MJ nu ts & bolts ore supplied wi th respective fittings.

REVISIONS	MATERIALS LIST FOR 1-1 /2" or 2" METER 8" DETECTOR CHECK SETTING	DRAWING NO. 211



PLAN

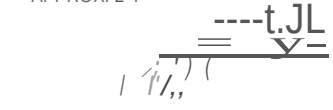
NO SCALE



ELEVATION

NO SCALE

P.E. x P.E. NIPPLE
APPROX. 24- LENGTH



5_1ii.,,

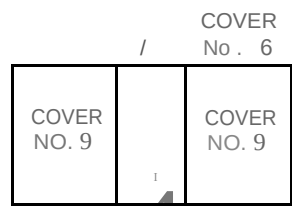
-W,-,-

_// ' 7 RETAINER CLANDS REQUIRED

ELEVATION

NO SCALE

NOTE: SEE " STANDARD METER VAULT PARTS" DWG.(02650-225 & 226) FOR METER VAULT DETAILS.



ROOF PLAN

NO SCALE

REVISIONS	6" DETECTOR CHECK	DRAWING NO 215

Q1Y.	DESCRIPTION
2	6" flanged x plain end nipples 30" long
2	6" 45· MJ bends
1	6" plain end x plain end nipple approx. 24" long
1	6" plain end x plain end nipple 24" min. length
7	6" MJ retainer glands
1	6" M.J. cap
• 7	6" M.J. gaskets
4	6" flanged gaskets
2	6" flanged gate valves
1	6" DC meter
• 4	3/ 4" x 3-1 /2" nuts & bolts for MJ
2	connections
• 4	5/8" x 3" nuts and bolts for MJ connections
• 42	5/8" x 2" set screws for retainer glands
32	3/4" x 3-1/4" nuts & bolts for flange connections
1	#1 cover
1	#6 cover
2	#9 covers
6	A sides
2	B sides
2	C sides
16	Angles
4	Plates
40	Bolts, nuts & washers, 1/2" x 3-1/2"
625	bricks

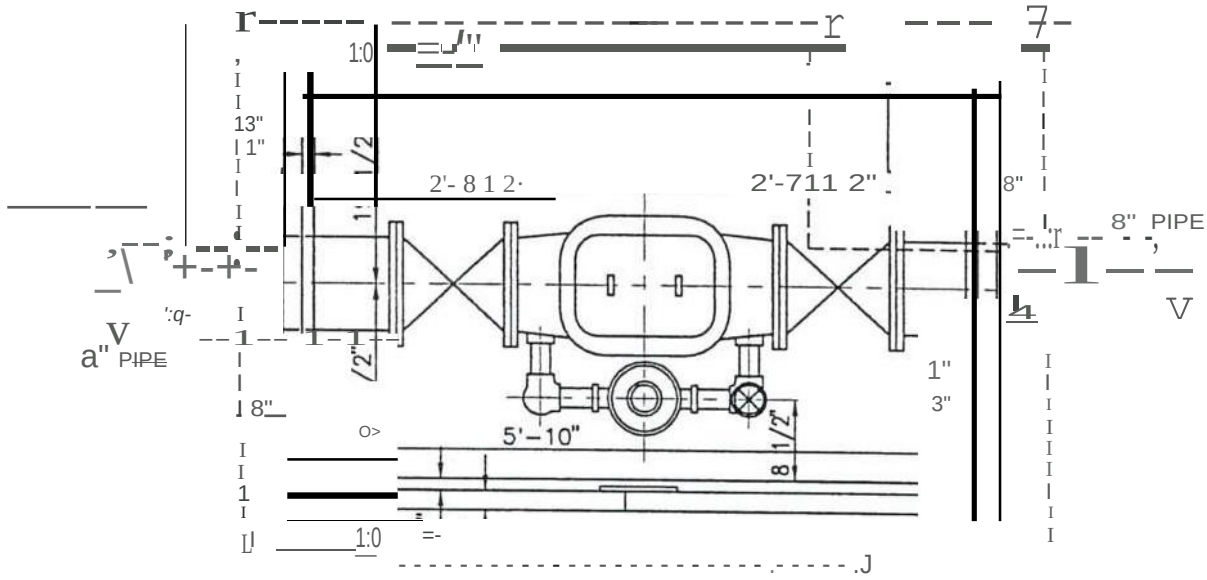
* Above MJ gaskets, set screws, & MJ nuts & bolts ore supplied with respective fittings.

REVISIONS

MATERIALS LIST FOR 6' DETECTOR CHECK

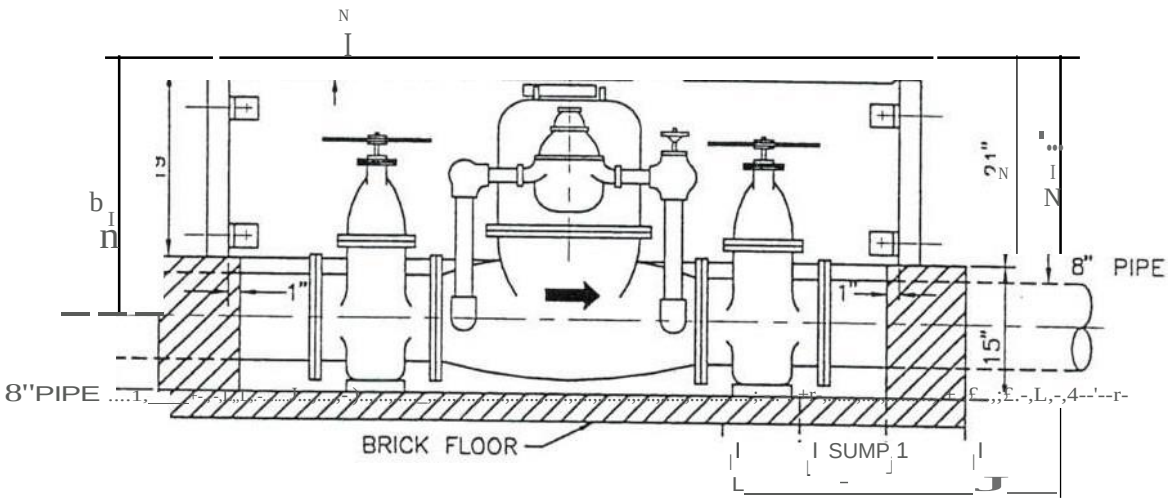
DR AWING NO

216



PLAN

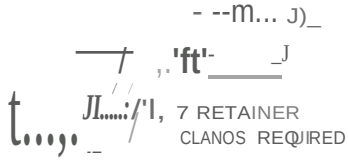
NO SCALE



ELEVATION

NO SCALE

P.E. x P.E. NIPPLE
APPROX. 24 LENG'ni

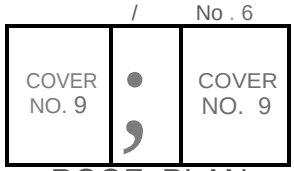


ELEVATON

NO SCALE

NOTE: SEE "STANDARD METER VAULT PARTS" DWG.(02650-225 & 226) FOR METER VAULT DETAILS.

COVER NO. 6



ROOF PLAN

NO SCALE

REVISIONS	8" DETECTOR CHECK	DRAWING N C
		220

QlY.	
1	8" DC METER
2	8" FLANGED GATE VALVES
2	8" FLANGED x PLAIN END NIPPLES 30" LONG
2	8" 45' BENDS
1	8" PLAIN END x PLAIN END NIPPLE APPROXIMATELY 24" LONG
1	8" PLAIN END x PLAIN ENO NIPPLE 24" MIN. LENGTH
1	8" MJ CAP
7	8" RETAINER GLANDS
• 7	8" MJ GASKETS
4	8" FLANGE GASKETS
32	3/4" x 3 1/2" NUTS AND BOLTS FOR FLANGE CONNECTIONS
•42	5/8" x 2" SET SCREWS FOR RETAINER GLANDS
• 4	5/8" x 3" NUTS AND BOLTS FOR MJ CONNECTIONS
•42	3/ 4" x 4" NUTS AND BOLTS FOR MJ CONNECTIONS
1	■ 1 COVER
1	▌6 COVER
2	▌9 COVERS
6	A SIDES
2	B SIDES
2	C SIDES
16	ANGLES
4	PLATES
40	NUTS, BOLTS AND WASHERS, 1/2" x 3 1 /2"
625	BRICKS

•ABOVE MJ GASKETS, SET SCREWS AND MJ NUTS AND BOLTS ARE SUPPLI ED WITH RESPECTIVE MJ FITTINGS.

REVISIONS

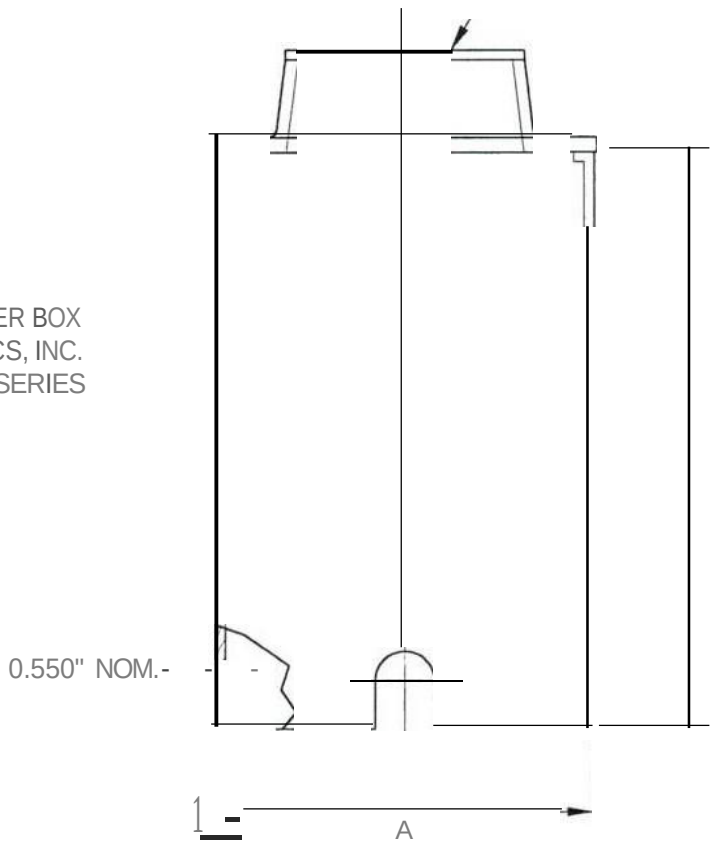
MATERIALS LIST FOR 8" DETECTOR CHECK

D RAWING NO

221

LID COVER
FORD METER BOX CO., INC.

METER BOX
MID-STATES PLASTICS, INC.
"B" SERIES



	"A., DIM.	LID COVER
:Y/ METER	18" DIA.	C3- T
1½" METER	30" DIA.	MC30- T

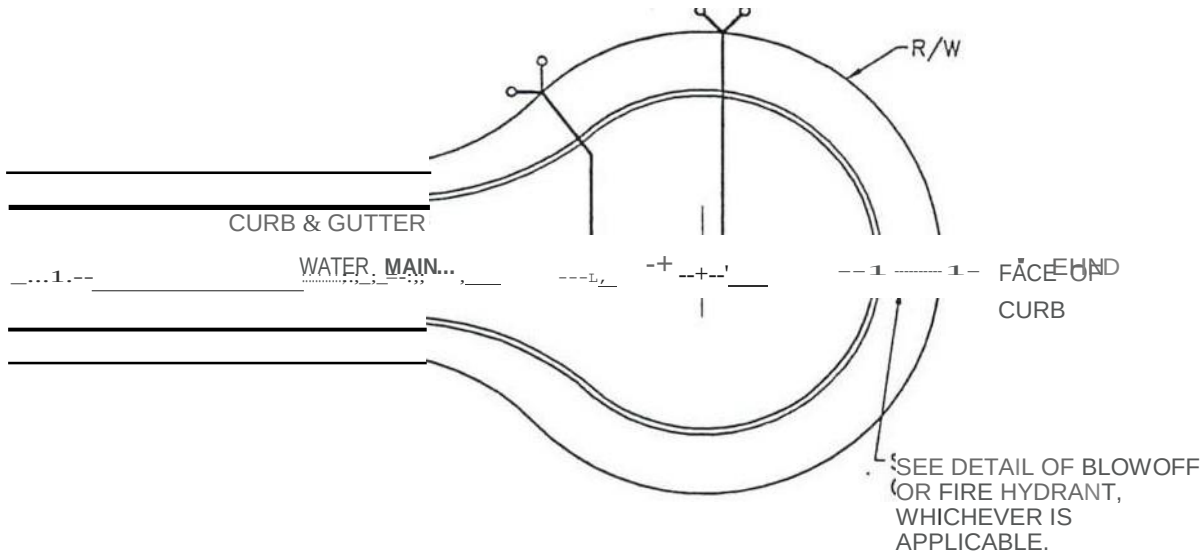
REVISIONS

6/29/95

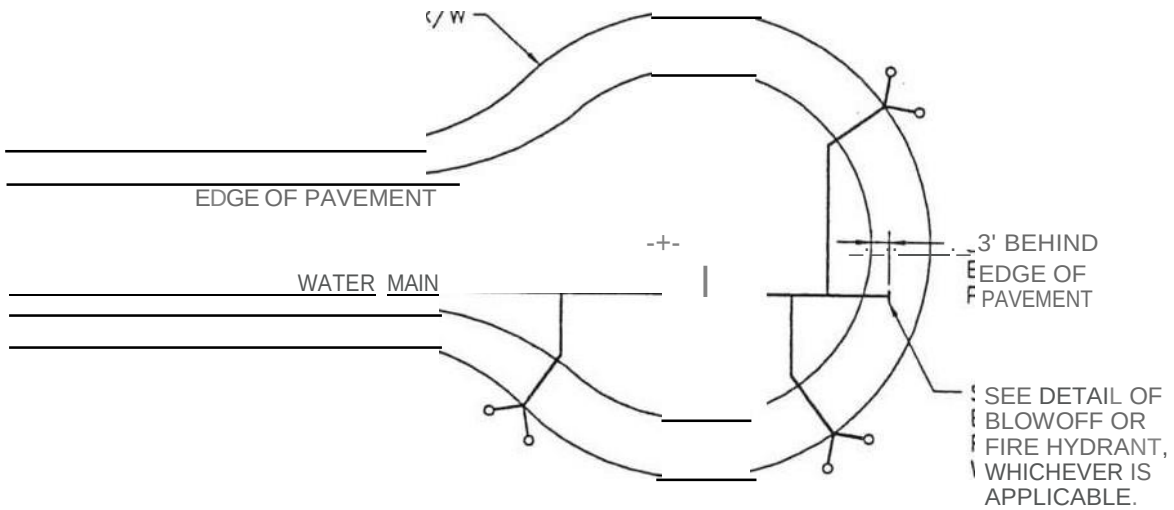
PLASTIC METER BOX

DRAV/IN G NO.

231



END OF MAIN LOCATION ON CUL-DE-SAC WITH EXISTING CURB AND GUTTER.

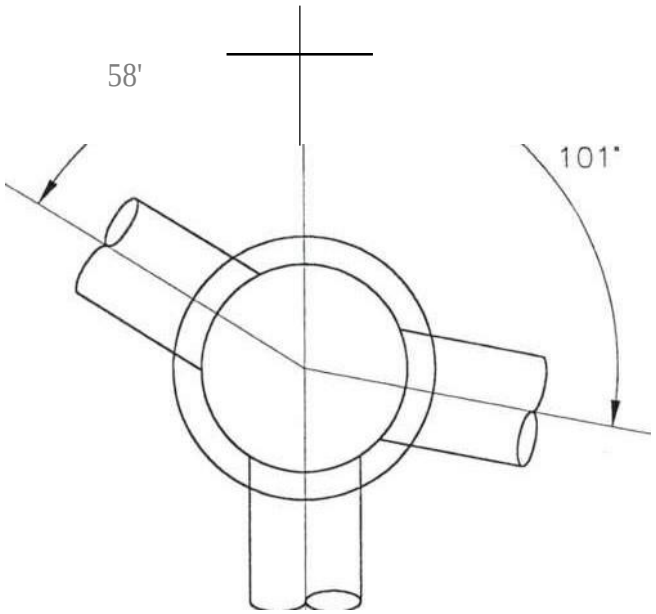


END OF **MAIN** LOCATION ON UNIMPROVED CUL-DE-SAC WITH OR WITHOUT FUTURE CURB ANO GUTTER.

REVISIONS

TYPICAL WATER MAIN LOCATION ON CUL-DE-SAC

DRAWING NO



MANHOLE SIZING TABLE

MAXIMUM 's AT MANHOLE (DEGREES)

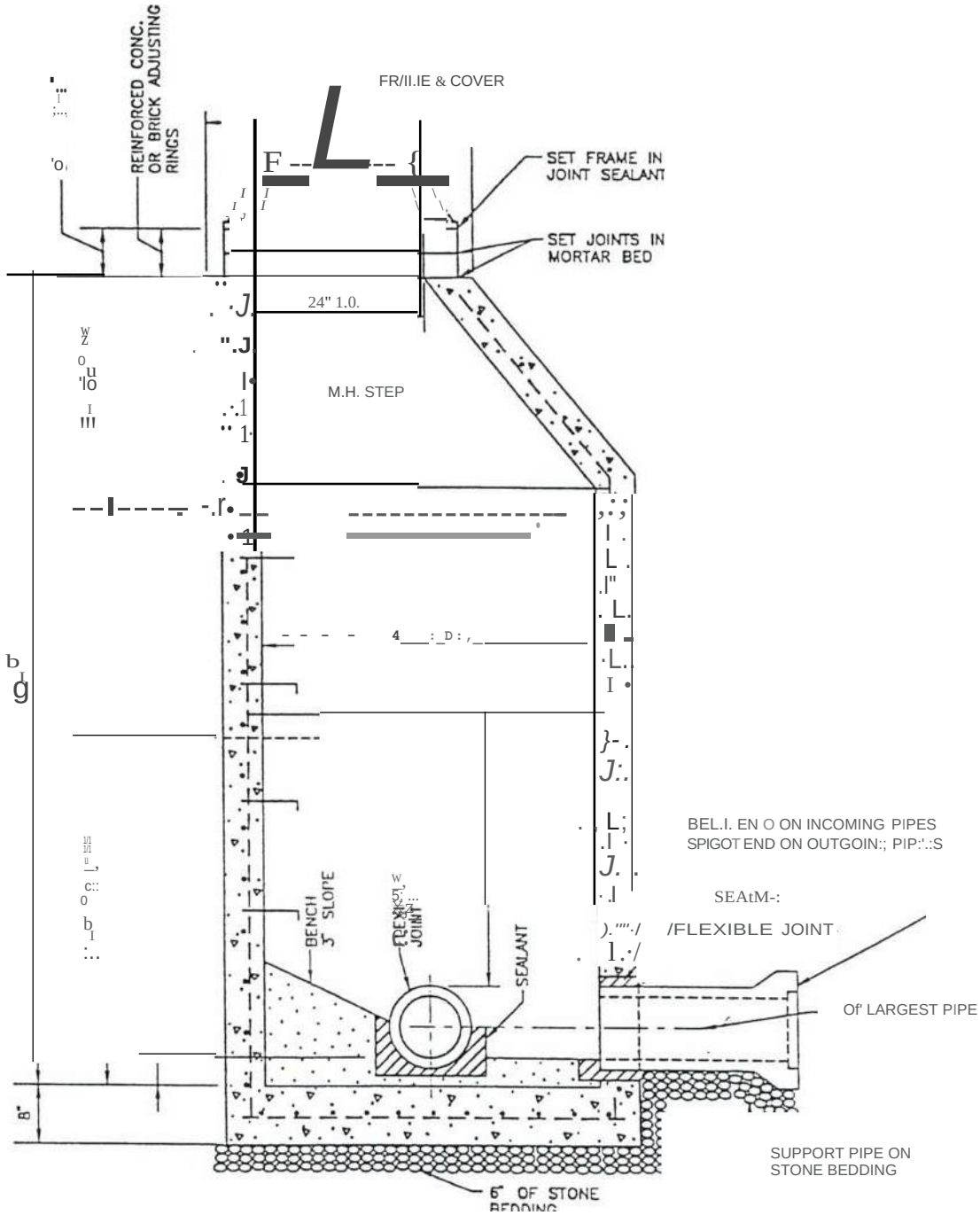
SEWER PIPE SIZE	SIZE OF MANHOLE				
	48"	60"	72"	84"	96"
21"	68"	92'	107'		
24"	58"	8s·	10,.		
27"	4T	7T	95·		
30"	35·	68'	89'	103"	
36"	USE NEXT SIZE	so·	75·	92'	103'
42"		USE NEXT SIZE	60'	SO·	94·
48"			USE NEXT SIZE	67'	8 4'
54"				USE NEXT SIZE	72'

REVISIONS

MANHOLE SIZING TABLE

DRAWING NO.

415



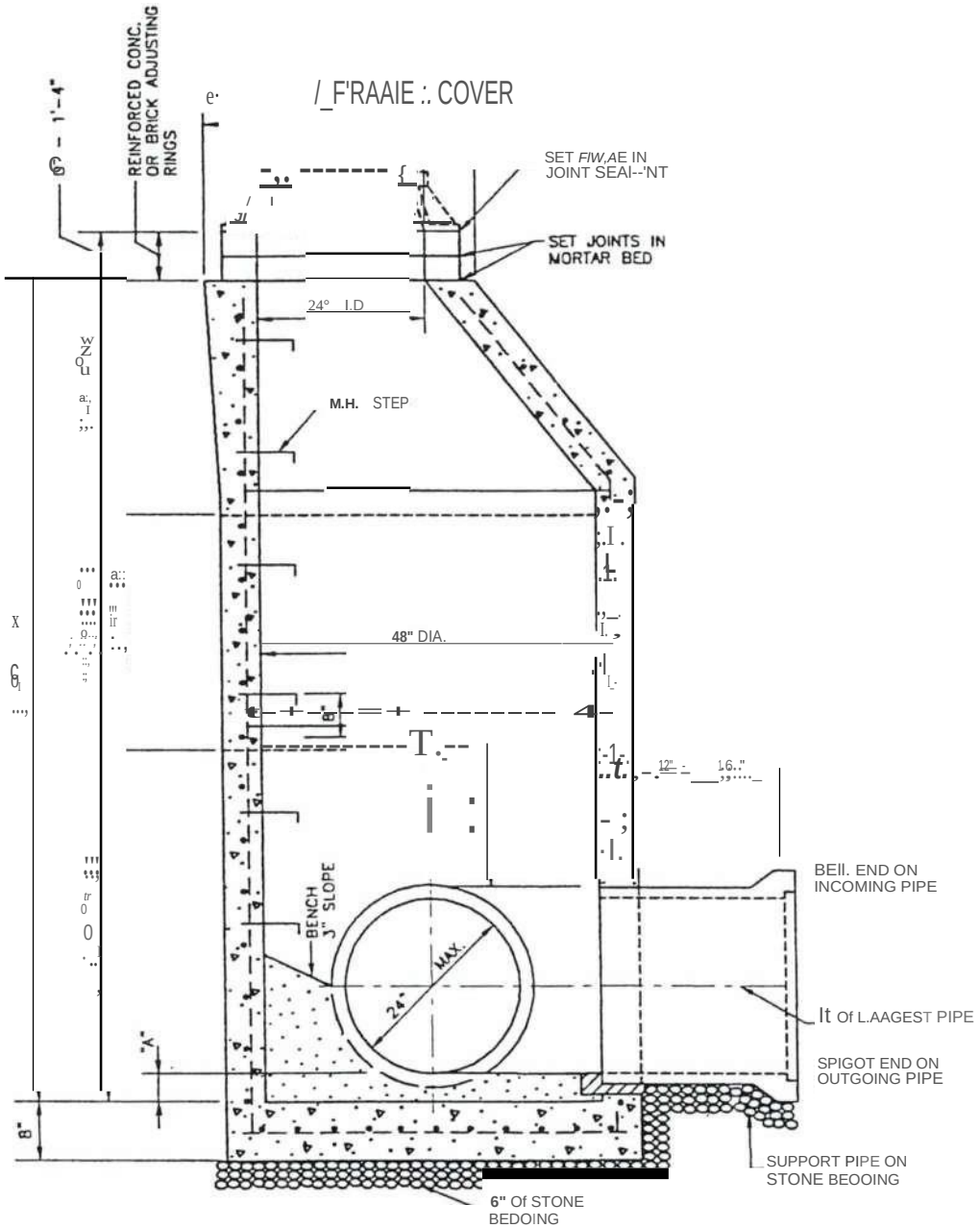
• Å DIMENSION EQUALS PIPE WALL THICKNESS PLUS 2" MINIMUM

R ISIONS

STANDARD PRECAST CONCRETE MANHOLE SEWERS 8" TO 15"

O AWII\':: :;'.

420



"A" DIMENSION EOUALS PIP(**WALL** THICKNESS PWS 2· MINIMU'-1

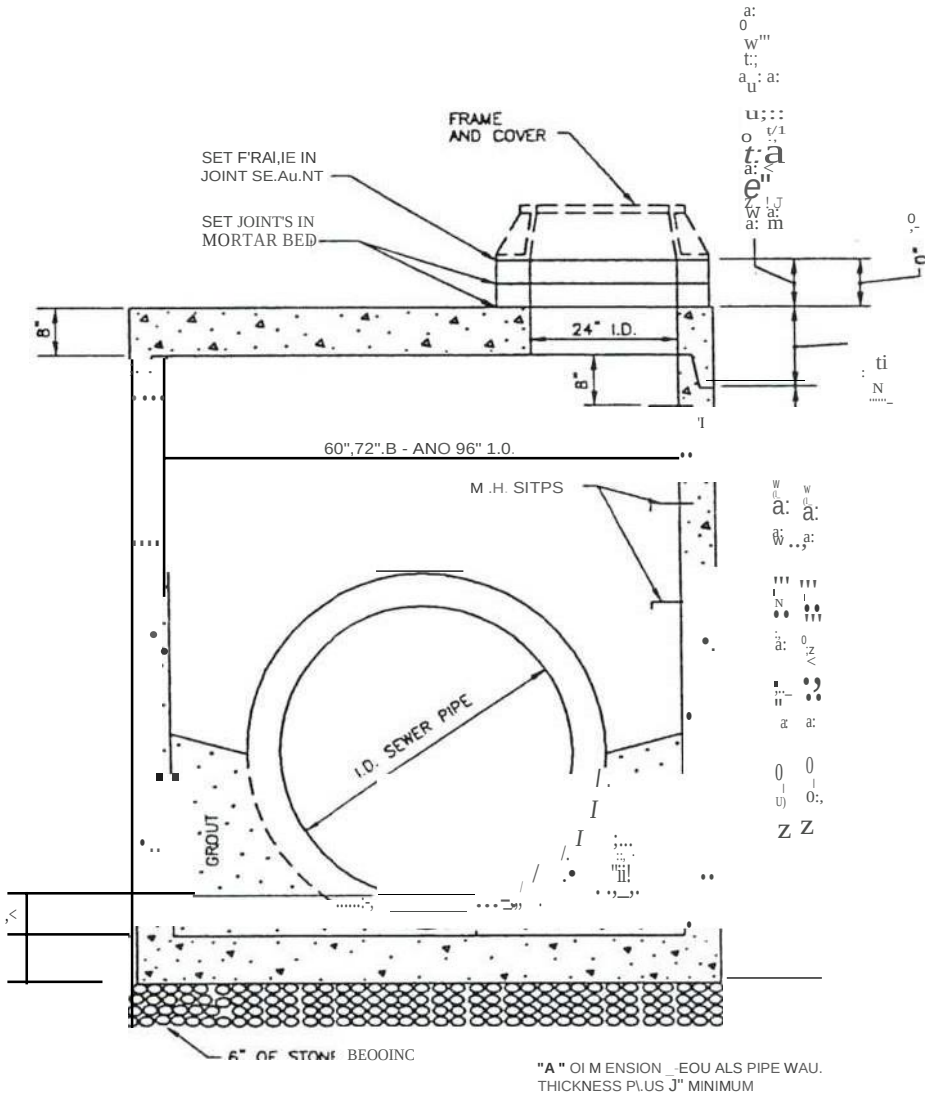
REVISIONS

STANDARD PRECAST CONCRETE MANHOLE SEWERS 18", 21" AND 24,,

D RAWING NO.

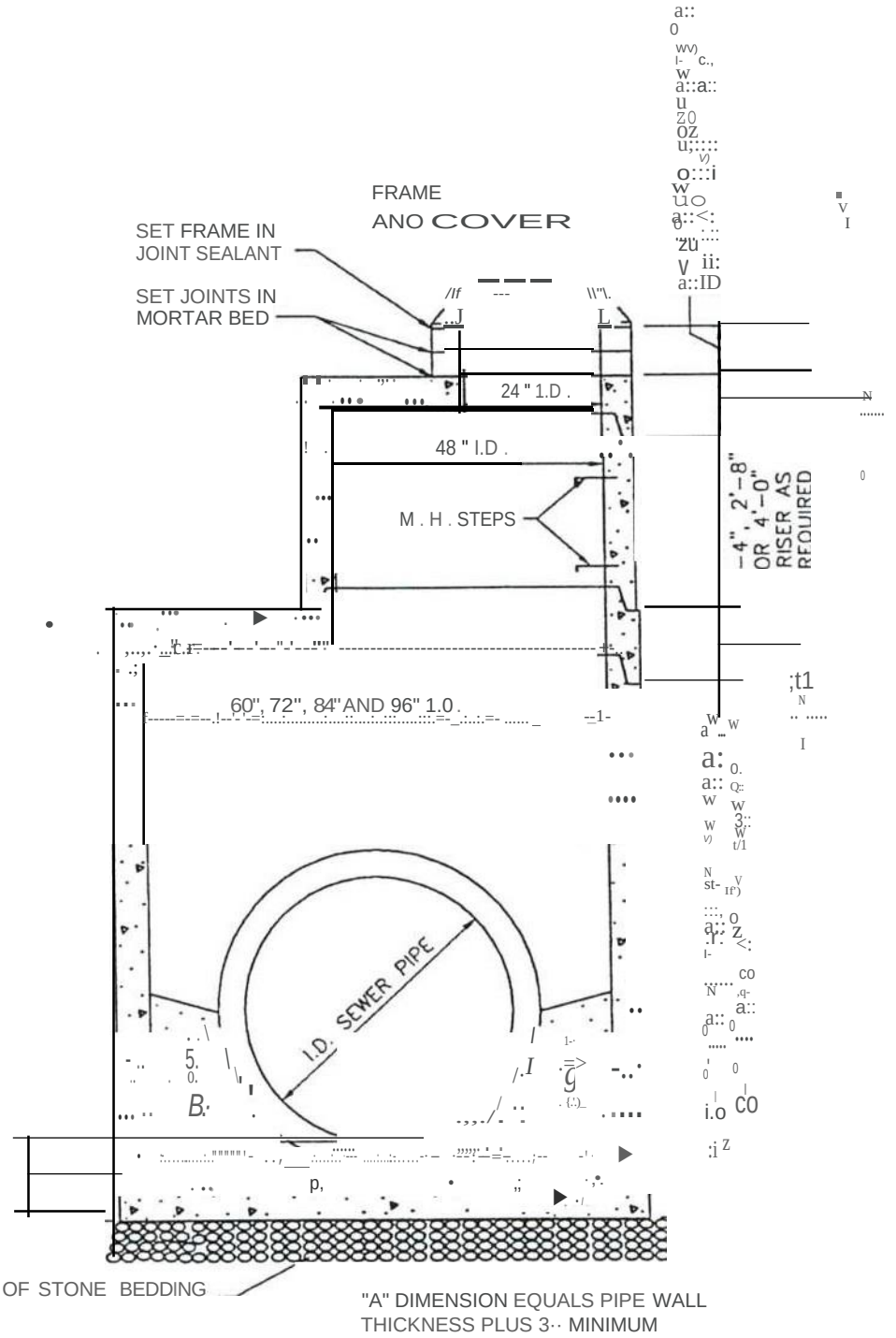
425

L



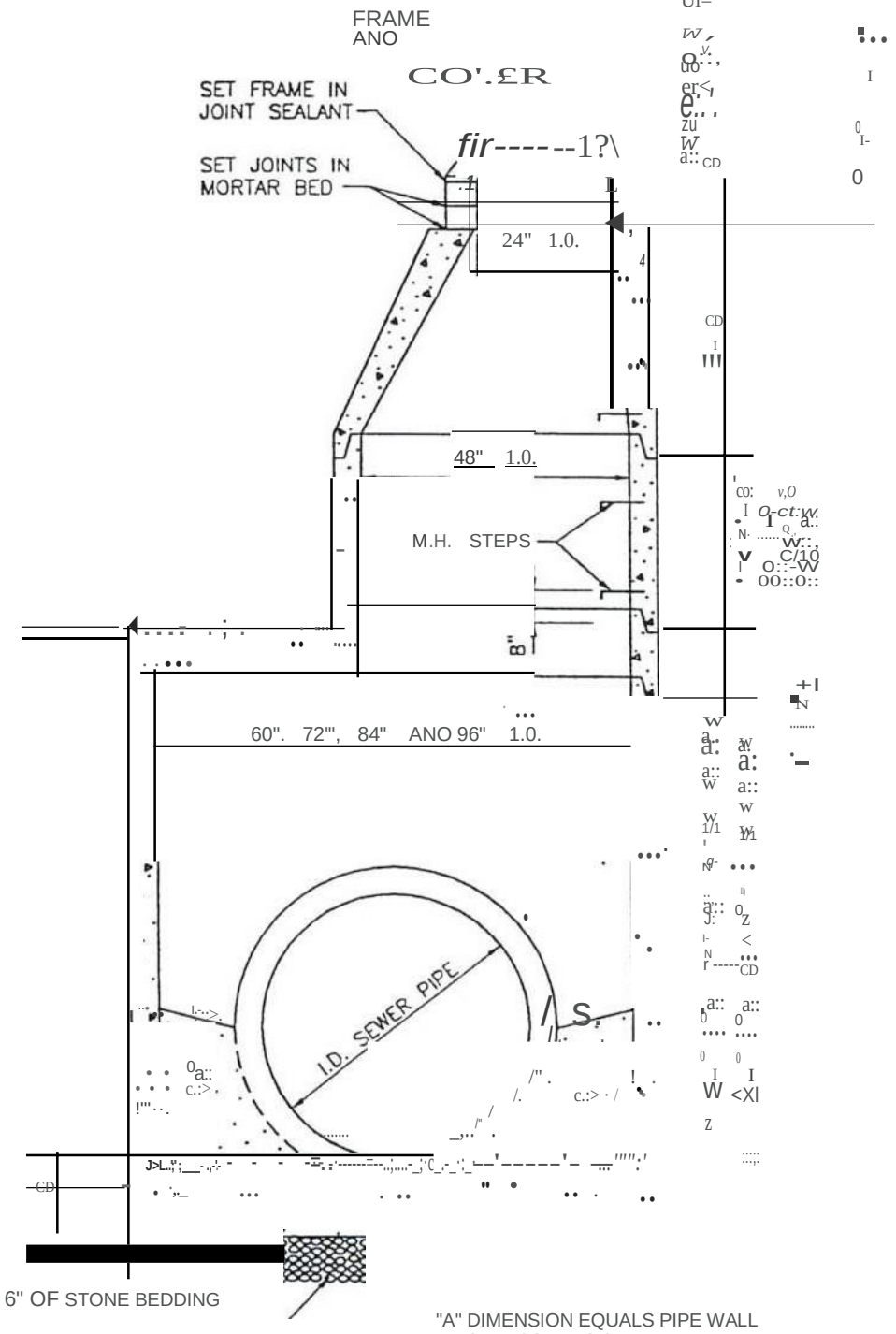
"A " OI M ENSION _-EOU ALS PIPE WAU.
THICKNESS P\.US J" MINIMUM

RE.VISIONS	60" , 72" , 84" AND 96" I.D. MANHOLE-I	DRAWING NO. 426



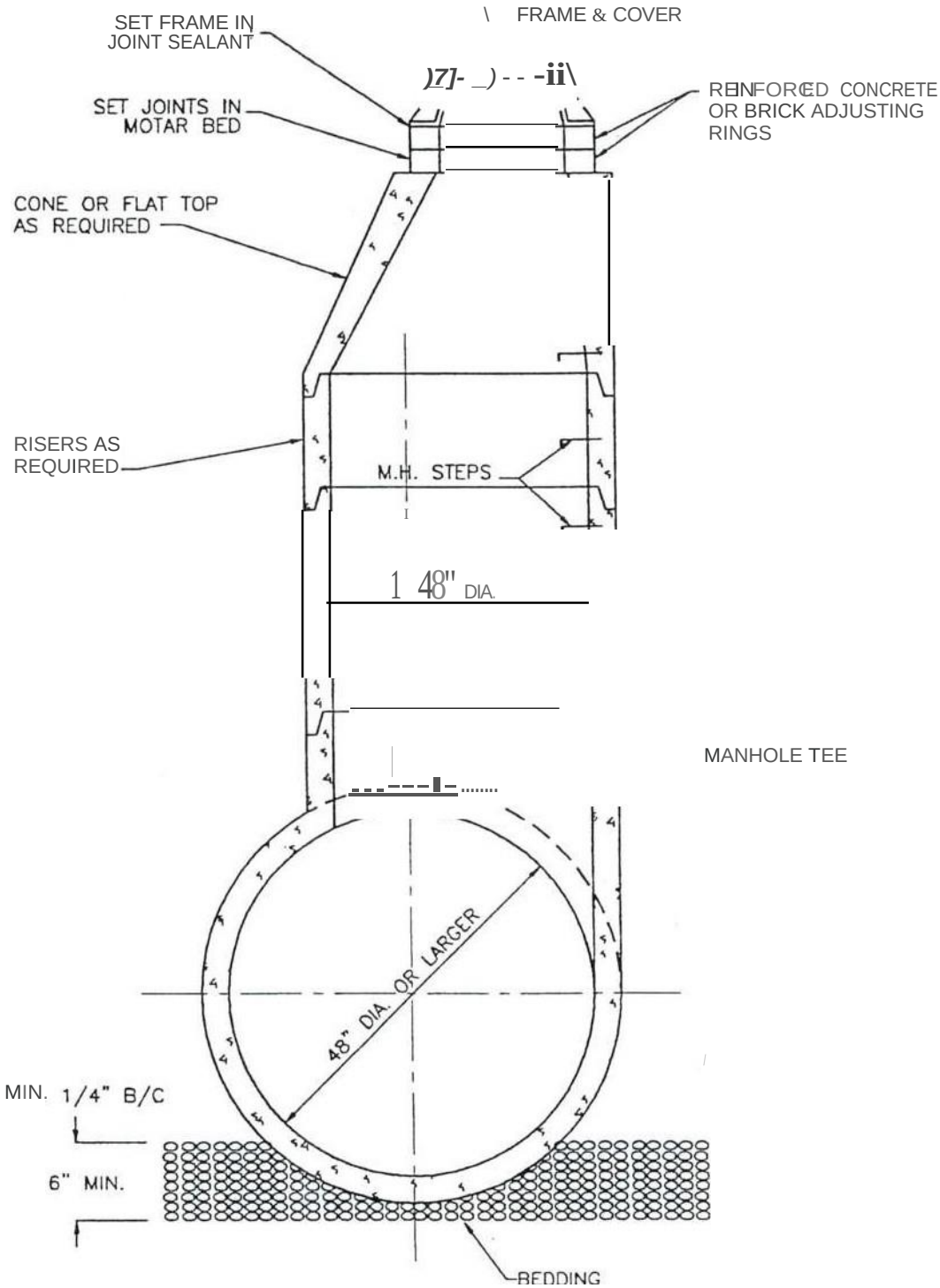
REVISIONS	72" 84" AND 96" I.D. MANHOLE- II	DRAWING N
		427

L



"A" DIMENSION EQUALS PIPE WALL
THICKNESS PLUS 3" MINIMUM

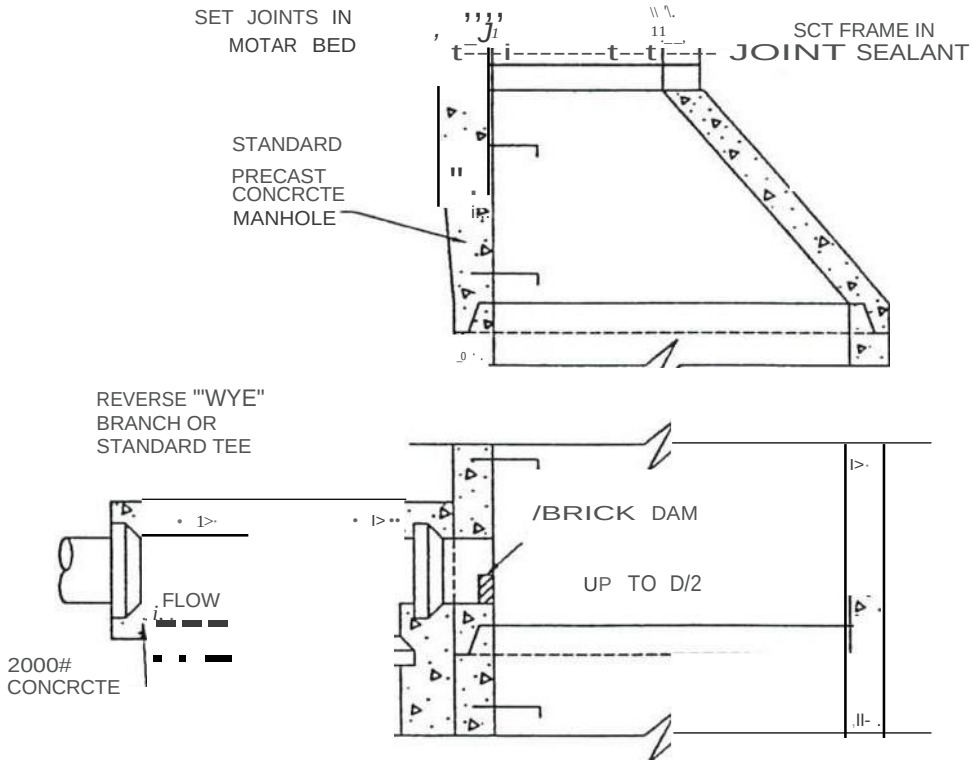
REVISIONS	60" 72", 84" AND 96" I.D. MANHOLE-III	DRAWING NO.
		428



REVISIONS	TEE MANHOLE	DRAWING NO.
		430

<F

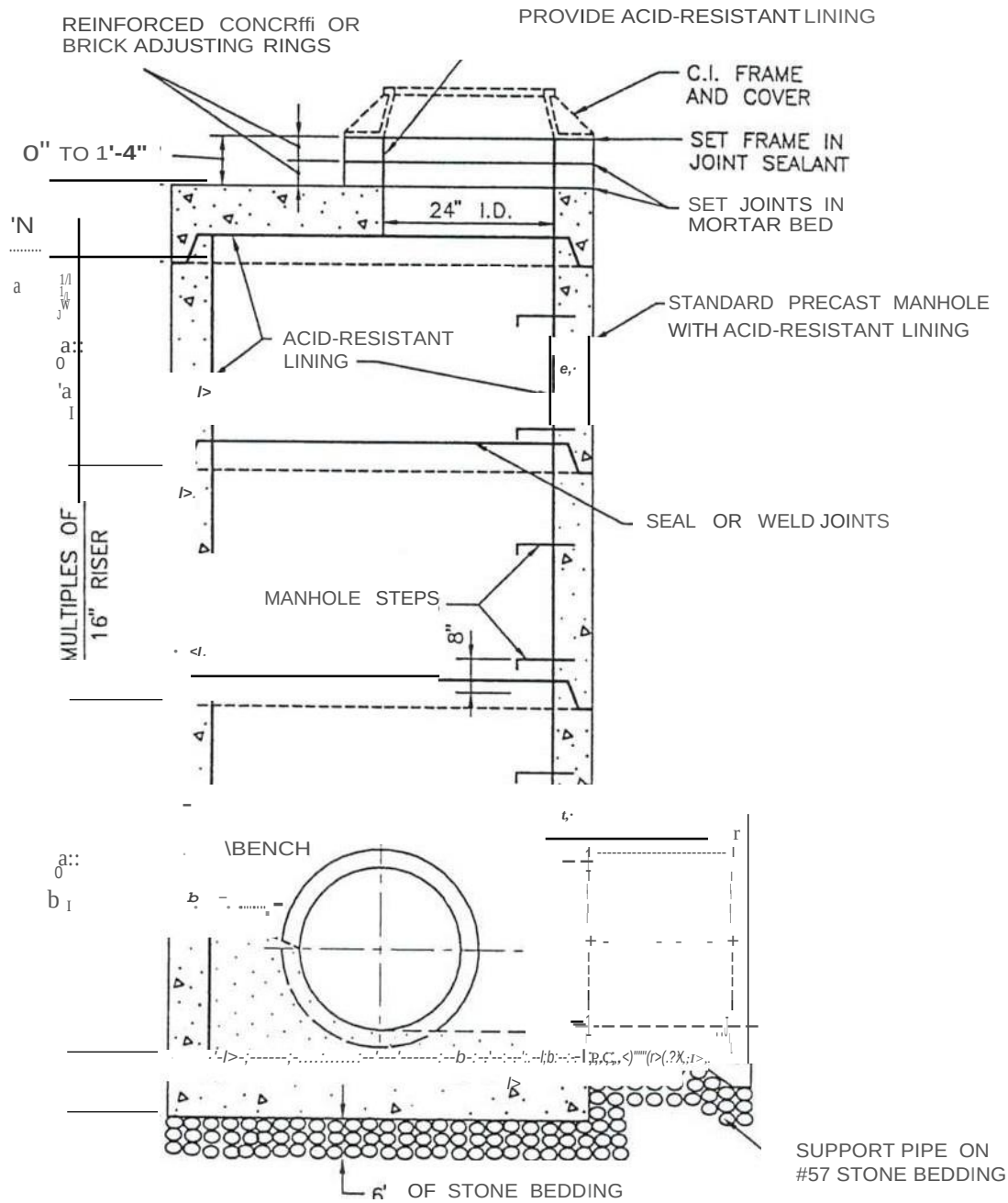
& COVER



NOTE: CONCRCTE ENCASEMENT MAY BE EUMINATED IF 0 .1 PIPE AND FITTINGS ARE USED FOR DROP CONNECTION.

REVISIONS	STANDARD DROP MANHOLE	DRAWING NO. 435

L



NOTE: USE SULFATE RESISTANT CEMENT TO PREPARE MORTAR IN BUILDING INVERT AND BENCH.

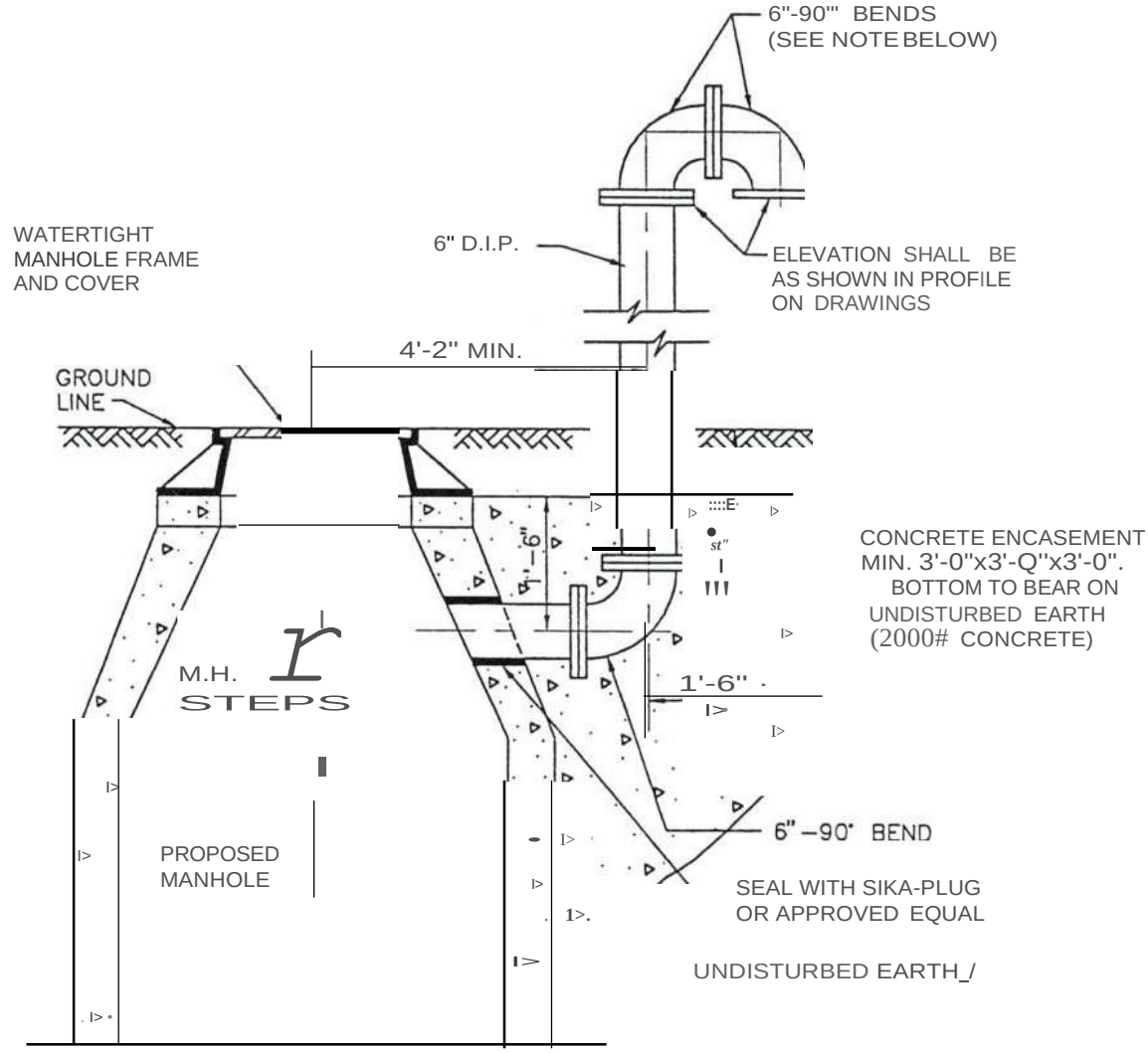
SEE DRAWING OF " STANDARD PRECAST CONCRETE MANHOLE" FOR ADDITIONAL MANHOLE DETAILS.

REVISIONS

ACID-RESISTANT LINING MANHOLE

DRAWING NO.

440



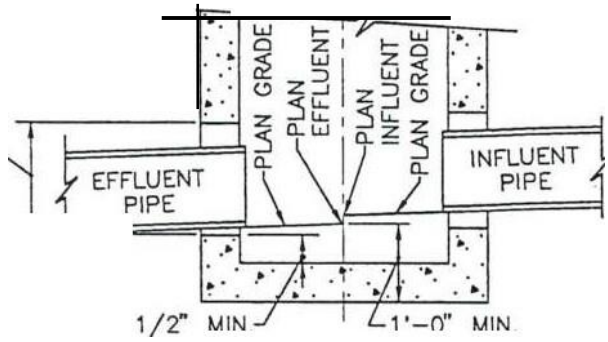
NOTE: IF TOP ELEVATION OF VENT IS LESS THAN 8 '- 0" ABOVE GROUND LINE, THE 2-6" SO° BENDS WILL BE REQUIRED. S'-O' AND HIGHER ABOVE GROUND UNE WILL NOT REQUIRE ANY FITTINGS. (OPEN TO ATMOSPHERE)

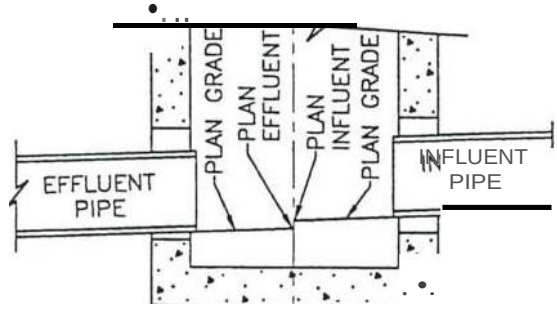
REVISIONS

MANHOLE VENT DETAIL

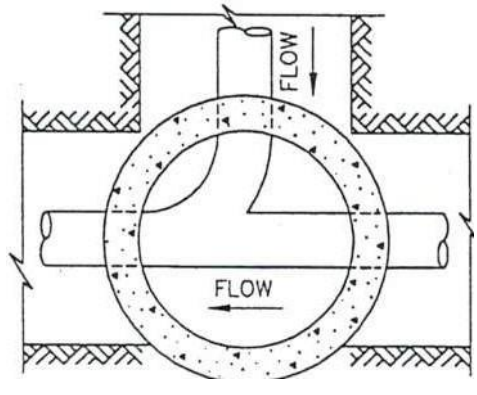
DRAWING NO.

445



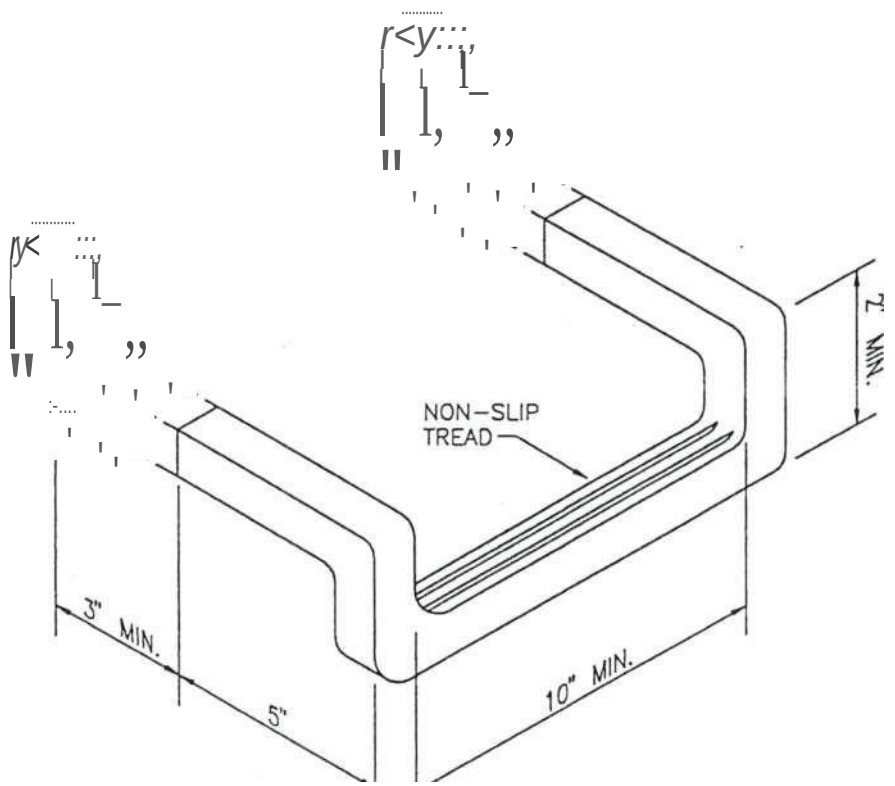


NOTE: THE EFFLUENT ELEVATION SHOWN AT A MANHOLE IS ESTABLJSHED FROM THE INFLUENT ELEVATION OF THE MANHOLE IMMEDIATELY DOWNSTREAM. ELEVATIONS SHOWN APPLY AT THE CENTERLINE OF MANHOLES AND ARE BASED ON THE HORIZONTAL DISTANCE, CENTERLINE TO CENTERLINE OF MANHOLE USING PERCENT OF GRADE INDICATED.



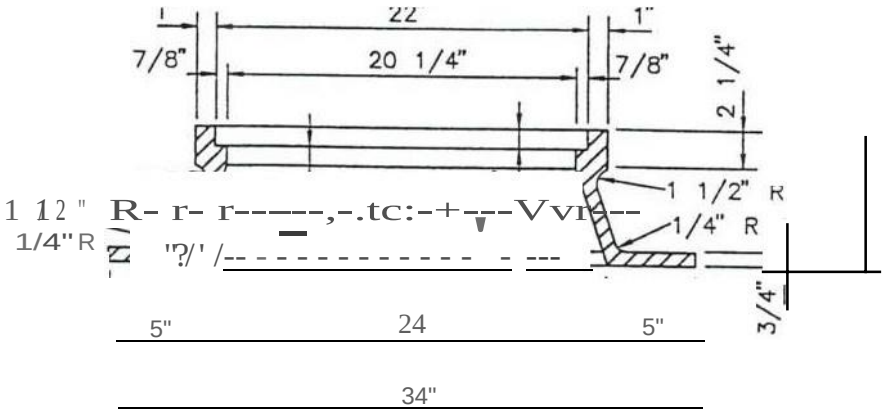
PLAN INVERT

R EVISIONS	STANDARD INVERT DETAILS	DRAWING NO. 455



NOTE: MANHOLE STEPS SHALL CONFORM TO O.S.H.A. STANDARDS AND SHALL BE SET 16" O.C. VERTICALLY.

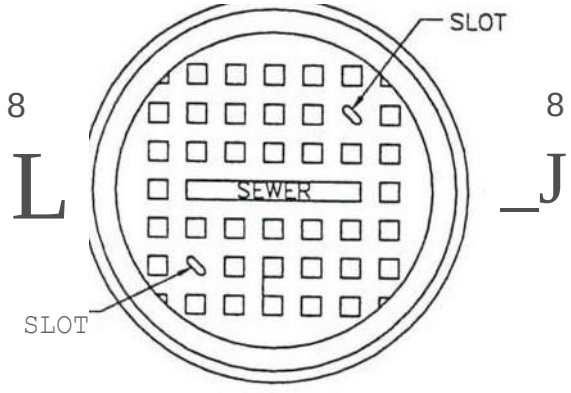
REVISIONS	STANDARD MANHOLE STEP	DRAWING NO. 460

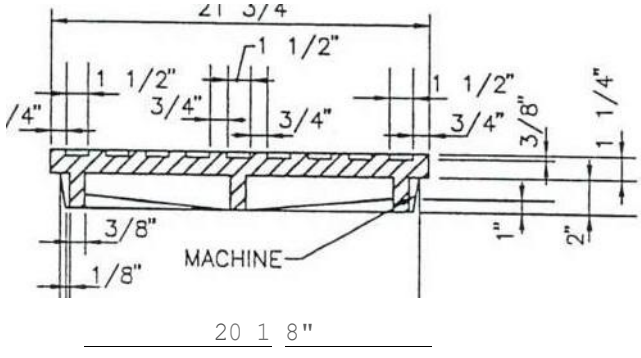


MIN. WEIGHTS

FRAME	210 LBS
COVER	130 LBS
TOTAL	340 LBS

FRAME SECTION





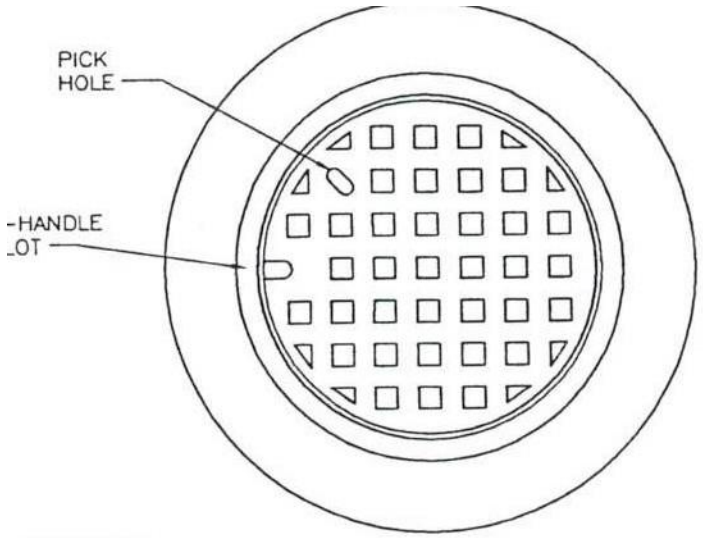
SECTION 8-8

REVISIONS

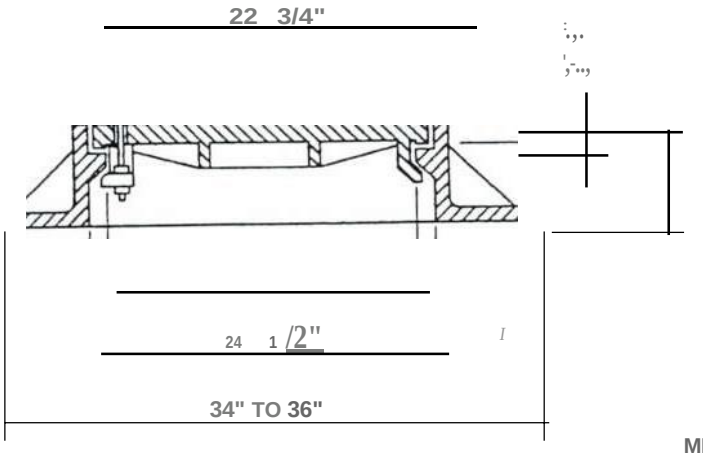
STANDARD MANHOLE FRAME & COVER

DRAWING NO.

465



'T" HANDLE REMOVABLE ONLY WHEN COVER IS LOCKED



MIN. WEIGHTS

FRAME	-	LBS
COVER	-	LBS
TOTAL	405	LBS

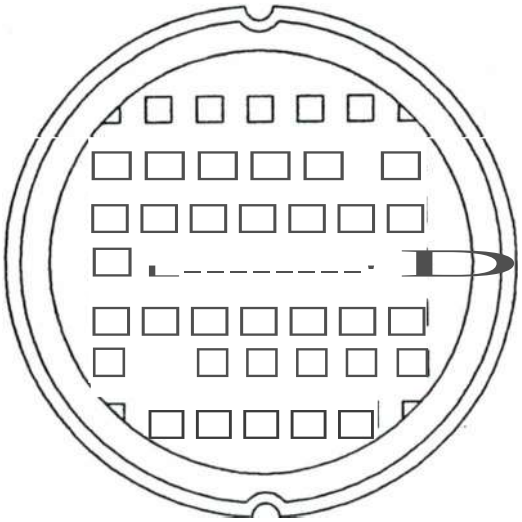
REVISIONS

VANDALPROOF MANHOLE FRAME & COVER

DRAWING NO

466

L

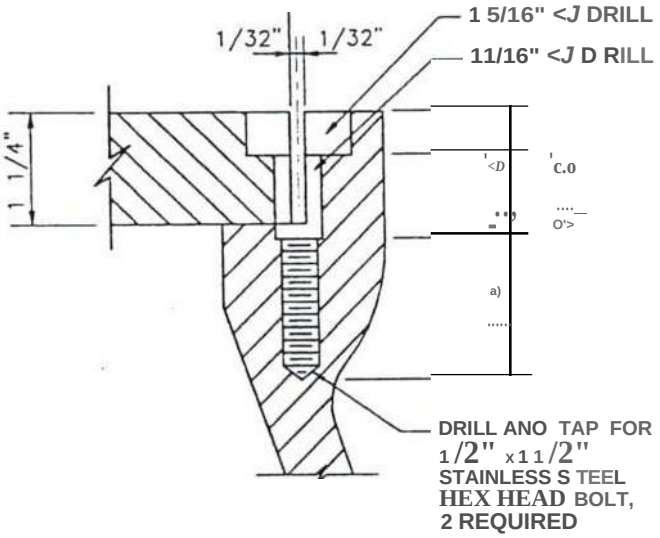


SEE SECTION THROUGH BOLT

NOTES:

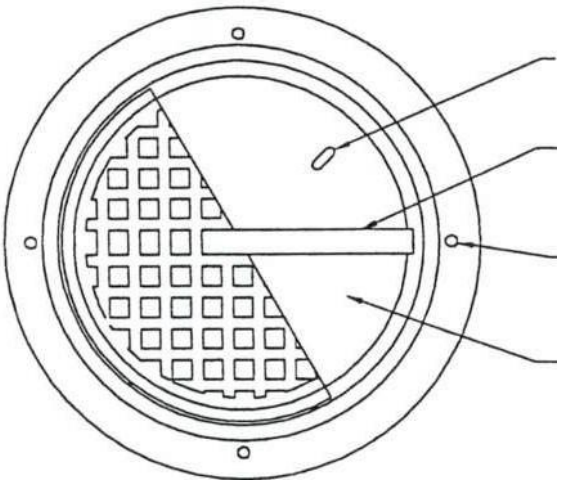
1. VANDALPROOF MANHOLE FRAME & COVER SHALL BE SAME DIMENSION AS "STANDARD MANHOLE FRAME & COVER".

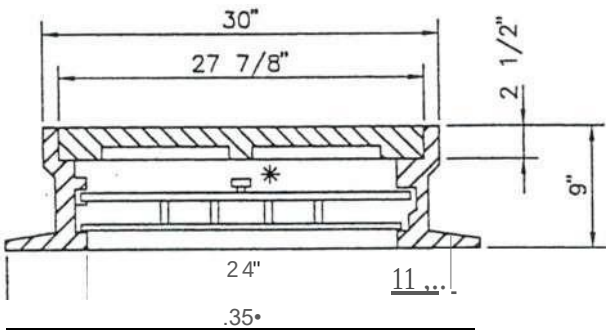
TOP DIAMETER 21 7 a:



SECTION THROUGH BOLT

REVISIONS	ALTERNATE VANDALPROOF MANHOLE FRAME & COVER	DRA WING NC 467





RECESSED PICK HOLE SHALL NOT EXTEND CLEAR THRU COVER.

* BRONZE OR BRASS HEX. HEAD BOLT WITH 5/8" SHANK.

STEEL INNER COVER, HANDLES AND LOCK BAR.

1/4" x 1" CONTINUOUS NEOPRENE GASKET BCTWEEN INNER COVER AND FRAME.

FRAME SHALL BE SET IN SEALANT AND BOLTED THRU TO THE MANHOLE CONE SECTION WITH 4 .3/4" ANCHOR BOLTS.

MI N. WEIGHTS

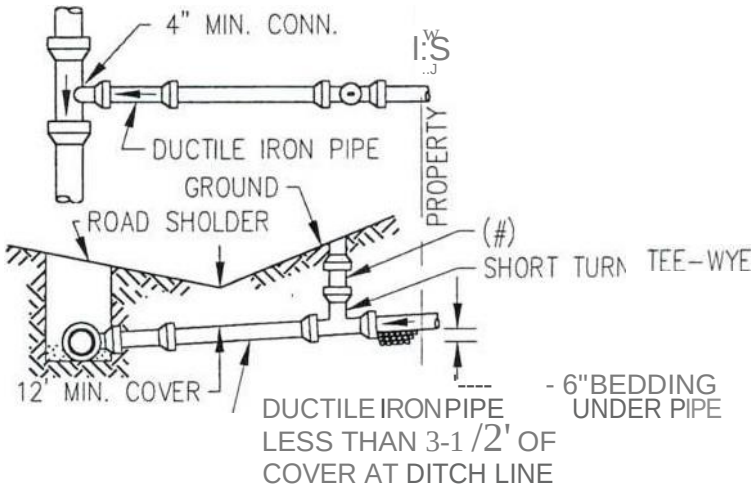
FRAME	295 LBS.
COVER	2.30 LBS.
INNER COVER	46 LBS.
TOTAL	571 LBS.

REVISIONS

WATERTIGHT MANHOLE FRAME & COVER

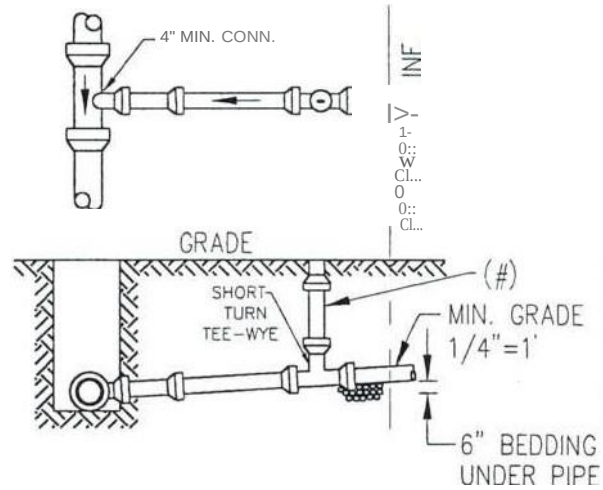
DRAWING NO

468



DITCH CROSSING

A



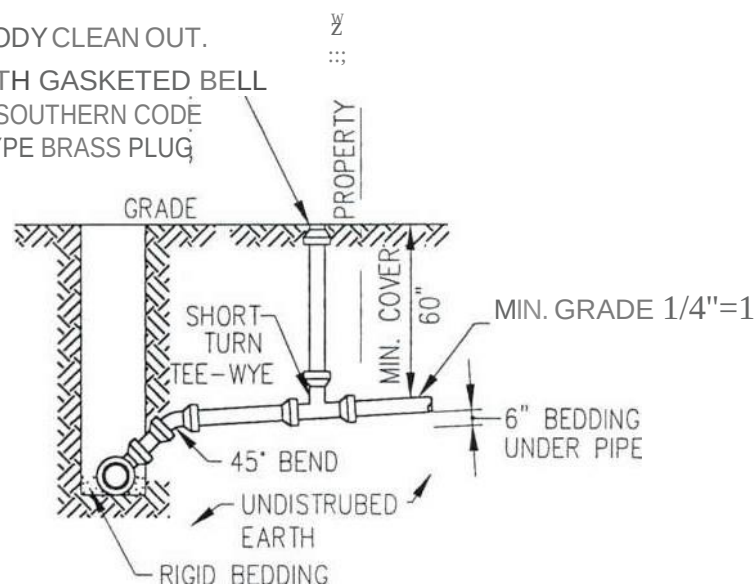
STANDARD HOUSE CONNECTION

B

(#) CAST IRON BODY CLEAN OUT.

ADAPTER WITH GASKETED BELL AND SOUTHERN CODE (RECESSED) TYPE BRASS PLUG

NOTE: 1/8"=1' GRADE MAY BE USED WITH A C.O. AT THE PROPERTY LINE WITH D.I. OR PVC PIPE.



"TEE" BRANCH CONNECTION W/ 45' BENO

C

REVISIONS	~~CASING~~ HOUSE CONNECTION DETAIL – WATER WITH CLEAN-OUT	DRAWING NO. 471

(#) MIN. GRADE

.U-1 1/ 4"=1'

'----6" BEDDING UNDER PIPE

DUCTILE IRON PIPE LESS THAN 3-1 /2' OF COVER AT DITCH LINE

6" BEDDING UNDER PIPE

DITCH CROSSING

A

STANDARD HOUSE CONNECTION

8

(#) CAST IRON BODY CLEAN OUT.

ADAPTER WITH GASKETED BELL AND SOUTHERN CODE (RECESSED) TYPE BRASS PLUG

NOTE: 1/ 8"=1' GRADE MAY BE USED WITH A C.O. AT THE PROPERTY LINE WITH D.I. OR PVC PIPE.

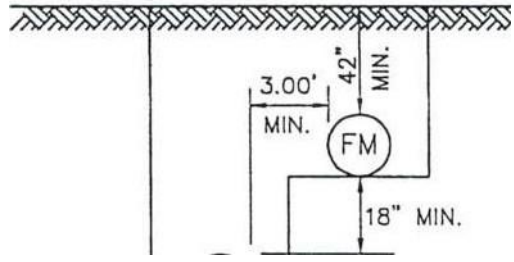
MIN. GRADE 1/4"=1'

6" BEDDING UNDER PIPE

" TEE" BRANCH CONNECTION W/45 BEND

C

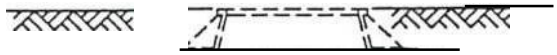
REVISIONS	HOUSE WATER CONNECTION DETAIL WITH CLEAN-OUT	DRAWING NO 471



S

TYPICAL SECTION

REVISIONS	SEWER AND FORCE MAIN IN SAME TRENCH	DRAWING NO. 700



C.I. FRAME & COVER

STANDARD PRECAST MANHOLE
WITH ACID RESISTANT LINING

FLEXIBLE
CONNECTION

3'-0 ±

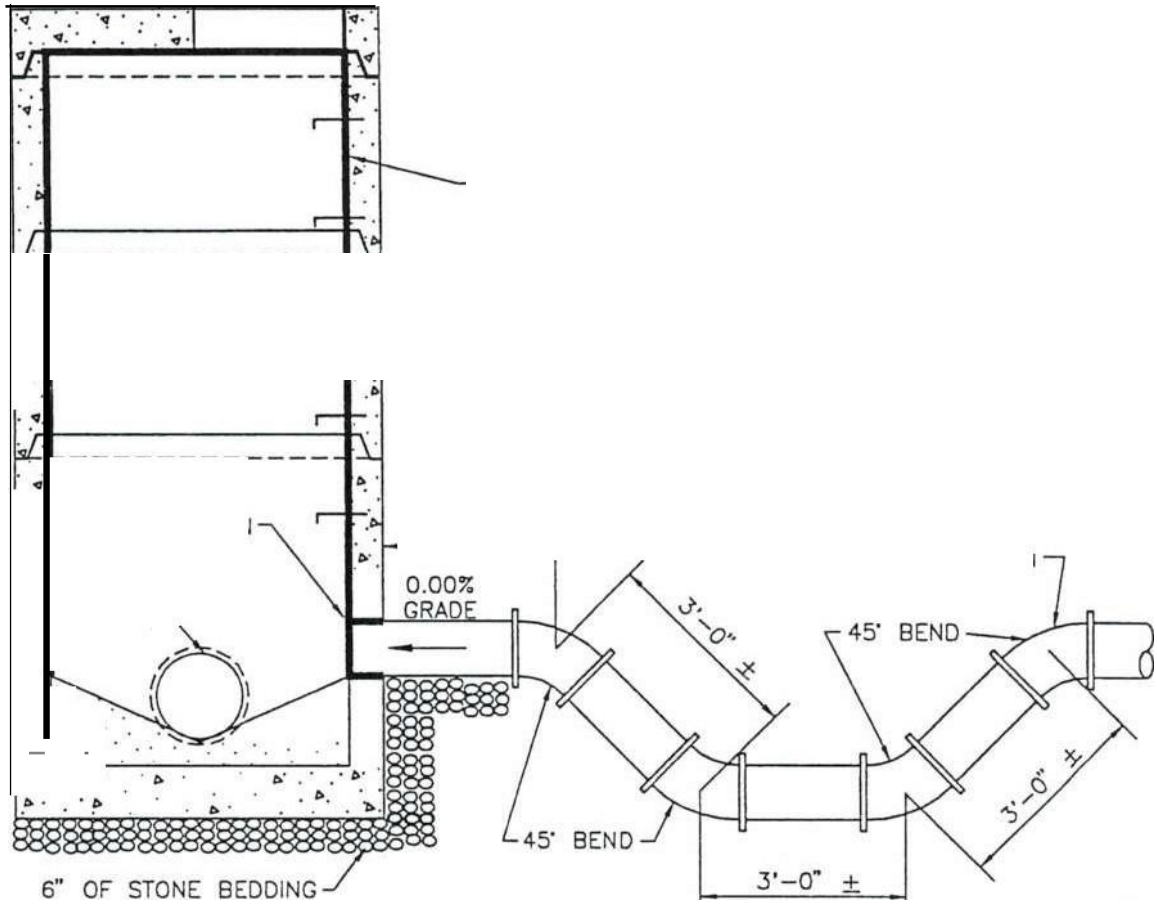
PROPOSED
FORCE **MAIN** FROM
PUMP STATION

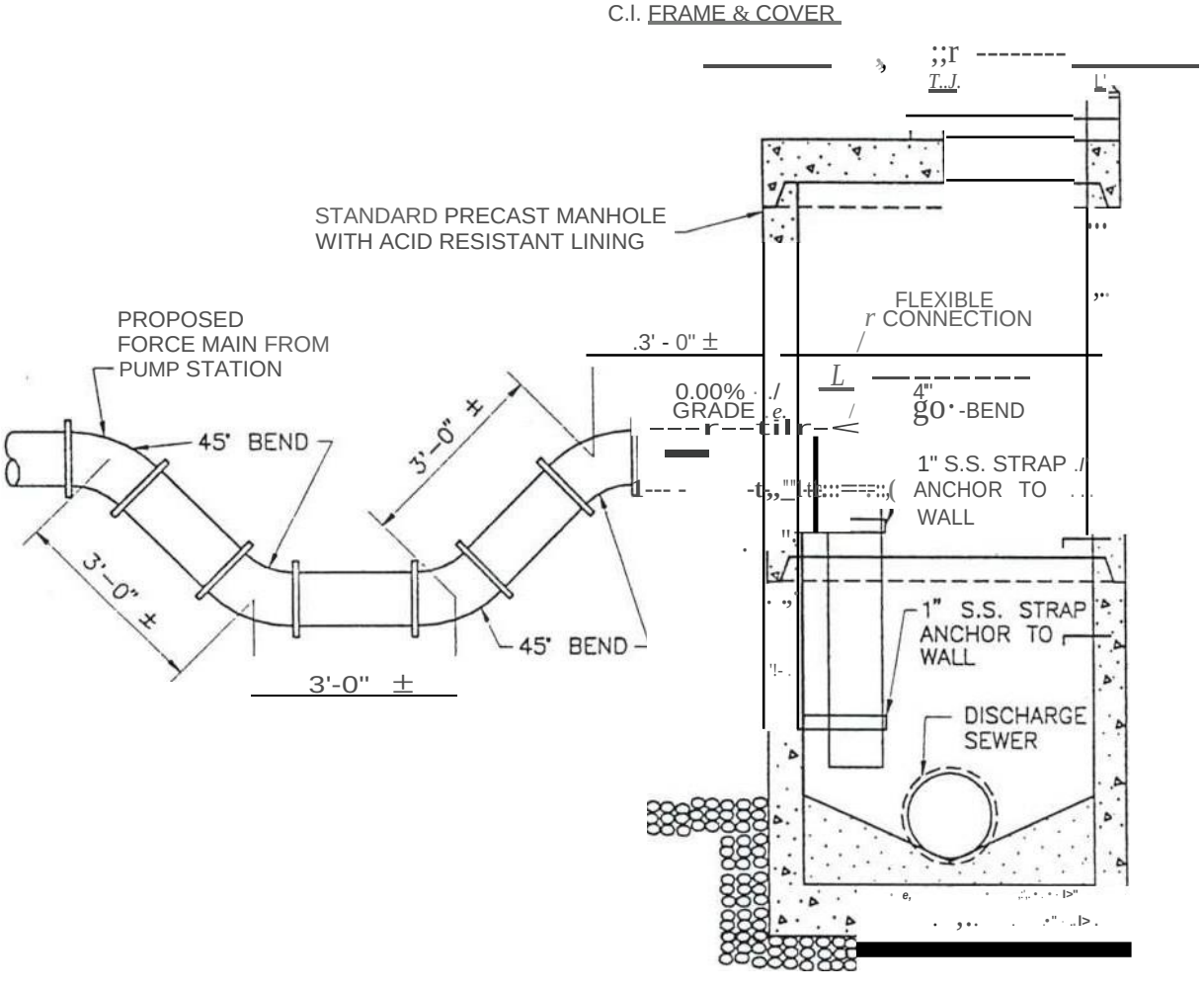
DISCHARGE
SEWER

NOTE USE SULFATE RESISTANT CEMENT TO PREPARE
MOTAR IN BUILDING INVERT & BENCH.

REVISIONS	FORCE MAIN TERMINATION AT	DRAWING NO. 705

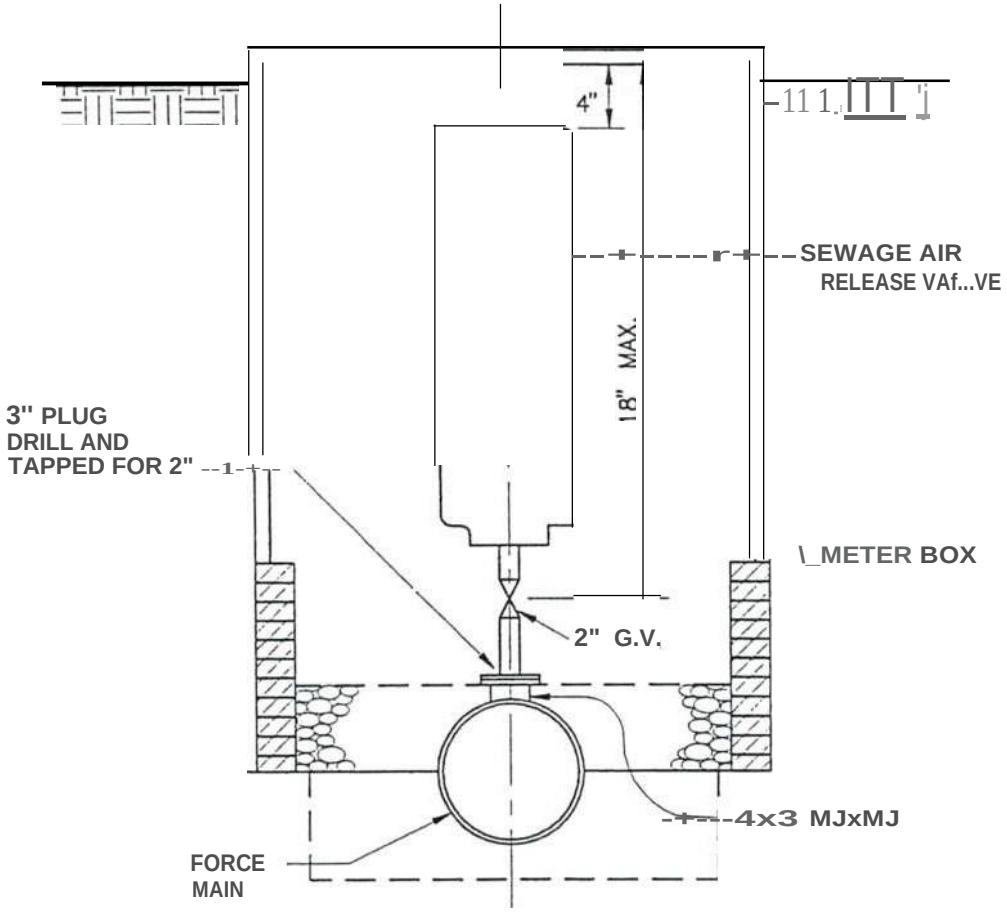
MANHOLE





REVISIONS	FORCE MAIN TERMINATION AT	DRAWING NO. 706

	MANHOLE	



REVISIONS

SEWAGE AIR RELIEF VALVE INSTALLATION

DRAWING NO.

710