Georgetown Charter Township

STANDARD

GENERAL REQUIREMENTS
AND
TECHNICAL SPECIFICATIONS

January 9, 2020

Revision Dates:
1972
1975
1989
1990
1999
2003
2006
2015
2016
2017
2018
2019

TO ALL PROSPECTIVE BIDDERS:

These STANDARD GENERAL REQUIREMENTS and TECHNICAL SPECIFICATIONS are incorporated in each Project by specific reference.

Please access latest revision dated as noted on cover page.

To access, go to www.georgetown-mi.gov and search “Specs”

2020 Amendments to Georgetown Township Spec Book

Section 02713, 2.01 Materials. Item C, Sub-item C.

Section 02713, 2.01 Materials. Item F, Sub-item 1, Sub-item A, Sub-item B.

Section 02713, 2.01 Materials. Item F, Sub-item 2, Sub-item A, Sub-item B.

Section 02713, 2.01 Materials. Item F, Sub-item 3, Sub-item A.

Section 02713, 2.01 Materials. Item N, Sub-item 3.

Section 02713, 2.01 Materials. Item N, Sub-item 10.

Section 02713, 3.02 Installation. Item D, Sub-item 2.

Section 02713, 3.02 Installation, Item D, Sub-item 3.

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DIVISION 2

DIVISION 3

DIVISION 4

DIVISION 5

SECTION 01010

SUMMARY OF

WORK

A. Materials and Equipment Furnished by OWNER:
   1. CONTRACTOR'S possession and responsibility:
      a. Starts: At time and place of pickup.
      b. Inspection: At time and place of pickup.
      c. Defective materials and equipment: Reject, notify ENGINEER.
      d. Surplus materials and equipment: Return to OWNER'S yard.
   2. Defective materials and equipment replacement:
      a. Prior to possession by CONTRACTOR: OWNER will replace.
      b. After possession by CONTRACTOR: OWNER will replace and CONTRACTOR shall remove and reinstall at no cost to OWNER.

B. Coordination with Owners of Existing Utilities:
   1. Notify all Owners that have utilities in the Work area prior to starting the Work.
      a. Call "Miss Dig" 800-482-7171.
   2. Starting the Work: After all existing utilities have been located.

C. Abbreviations:
   1. Standards:

      AASHTO: American Association of State Highway and Transportation Officials.
      ACI: American Concrete Institute.
      ANSI: American National Standard Institute.
      ASTM: American Society of Testing and Materials.
      AWS: American Welding Society.
      AWWA: American Water Works Association.
      CRSI: Concrete Reinforcing Steel Institute.
      MDEQ: Michigan Department of Environmental Quality.
      MDPH: Michigan Department of Public Health.
      MDOT: Michigan Department of Transportation.
      NEC: National Electrical Code.

D. Reference Specifications:
   1. MDOT: 1990 edition of the Standard Specifications for Construction.

SECTION 01200

PROJECT

MEETINGS

A. Preconstruction Conference:
   1. Schedule: ENGINEER will establish date and time.
      a. Place: As indicated in written notice of preconstruction conference.
   2. Attendance:
      a. OWNER
      b. ENGINEER
      c. CONTRACTOR'S superintendent.
      d. Other interested parties.

B. Progress Meetings:
   1. Schedule: At request of either OWNER or CONTRACTOR.
      a. Place: Jobsite.
   2. Attendance:
      a. OWNER
      b. ENGINEER
      c. CONTRACTOR'S superintendent.
      d. Other interested parties.

SECTION 01300

SUBMITTALS

A. Progress Schedule:
   1. General: DIVISION 0 GENERAL CONDITIONS.
      a. Coordination: With OWNER, Utility service companies and other contractors.
   2. Change in the Work or change in the Contract Time: Revise approved schedule and resubmit.
   3. Final schedule submission: Within 10 days of start of the Work.
   4. Time scale: In weeks.
   5. Number of forms: Original and 2 copies.
      a. Space for signature of approval: Include for CONTRACTOR, OWNER and ENGINEER.
   6. Distribution: After approval to CONTRACTOR, OWNER and ENGINEER.
B. Shop Drawings:
   1. General: DIVISION 0 GENERAL CONDITIONS.
      a. All shop drawings in a system or assembly must be submitted together for review at the same time.
   2. Number of forms: Number CONTRACTOR requires plus 3 for ENGINEER.
   3. Transmittal letter: Furnish.
      a. Contents:
         (1) Date.
         (2) Project title and ENGINEER'S project number.
         (3) CONTRACTOR'S name, address and telephone number of contact person.
         (4) Identification of product including model and catalog number.
         (5) Manufacturer.
         (6) Number of each shop drawing submitted.
         (7) Notification of deviations from Contract Documents.
         (8) CONTRACTOR'S signature.
   4. Additional information: Furnish on Shop Drawings.
      a. Date and revision dates.
      b. Project title and ENGINEER'S project number.
      c. CONTRACTOR'S name.
      d. Identification of product and manufacturer.
      e. Relation to adjacent structures or products.
      f. Field dimensions, identified as such.
      g. Applicable standards.
      h. Identification of deviations from Contract Documents.
      i. CONTRACTOR'S stamp of approval and signature.
   5. Distribution: After approval to CONTRACTOR, OWNER and ENGINEER.
C. Samples:
   1. General: DIVISION 0 GENERAL CONDITIONS.
   2. Number of specimens: Number CONTRACTOR requires plus 1.
   3. Transmittal letter: Furnish.

a. Contents: Same as for Shop Drawings.

4. Additional information: Furnish imprinted on specimen or specimen container.
   a. Description.
   b. Model number, type or catalog number.
   c. Manufacturer.
   d. Applicable standards.
   e. CONTRACTOR'S stamp of approval and signature.

D. Operation and Maintenance Data:
   1. Manufacturer's instructions: Furnish 4 copies prior to start up.
      a. Form: Bound and indexed.
      b. Contents:
         (1) Lubrication: Materials, frequency and procedure.
         (2) Start up instructions.
         (3) Calibration and adjustment.
         (4) Trouble shooting procedures.
         (5) Cleaning: Materials and procedures.
         (6) Parts list.
         (7) Recommended spare parts.
         (8) Source of replacement parts: Name, address and telephone number.
         (9) Special tools required.
         (10) Other pertinent data.

E. Schedule of Values:
   1. Lump sum Contract:
      a. Breakdown:
         (1) Submit within 10 days of date indicated in Notice to Proceed.
         (2) Component parts aggregating the Contract Price.
         (3) Application: Basis for progress payments and final payment.
   2. Cost of the work:
      a. General: DIVISION 0 GENERAL CONDITIONS.
      b. Records to ENGINEER: Daily.
         (1) Contents:
            (a) Work: Nature and location.
            (b) Labor: Identifying workmen, trade, time and rate.
            (c) Products: Identifying character, amount, source and cost.
            (d) Construction equipment: Identifying type, number, time and rate.

F. Material and Equipment Substitutions:
   1. General: DIVISION 0 GENERAL CONDITIONS.
   2. Reason for request: Furnish.

G. Televised Video Record of Construction Area:
   1. Video tapes: Furnish to ENGINEER.

H. Televising Interior of Pipe:
   1. Written report and video tapes: Furnish to ENGINEER within one week of completion of televising.

SECTION 01400

QUALITY CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work Included:
   1. This Section encompasses the work required for all quality control.
   2. All work necessary for completion, but not specifically listed as a pay item will be deemed to be included in one or more of the Bid Form items.

B. Method of Measurement and Basis of Payment:
   1. Fee by testing laboratory for acceptable results: Cash allowance.
   2. Inspection fees by others: DIVISION 2 EXCAVATION AND BACKFILL FOR UNDERGROUND UTILITIES.

1.02 QUALITY ASSURANCE:

A. General:
   1. Test specimen selection: By ENGINEER.
   2. Testing procedures: Current standard specified.

1.03 SUBMITTALS:

A. Test Specimens:
   1. Delivery: By CONTRACTOR to place of inspection and testing.

B. Testing Laboratory:
   1. Selection: By CONTRACTOR; approval by OWNER.

C. Certification of Quality by Producer:
   1. Delivery: To ENGINEER.

D. Certification of Welders:
   1. Delivery: To ENGINEER.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Inspection and Testing Agencies:
   1. Requirements: ASTM E329.
   2. Reporting: To ENGINEER.

PART 3 - EXECUTION

3.01 PERFORMANCE:

A. Acceptance Test and Inspection:
   1. Aggregate: Sieve analysis by testing laboratory
   2. Asphalt cement: Certification of quality by producer
   3. Asphalt mix composition:

a. Sample: ASTM D979.
b. Extraction test: AASHTO T30, AASHTO T168 and ASTM D2172.
c. Frequency: One for each 500 tons or portion thereof, each mixture placed.

4. Asphalt pavement density:
   a. Sample: ASTM D979.
   b. Comparative density tests of in-place material against laboratory specimens of the same material: ASTM D1559 and ASTM D2726.
   c. Frequency: One for each 2500 square yards or portion thereof, each mixture placed.
5. Brick and block: Visual inspection on site.
6. Cement: Certification of quality by producer.
7. Concrete:
   a. Sample: ASTM C172.
   b. Frequency: One for each 25 cubic yards or portion thereof, each class of concrete placed.
   c. Perform following from sample:
      (1) Mold 3 - 6 inch cylinders, compressive strength specimens: ASTM C31.
      (2) Slump test: ASTM C143.
      (3) Air content test: ASTM C231.
      (4) Yield test: ASTM C138.
      (5) Strength test: ASTM C39.
8. Precast manhole wall sections: Certification of quality by producer.
9. Painting:
   a. Workmanship: Visual inspection on site.
   b. Film thickness test: Gauge or yield by ENGINEER.
10. Pipe: Certification of quality by producer.
    a. Reinforced concrete pipe through 24 inch diameter: Marked to show vacuum or air test performed.
    b. Plastic pipe: Provide seating marks where couplings are used for jointing.
11. Steel (reinforcing, structural and miscellaneous): Certification of quality by producer.
12. Welding:
    a. Certification of welders as follows:
       (1) Buildings: AWS D1.0 Appendix A.
       (2) Water tanks: AWS D1.0 Appendix A.
    b. Visual on site inspection and nondestructive testing as follows:
       (1) Buildings: AWS D1.0 Appendix B.
       (2) Water tanks: AWWA D100.

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

A. CONTRACTOR'S Temporary Field Office:
   1. Facility with telephone: Provide and maintain.
B. Traffic Regulation:
   1. Protection of work and public:
      a. Materials and devices: Provide.
         (1) Maintenance: Perform.
         (2) Layout: Submit to the Ottawa County Road Commission for approval.
   2. Roadway and alley closing:
      a. Detours: Submit written plan to ENGINEER for approval.
      b. Notification: Inform police and fire departments and schools.
      c. Fire hydrant accessibility: Maintain.
   3. Emergency access: Maintain.
   4. Devices: Michigan Manual on Uniform Traffic Control Devices.
      a. Duration: Maintain until all surface restoration within road right-of-way is completed.
C. Special Controls:
   1. Sidewalks:
      a. Pedestrian traffic: Accommodate.
   2. Surface: drainage:
      a. Protection: Provide.
      b. Maintenance: Perform.
   3. Dust control: Provide.
   4. Open trench at end of day: Provide adequate barricading and signing, and enclose with fencing.
D. Water for Construction:
   1. OWNER'S system: Make application and secure approval of OWNER before using any water.
      a. Charges: Pay

SECTION 01568

SOIL EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work Included:
   1. This Section encompasses the work required for soil erosion and sedimentation control measures for the construction of underground utilities.
   2. All work necessary for completion, but not specifically listed as a pay item, will be deemed to be included in one or more of the Bid Form items.

B. Method of Measurement and Basis of Payment:
   1. Soil erosion and sedimentation control measures including permit from the County of Ottawa: Lump sum.

1.02 JOB CONDITIONS:

A. Scheduling:
   1. Clean-up: Within one week after soil erosion and sedimentation control measures are no longer needed.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. General:
   1. Adequate for purposes intended.

PART 3 - EXECUTION

3.01 PERFORMANCE:

A. Soil Erosion and Sedimentation Control Measures:
   1. Provide and maintain the following (minimum):
      a. Excavated or borrow material stockpile:
         (1) Bales of straw or approved filter fence around stockpile in a manner that prevents eroded material from entering the drainage system or leaving the site.
      b. Trench backfill in place:
         (1) Bales of straw or approved filter fabric fence across trenches, ditches and around inlets and basins to prevent eroded material from entering the drainage system or leaving the site until:
            (a) Nonpavement area has stabilized (suitable growth) and is approved by the ENGINEER.
            (b) Aggregate has been placed in bituminous and aggregate pavement areas.
            (c) Concrete has been placed in concrete pavement areas.

c. Dewatering discharge: Bales of hay or straw at point of discharge, adequately anchored.
d. Maintain measures during work and nonworking hours, if weather so requires.

SECTION 02151

SHORING

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work Included:

1. This Section encompasses the work required for all shoring.
2. All work necessary for completion, but not specifically listed as a pay item, will be deemed to be included in one or more of the Bid Form items.

B. Definitions:

1. Permanent shoring: Shoring required and authorized by ENGINEER to be left in place
2. Temporary shoring: Shoring required by CONTRACTOR for safety or convenience which may or may not be removed following installation of utility or structure.

C. Method of Measurement and Basis of Payment:

1. Permanent Shoring: Will be measured by the square foot of material remaining in completed Work.

1.02 SUBMITTALS:

A. Operational Data:

1. Permanent shoring driving schedule: Approval required.
2. Temporary showing driving and extraction schedule: Approval required.

1.03 JOB CONDITIONS:

A. Interrupted Utility Service:

1. Stand-by service: Provide prior to shoring installation to Utility Owner standards.

B. Installing and Removing Shoring by Jetting:

1. Prohibited.

C. Scheduling:

1. Clean-up:
   a. Permanent shoring: Promptly following shoring installation.
   b. Temporary shoring: Promptly following shoring installation.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Permanent Shoring:

1. Timber and lumber: MDOT 8.12.
2. Steel: MDOT 5.01.02, new.

B. Temporary Shoring:

1. Wood or steel: New or used

PART 3 - EXECUTION

3.01 PERFORMANCE:

A. Installation:

1. Shoring:
   a. Protect adjacent property.
   b. Construction methods:
      (1) Timber and lumber: MDOT 5.15.03 thru 5.15.05.
      (2) Steel: MDOT 5.01.03.
2. Temporary shoring:
   a. Pipe laying box:
      (1) Box dimensions: DIVISION 2 EXCAVATION AND BACKFILL FOR UNDERGROUND UTILITIES.
   b. Left in place: Cut off minimum 2 feet below finished grade.

3.02 QUALITY CONTROL:

A. Testing:

1. DIVISION 1 QUALITY CONTROL.

SECTION 02221

EXCAVATION AND BACKFILL FOR UNDERGROUND UTILITIES

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work Included:
   1. This Section encompasses the work required for all excavating and backfilling for the construction of underground utilities.
   2. All work necessary for completion, but not specifically listed as a pay item, will be deemed to be included in one or more of the Bid Form items.

B. Definitions:
   1. Maximum density: Maximum dry weight in pounds per cubic foot of a specific material.
   2. Optimum moisture: Percentage of water at maximum density.
   3. Rock excavation: Includes all boulders or rock weighing 4,000 pounds (approximately one cubic yard) or more and all solid or ledge rock, slate, shale, sandstone, and other hard materials that require continuous use of pneumatic tools, heavy rippers, or continuous drilling and blasting for removal. Pavement not included.
   4. Suitable excavated material: Free of cinders, ashes, refuse, sod, vegetable or other organic material, boulders, rock or pavement.
   5. Unsuitable material:
      a. Clay, muck, silt and organic content soils and highly saturated plastic soils when encountered under existing or proposed pavement.
   6. Backfill terminology: Article 3.04 SCHEDULES.

C. Method of Measurement and Basis of Payment:
   1. Crossing other jurisdictions: Final inspection cost by OWNER.
   2. Alterations of conflicting underground utilities: Payment by OWNER.
   3. Rock excavation: Will be measured by profiling the rock surface and computing minimum volume required to install the proposed utility and paid for by the cubic yard.
   4. Special foundation material: Will be measured along the centerline of the utility and paid for the linear foot.
   5. Unsuitable material replacement in Trench Area: Will be measured along the centerline of the utility and paid for by the linear foot.

1.02 JOB CONDITIONS:

A. Blasting:
   1. Hours: Fixed by ENGINEER where permitted by law.

B. Length of Open Trench:
   1. Maximum: 200 feet in public right-of-way and 400 feet elsewhere

C. Protection of Existing Underground Utilities:
   1. Report all damage to Utility Owner and arrange for repair.

D. Surface Erosion and Sedimentation Control:
   1. DIVISION 1 SOIL EROSION AND SEDIMENTATION CONTROL.

E. Interrupted Utility Service:
   1. Notice: 24 hours in advance to occupants giving time and duration.

2. Stand-by service: As required by Utility Owner.

F. Other Jurisdictions:
1. Comply with permit requirements.

G. Scheduling:
1. Clean-up: Promptly following backfilling operations.

H. Dust Control:
1. Broom or apply dust control materials.

PART 2 PRODUCTS

2.01 MATERIALS:

A. Backfill:
1. Special Foundation Area and Bedding Area:
a. Granular material: Any of the following except as noted:
(1) MDOT 8.02.06, Class II limited to 1 inch maximum size.
(2) Pea gravel meeting following requirements:

Sieve Size	Total Percent Passing
½”	100
3/8”	95-100
#4	30-65
#8	0-10
Percent loss by washing	0-1

(3) MDOT 8.02.06, Class I: For sewer pipe underdrain only.
(a) DIVISION 2 STORM DRAINAGE COLLECTION SYSTEM.
b. Suitable excavated material meeting granular material requirements.
2. Trench Area:
a. Under pavement:
(1) Suitable excavated material: MDOT 8.02.06, Class I or Class II.
b. Under nonpavement:
(1) Suitable excavated material.

PART 3 - EXECUTION

3.01 PERFORMANCE:

A. Excavation:
1. General:
a. Surplus and unsuitable material: Property of CONTRACTOR for disposal.
b. Unsuitable material below Bedding Area: Notify ENGINEER and obtain instructions.
c. Storage: Avoid property damage.
2. Utility pipe:
a. Depth: Provide a uniform and continuous bearing and support.
b. Width:

(1) Minimum: Allow space for jointing and bedding.
(2) Maximum at utility pipe crown:
(a) 6 thru 10 inch pipe: 30 inches.
(b) 12 thru 30 inch pipe: Inside diameter plus 24 inches.
(c) 30 inch pipe and larger: Outside diameter plus 24 inches.
(d) Elliptical pipe: Use springline dimension for diameter.

c. Minimum clearance in rock: 6 inches below and 12 inches on each side of utility pipe.

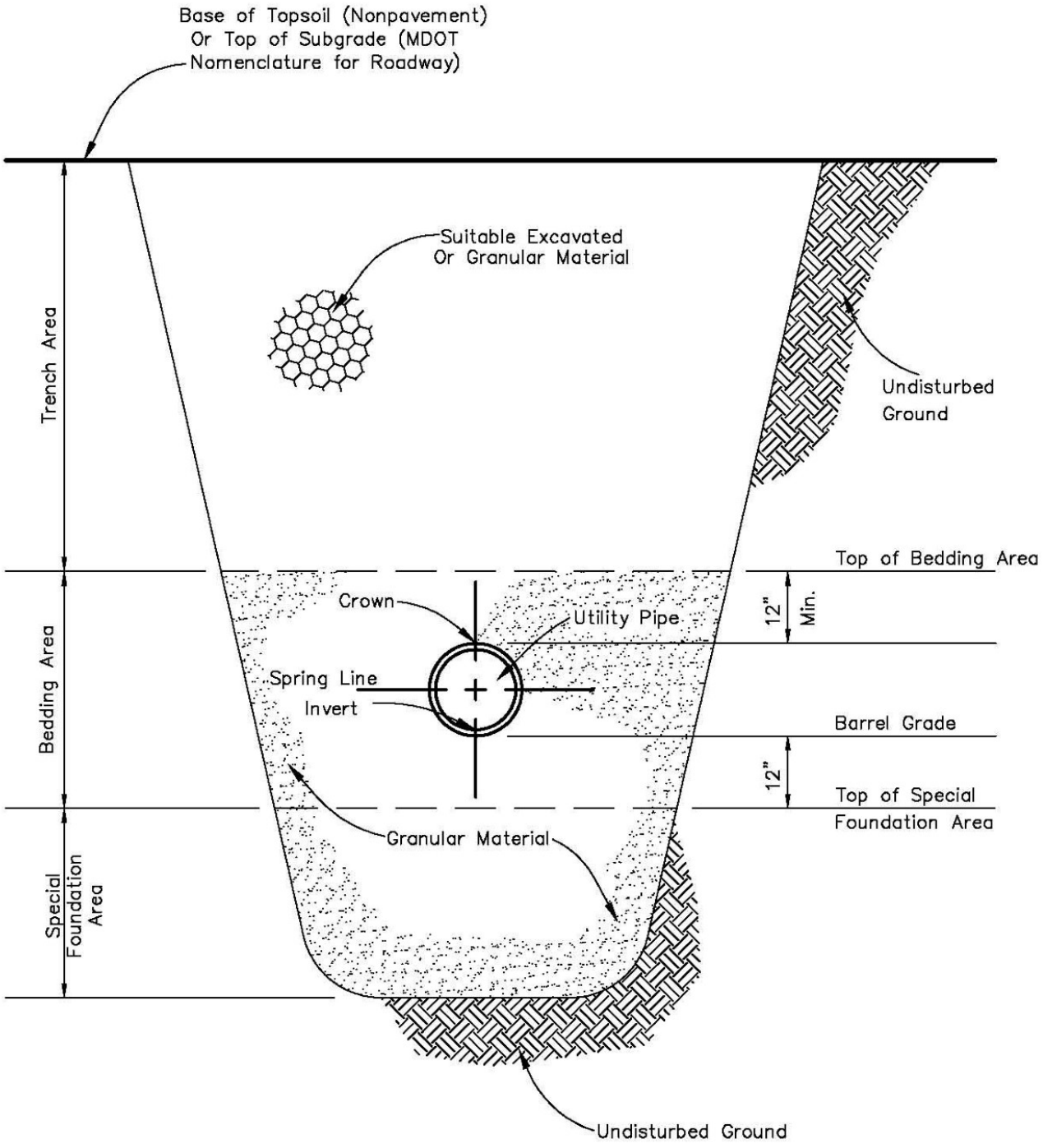
3. Utility structures:
a. Clearance in rock: 6 inches below and 12 inches horizontally.

B. Backfill:
1. General: Place backfill around utility structures only after 75 percent of concrete design strength has been reached.
2. Compaction:
a. Special Foundation Area and Bedding Area: Compact granular material to 95 percent of maximum density in layers not exceeding 12 inches.
b. Trench Area:
(1) Under pavement and undercut existing structures: Compact suitable excavated material to 95 percent of maximum density in layers not exceeding 12 inches.
(2) Under nonpavement areas: Compact suitable excavated material to 90 percent of maximum density.
(3) Under existing utility: Compact suitable excavated material to 95 percent of maximum density in layers not exceeding 12 inches.

3.02 QUALITY CONTROL:
A. Testing and Inspection:
1. General:
a. Observation: By ENGINEER.
2. Compaction testing:
a. Taken at various levels as determined by ENGINEER, during and after backfilling operations.
b. Performance and test equipment: By ENGINEER.
c. Maximum density: ASTM D698 (Standard Proctor).
d. Access to test location and depth: Furnish equipment and personnel.

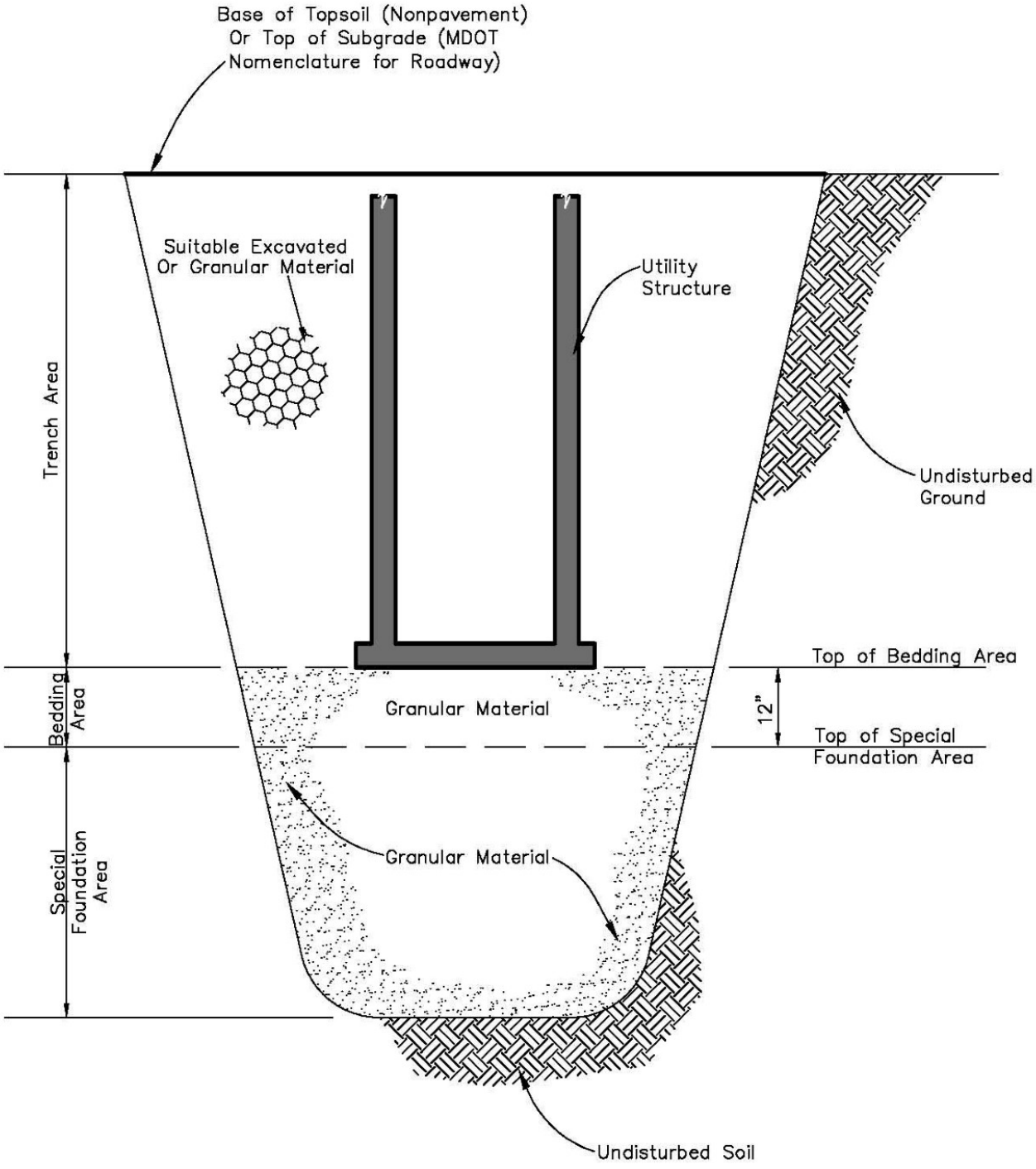
3.03 SCHEDULES:
A. Standard Details:
1. Backfill terminology for utility pipe. 5.
2. Backfill terminology for utility structure. 6.

3.03 SCHEDULES



BACKFILL TERMINOLOGY FOR UTILITY PIPE

3.03 SCHEDULES



BACKFILL TERMINOLOGY FOR UTILITY STRUCTURE

SECTION 02345

CASING

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work Included:
   1. This Section encompasses the work required for the installation of all casing for the construction of underground utilities.
   2. All work necessary for completion, but not specifically listed as a pay item, will be deemed to be included in one or more of the Bid Form items.

B. Method of Measurement and Basis of Payment:
   1. Crossing other jurisdictions: Final inspection cost by OWNER.
   2. Alterations of conflicting underground utilities: Payment by OWNER.
   3. Casing: Will be measured along the centerline of casing and paid for by the linear foot.
      a. No additional payment will be made for length of casing in excess of the Bid Form item quantity unless authorized by ENGINEER prior to installation.

1.02 JOB CONDITIONS:

A. Other Jurisdictions:
   1. Comply with permit requirements.

B. Scheduling:
   1. Clean-up: Promptly following casing and utility installation.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Pipe:
   1. Steel, ASTM A139, Grade B, minimum yield strength 35,000 psi.

B. Joints:
   1. Welded, water tight.

PART 3 - EXECUTION

3.01 PERFORMANCE:

A. Casing Pipe Extended in Open Trench:
   1. Place at line and grade to accommodate underground utility.

B. Bore and Jack Casing:
   1. Jacking pit: Provide tight-sheeting as necessary.
   2. Augering: Maintain within casing.

SECTION 02401

DEWATERING

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work Included:

1. This Section encompasses the work required for all dewatering for the construction of underground utilities.
2. All work necessary for completion, but not specifically listed as a pay item, will be deemed to be included in one or more of the Bid Form items.

1.02 SUBMITTALS:

A. Operation Data:

1. Procedure method: Approval required.

1.03 JOB CONDITIONS:

A. Private Wells:

1. Interruption: Notify OWNER.
2. Responsibility:
   a. If township project – owner responsibility
   b. If private project – developer responsibility

B. Dewatering Disposal:

1. To OWNER'S storm drainage collection system: Permission required.
2. To OWNER'S sanitary sewage collection system: Prohibited.
3. Surface erosion and sedimentation control: DIVISION 1 SOIL EROSION AND SEDIMENTATION CONTROL.

C. Scheduling:

1. Clean-up: Promptly following termination of dewatering operations.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT:

A. General:

1. Adequate for purposes intended.

PART 3 - EXECUTION

3.01 PERFORMANCE:

A. General:

1. Insure dry working conditions until utility is completed.

B. Hydraulic stressing of structures:

1. Prevent.

3.02 REMOVAL:

A. Plugging of Dewatering Wells:

1. Procedure: As approved in writing by the MDPH.

3.03 QUALITY CONTROL:

A. Dewatering:

1. By firm(s) qualified and specializing in such work.

SECTION 02440

SITE IMPROVEMENT PROTECTION, REMOVAL AND RESTORATION

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work Included:

1. This Section encompasses the work required for all site improvement protection, removal and restoration for the construction of underground utilities.
2. All work necessary for completion, but not specifically listed as a pay item, will be deemed to be included in one or more of the Bid Form items.

B. Definitions:

1. Site improvements: Street, highway and parking appurtenances, fences, mailboxes and playing field and yard accessories.
   a. Mailbox removal and replacement: Removal, temporary location(s) and resetting to approximate original location.

C. Method of Measurement and Basis of Payment:

1. Mailbox removal and replacement: Lump sum.

1.02 JOB CONDITIONS:

A. Scheduling:

1. Restoration: Promptly following backfilling operations.
2. Clean-up: Promptly following site improvement restoration.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:

1. All materials provided shall be equal to or better than existing prior to the start of construction. Approval by ENGINEER required for material(s) substantially different from existing.
   a. Mailbox posts: Rotted or corroded posts shall be replaced with new posts furnished by OWNER.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Inspection:

1. Applicable item: Approval required.

3.02 PERFORMANCE:

A. General:

1. Removal: Only as necessary for construction.

2. Protection: Preserve all items removed until replaced.

B. Mailbox Removal and Replacement:
   1. Temporary location: As approved by the ENGINEER.
      a. Mount for convenient use by postal department.
   2. Permanent location:
      a. Face of mailbox:
         (1) Bituminous or concrete roadway:
            (a) With shoulder (aggregate or paved): At edge of shoulder.
            (b) Without shoulder: 6 inches back of roadway.
         (2) Aggregate roadway: At edge of roadway.
      b. Base of mailbox: 4 feet above edge of shoulder or roadway.
      c. Anchorage: Provide.

3.03 QUALITY CONTROL:

A. Restoration:
   1. By firm(s) qualified and specializing in such work.

SECTION 02480

LANDSCAPE PROTECTION, REMOVAL AND RESTORATION

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work Included:
   1. This Section encompasses the work required for all landscape feature protection, removal and restoration for the construction of underground utilities.
   2. All work necessary for completion, but not specifically listed as a pay item, will be deemed to be included in one or more of the Bid Form items.

B. Definitions:
   1. Landscaping: Trees, shrubs, ground cover plants and lawn.
   2. Clearing and grubbing: Cutting and disposing of trees, stumps, brush and other vegetations.
   3. Tree and stump removal: Cutting and disposing selected trees and stumps not included in a clearing and grubbing area.

C. Method of Measurement and Basis of Payment:
   1. Sodding: Will be measured along centerline of utility and paid for by the linear foot.
   2. Clearing and grubbing: Will be measured along centerline of utility and paid for by the linear foot.
   3. Tree removal: Trees removed 8 inches in diameter and larger will be counted and paid for by the unit.
   4. Stump removal: Stumps removed 8 inches in diameter or larger will be counted and paid for by the unit.

1.02 SUBMITTALS:

A. Topsoil:
   1. Analysis: Certification of suitability by local agricultural agent.

B. Seed:
   1. Analysis: Certification of purity and germination by producer.

C. Trees and Shrubs:
   1. Source and species: Certification by producer.

1.03 JOB CONDITIONS:

A. Lawn Areas:
   1. Restoration:
      a. Street rights-of-way: By seeding unless otherwise noted on Drawings or directed by ENGINEER.
      b. Private property: By sodding.

B. Nonlawn Areas:
   1. Restoration: By seeding unless otherwise noted on Drawings or directed by ENGINEER.

C. Seasonal Limitations:
   1. Trees and shrubs: Spring and Fall; MDOT 6.50.05.
   2. Sodding: MDOT 6.53.08.

3. Seeding: Spring, Summer and Fall: MDOT 6.53.05c.

D. Scheduling:
1. Restoration: Promptly following the utility installation or as soon as allowed by seasonal limitations.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Trees, Shrubs and Plants:
1. MDOT 8.21.01.

B. Chemical Fertilizer:
1. MDOT 8.21.10.
a. Available Nitrogen by weight: 12 percent.
b. Available Phosphoric Acid by weight: 12 percent.
c. Available Potash by weight: 12 percent.

C. Grass Seed:
1. MDOT 8.21.09:
a. Lawn areas: Mixture Class A.
b. Nonlawn areas: Mixture Roadside.

D. Sod:
1. MDOT 8.21.12.
a. Lawn areas: Class A.
b. Nonlawn areas: Class B.

E. Mulch:
1. MDOT 8.21.11.

F. Pegs:
1. MDOT 8.21.12d.

G. Topsoil:
1. MDOT 6.50.02a: Free of stones and rocks over ½ inch in diameter and as approved by ENGINEER prior to spreading.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Inspection:
1. Beds, pits and trenches: Approved required.

3.02 PERFORMANCE:

A. General:
1. Removed vegetation: Property of CONTRACTOR for disposal.
a. Burning on site: Prohibited.
b. Disposal: Offsite.

B. Clearing and Grubbing:
1. Removal: Only where indicated on the Drawings.

a. Cut off remaining stumps at an elevation of not more than 4 inches above existing ground level.

C. Trees and Stumps:
1. Removal: Only items indicated on Drawings or authorized by ENGINEER.
2. Protection: All items not authorized by the ENGINEER for removal and all salvaged items to be replanted.
3. Damaged branches: Trim and seal within 15 days.
4. Replacement:
a. Construction methods: MDOT 6.50.03 thru 6.50.14

D. Shrubs and Plants:
1. Removal: Only as necessary for construction.
2. Protection: All items not removed and salvaged items to be replanted.
3. Damaged items: All items removed unless otherwise directed by ENGINEER.
4. Replacement: All items removed unless otherwise directed by ENGINEER.
a. Construction methods: MDOT 6.50.03 thru 6.50.14.

E. Topsoil, Seed, Fertilizer and Mulch:
1. Topsoil: May be salvaged and reused if it meets the requirements of ARTICLE 2.01 MATERIALS.
2. Construction methods: MDOT 6.53.03 thru 6.53.07 and 6.53.09.
a. Topsoil: Minimum 4 inches thick.
b. Grass seed:
(1) Lawn areas: 4 pounds per 1,000 square feet.
(2) Nonlawn areas: 3 pounds per 1,000 square feet.
c. Chemical fertilizer: 10 pounds per 1,000 square feet.
d. Mulch: 150 pounds per 1,000 square feet.
(1) Adhesive: Required.
e. Hydro-seed-mulch: Allowed.

F. Sodding:
1. Construction methods: MDOT 6.53.03, 6.53.08 and 6.53.09.
2. Pegs: MDOT 6.53.08.

3.03 QUALITY CONTROL:

A. Restoration:
1. By firm(s) qualified and specializing in such work.

SECTION 02580

PAVEMENT REMOVAL AND RESTORATION

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work Included:
   1. This Section encompasses the Work required for all pavement removal and restoration for the construction of underground utilities.
   2. All work necessary for completion, but not specifically listed as a pay item, will be deemed to be included in one or more of the Bid Form items.

B. Definitions:
   1. Pavement: All improved surfaces or roadway, highway, shoulder, parking lot, alley, curb, sidewalk, curb and gutter, gutter pan, driveway and respective supporting foundations.
   2. Permanent pavement: All improved surfaces above the quality of treated or untreated aggregate (gravel).
   3. Dirt driveway and roadway: Considered aggregate surface for restoration purposes.
   4. Temporary surface: Any surface used for pedestrian or vehicular traffic prior to the restoration of pavement.
   5. Payment information: Article 3.04 SCHEDULES.

C. Method of Measurement and Basis of Payment:
   1. Permanent pavement removal and restoration: Will be measured along the centerline of utility and paid for by the linear foot of the pavement classification vertically above.
      a. Exceptions:
         (1) Parallel utilities: Considered a single utility where less than 11 feet apart center to center.
         (2) Sidewalk, curb, gutter pan and curb and gutter:
            (a) Crossing of pavement: Will be counted and paid for by the crossing.

1.02 JOB CONDITIONS:

A. Seasonal Limitations:
   1. Removal of permanent pavement: March 15 to October 15.
   2. Restoration of permanent pavement: April 15 to November 15.

B. Scheduling:
   1. Restoration of pavement: Within 35 days of utility installation.
   2. Clean-up: Promptly following pavement restoration.

C. Other Jurisdictions:
   1. Comply with permit requirements.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Aggregate Base:
   1. MDOT 8.02, 22A aggregate.

B. Aggregate Surface and Shoulder:
   1. MDOT 8.02, 22A or 23A aggregate.
C. Prime Coat:
   1. MDOT 8.04.03, MS-Op.
D. Bond Coat:
   1. MDOT 8.04.03, SS-1h.
E. Bituminous Base:
   1. MDOT 7.10. Mixture No. 700, 20C aggregate, asphalt cement penetration grade 120-150.
F. Bituminous Leveling Course: MDOT 7.10, Mixture 1100L, 20AA aggregate, asphalt cement penetration grade 85-100.
G. Bituminous Top Course:
   1. MDOT 7.10, Mixture No. 1100T, 20AA aggregate, asphalt cement penetration grade 85-100
H. Temporary Bituminous Patch:
   1. MDOT 7.11, Mixture CP-1.
I. Concrete:
   1. MDOT 7.01, 3500 psi air entrained.
      a. Roadway, highway and driveway: Grade 35HE.
      b. Curb, gutter pan, curb and gutter and sidewalk: Grade 35HE, 35S or 35P.
J. Concrete Joint:
   1. Filler: MDOT 8.16.03.
   2. Sealant: MDOT 8.16.04a.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Inspection:
   1. Base and subbase: Approval required.

3.02 PERFORMANCE:

A. Existing Pavement:
   1. Removal limits for permanent pavement:
      a. Maintain a minimum of 12 inches between edges of remaining pavement and excavation.
      b. Remove to edge or joint where remnant is less then 3 feet.
      c. Curb, gutter pan, curb and gutter and sidewalk: Remove to a joint.
   2. Cutting permanent pavement: Saw vertically in straight line at right angles or parallel to pavement centerline.
      a. Driveway: Sawcut full width of driveway unless otherwise directed by ENGINEER.
   3. Concrete surface: Breaking with a crane and ball pavement breaker or equivalent is prohibited.
   4. Removed pavement: Property of CONTRACTOR for disposal.
B. Temporary Surface:

1. Maintenance: Perform until pavement is in place.

C. Aggregate Base:
   1. Restoration thickness compacted: 6 inches.
   2. Construction methods: MDOT 3.01.04 thru 3.01.07b and 3.01.08.
      a. Vibratory roller: Prohibited.

D. Aggregate Surface:
   1. Restoration thickness compacted: 6 inches.
   2. Construction methods: MDOT 3.08.09 thru 3.08.11.
      a. Vibratory roller: Prohibited.

E. Aggregate Shoulder:
   1. Restoration thickness compacted: 4 inches.
   2. Construction methods: MDOT 3.09.03 thru 3.09.06, Class A.
      a. Vibratory roller: Prohibited.

F. Prime Coat:
   1. General: Required with complete pavement restoration.
   2. Rate of application: 0.25 gallons per square yard.
   3. Construction methods: MDOT 4.00.08.

G. Bond Coat:
   1. Rate of application: 0.05 gallons per square yard.
   2. Construction methods: MDOT 4.00.08.

H. Bituminous Base:
   1. Density requirements: Minimum density of in place material shall be 95 percent of recorded laboratory specimen density.
   2. Restoration thickness: 4 inches, single course.
   3. Construction methods: MDOT 4.00.04 thru 4.00.06 and 4.00.09 thru 4.00.14.
      a. Vibratory roller: Prohibited.

I. Bituminous Leveling and Top Courses:
   1. Density requirements: Minimum density of in place material shall be 95 percent of recorded laboratory specimen density.
   2. Restoration thickness: Refer to Project Technical Specifications.
   3. Construction methods: MDOT 4.00.04 thru 4.00.06 and 4.00.09 thru 4.00.14.
      a. Vibratory roller: Prohibited.
      b. Paver speed: Shall not exceed 90 feet per minute unless written permission to exceed this rate is obtained from ENGINEER.

J. Temporary Patch:
   1. Restoration thickness:
      a. 4 inches with 6 inch aggregate base.
      b. 4 inches with 4 inch bituminous base.
   2. Construction methods:
      a. Vibratory roller: Prohibited.

K. Concrete Surface:
   1. Restoration section:
      a. Roadway, driveway, parking lot and alley: 6 inches, nonreinforced.
      b. Curb, gutter pan and curb and gutter: OWNERS' standards.

c. Sidewalk:
(1) At driveway and alley: 6 inches, nonreinforced.
(2) Remaining areas: 4 inches, nonreinforced.

2. Construction methods:
a. Roadway, driveway, parking lot and alleys: MDOT 4.50.05, 4.50.06, 4.50.08, 4.50.11 thru 4.50.14, 4.50.16, 4.50.17, 4.50.21 and 4.50.22.
b. Curb, gutter pan and curb and gutter: MDOT 6.09.03 thru 6.09.11.
(1) Expansion joint: Locate at springline of return, at junction with existing pavement and every 100 feet.
(2) Plane of weakness joint: Locate every 10 feet.
c. Sidewalk: MDOT 6.11.03 thru 6.11.07 and 6.11.09.
(1) Expansion joint: Locate at junction with existing pavement and every 50 feet.
(2) Plane of weakness joint: Locate every 5 feet.

3.03 QUALITY CONTROL:

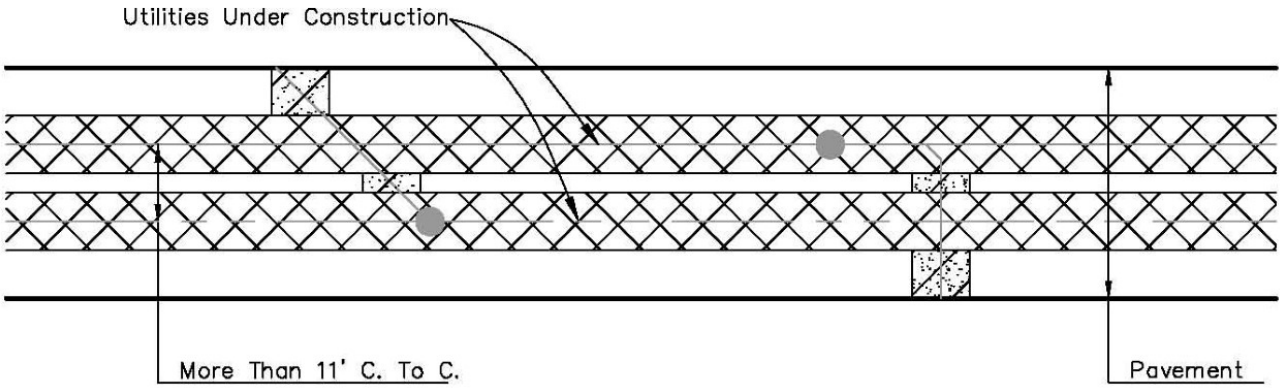
A. Testing and Inspection:
1. General:
a. Observation: By ENGINEER.
b. Acceptance testing: DIVISION 1 QUALITY CONTROL.

B. Restoration:
1. By firm(s) qualified and specializing in such work.

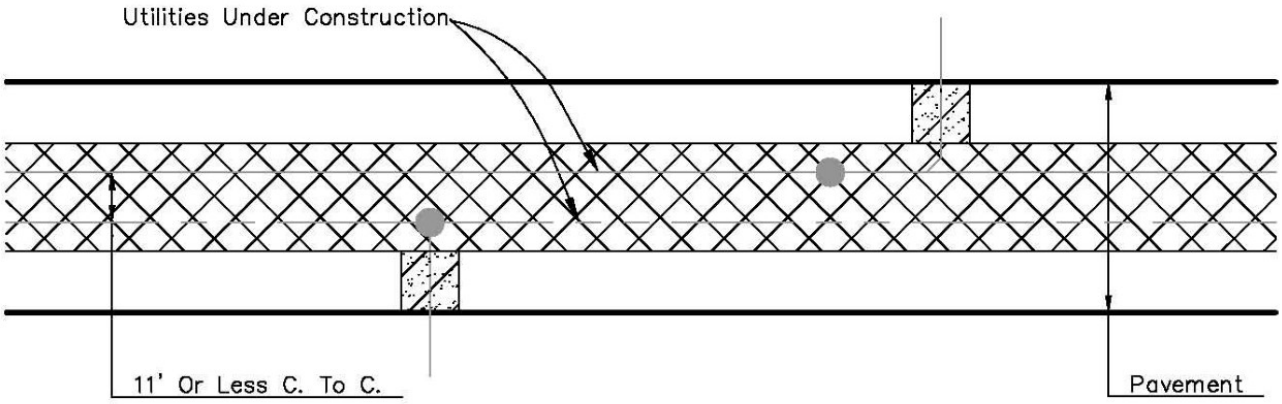
3.04 SCHEDULES:

A. Standard Details:
1. Payment information. 5.

3.04 SCHEDULES



PLAN VIEW



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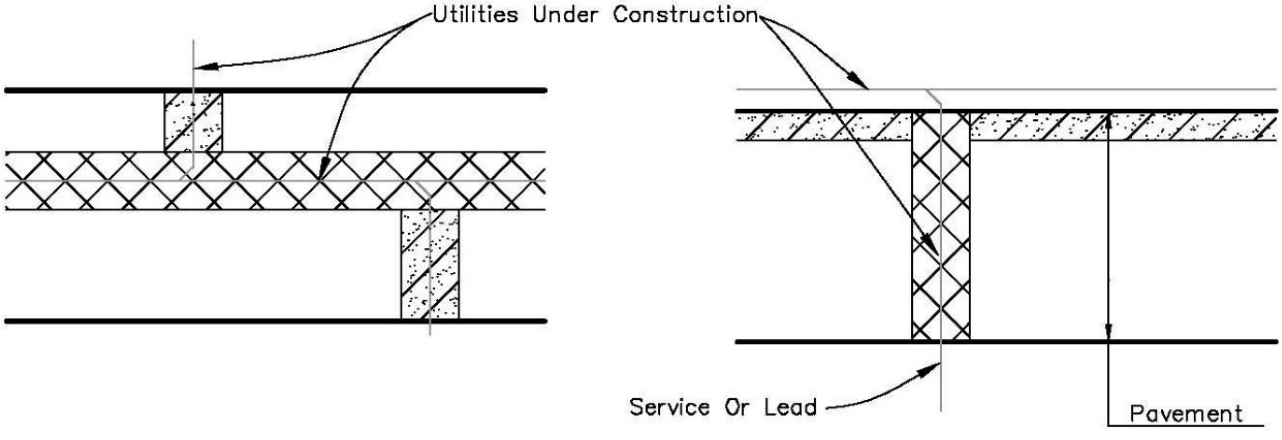
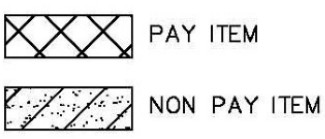


PLAN VIEW

PAYMENT INFORMATION



SECTION 02713

WATER DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work Included:
   1. This Section encompasses the work required for all water distribution systems.
   2. All work necessary for completion, but not specifically listed as a pay item, will be deemed to be included in one or more or the Bid Form items.

B. Definitions:
   1. Fittings: Bend, offset, reducer, increaser, cross, tee, hydrant tee, sleeve, plug, adaptor, cutting-in sleeve and cutting-in tee.
   2. Hydrant lead: Considered as part of the hydrant for payment purposes.
   3. Witnesses: Horizontal measurements to 3 permanent surface features.

C. Method of Measurement and Basis of Payment:
   1. Water line: Will be measured on the surface along the centerline of water line and paid for by the linear foot.
   2. Service line: Will be measured on the surface along the centerline of the service line from the centerline of water and paid for by the linear foot.
   3. Corporation stop, curb stop and box: Will be counted as a unit and paid for by the unit.
   4. Double strap service saddle: Will be counted and paid for by the unit.
   5. Water line through casing: Will be measured on the surface along the centerline of water line and paid for by the linear foot.
   6. Valve and box and valve and chamber: Will be counted as a unit and paid for by the unit.
   7. Tapping sleeve, tapping valve and box: Will be counted as a unit and paid for by the unit.
   8. Hydrant: Will be counted and paid for by the unit.
   9. Hydrant extension: Will be measured and paid for by the vertical linear foot.
      a. Valve box extension: Incidental to hydrant extension.
      b. Extended valve operator: Supplied by OWNER.
      c. An extended operator will be used if valve is greater than 6’ below grade.
   10. Fitting: Will be counted and paid for by the unit.
   11. Polyethylene encasement: Will be measured on the surface along centerline of water line and paid for by the linear foot.
      a. Fittings, valves, hydrants, leads, etc., payments incidental to appurtenances.
   12. Salvage plug and connect to existing water line: Will be counted as a unit and paid for by the unit.
   13. Salvage and reset hydrant: Will be counted as a unit and paid for by the unit.
   14. Salvage and reset valve and box: Will be counted as a unit and paid for by the unit.
   15. Salvage fitting: Will be counted and paid for by the unit.
   16. Salvage fitting and reuse: Will be counted as a unit and paid for by the unit.
   17. Access structure: Will be counted as a unit and paid for by the unit.
   18. Trace wire/test stations: incidental to water main.

1.02 SUBMITTALS:

A. Valve and Hydrant Drawings:

1.02 Submittals:

A. Valve and hydrant drawings:
   1. Division 1 submittals
B. Connection to existing water line:
   1. Detail for each: approval required
C. Service line witnesses:
   1. Curb stop box and chamber: report on record drawings
D. Water line witnesses:
   1. End of water line: report on record drawings
   2. Fitting for future extension: report on record drawings
   3. Fitting for future extension: report on record drawings
E. Flushing, pressure, leakage, and chlorination procedures:
   1. Equipment, materials, and method: approval required
F. Field Information required:
   1. Type of pipe, material list
   2. Valve box witnessed for all line valve
   3. Stopbox witnessed to each lot's property corner
   4. Tap location witness in cul-de-sacs and all other abnormal locations
   5. Bend witness
   6. Hydrant detail
   7. Any and all changes from proposed plan
G. As-Built Requirements

   Design engineering is to provide:

   1) "Preliminary "As-Builts":
      a) 2 paper copies of completed "preliminary" as-builts for Township review and approval and transfer of Township inspector field information. Township will contact design regarding needs and acceptance of.
   2) Final "As-Builts" filing requirements:
      a) 1 paper copy of final
      b) 1 flash drive of "As-Builts", entire project

1.03 Job Conditions:

A. Interrupting water service:
   1. Existing valve operation: by owner's employees only
   2. Contamination of existing water system: prevent
B. Scheduling:
   1. Service line installation: after testing of water line
   2. Clean-up: promptly following backfilling operations

PART 2 – PRODUCTS

2.01 Materials:

A. General: all materials shall be American or Canadian made unless otherwise allowed in the Project Technical Specifications
B. Water Line Pipe:
   1. General: any of the following materials except where specific materials are indicated on the drawings or in the Project Technical Specifications
   2. Ductile iron: ANSI/AWWA C151/A21.51
      a. Thickness: ANSI/AWWA C150/A21.50, Class 52
   3. Plastic (PVC): AWWA C900, AWWA C905 and AWWA C909
      a. Outside diameter: identical to outside diameter of cast iron and ductile iron pipe.
      b. Color: blue

c. Pressure rating or dimension ratio (DR):
(1) 6 thru 10 inch – AWWA C900 or C909: pressure rating 200 pounds per square inch (psi) or 150 psi, DR 14 or 18
(2) 12 inch – AWWA C909: pressure rating 200 psi or 150 psi
(3) 16 inch and larger – AWWA C905/C909: DR 18 or 14
(4) "NSF-PW" with SDR rating 18 or less stamped on pipe

C. Hydrant lead:
1. Anchoring coupling and pipe:
a. Ductile iron: ANSI/AWWA C151/A21.51
(1) Thickness: ANSI/AWWA C150/A21.50, Class 52
(2) Clow Corporation #F-1211, #F-1215, #F-1216 or equal
b. Swivel 90 degrees elbow:
(1) GLOW F-1218 Anchoring Elbow
(2) Tyler 5-197 Swivel x Swivel ELL
c. On a permanent dead end needs 20' of ductile iron and to be the same size or the main line layed.

D. Service Line Pipe:
1. Copper ASTM B-88, Type K, annealed and soft temper

E. Water Line Valve:
1. Gate valve: (open right)
a. "Flowmaster" resilient wedge, EJIW NSA/AWWA C515, C509
b. "Metroseal" 250 Resilient Gate, U.S. Pipe, C509, USPO Series Resilient Wedge
2. Butterfly: AWWA C504, Class 150B, cast iron short body, cast iron disc, worm gear or traveling nut operator for direct burial; Henry Pratt Company, Groundhog or equal

F. Service Line Valve:
1. Coproation stop:
a. 1 inch size flared: Ford Meter Box Company, Inc. F600 or equal
b. 1 ½ inch and 2 inch compression: Ford Meter Box Company Inc., FB1000 compression fitting with CTS pack joint
2. Curb Stop
a. 1 inch flared: Ford Meter Box Company Inc., FB600 or equal
b. 1 ½ & 2 inch compression: Ford Meter Box Company Inc., B44-666-NL, B44-777-NL or equal.
3. Curb Box Lock
a. The Vadle Curb Box Lock or equal.

G. Valve Box:
1. Gate and butterfly valves
a. Standard: cast iron, screw type; Tyler Pipe 6860 Series, Item D or equal.
(1) Lid: imprinted with the word WATER

H. Curb Box:
1. Standard: cast iron, screw type; Tyler Pipe 6500 Series, Item 95-E, or equal

I. Hydrant:
1. Standard: AWWA C502, 5 inch size, 2-2 ½ inch hose nozzles and 1-4 ½ inch pumper nozzle; EJIW 5-BR model 250, hydrant #55425D WITHOUT EAR CHAINS

J. Valve Chamber and Access Structure:
1. Concrete: Class B, DIVISION 3 CAST-IN-PLACE CONCRETE
2. Grade ring: ASTM C478
3. Wall section: Precast; ASTM C478
a. Joint: Rubber O-ring: ASTM C443
4. Concrete base: Precast
5. Mortar: ASTM C270, Type S
6. Chamber steps:
a. Plastic: Reinforced with 3/8 inch steel rod and dimensioned as cast iron.
7. Chamber and access structure casting: EJIW 1045, Type C Cover or equal.
a. Cover: Imprinted with the word WATER

8. Expansion joint material: fiber or cellular, asphalt sealed with bituminous mastic.

K. Service Saddle:
   1. Standard: single or double strap with AWWA C800 threads
      a. Ductile iron, cast iron and asbestos-cement water line
         (1) 6 and 8 inch pipe: Ford Meter Box Company, Inc. Styles 101B or 202B or equal.
         (2) 12 inch and larger pipe: Ford Meter Box Company, Inc. Style 202B, or equal
      b. Plastic pipe:
         (1) 6 and 8 inch pipe: Ford Meter Box Company, Inc. Styles 101BS or 202BS, or equal.
         (2) 12 inch and larger pipe: Ford Meter Box Company, Inc. Style 202BS, or equal.

L. Fitting:
   1. Ductile iron and plastic water line:
      a. Cast iron: ANSIA/WWA C110.
         (1) Pressure rating 3 thru 12 inch, 250 pounds per square inch (psi); 14 inch and larger, 150 psi
      b. Ductile iron: ANSI/AWWA C110
         (1) Pressure rating: 3 thru 12 inch, 350 psi; 14 inch and larger, 250 psi
   2. Copper service line: ASTM B-88

M. Cement Lining:
   1. Cast iron and ductile iron water line pipe and fittings: ANSIA/WWA C104/A21.4

N. Joints:
   1. Water line pipe:
      a. Ductile iron:
         (1) Mechanical: ANSIA/ WWA C111/A21.11 (2) Push-on: ANSIA/WWA C111/A21.11
      b. Plastic:
         (1) Bell and spigot with elastomeric gasket: AWWA C900.
   2. Hydrant lead: Mechanical anchoring.
   3. Service line pipe: 1 inch Flared, 1 ½ & 2 inch compression; ASTM B-88.
   4. Water line valve:
      a. Gate: Mechanical
      b. Butterfly: Mechanical
   5. Hydrant auxiliary valve:
      a. Gate: Mechanical.
   6. Service line valve:
      a. Corporation stop: Threaded; AWWA C800.
      b. Curb stop: Flared; ASTM B-88.
   7. Service saddle: Threaded; AWWA C800.
   8. Fittings: Mechanical with EBAA IRON INC “MEGALUG” following gland. SERIES 19MJ00 for C909.
   9. Restrained In-Line pipe joints, EBAA IRON INC SERIES 1900 for C909 & C900
   10. Bolting. MJ T Bolts shall be corrosion – resistant, high strength low alloy steel that conforms to ANSI/AWWA C111/A21.11. The bolts shall have a baked on Teflon, Xyland, PTFE or Fluorocarbon – Blue coating

O. Polyethylene Encasement:
   1. Tubing: ANSIA/WWA C105 Class C.
   2. Closing Tape: 2 inch wide Poly Ken #900 and Scotchwrap #50

P. Miscellaneous Concrete
   1. Class B, DIVISION 3 CAST-IN-PLACE CONCRETE

Q. Witness marker:
   1. Wood stake: Full 2x2 green oak or 2x4 wolmanized
R. Geotextile filter fabric:
   1. Valve box wrapping: nonwoven
S. Trace Wire/Test Stations
   1. A tracer wire shall be placed with PVC/HDPE pipe installation
      a. The tracer wire shall be #12 AWG high strength locater wire with a minimum break load of 1150 lbs.
      b. Protective coating shall be minimum of 45 mil. High Molecular Weight, High Density Polyethylene (HMW-HDPE)
      c. Wire connectors shall be watertight and shall provide for electrical continuity.
   2. Test station
      a. Copperhead Lite Duty LD14*TP-ADJ Test Station or approved equal shall be supplied at ground level near the hydrant and shall be colored blue.
      b. Tracer wire shall terminate at a test station at every hydrant or as directed by the Township.

PART 3 – EXECUTION

3.01 Preparation:

A. Alignment and grade:
   1. Deviations: Notify engineer and obtain instructions where there is a grade discrepancy or an obstruction not shown on drawings
   2. Depth of water line: surface to centerline of water line – 5 feet – 9 inches
   3. High points in water line: locate at services and hydrants
B. Bedding:
   1. Method: Article 3.05 Schedules
   2. Bedding Area backfill: Division 2 excavation and backfill for underground utilities
   3. Bearing: support entire length of pipe barrel evenly
C. Cleaning pipe and fittings:
   1. General: Interior free of reign material and joint surfaces free of lumps and blisters.
   2. Exterior free of any foreign material prior to poly wrap

3.02 Installation:

A. Laying pipe:
   1. General:
      a. Contamination protection: prevent entrance of foreign material; plug water tight where left unattended
      b. Placement: pipe length and bedding as a unit in a frost-free, dry trench
      c. Special supports and saddles: Article 3.05 Schedules
   2. Joint deflection: manufacturer's recommendations
   3. Water line through casting:
      a. Pull water through casing on wooden skids as recommended by manufacturer
         (1) Skids: hick enough to prevent water line joints from contacting casing and notched so that straps or wires do not contact casing
         (2) Lubricating: casing or skids
      b. Fill void between casing and water with granular material and plug ends of casing with masonry
B. Cutting pipe:
   1. Plastic: power or hand saw
   2. Ductile iron: power saw
   3. Asbestos-cement: power or hand saw

C. Jointing:
   1. Mechanical:
      a. Lubricating: vegetable soap
      b. Bolting: Tighten evenly to 75 to 90 pounds
   2. Push-on:
      a. Lubricating: manufacturer's recommendations
      b. Beveling: shape to manufacturer's recommendations
   3. Bell and spigot (plastic):
      a. Lubricating: spigot end only, manufacturer's recommendations
   4. In-line restraint to be predetermined at plan review, adjustments may be determined in field by Township inspectors. Article 3.05 Schedules (replaces existing details.)

D. Setting curb stop, valve, box, and hydrant:
   1. Locations: Article 3.05 Schedules
   2. Curb stop and valve: plumb with curb box lock
   3. Curb box: plumb with curb box lock
   4. Valve box:
      a. Positioning: center and plumb over operating nut
         (1) Sand infiltration protection: wrap around and under with 4 ounce per square yard geotextile filter fabric. Tape joints of fabric
      b. Lid:
         (1) Permanent pavement and lawn areas: finished grade
         (2) Aggregate areas: 4 to 6 inches below finished grade
         (3) Nonpavement and nonlawn areas: finished grade
   5. Hydrant: all materials to be assembled and installed by contractor as part of hydrant or hydrant extension pay items
      a. Connection: with auxiliary valve.
         (1) Minimum 2 feet – 6 inches from auxiliary valve
      b. Positioning: plumb with pumper nozzle facing street and nozzle centerline 20 inches above finished grade (remove ear chains)
      c. Shoe (base) 5/8" stone bedding, weep hole protection required

E. Chamber and access structure:
   1. General: Article 3.05 Schedules
   2. Concrete base: on a minimum of 4 inches of pea gravel with full and even bearing
   3. Grade rings: full mortar bed, tooled
   4. Wall section: fill joint completely with mortar and trowel
   5. Casting setting:
      a. Permanent pavement and lawn areas: finished grade
      b. Aggregate areas: 4 to 6 inches below finished grade
         (1) Protect casing with an 8 mil thick polyethylene sheet before covering with aggregate
      c. Nonpavement and nonlawn areas: finished grade

F. Connection:
   1. Existing water line
      a. General:
         (1) Dimension: may require special fitting
         (2) Temporary support: provide.
         (3) Disinfection: swab pipe, valves and fittings with 4 percent chlorine solution
      b. Pressure off: install solid or cutting-in sleeve
      c. Pressure on: install tapping sleeve or tapping valve
      d. Salvaged materials: deliver to owner's storage yard
   2. Service line:

a. Line and grade:
(1) Alignment: right angles to street line
(2) Minimum depth: same as for water line
b. Tapping: 45 degrees above center and provide horizontal loop at corporation stop
c. Maximum tap sizes: Listed in Table, Article 3.05 Schedules

G. Polyethylene Encasement:
1. Install around cast iron and ductile iron water line and appurtenances and tape seams

H. Witness marker:
1. Dimensions:
a. Section: 2x2 full green oak or 2x4 wolmanized
2. Locations:
a. End of service line and water line: extended vertically from end to 3 feet above finished grade
b. Valve box, valve chamber, curb box and bend: extend from 3 feet below to 3 feet above finished grade

I. Trace Wire/Test Stations
1. Refer to Division 4, Section 04000 Trace Wire Specifications

3.03 QUALITY CONTROL:

A. Testing and inspection:
1. General:
a. Observation: by engineer
b. Completion: Before connecting to existing water line
c. Notification: Pretest and then arrange with engineer for inspection and test
d. Required water: provide
2. Electrical continuity: test ductile iron water line for continuity and repair breaks
3. Pressure:
a. Conditions: Air and air-water methods of applying pressure prohibited
b. Procedure: Article 1.02 Submittals
(1) Fill system slowly, expel air to high points and apply pressure
c. Range: 140 to 150 pounds per square inch at lowest elevation
d. Duration: 1 hour minimum and until completion of inspection
e. Corrections: Repair defects, visible leaks and repeat test until acceptable
4. Leakage:
a. Sequence: following pressure test
b. Procedure: Article 1.02 submittals

(1) Filling: As in pressure test.
(2) Supplying make-up water: Measurable source.
(3) Leakage: Quantity of water supplied to maintain test pressure at beginning of test

c. Average test pressure: Within pressure test range.
d. Duration: 2 hours
e. Allowable: Less than;

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

L = allowable leakage, in gallons per hour (gph)
S = length of pipe tested, in feet
D = nominal pipe diameter, in inches
P = average test pressure, in pounds per square inch (psi)
Note: Formula results in allowable leakage of 10.49 gallons per day per mile per inch nominal diameter at a pressure of 150 psi.

f. Testing valves only: Maintain pressure on water line and check all valves as follows;
(1) Vent extreme ends of water line and briefly check each valve progressively back towards test point.
(2) Allowable: Pressure drop less than 10 psi in 5 minutes with test pump off.
g. Connections: Repair defects and repeat test until acceptable.

3.04 ADJUST AND CLEAN

A. Flushing:
1. Conditions:
a. Maximum intervals: One quarter mile.
b. Required water: Provide
2. Sequence: Following pressure and leakage testing and prior to chlorination.
a. Fill and Flush: Stand Pipe Requirements
4"- 8" W.M. = 2" stand/valve/fittings
10"- 20" W.M. = 4" stand/valve/fittings
24" and larger W.M. = 6" stand/valve/fittings
b. Chlorination: By solution, only after approval of flushing procedure, to be observed by Township Inspector
c. Pressure Testing: To be observed by Township Inspector
Do Not pressurize W.M. that has been tied into the existing W.M. system! Flushing, chlorination and 2 good sets of BAC-T Samples must be received prior to any pressurizing.
d. Taps
- not allowed until after good BAC-T results
- through saddle only, set at 45 degrees
- tap site is to be witnessed in cul-de-sacs and other abnormal locations
3. Procedure: Article 1.02 SUBMITTALS

a. Standpipe requirements (minimum):
(1) 4 thru 8 inch pipe: 2 inch diameter pipe, valve, and fittings
(2) 10 thru 24 inch pipe: 4 inch diameter pipe, valve, and fittings
b. Minimum velocity: 3 ½ feet per second

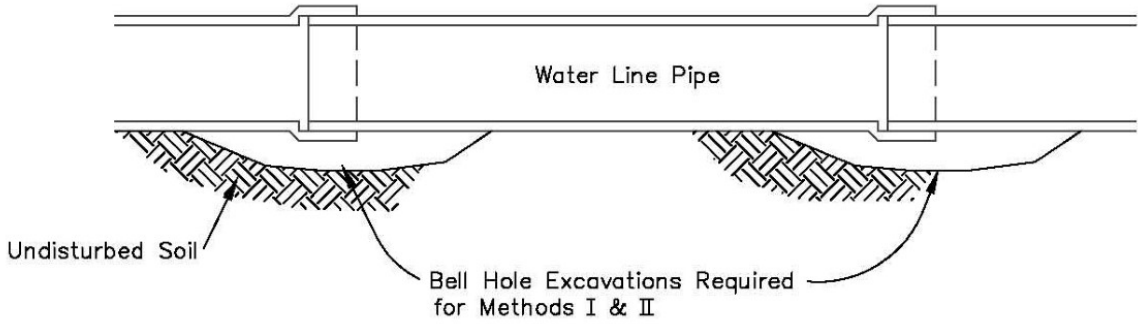
B. Chlorination:
1. Conditions:
a. Observation: by engineer
b. Required water: provide
c. Chlorine gas: prohibited
2. Sequence: following flushing
3. Procedure: Article 1.02 Submittals
a. Inject chlorine solution at constant rate to produce chlorine concentration of 50 to 100 parts per million (ppm) residual free chlorine in water line, operate valves, and clear line of residual chlorine after retention period.
4. Retention period: 16 to 24 hours for 50 ppm and 8 to 12 hours for 100 ppm.
a. Discharge of 10 ppm or higher of chlorinated water to sanitary sewer is to be governed by Georgetown Township, and approved by Grandville Treatment Plant Operations in writing prior to discharge.
b. Discharge of 10 ppm or higher of chlorinated water to ground water or storm sewer must be neutralized to less than .5 ppm thru an approved de-chlorination device.
5. Sampling and delivery of sample to testing laboratory: required
6. Corrections: Re-chlorinate sections not meeting DEQ bacteriological requirements

3.05 SCHEDULES:

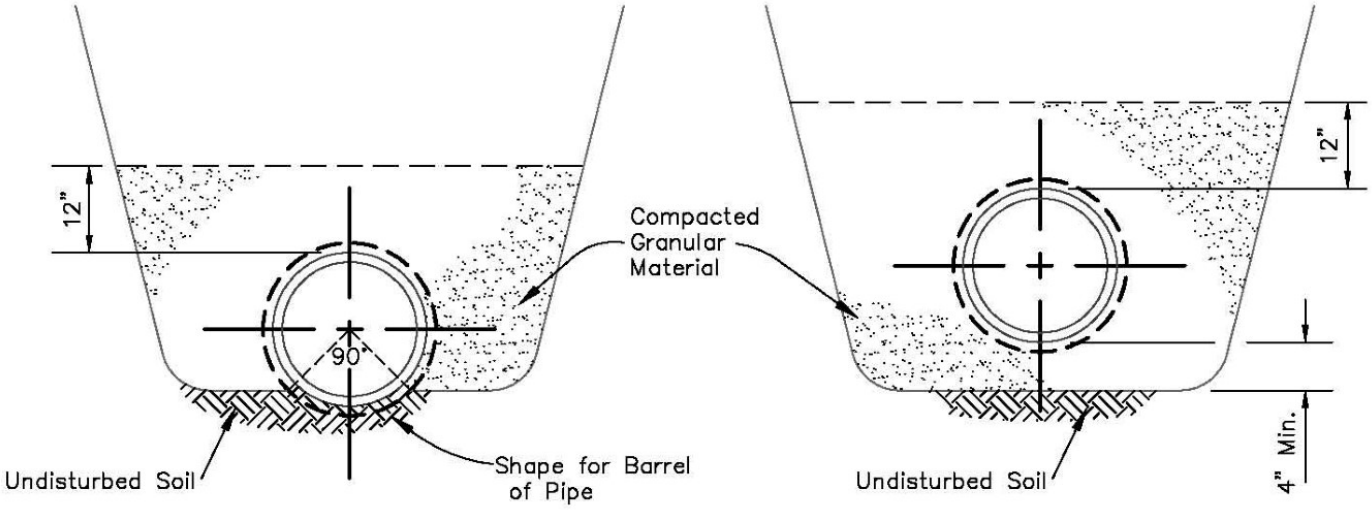
A. Standard details:
1. Methods of bedding pipe
2. Special supports for underground utilities
3. Pipe saddles
4. Typical hydrant and valve locations
5. Standard gate valve chamber
6. Standard 12” to 24” butterfly valve chamber
7. Fabric/poly encasement of valve and box
8. Access structure

B. Tables:
1. Maximum tap sizes
2. Deleted
3. Pipe restraint schedule

3.05 SCHEDULES



EXCAVATION FOR BELLS



Method I

Method I: In Areas of Unconsolidated Soils (Sand, Gravel & Etc.)

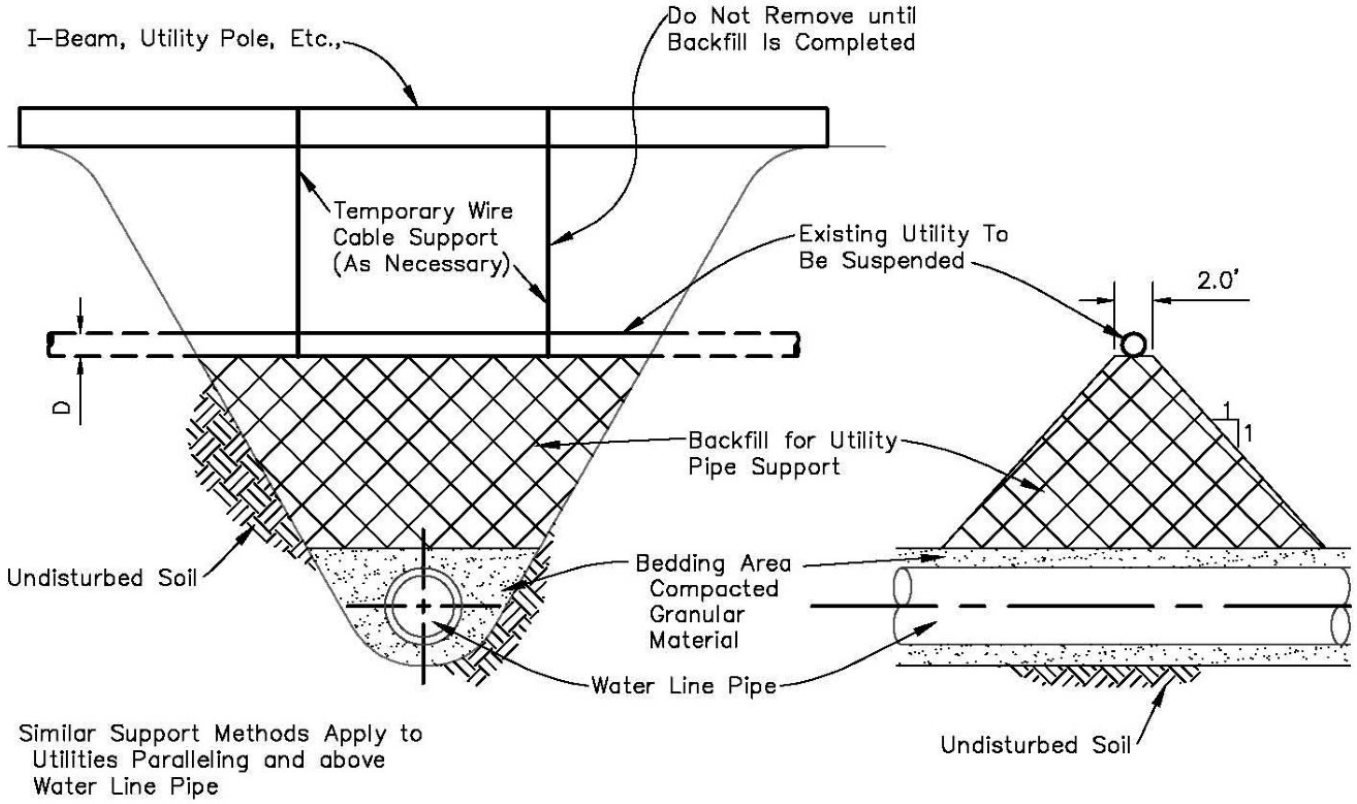
Method II

Method II: In Areas of Consolidated Soils (Clay, Hardpan, Rock & Etc.)

METHODS OF BEDDING PIPE

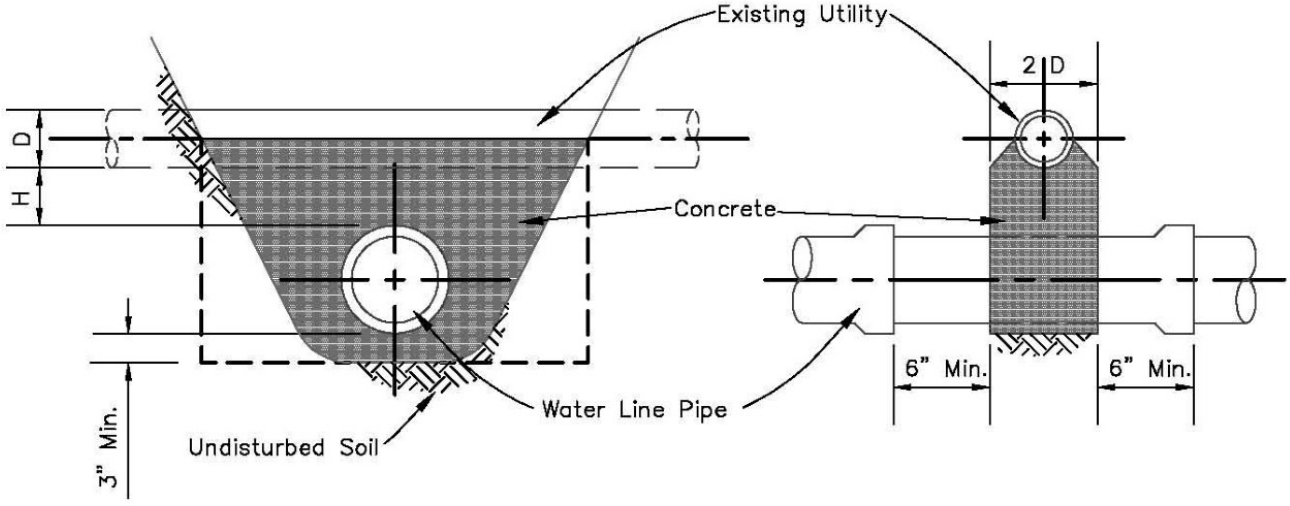
No Scale

3.05 SCHEDULES



SPECIAL SUPPORTS FOR EXISTING UNDERGROUND UTILITIES

No Scale



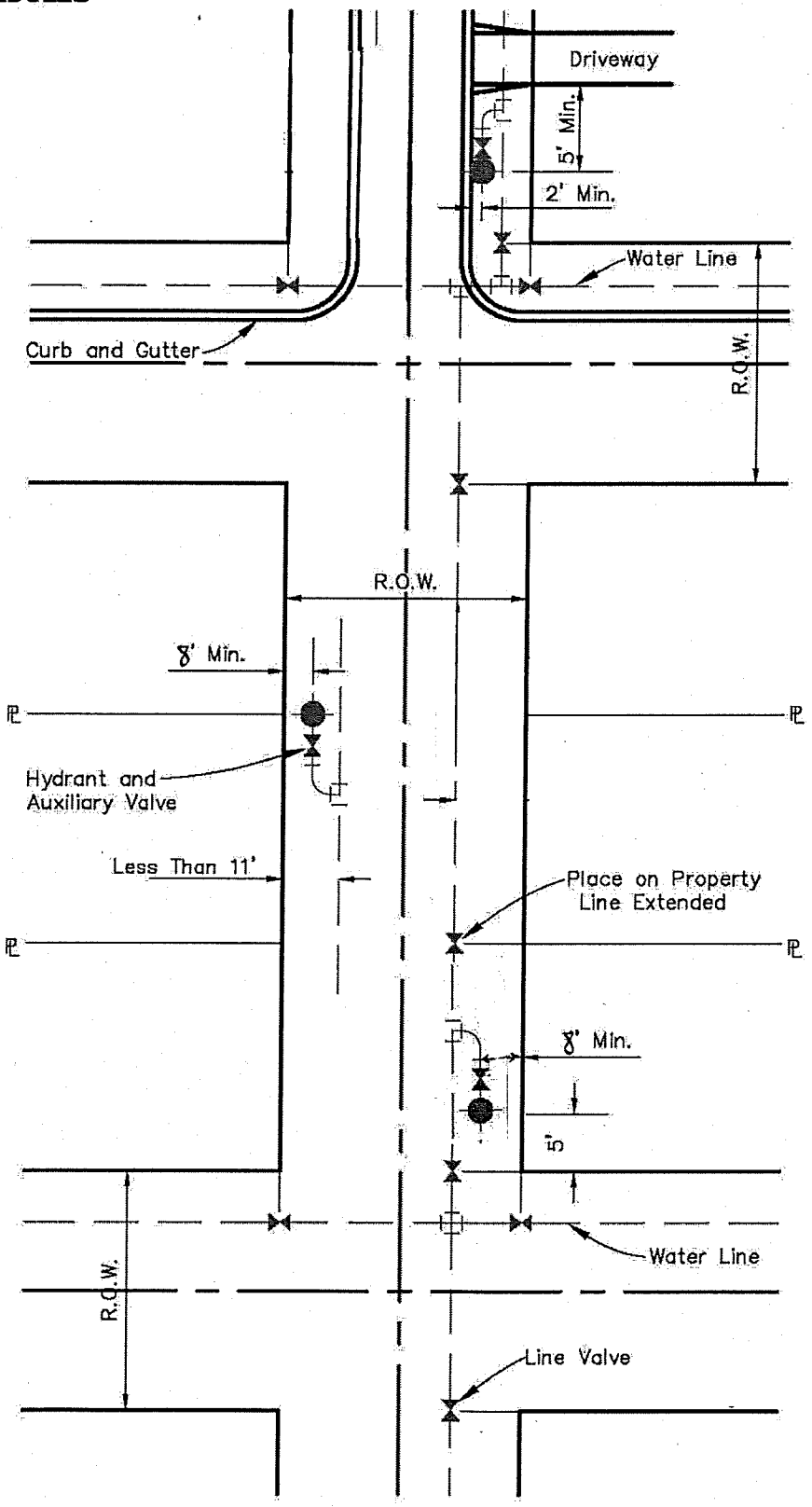
Not Required When Existing Utility Is 2" Or Smaller

Saddle Requirements	
H	D
0" to 3"	Less than 15"
0" to 6"	18" thru 36"
0" to 12"	42" and Over

PIPE SADDLES

No Scale

3.05 SCHEDULES

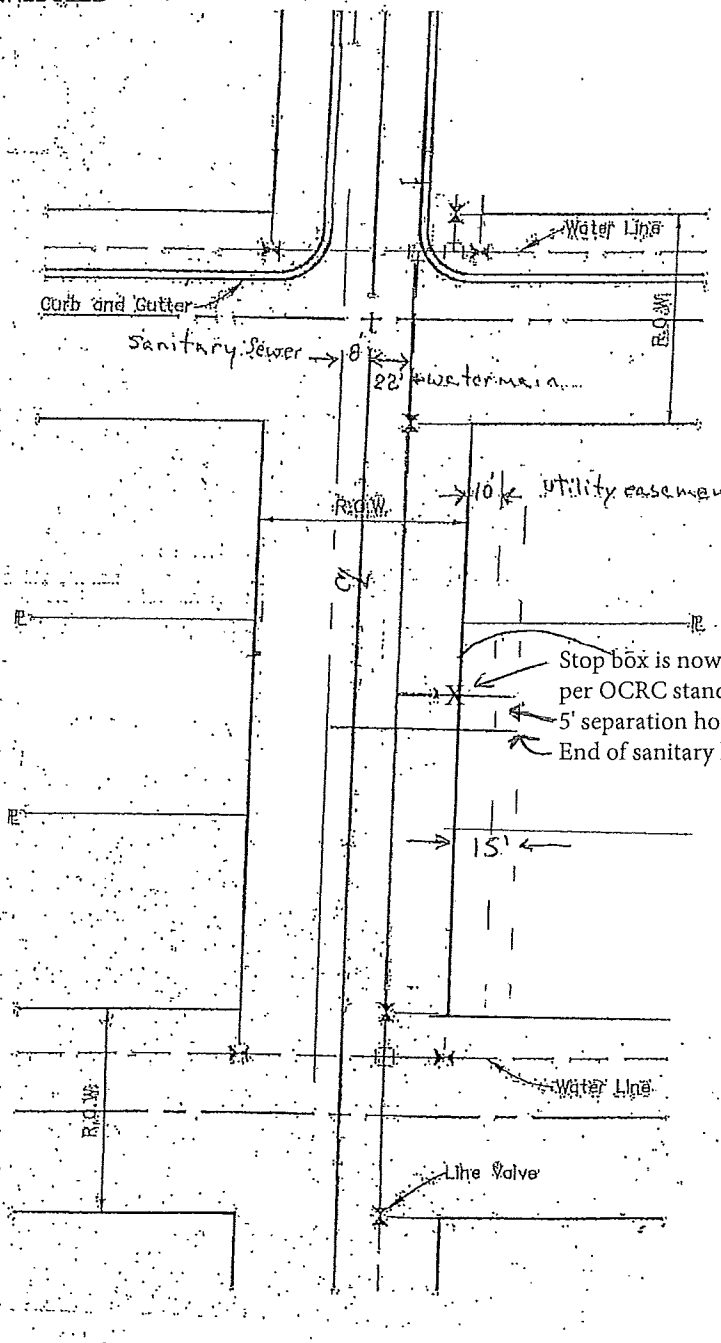


TYPICAL HYDRANT AND VALVE LOCATIONS

No Scale

SECTION 02713

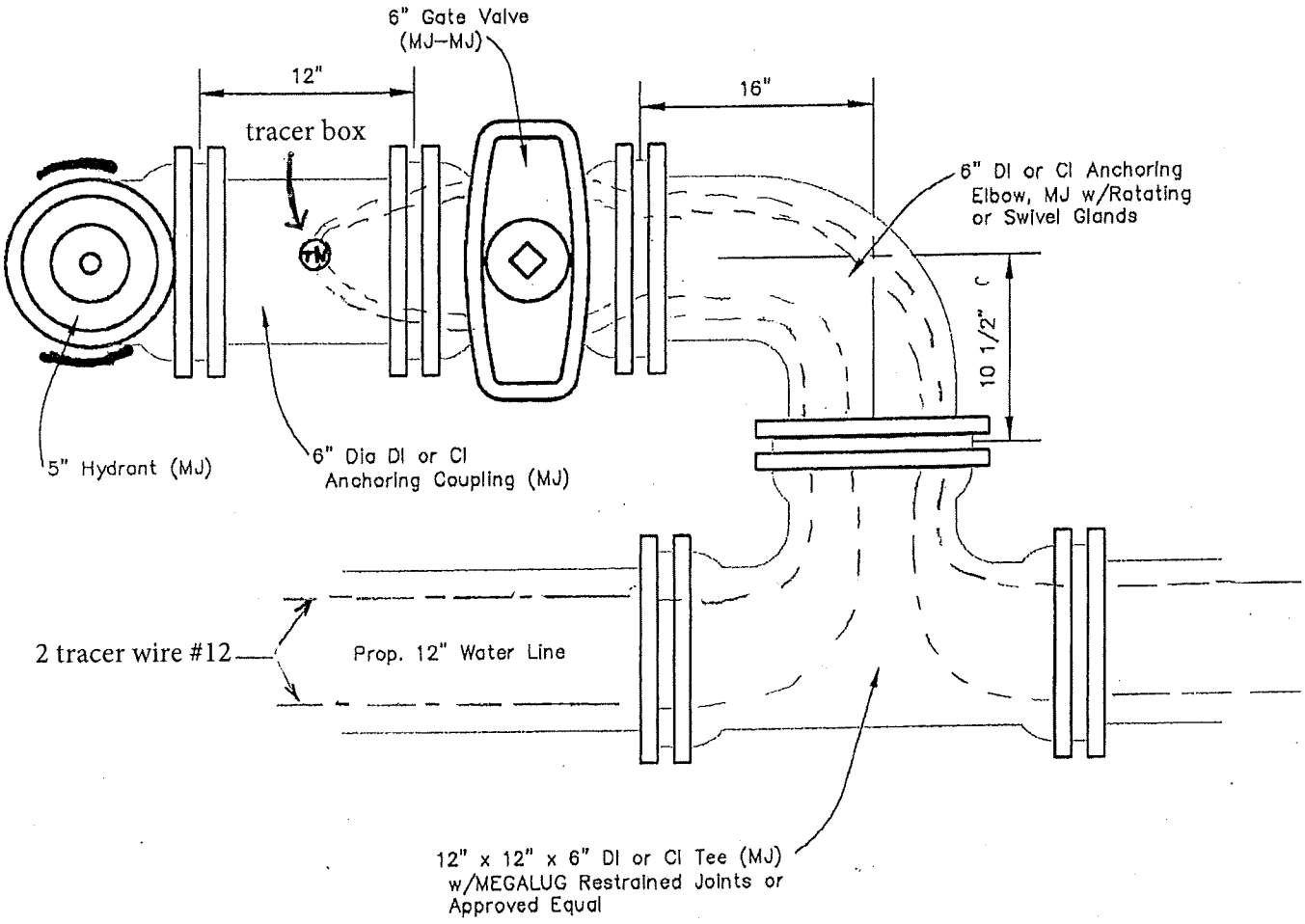
3.05 SCHEDULES



TYPICAL WATER/SEWER SERVICES
NO SCALE

3.05 SCHEDULES:

Wheep Hole Protection
2-8" C.P.P. x 6" length
halved/taped to base
prior to poly-wrap with 4" slit at wheep holes

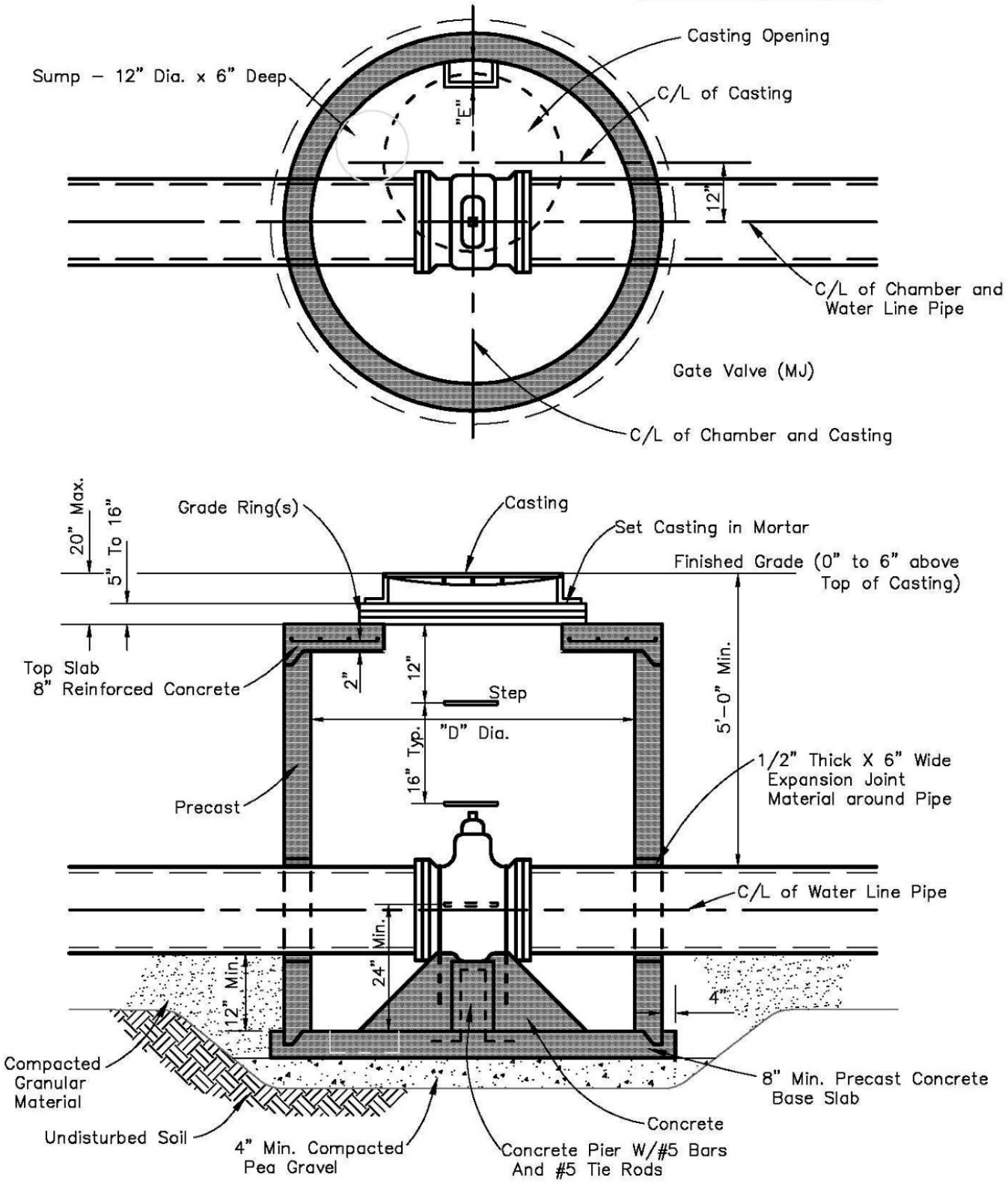


TYPICAL HYDRANT ASSEMBLY

Rev. 1–22–03

3.05 SCHEDULES

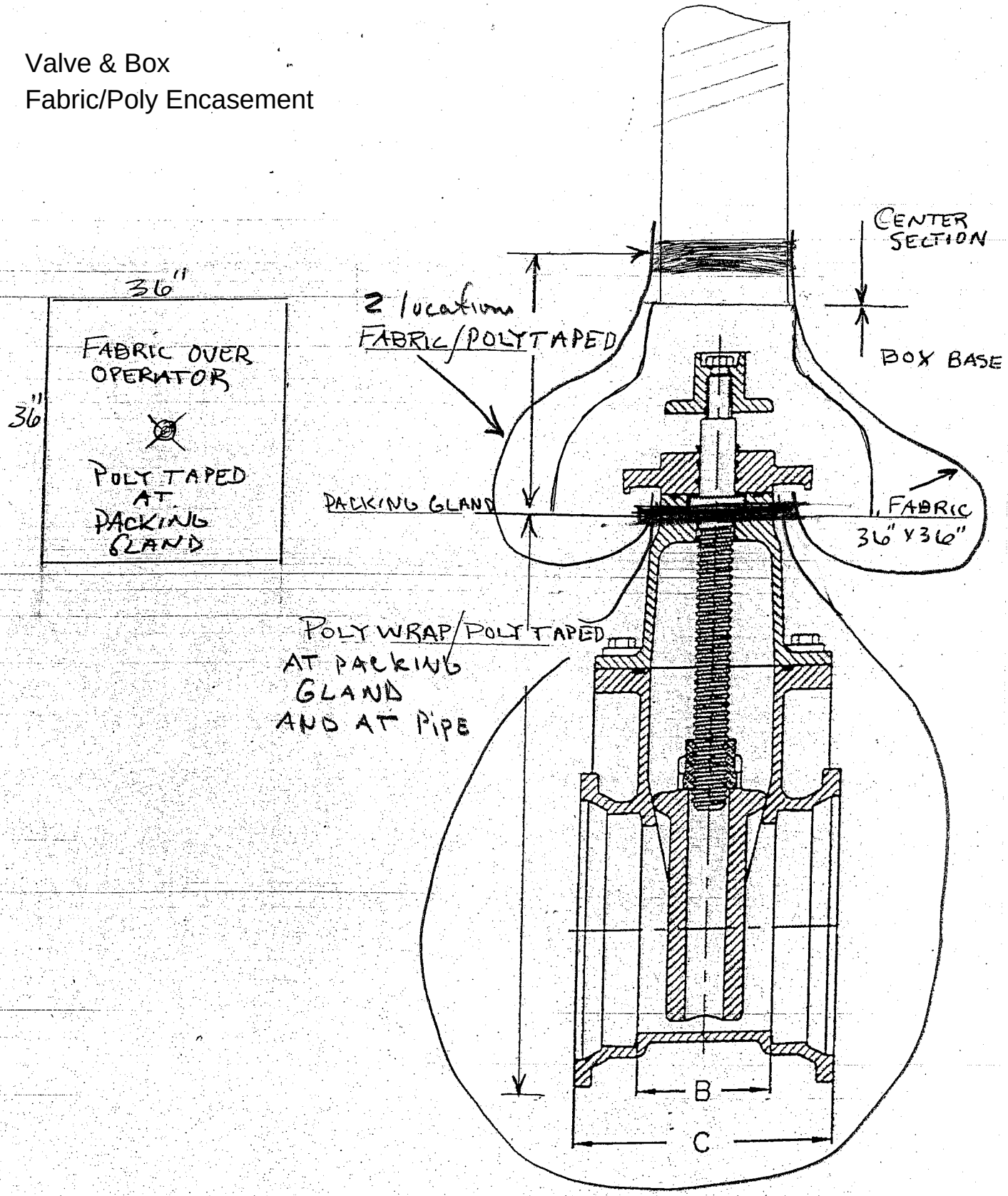
Valve	"D"	"E"
6" to 10"	4'-0"	5"
12" to 24"	5'-0"	3"



STANDARD GATE VALVE CHAMBER

No Scale

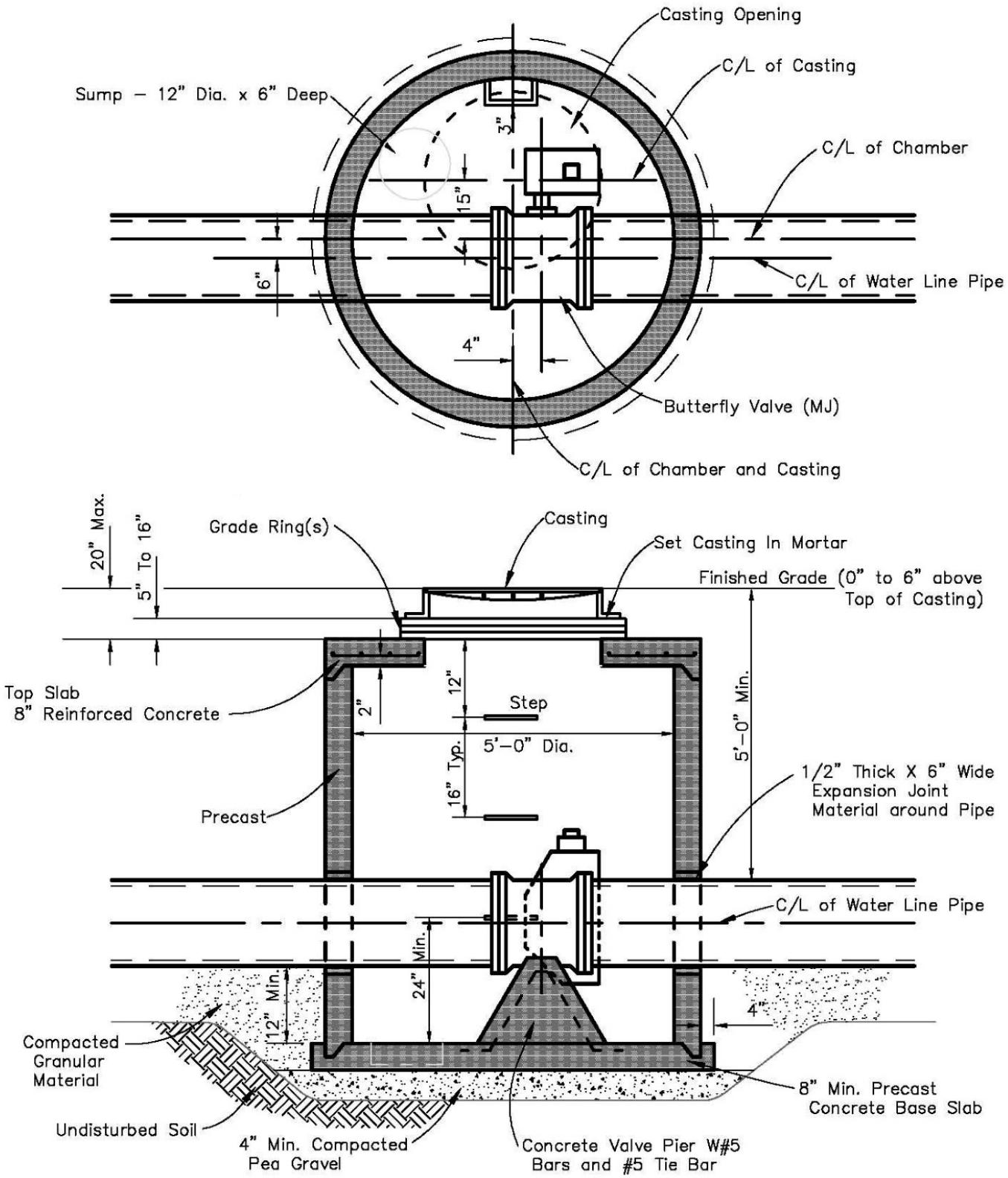
Valve & Box
Fabric/Poly Encasement



M.J. x M.J.

Revised 2-2017

3.05 SCHEDULES

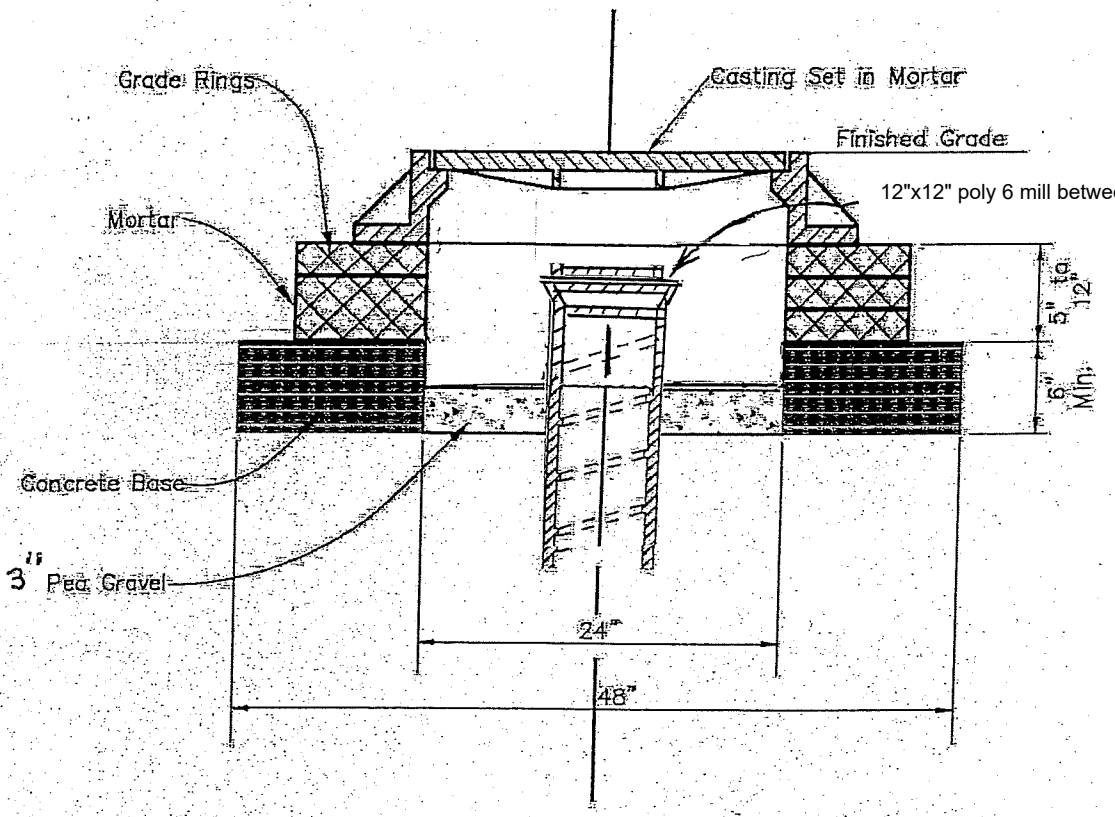


STANDARD 12" TO 24" BUTTERFLY VALVE CHAMBER

No Scale

SECTION 02713

3.05 SCHEDULES



ACCESS STRUCTURE
No Scale

3.05 SCHEDULES

SECTION 02713
PIPE RESTRAINT LENGTH REQUIRED, FEET

Pipe Diameter	Tees, 90° Bends	45° Bends	22-1/2° Bends	11-1/4° Bends	Dead Ends	Reducers (one size)	**
4"	23	9	5	2	57		
6"	32	13	6	3	82	43	63
8"	41	17	8	4	104	43	55
12"	58	24	12	6	149	80	120
16"	74	31	15	7	192	82	110
20"	89	37	18	9	233	82	104
24"	104	43	21	10	272	82	99
30"	123	51	25	12	328	115	148
36"	141	58	28	14	379	115	140

** If straight run of pipe on small side of reducer exceeds this value, then no restrained joints are necessary.

NOTE: The length of restrained pipe required as shown in Section 02713 is based on trench backfill being compacted to 95% of the maximum unit weight as measured by the modified Proctor, AASHTO T-180. If the pipe is to be wrapped in polyethylene, the length of restrained pipe required will be as shown on the drawings or in the special specifications. Section 02713 does not consider polyethylene wrapped pipe.

3.05 SCHEDULES: MAXIMUM TAP SIZE

	Pipe Size and Maximum Tap Size in Inches								
Type of Pipe (Type of Tap)	6	8	10	12	14	16	18	20	24
Cast Iron C1 22 (direct)	¾	1	1¼	2	2	2	2	2	2
Ductile Iron C1 52 (direct)	1	1	1¼	2	2	2	2	2	2
Asbestos-Cement C1 150 (direct)	not allowed			1	1	1	1	1	1
PVC (direct)	not allowed								
All Pipe (w/dbl strap service saddle)	1½	2	2	2	2	2	2	2	2

SECTION 02721

STORM DRAINAGE COLLECTION SYSTEM

PART 1 –GENERAL

1.01 DESCRIPTION:

A. Work Included:
   1. This Section encompasses the work required for all storm drainage collection systems.
   2. All work necessary for completion, but not specifically listed as a pay item, will be deemed to be included in one or more of the Bid Form items.

B. Definitions:
   1. Standard manhole unit: Depth of 10 feet or less, lowest invert to top of casting.
   2. Additional manhole depth: Depth in excess of 10 feet.
   3. Sewer pipe underdrain:
      a. Concrete pipe: Top half of joint open and joint completely wrapped in geotextile filter fabric.
      b. Plastic pipe: Perforated and completely encased in geotextile filter fabric.
   4. Culvert: Considered a utility.
   5. Open ditch: Considered a utility.
   6. Drainage structures: Manhole, inlet, curb inlet, catch basin and leaching basin.
   7. Fittings: Wye, tee, cross, bend and end section.
   8. Line and grade control terminology: Article 3.05 SCHEDULES.
   9. Witnesses: Horizontal measurements to 3 permanent surface features.

C. Method of Measurement and Basis of Payment:
   1. Storm sewer: Will be measured on the surface along the centerline of storm sewer from center to center of structures and paid for by the linear foot.
   2. Sewer pipe underdrain (SPU): Will be measured on the surface along the centerline of SPU from center to center of structures and paid for by the linear foot.
   3. Storm sewer through casing: Will be measured on the surface along the centerline of storm sewer and paid for by the linear foot.
   4. Catch basin, leaching basin and inlet lead: Will be measured on the surface along the centerline of lead from center to center of structures and paid for by the linear foot.
   5. Culvert: Will be measured on the surface along the centerline of culvert and paid for by the linear foot.
   6. Fittings: Will be counted and paid for by the unit.
   7. Concrete headwall: Will be counted and paid for by the cubic yard.
   8. Drainage structures:
      a. Standard manhole unit: Will be counted and paid for by the unit.
         (1) Additional manhole depth: Will be measured and paid for by the vertical linear foot.
      b. All other: Will be counted and paid for by the unit.
   9. Riprap: Will be measured in place and paid for by the square yard.
   10. Construct drainage structure at end of existing storm sewer or SPU: Will be counted and paid for by the unit.
   11. Construct drainage structure over existing storm sewer or SPU: Will be counted and paid for by the unit.
   12. Connect to existing drainage structure: Will be counted and paid for by the unit.
   13. Connect to existing storm sewer or SPU: Will be counted and paid for by the unit.

14. Open ditch: Will be measured along the centerline of open ditch and paid for by the linear foot.
15. Open ditch cleanout: Will be measured along the centerline of open ditch and paid for by the linear foot.

1.02 SUBMITTALS:

A. Radius Pipe Drawings:
   1. DIVISION 1 SUBMITTALS.
B. Test Specimens:
   1. DIVIDION 1 SUBMITTALS and QUALITY CONTROL.
C. Presence of Underground Utilites:
   1. Report.
D. Line and Grade Control:
   1. Method: Specify.
E. Storm Drainage Witnesses:
   1. Wye, tee and cross: Report on record Drawings.
   2. Storm sewer and SPU termini without structures: Report on record Drawings.

1.03 JOB CONDITIONS:

A. Existing Storm Drainage Collection System:
   1. Maintain operational.
B. Scheduling:
   1. Catch basin, leaching basin and inlet lead installation: As storm sewer and SPU installation progresses.
   2. Clean-up: Promptly following backfilling operations.

PART 2 – PRODUCTS

2.01 MATERIALS:

A. General: All materials shall be American or Canadian made unless otherwise allowed in the Project Technical Specifications.
B. Storm Sewer and SPU Pipe:
   1. General: Any of the following materials except where specific materials are indicated on the Drawings or in the Project Technical Specifications.
   2. Nonreinforced concrete:
      a. ASTM C14.
      b. Michigan Designation C14 XM5: As indicated in table, Article 3.05 SCHEDULES.
   3. Reinforced concrete: ASTM C76.
      a. Circular reinforcement.
      b. Wall B.
   4. Corrugated polyethylene: AASHTO M252 and AASHTO M294, Type S.
C. Catch Basin, Leaching Basin and Inlet Lead Pipe:
   1. General: Any of the following materials excepts where specific materials are indicated on the Drawings or in the Project Technical Specifications.
   2. Nonreinforced concrete: ASTM C14.
   3. Reinforced concrete: ASTM C76.

4. Corrugated polyethylene: AASHTO M294, Type S.

D. Culvert Pipe:
   1. General: Any of the following materials except where specific materials are indicated on the Drawings or in the Project Technical Specifications.
   2. Nonreinforced concrete: ASTM C14.
   3. Reinforced concrete: ASTM C76.
      a. Circular reinforcement.
      b. Wall B.
   4. Corrugated steel: AASHTO M36.
      a. Galvanized or aluminized.
   5. Corrugated polyethylene: AASHTO M294, Type S.

E. Design Classification:
   1. Strength: Not less than that listed in table, Article 3.05 SCHEDULES.

F. Joints:
   1. Storm sewer pipe:
      a. Nonreinforced and reinforced concrete:
         (1) Mortar: ASTM C270, Type S.
         (2) Rubber O-ring: ASTM C443.
      b. Corrugated polyethylene: Coupling, corrugated to match pipe with width not less than ½ nominal diameter of pipe and sealed to form a watertight joint.
   2. SPU pipe:
      a. Concrete: Mortar; ASTM C270, Type S.
      b. Cottugated polyethylene: Coupling, corrugated to match pipe with width not less than ½ nominal diameter of pipe.
   3. Catch basin, leaching basin and inlet lead pipe:
      a. Mortar: ASTM C270, Type S.
      b. Rubber O-ring: ASTM C443.
      c. Corrugated polyethylene: Coupling, corrugated to match pipe with width not less than ½ nominal diameter of pipe and sealed to form a watertight joint.
   4. Culvert pipe:
      a. Concrete:
         (1) Mortar: ASTM C270, Type S.
         (2) Rubber O-ring: ASTM C443.
      b. Corrugated steel: Coupling band.
         (1) Material: Same as pipe, in 2 halves.
         (2) Width: Minimum 12 inch for pipe 12 thru 36 inch; minimum 24 inch for pipe 42 inch and larger.
         (3) Waterproofing: 3/8 inch soil Neoprene; 7 inch width for 12 inch band and 12 inch width for 24 inch band.
      c. Corrugated polyethylene: Coupling, corrugated to match pipe with width not less than ½ nominal diameter of pipe and sealed to form a watertight joint.

G. Manhole, Catch Basin, Leaching Basin and Inlet:
   1. Concrete: Class B, DIVISION 3 CAST-IN-PLACE CONCRETE.
   2. Brick: Concrete; ASTM C55, GRADE S-II.
   3. Grade ring: ASTM C478.

4. Wall section:
   a. Precast: ASTM C478.
      (1) Mortar: ASTM C270, Type S.
      (2) Rubber O-ring: ASTM C443.
   b. Concrete radial unit: ASTM C139.
      (1) Mortar: ASTM C270, Type S.
5. Base slab: Precast.
6. Mortar: ASTM C270, Type S.
7. Manhole steps:
   a. Plastic: Reinforced with 3/8 inch steel rod and dimensioned as cast iron.
8. Manhole casting: EJIW 1145, Type B cover or equal.
9. Catch basin, leaching basin and inlet casting:
   a. Ditch section: EJIW 6508 or equal.
   b. Curb and gutter section:
      (1) Standard: EJIW 7045. Type M1 grate or equal.
      (2) Double: EJIW 7035, Type M3 grate, Type 1 back.
   c. Valley gutter section:
      (1) Standard: EJIW 7065, Type M1 grate or equal.
      (2) Double: EJIW 7035, Type M3 grate, Type T3 back.

H. Wye, Tee, Cross and Bend:
   1. Same material and strength classification as adjoining pipe.

I. End Section:
   1. Concrete and corrugated steel: MDOT 8.08.07 and 8.08.08.
      a. Concrete: MDOT Standard Plan IV-86C.
      b. Corrugated steel: MDOT Standard Plan IV-88C.
      c. Corrugated polyethylene: As recommended by manufacturer.

J. Geotextile Filter Fabric:
   1. Pipe wrapping: MDOT 8.10.04.
   2. Riprap liner: MDOT 8.10.04.

K. Riprap:
   1. MDOT 8.19.

L. Miscellaneous Concrete:
   1. Class B, DIVISION 3 CAST-IN-PLACE CONCRETE.

PART 3 – EXECUTION

3.01 PREPARATION:

A. Alignment and Grade:
   1. Deviations: Notify ENGINEER and obtain instructions where there is a grade discrepancy or an obstruction not shown on the Drawings.
   2. Line and grade control: By laser beam.
      a. Check points: At set-up point, 25 feet, 50 feet, 100 feet and 100 foot points thereafter to the next set-up point.
      b. Proejctor advancement: Reset at each manhole.

B. Bedding:
   1. Method: Article 3.05 SCHEDULES
   2. Bedding Area backfill DIVISION 2EXCAVATION AND BACKFILL FOR UNDERGROUND UTILITIES
   3. Bearing: Support entire length of pipe barrel evenly
C. Cleaning Pipe and Fittings”
   1. General: Interior free to foreign materials and joint surfaces free of lumps and blisters.

3.02 INSTALLATION

A. Laying Pipe:
   1. Direction:
      a. Concrete: Upstream with spigot or tongue end downstream
      b. Corrugated steel: Upstream
      c. Corrugated polyethylene: Upstream
   2. Joints: Smooth and clean
   3. Placement: Pipe length and bedding as a unit in a frost-free, dry trench
   4. Special supports and saddles: Article 3.05 SCHEDULES
   5. Storm sewer through casing:
      a. Pull storm sewer through casing on wooden skids as recommended by manufacturer.
         (1) Skids: Thick enough to prevent storm sewer joints from contacting casing and notched so that straps or wires do not contact casing.
         (2) Lubricating: Casing or skids.
      b. Fill void between casing and storm sewer with granular material and plug ends of casing with masonry.
   6. Termination:
      a. Plug: Pipe 6 thru 21 inch with standard disc.
      b. Bulkhead: Pipe 24 inch and larger with brick and mortar and ½ inch cement mortar outside.
         (1) 24 thru 36 inch: 4 inches thick
         (2) 39 thru 60 inch: 8 inches thick
         (3) 66 inch and larger: 12 inches thick.
B. Cutting pipe:
   1. Concrete: Power saw
   2. Corrugated steel: Power saw
   3. Corrugated polyethylene: Saw.
C. Jointing:
   1. Storm sewer pipe:
      a. Concrete:
         (1) Mortar:
            (a) Fill joint completely
            (b) Wipe and finish smooth the inside of 30 inch pipe and larger.
         (2) Rubber O-ring:
            (a) Lubricants: Manufacturer’s recommendations
            (b) Gasket position: Confirm
      b. Corrugated polyethylene: Securely band.
      c. Per OCRC specs, all joints to be fabric wrapped.
   2. SPU pipe:

a. Concrete: MDOT 6.02.05.
b. Corrugated polyethylene: Securely band.

3. Culvert pipe:
a. Concrete:
(1) Mortar:
(a) Fill joint completely.
(b) Wipe and finish smooth the inside of 30 inch pipe and larger.
(2) Rubber O-ring:
(a) Lubricants: Manufacturer's recommendations.
(b) Gasket position: Confirm.
b. Corrugated steel: Securely band.
c. Corrugated polyethylene: Securely band.

D. Manhole, Catch Basin, Leaching Basin and Inlet:
1. General: Article 3.05 SCHEDULES.
2. Base slab: On a minimum of 4 inches of pea gravel with full and even bearing.
3. Wall section:
a. Precast: Fill joint completely with mortar and trowel.
b. Concrete radial unit:
(1) Set in full bed of mortar with key slots filled.
(2) Maximum joint spacing at inside face: ½ inch.
(3) Wipe all joints.
4. Casting setting:
a. General: Article 3.05 SCHEDULES.
b. Manhole:
(1) Permanent pavement: Finished grade.
(2) Lawn and aggregate areas: 4 to 6 inches below finished grade.
(a) Protect casting with 8 mil thick polyethylene sheet before covering with soil or aggregate.
(3) Nonpavement and nonlawn areas: Finished grade.
c. Catch basin, leaching basin and inlet:
(1) Permanent pavement: 1 ¼ inches below gutter grade.
(2) Nonpavement areas: Top of grate 5 inches above finished grade.

E. Connections:
1. Existing storm drainage collection system:
a. Structures:
(1) Brick and block: Relay and repoint loose bricks and blocks.
(2) Precast and cast-in-place: Repair disturbed area.

3.03 QUALITY CONTROL:

A. Inspection:
1. General:
a. Observation: By ENGINEER.
b. Notification: Clean and then arrange with ENGINEER for inspection.
c. Completion: Before placing in service.

2. Line and grade: Allowable tolerances between structures from proposed alignment.
    a. Line:
        (1) Pipe thru 36 inch: 0.40 foot.
        (2) Pipe 39 inch and larger: 0.80 foot.
    b. Grade:
        (1) Pipe thru 36 inch: 0.05 foot.
        (2) Pipe 39 inch and larger: 0.10 foot.

3.04 ADJUST AND CLEAN:

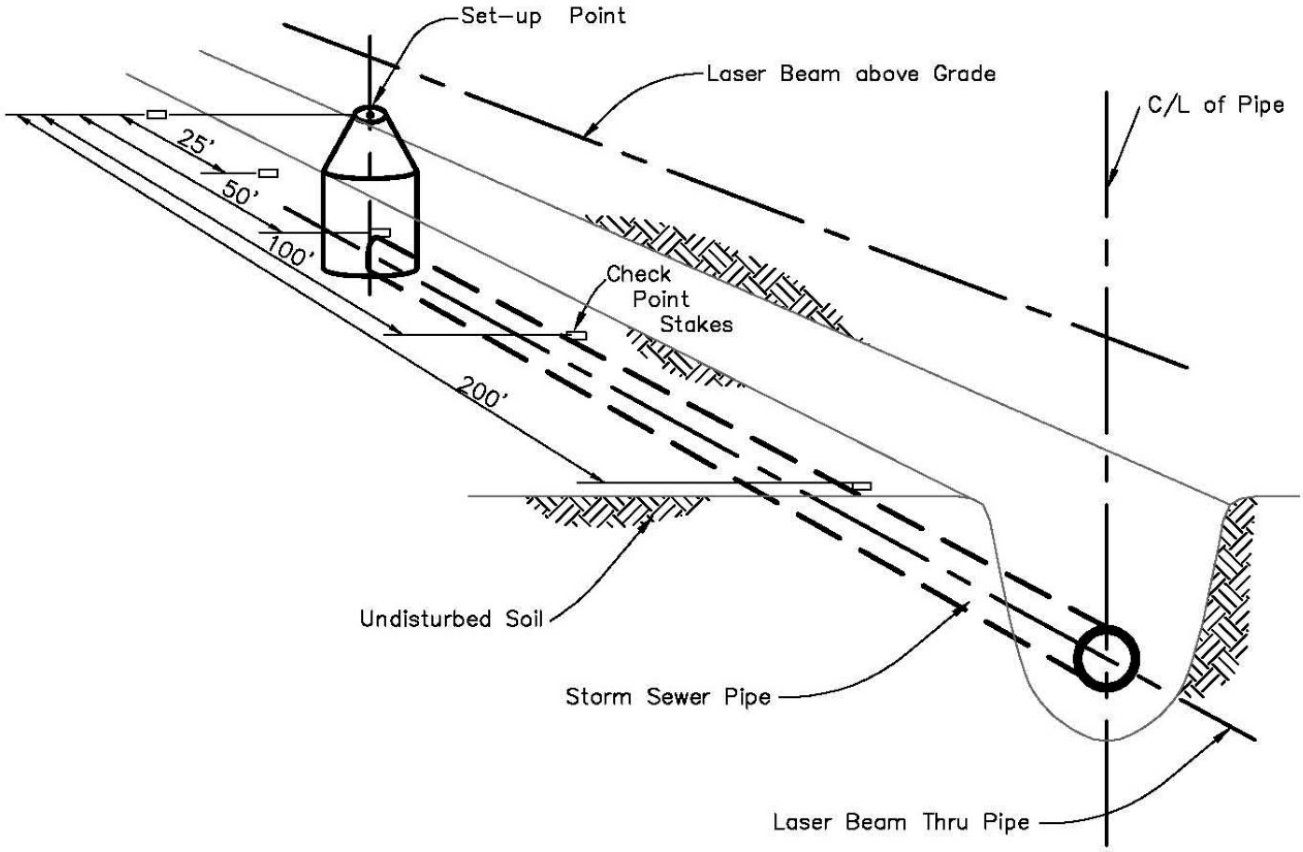
A. General:
    1. Keep collection system clean as work progresses.

3.05 SCHEDULES:

A. Standard Details:
    1. Line and grade control terminology.
    2. Methods of bedding pipe.
    3. Special supports for underground utilities
    4. Pipe Saddles.
    5. Standard storm drainage manhole
    6. Standard storm drainage tee manhole.
    7. Standard storm drainage catch basin.
    8. Standard inlets.

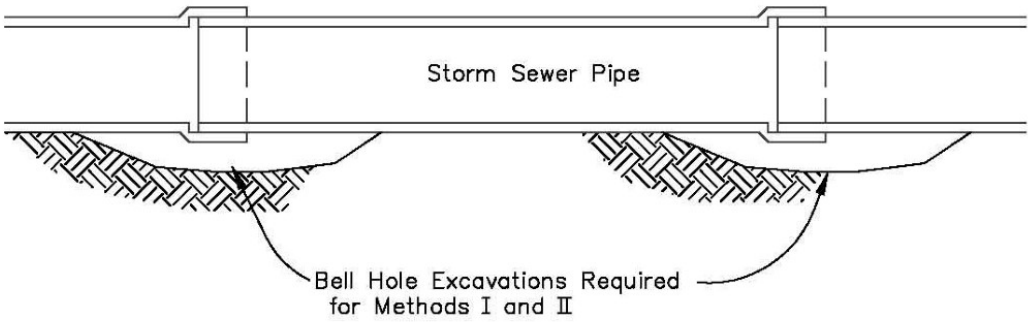
B. Tables:
    1. Michigan designation C14 XM5.
    2. Storm drainage collection pipe, design classification.

3.05 SCHEDULES

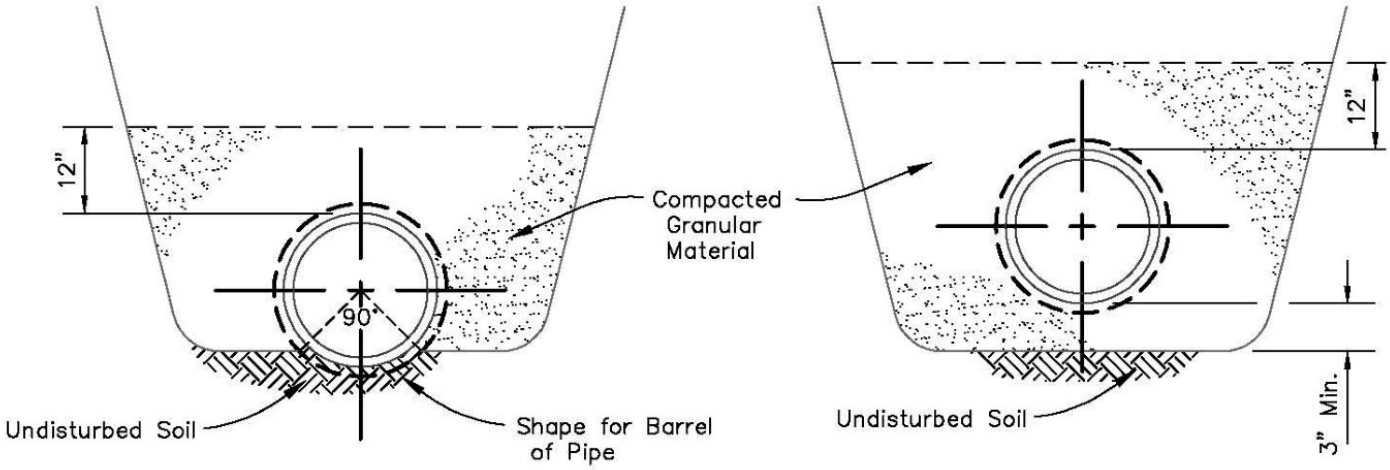


LINE AND GRADE CONTROL TERMINOLOGY
No Scale

3.05 SCHEDULES



EXCAVATION FOR BELLS

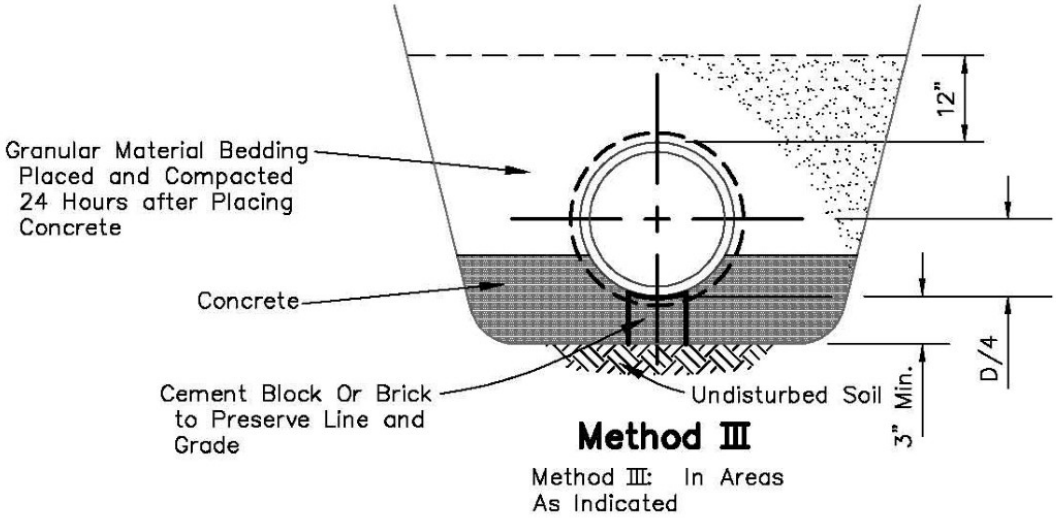


Method I

Method I: Areas of Unconsolidated Soils (Sand, Gravel & Etc.)

Method II

Method II: Areas of Consolidated Soils (Clay, Hardpan, Rock & Etc.)



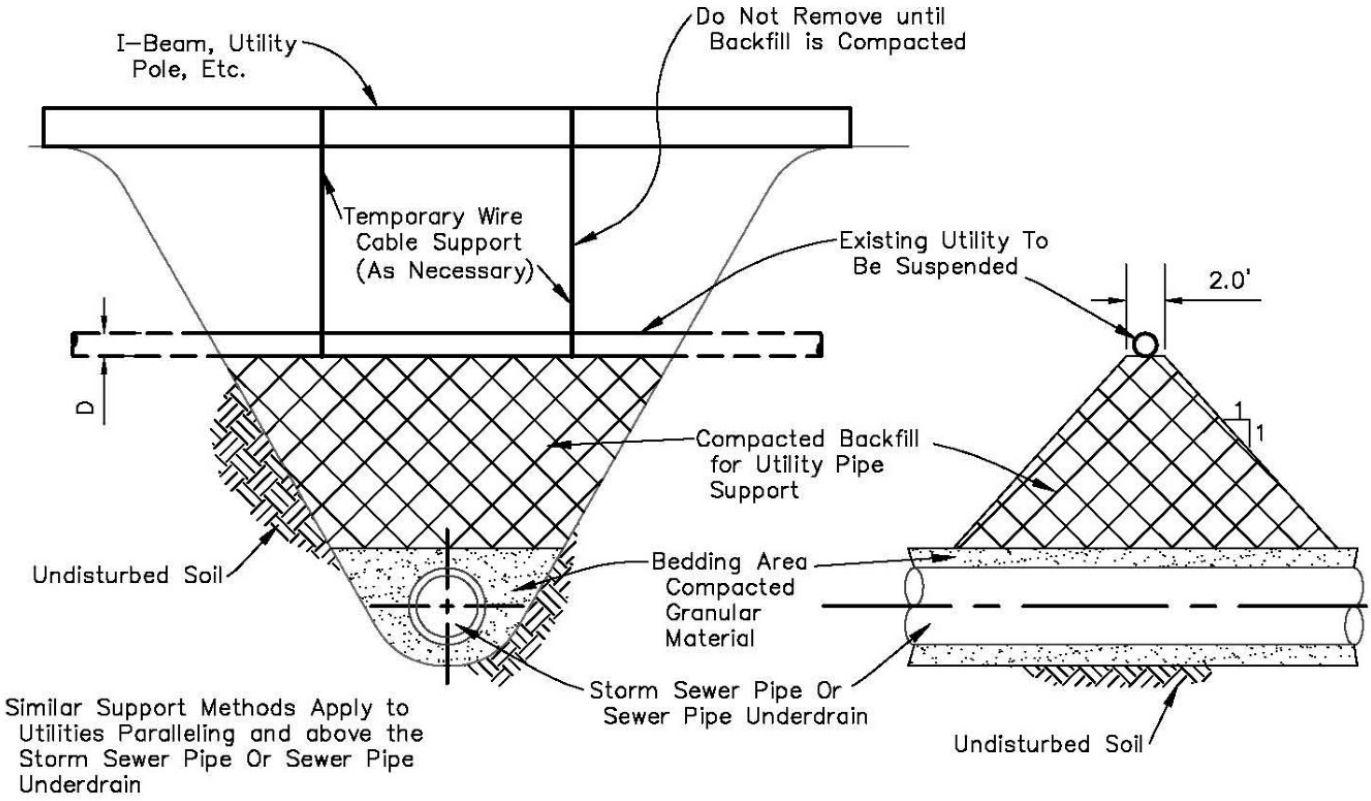
Method III

Method III: In Areas As Indicated

METHODS OF BEDDING PIPE

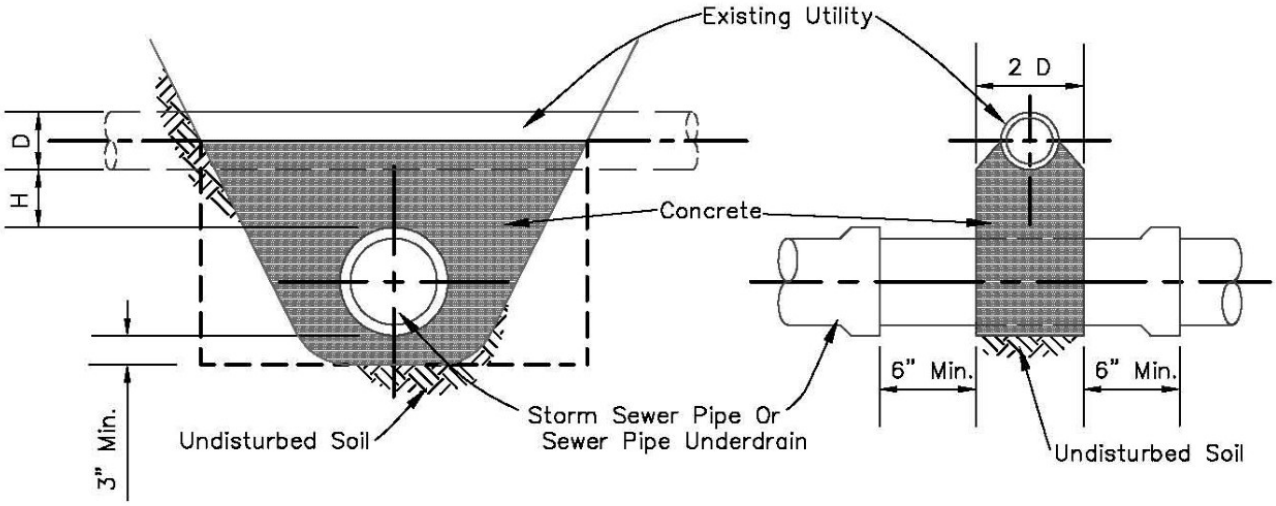
No Scale

3.05 SCHEDULES



SPECIAL SUPPORTS FOR EXISTING UNDERGROUND UTILITIES

No Scale



Not Required When Existing Utility Is 2" Or Smaller

Saddle Requirements	
H	D
0" to 3"	Less than 15"
0" to 6"	18" thru 36"
0" to 12"	42" and Over

PIPE SADDLES

No Scale

3.05 SCHEDULES

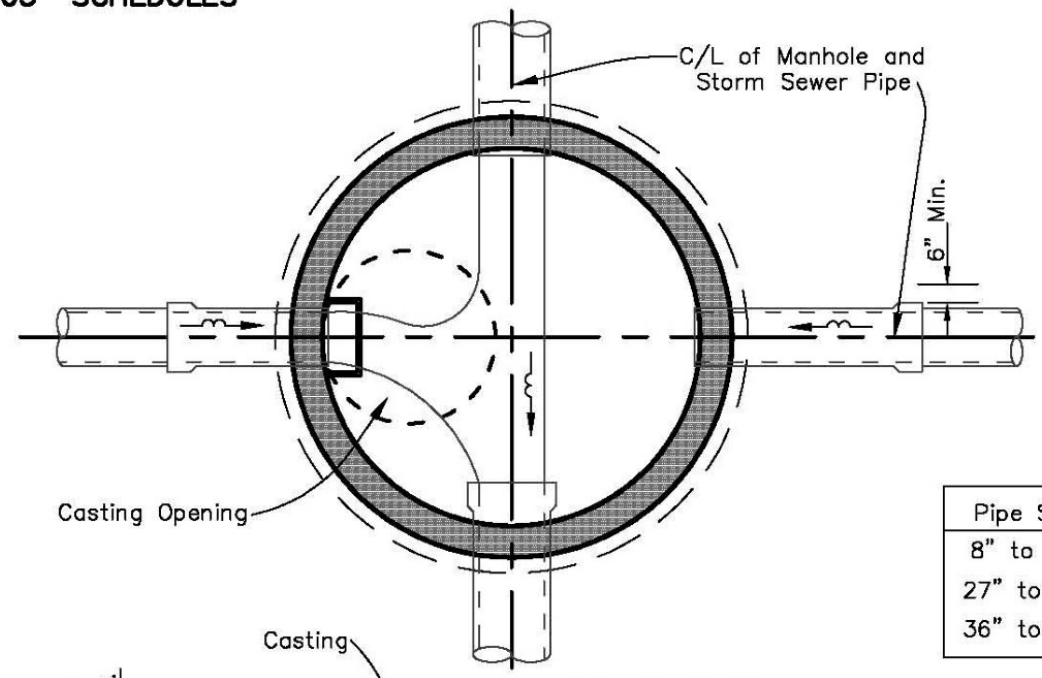
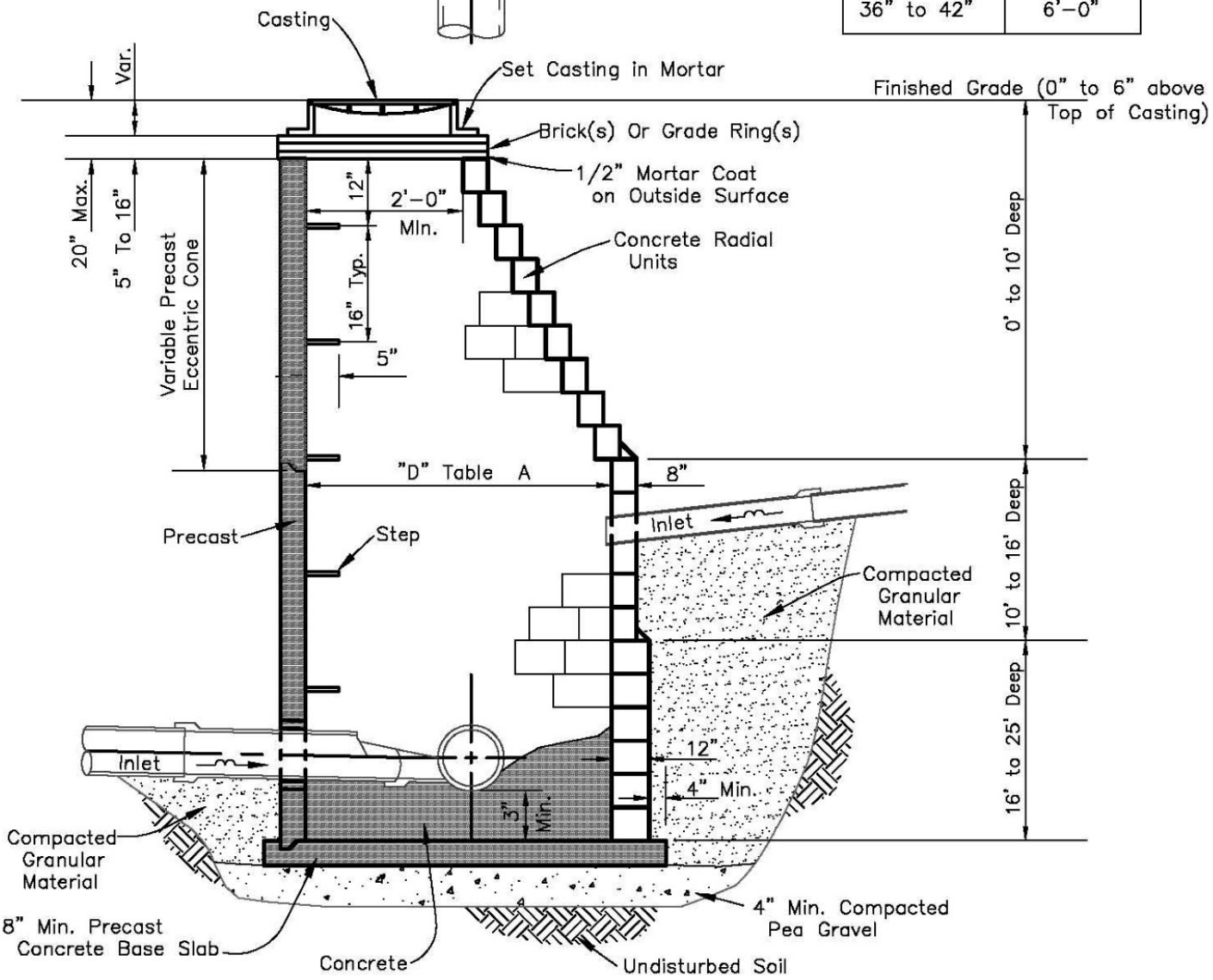


TABLE A

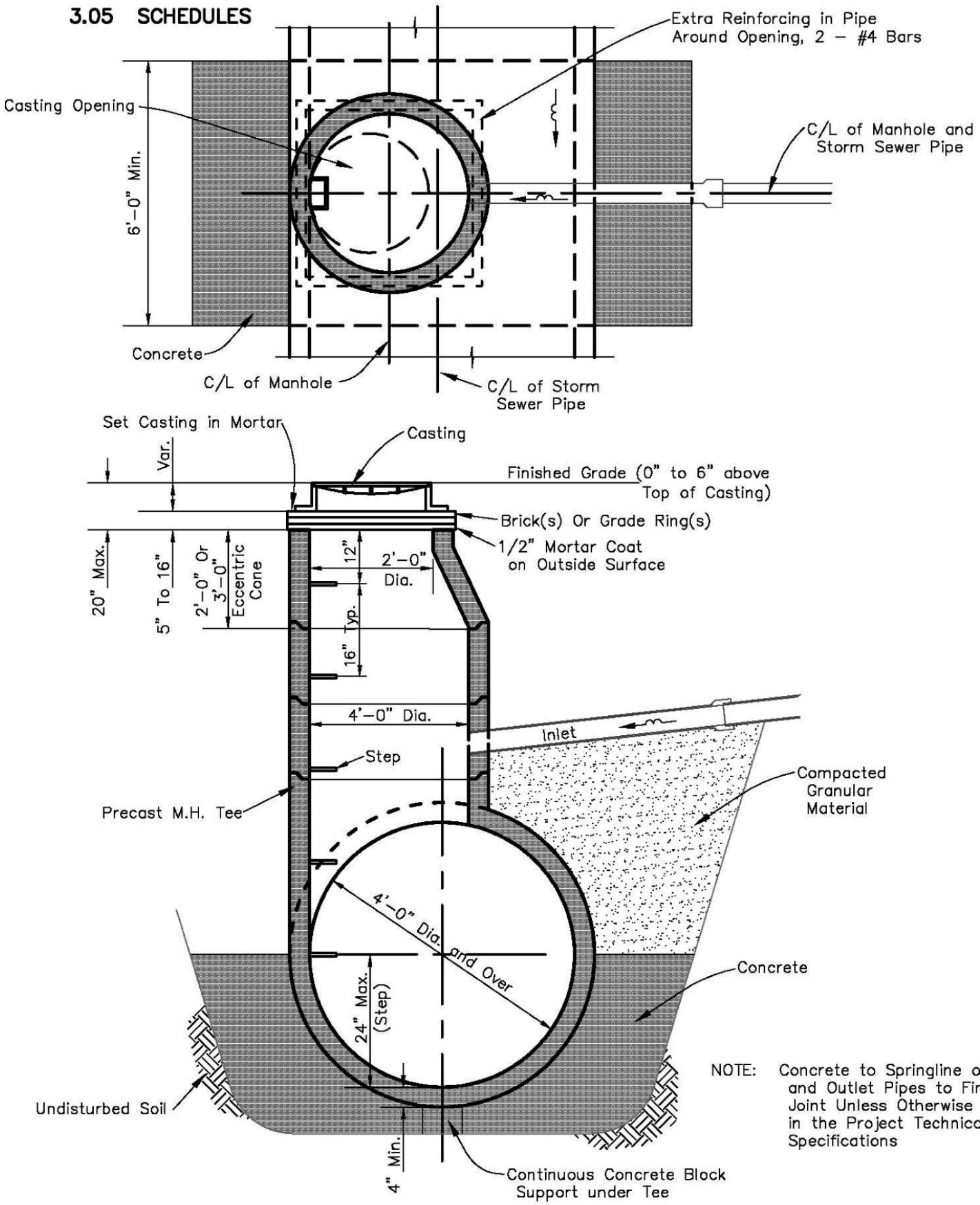
Pipe Size	Size "D"
8" to 24"	4'–0"
27" to 33"	5'–0"
36" to 42"	6'–0"



STANDARD STORM DRAINAGE MANHOLE

No Scale

3.05 SCHEDULES

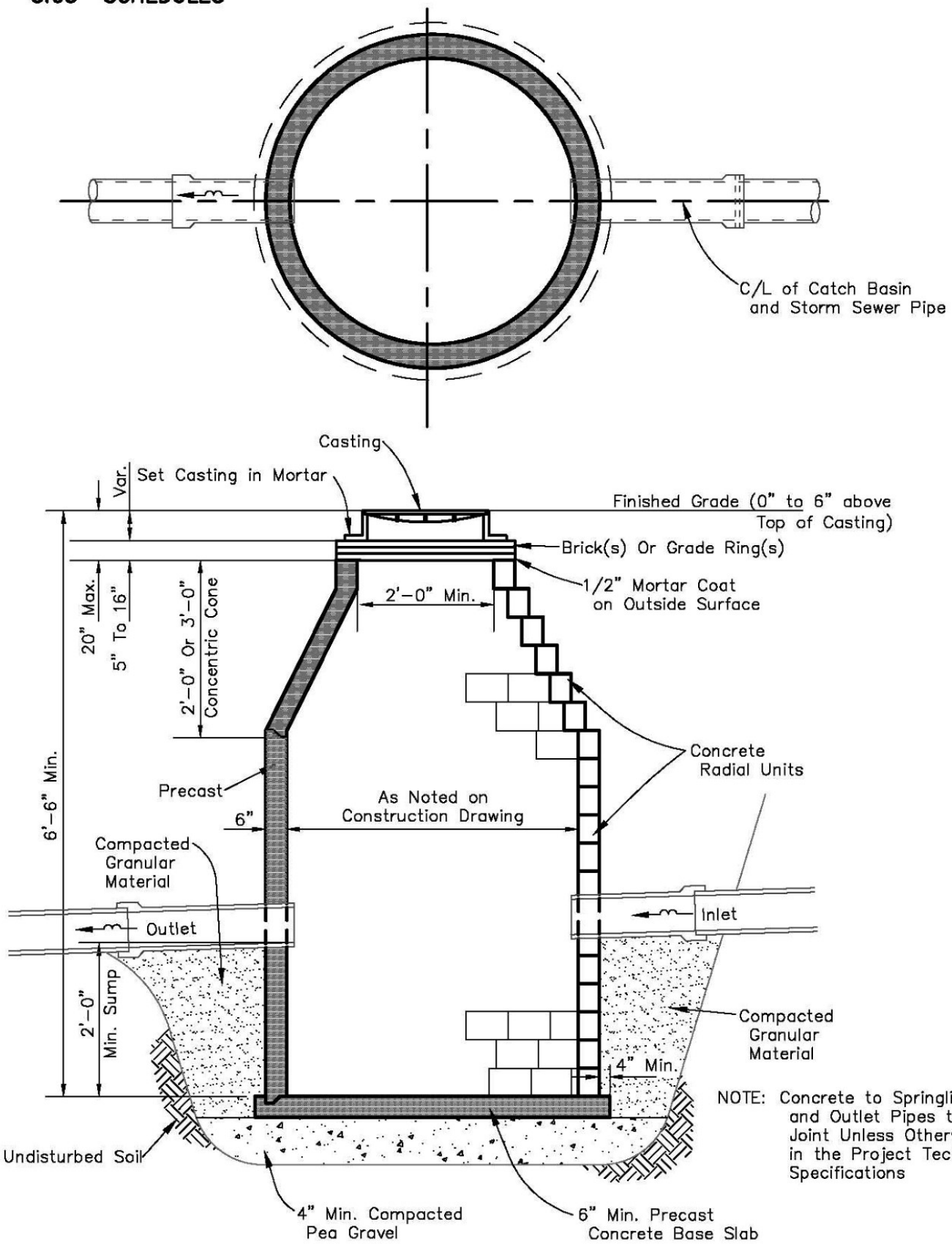


NOTE: Concrete to Springline of Inlet and Outlet Pipes to First Pipe Joint Unless Otherwise Noted in the Project Technical Specifications

STANDARD STORM DRAINAGE TEE MANHOLE

No Scale

3.05 SCHEDULES

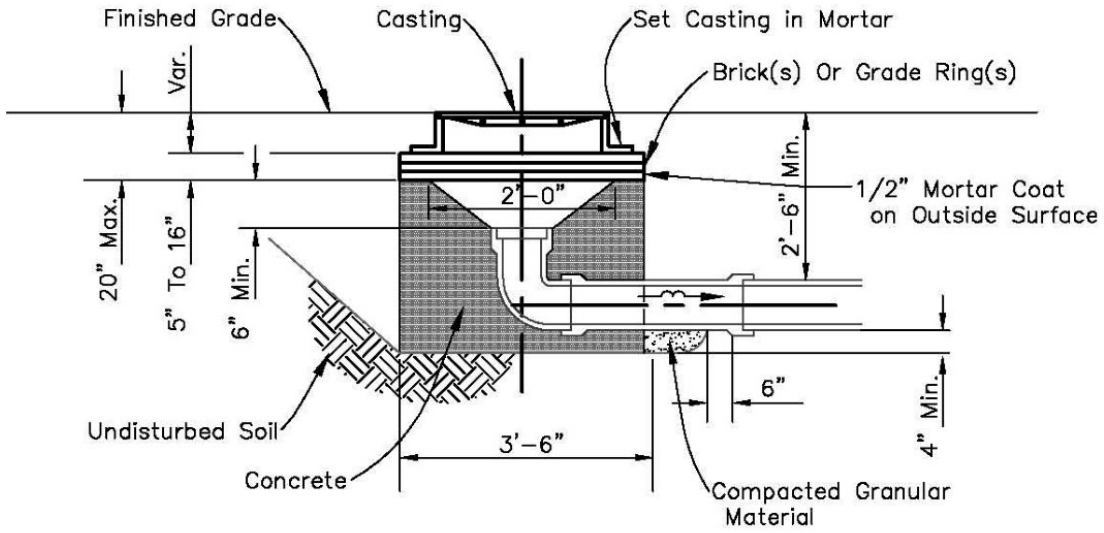


NOTE: Concrete to Springline of Inlet and Outlet Pipes to First Pipe Joint Unless Otherwise Noted in the Project Technical Specifications

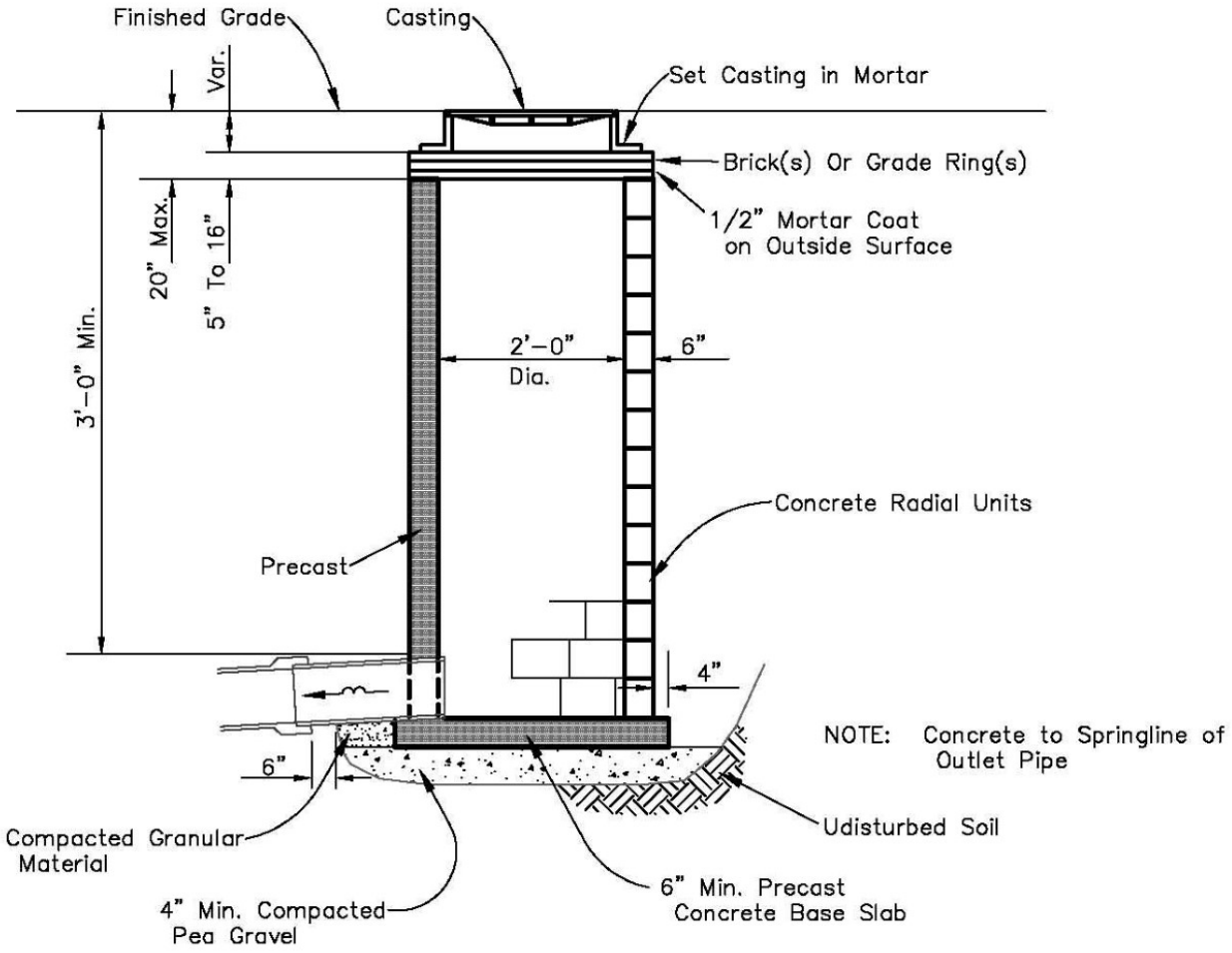
STANDARD STORM DRAINAGE CATCH BASIN

No Scale

3.05 SCHEDULES



CURB INLET
No Scale



INLET

STANDARD STORM DRAINAGE INLETS

No Scale

3.05 SCHEDULES:

CONCRETE PIPE Association of Michigan

MICHIGAN SPECIFICATION FOR EXTRA STRENGTH CONCRETE SEWER PIPE

P.O. Box 1348
Ann Arbor, Mi. 48106
(313) 426-4940

Michigan Designation: C 14 XM5

This specification is to supplement American Society for Testing and Materials Specification covering nonreinforced concrete pipe intended to be used for the conveyance of sewage, industrial wastes, and storm water. All of the A.S.T.M. Designation C 14 Standard Specification for Concrete Sewer Pipe shall apply to this Michigan Specification with the addition of Table 1B as follows:

TABLE 1B - Physical and Dimensional Requirements of Michigan Extra Strength Class 5 Nonreinforced Concrete Sewer Pipe*.

Internal Diameter, Inches	Minimum Thickness of Wall, Inches	Minimum Strength Lb./Lin.Ft. Three-Edge Bearing
8	1-1/8	2500
10	1-7/8	3125
12	2	3750
15	2-1/4	4685
18	2-1/2	5625
21	3	6560
24	3-3/4	7500

* Subject to Tolerances in Section 10.

Nonreinforced concrete sewer pipe meeting the above requirements shall be marked as follows: C 14-XM5.

This Specification supercedes Michigan Designation C 14-XM which can now be specified as A.S.T.M. C 14 Class 3.

7-79

3.05 SCHEDULES:

STORM DRAINAGE COLLECTION PIPE
DESIGN CLASSIFICATION

Pipe Size(In.)	Material	Classification		
		D1*	D2*	D3
6 - 10	Reinforced Concrete	---	---	---
	Nonreinforced Concrete	C14 XM5	Class 3	Class 3
	Corrugated Polyethylene	AASHTO M252	AASHTO M252	AASHTO M252
12 - 15	Reinforced Concrete	Class IV	Class II	Class IV
	Nonreinforced Concrete	C14 XM5	Class 2	Class 3
	Corrugated Steel(A)	---	16 gage	16 gage
	Corrugated Polyethylene	AASHTO M294	AASHTO M294	AASHTO M294
18 - 21	Reinforced Concrete	Class IV	Class II	Class III
	Nonreinforced Concrete	C14 XM5	Class 2	Class 3
	Corrugated Steel(A)	---	16 gage	16 gage
	Corrugated Polyethylene	AASHTO M294	AASHTO M294	AASHTO M294
24	Reinforced Concrete	Class IV	Class II	Class III
	Nonreinforced Concrete	C14 XM5	Class 2	Class 3
	Corrugated Steel(A)	---	16 gage	14 gage
	Corrugated Polyethylene	AASHTO M294	AASHTO M294	AASHTO M294
27 - 30	Reinforced Concrete	Class IV	Class II	Class III
	Nonreinforced Concrete	---	Class 2	Class 3
	Corrugated Steel(A)	---	14 gage	14 gage
	Corrugated Polyethylene	AASHTO M294	AASHTO M294	AASHTO M294
33 - 36	Reinforced Concrete	Class IV	Class II	Class III
	Nonreinforced Concrete	---	Class 2	---
	Corrugated Steel(A)	---	14 gage	14 gage
	Corrugated Steel(B)	---	16 gage	14 gage
	Corrugated Polyethylene	AASHTO M294	AASHTO M294	AASHTO M294

Table Continued

3.05 SCHEDULES:

Pipe Size(In.)	Material	Classification		
		D1*	D2*	D3
39 - 42	Reinforced Concrete	Class IV	Class II	Class III
	Corrugated Steel(A)	---	14 gage	14 gage
	Corrugated Steel(B)	---	14 gage	14 gage
	Corrugated Polyethylene	AASHTO M294	AASHTO M294	AASHTO M294
48	Reinforced Concrete	Class IV	Class II	Class III
	Corrugated Steel(A)	---	12 gage	12 gage
	Corrugated Steel(B)	---	14 gage	12 gage
	Corrugated Polyethylene	AASHTO M294	AASHTO M294	AASHTO M294
54	Reinforced Concrete	Class IV	Class II	Class II
	Corrugated Steel(A)	---	10 gage	10 gage
	Corrugated Steel(B)	---	14 gage	12 gage
60	Reinforced Concrete	Class IV	Class II	Class II
	Corrugated Steel(A)	---	8 gage	8 gage
	Corrugated Steel(B)	---	12 gage	10 gage
66	Reinforced Concrete	Class IV	Class II	Class II
	Corrugated Steel(A)	---	8 gage	8 gage
	Corrugated Steel(B)	---	12 gage	10 gage
72	Reinforced Concrete	Class IV	Class II	Class II
	Corrugated Steel(A)	---	8 gage	8 gage
	Corrugated Steel(B)	---	10 gage	10 gage

* Catch basin, leaching basin and inlet lead pipe shall be C76-III or C14-XM5.

A - 2 2/3" x 1/2" corrugations

B - 3" x 1" corrugations

SECTION 02722

SANITARY SEWAGE COLLECTION SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work Included:
   1. This Section encompasses the work required for all sanitary sewage collection systems.
   2. All work necessary for completion, but not specifically listed as a pay item, will be deemed to be included in one or more of the Bid Form items.

B. Definitions:
   1. Standard manhole unit: Depth of 10 feet or less, lowest invert to top of casting.
   2. Additional manhole depth: Depth in excess of 10 feet.
   3. Line and grade control terminology: Article 3.05 SCHEDULES.
   4. Fittings: Wye, tee and adaptor.
   5. Witnesses: Horizontal measurements to 3 permanent surface features.

C. Method of Measurement and Basis of Payment:
   1. Sanitary sewer: Will be measured on the surface along the centerline of sanitary sewer from center to center of manholes and paid for by the linear foot.
   2. Service line: Will be measured on the surface along centerline of service line from centerline of sanitary sewer and paid for by the linear foot excluding fittings and property line riser.
   3. Sanitary sewer through casing: Will be measured on the surface along the centerline of sanitary sewer and paid for by the linear foot.
   4. Manhole:
      a. Standard manhole unit: Will be counted and paid for by the unit.
      b. Additional manhole depth: Will be measured and paid for by the vertical linear foot.
      c. Drop manhole: Will be counted and paid for by the unit.
   5. Property line riser: Will be counted and paid for by the unit.
   6. Fitting: Will be counted and paid for by the unit.
   7. Construct manhole at end of existing sanitary sewer: Will be counted and paid for by the unit.
   8. Construct manhole over existing sanitary sewer: Will be counted and paid for by the unit.
   9. Connect to existing sanitary sewer manhole: Will be counted and paid for by the unit.
   10. Cut-in to existing sanitary manhole: Will be counted and paid for by the unit.
   11. Cut-in existing sanitary manhole including drop: Will be counted and paid for by the unit.
   12. Connect to exiting sanitary sewer: Will be counted and paid for the unit.
   13. Remove sanitary sewer stub and connect to existing sanitary manhole: Will be counted as a unit and paid for by the unit.
   14. Televising interior of sanitary sewer: Will be measured on the surface along the centerline of sanitary sewer from center to center of manholes and paid for by the linear foot.

15. DELETE
16. Polyethylene encasement: incidental to pipe installation.
    a. Fittings, valves, etc. payment incidental to appurtenances.

1.02 SUBMITTALS

A. Test Specimens:
    1. DIVISION 1 SUBMITTALS AND QUALITY CONTROL
B. Presence of Underground Utilities:
    1. Report
C. Line and Grade Control:
    1. Method: specify
D. Service Line Witnesses:
    1. Wye, tee, and marker at end of service line: Report on record drawings
E. Leakage Test:
    1. Equipment, materials, and method: approval required.
F. Video Records:
    1. DIVISION 1 SUBMITTALS
G. As-Built Requirements
    a) Design engineering to provide:
        1. "Preliminary" As-Builts:
            (1) 2 paper copies (24"x36") of completed "preliminary" as builts for Township review/approval and transfer of Township inspector field information. Township will contact design regarding needs/acceptance of.
            (2) "Final" As-Builts filing requirements:
                (a) 1 paper copies of final
                (b) 1 flash drive of "As-Builts", entire project
    b) Field information required:
        1. Type of pipe
        2. Wye/location, measured from downstream manhole
        3. Length of lateral
        4. Main and property riser detail for each lateral
        5. Length of main, manhole to manhole
        6. All lateral ends are to be witnessed to property corner irons

        Note: Pre-established inverts for both main line risers (MLR) and property line risers (PLR) are designated at the time of design.

1.03 JOB CONDITIONS:

A. Existing sanitary sewage collection system:
    a) Maintain operational
B. Scheduling:
    a) Service line installation: as sanitary sewer installation progresses
    b) Clean-up: promptly following backfilling operations
    c) Televising interior of sanitary sewer: all sanitary sewer shall be televised after Jet-vac.
        i) Owner notification: at least 48 hours prior to commencing and tests are only acceptable if witnessed by owner or engineer
C. Property line risers (PLR) required on all laterals

<u>PART 2 – PRODUCTS</u>

2.01 MATERIALS:

A. General: All materials shall be American or Canadian made unless otherwise allowed in the Project Technical Specifications

B. Pipe:
   1. General: Any of the following materials except where specific materials are indicated on the Drawings or in the Project Technical Specifications
      a. Clay: ANSI/ASTM C700
      b. Ductile iron: ANSI/AWWA C151/A2.51.
      c. Deleted
         (1) Deleted
         (2) Deleted
      d. Plastic (ABS): ASTM D2751
         (1) Color: green or white
      e. Plastic composite (ABS and PVC): ASTM 2680
         (1) Color: green, white, or black
      f. Plastic (PVC): ANSI/ASTM D3034, Type I, Grade I and ASTM F679
         (1) Color: green or white

C. Design classification:
   1. Strength: not less than listed in table, Article 3.05 Schedules

D. Joints:
   1. Clay: ASTM C425
   2. Ductile iron:
      a. Mechanical: ANSI/AWWA C111/A21.11
      b. Push-on: ANSI/AWWA C151/A21.51
   3. Deleted
   4. Plastic (ABS): ASTM D2751
      a. Solvent cement or gasket except service line shall be solvent cement only.
         (1) Wye and bend at sewer main: solvent weld or gasketed.
   5. Plastic composite (ABS and PVC): ASTM D2680
      a. Solvent cement or gasket except service line shall be solvent cement only.
         (1) Wye and bend at sewer main: solvent weld or gasketed.
   6. Plastic (PVC): ASTM D3034 and ASTM F679
      a. Solvent cement or gasket except service line shall be solvent cement only.
         (1) Wye and bend at sewer main: solvent weld or gasketed.

E. Manhole:
   1. Concrete: Class B, Division 3 cast-in-place concrete
   2. Grade ring: ASTM C478
   3. Wall section:
      a. Precast: ASTM C478 modified to C76 Class III, Wall B thickness or ASTM C76 Class III
         (1) Joint: Rubber O-ring; ASTM C443
         (2) Pipe openings: Rubber boot and stainless steel bands or pipe joint cast in wall section
      b. Drop, integrally formed as part of base and sections
         (1) Article 3.05 schedules
   4. Concrete base: integrally precast with wall section
   5. Mortar: ASTM C270, Type S
   6. Manhole steps:

a. Plastic: reinforced with 3/8” steel rod and dimensioned as cast iron (East Jordan Iron Works 8509)
b. To be aligned vertically above downstream outlet

7. Manhole casting:
a. Cover: Imprinted with the letter G.T. logo
b. Vented: EJIW 1045, Type B cover or equal
c. Standard: EJIW 1045, Type A cover or equal
d. Watertight and bolt down: EJIW 1045 PT, areas outside of pavement

F. Sanitary Lateral Cleanout:
1. Pipe: Same material and strength classification as adjoining pipe
a. Joint: Solvent weld only
2. Plug, screw type
a. Female adapter with raised plug
3. Castings: sewer lids
a. Non-paved areas EJIW 1566Z A Assembly
b. Paved areas EJIW V8502 Assembly

G. Wye, Tee, and Bend:
1. Same material and strength classification as adjoining pipe.
a. Exception: 45 degree bend at base of property line riser shall be SDR 26 or SDR 23.5.

H. Polyethylene Encasement:
1. Tubing: ANSI/AWWA C105 Class C
2. Closing tape: 2 inch wide Poly Ken #900 or Scotchwrap #50

I. Miscellaneous Concrete:
1. Class B, DIVISION 3 CAST-IN-PLACE CONCRETE

J. Service Line Marker:
1. Wood stake: Full 2x2 green oak or 2x4 wolmanized

PART 3 – EXECUTION

3.01 PREPARATION

A. Alignment and Grade:
1. Deviations: Notify ENGINEER and obtain instructions where there is a grade discrepancy or an obstruction not shown on the drawings.
2. Line and grade control: By laser beam:
a. Check points: At set-up point, 25 feet, 50 feet, 100 feet, and 100 foot points thereafter to the next set-up point.
b. Projector advancement: Reset at each manhole.

B. Bedding:
1. Method: Article 3.05 SCHEDULES
2. Bedding area backfill: DIVISION 2 EXCAVATION AND BACKFILL FOR UNDERGROUND UTILITIES
3. Bearing: Support entire length of pipe barrel evenly.

C. Cleaning Pipe and Fittings:
1. General: Interior free of foreign material and joint surfaces free of lumps and blisters.

D. Televising Interior of Sanitary Sewer:
1. To be done after:
a. Interior work is complete
b. All final air and no-go testing has been observed by Georgetown inspector

c. All lines have been jet-vac'd and all jet vac operation is shutdown avoiding any disturbance/misread

2. Test balls are to be removed after jet/vac operation, prior to televising.
   a. Swabbing after flushing: Not allowed.

3.02 INSTALLATION

A. Laying pipe:
   1. Direction: Upstream with spigot or tongue end downstream.
   2. Joints: Smooth and clean.
   3. Placement: Pipe length and bedding as a unit in frost-free, dry trench.
   4. Special supports and saddles: Article 3.05 SCHEDULES
   5. Sanitary sewer through casing:
      a. Pull sanitary sewer through casing on wooden skids as recommended by manufacturer.
         1. Skids: Thick enough to prevent sanitary sewer joints from contacting casing and notched so that straps or wires do not contact casing
         2. Lubricating: Casing or skids.
      b. Fill void between casing and sanitary sewer with grout or pea stone and plug ends of casing with masonry.
   6. Termination:
      a. Plug: Pipe 6 thru 21 inch with standard disc.
      b. Bulkhead: Pipe 24 inches and larger with brick and mortar and ½ inch mortar outside.
         1. 24 thru 36 inch: 4 inches thick
         2. 39 inch and larger: 8 inches thick

B. Cutting pipe:
   1. Clay: Power saw.
   2. Ductile iron: Power saw.
   3. Reinforced concrete: Power saw.
   4. Plastic: Power or hand saw.

C. Jointing:
   1. Solvents, adhesives, and lubricants: Manufacturer's recommendations
   2. Gasket position: Confirm.

D. Manhole:
   1. General: Article 3.05 SCHEDULES
   2. Concrete base: On a minimum of 4 inches of pea gravel with full and even bearing.
   3. Grade ring: Full mortar bed, tooled.
   4. Wall section: Fill joint completely with mortar and trowel.
   5. Casting setting:
      a. Article 3.05 SCHEDULES
      b. Permanent pavement: Finished grade.
      c. Aggregate areas: 4 to 6 inches below finished grade.
         1. Protect casting with an 8 mil thick polyethylene sheet before covering with aggregate.
      d. Nonpavement and lawn areas: Finished grade or as directed by OWNER.
   6. Compacted road gravel around casting setting, no poured concrete

E. Connections:
   1. Existing sanitary sewage collection system:
      a. Structures:
         1. Article 3.05 SCHEDULES

2. Brick and block: Relay and repoint loose bricks and blocks.
3. Precast and cast-in-place: By concrete coring or drilling machine:
    a. Install rubber boot sized for the type of pipe to be used.

b. Sewer: Use same material as existing, to next structure.

F. Corrosion Protection, Poly Wrap:
1. All iron to be wrapped per Ductile Iron Pipe Research Association Specification.

G. Service line:
1. Line and grade:
    a. Alignment: Right angles to main line sewer unless otherwise directed by ENGINEER.
    b. Grade: Uniform rate, from connection or main riser to the property line but not less than 1 percent.
    c. Minimum depth: In general, the minimum depth of the service line at the street right-of-way line or the easement line shall be determined as follows:
        1. Standard house with basement:12 feet below first floor elevation
        2. Tri-level house: 4 feet below basement floor elevation
        3. House with walkout basement: 5 feet below basement floor elevation
        4. Commercial buildings, schools, churches, etc.: determined in the field by the ENGINEER
        5. Unimproved lot or parcel served by sanitary sewer: 10 feet below centerline of street
        6. Easement areas: as determined in the field by the ENGINEER.
        7. Property line riser not subject to above depth requirements
    d. Connection fitting:
        1. Location: by ENGINEER
        2. Wye, 45 degrees: all sanitary sewer
        3. Tee: Sanitary sewer 24 inch and larger
    e. Main riser: Article 3.05 SCHEDULES
        1. Allowed only where cover exceeds 12 feet at connection and minimum depth requirements can be maintained.
    f. Plugging: Standard plugs or caps securely blocked.
    g. Marker:
        1. Dimensions:
            a. Wood stake: Full 2x2 green oak or 2x4 wolmanized.
        2. Location: Extend vertically from end of service line to 3 feet above finished grade.
    h. Property line riser: Article 3.05 SCHEDULES
    i. Termination: At street right-of-way line or easement line unless otherwise directed by ENGINEER.

3.03 QUALITY CONTROL:

A. Testing and Inspection:
1. General:
    a. Observation: By ENGINEER
    b. Notification: Clean and pretest, then arrange with ENGINEER for inspection and test.
    c. Completion: Final no-go and air test to be witnessed by Georgetown Township after castings have been raised thru first course of bit.
2. Line and grade: Allowable tolerance between structures from proposed alignment.
    a. Line:

1. Pipe thru 36 inch: 0.20 foot.
2. Pipe 39 inch and larger: 0.40 foot.

b. Grade:
1. Pipe thru 36 inch: 0.02 foot.
2. Pipe thru 39 inch and larger: 0.05 foot.

3. Plastic pipe deformation:
a. General: Check with go, no-go gauge pulled through sanitary sewer.
b. Gauge:
1. Outside diameter: 95 percent of actual inside diameter of pipe.
2. Manufacturer: Wartco, Inc. 9-arm deflector mandrel or approved equal.
c. Schedule: Perform at least 30 days after backfilling operations and after gauge has been checked with proving ring.

4. Leakage:
a. General:
1. Acceptable leakage after repairing visible leaks (air or water):
a. Water: Less than 200 gallons per inch of pipe diameter per mile of pipe per 24 hours.
b. Air: Holding time not less than that listed in table, Article 3.05 SCHEDULES
2. Manholes: Allowable leakage included as pipe of equal diameter.
3. Corrections: Repair defects and repeat test until acceptable.
b. Infiltration test (water):
1. Conditions: Minimum groundwater depth 2 feet above crown of pipe at high point of collection system under test.
2. Procedure:
a. “V” notch weir: Install and maintain at low end of collection system under test.
i. Leakage: Quantity of water measured with “V” notch weir.
3. Televising: All pipe after groundwater table has returned to approximate level prior to dewatering operations.
a. Repair all visible leaks by removing and replacing leakage sections(s) of pipe or, sealing with grout
b. Retelevise entire length of sewer between manholes where observed leaks were repaired.
c. Exfiltration test (water):
1. Conditions: determine groundwater elevation
2. Procedure:
a. Filling: minimum 2 feet above crown of pipe at high point of collection system or 2 feet above groundwater elevation, whichever is higher.
b. Supplying make-up water: measurable source.
c. Leakage: quantity of water supplied to maintain level at beginning of test.
d. Exfiltration test (air):
1. Conditions: Determine groundwater elevation
2. Procedure:
a. Pressurizing system: Apply 4.0 pounds per square inch gauge (psig) above average groundwater head. Allow 2 minutes for

temperature stabilization. Adjust start pressure to 3.5 psig above groundwater head.

b. Leakage (air loss): measure time interval for pressure to drop 1.0 psig

5. Depth of service line at termination excluding property line riser: to be pre-determined through engineering with adherence to Georgetown Township standards, invert elevation is to be recorded on as-builts

3.04 ADJUST AND CLEAN

A. General:

1. Keep collection system clean as work progresses

3.05 SCHEDULES

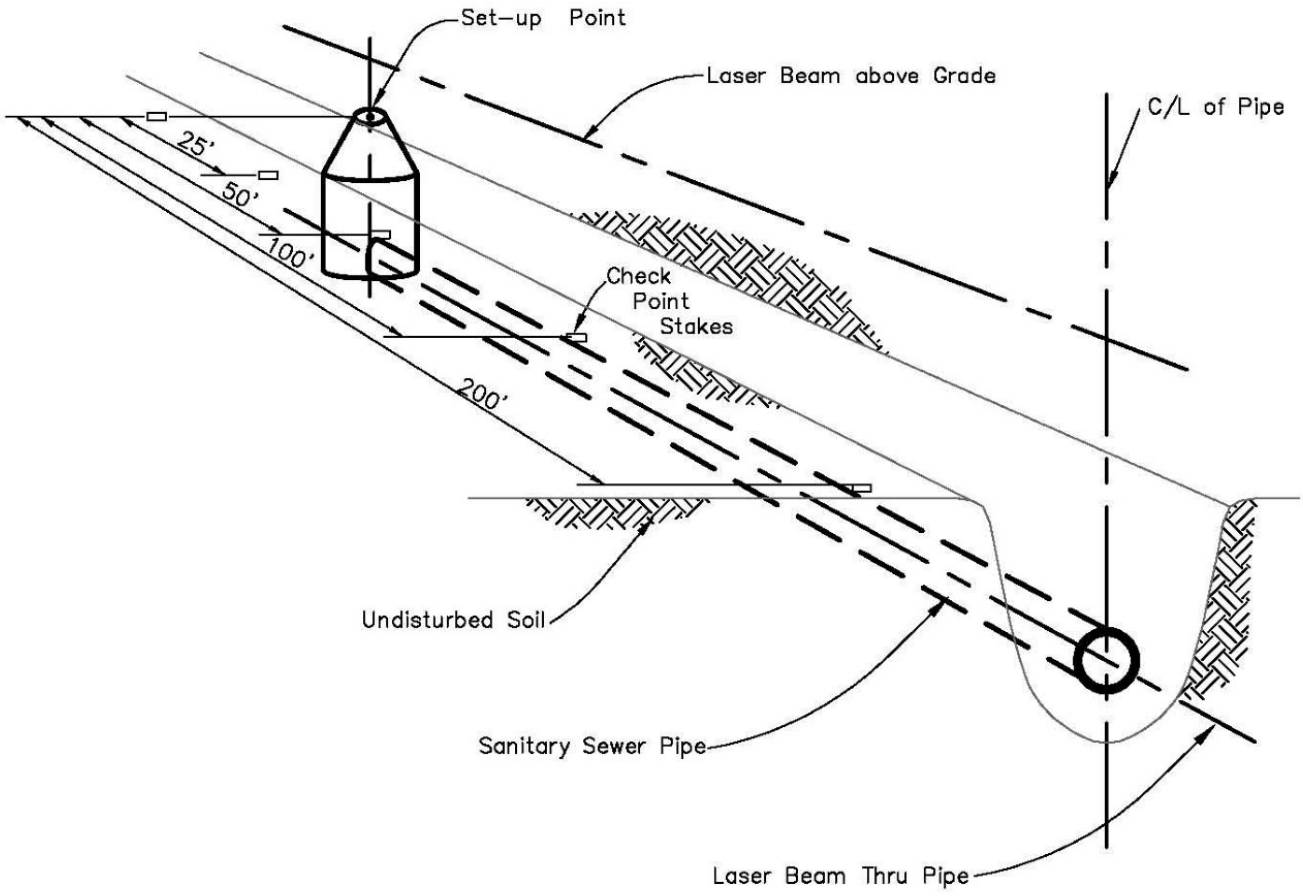
A. Standard details:

1. Line and grade control terminology
2. Methods of bedding pipe
3. Special supports for existing and underground utilities
4. Pipe saddles
5. Precast drop manhole
6. Standard manhole
7. External drop at existing manhole
8. Standard tee manhole
9. Water tight and bolt down manhole casting
10. Plastic pipe construction to existing manhole
11. Main risers
12. Property line riser
13. DELETE

B. Tables:

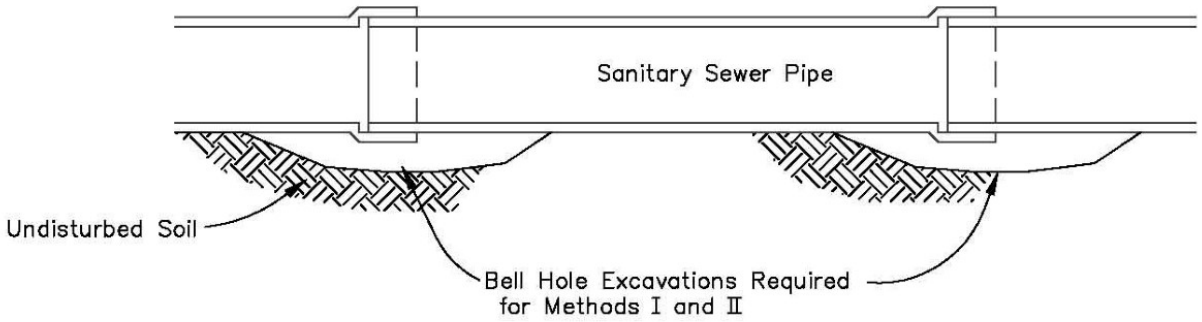
1. Sanitary sewage collection pipe, design classification
2. Air test-holding time

3.05 SCHEDULES

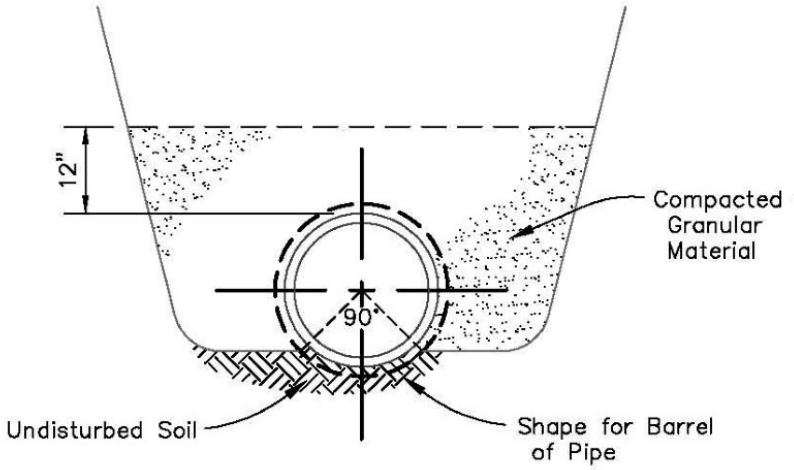


LINE AND GRADE CONTROL TERMINOLOGY

3.05 SCHEDULES

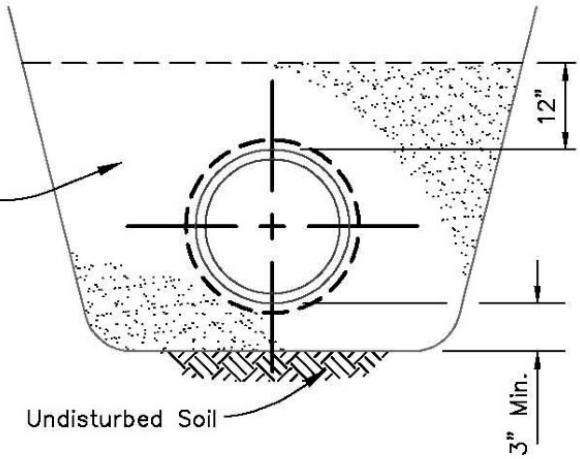


EXCAVATION FOR BELLS



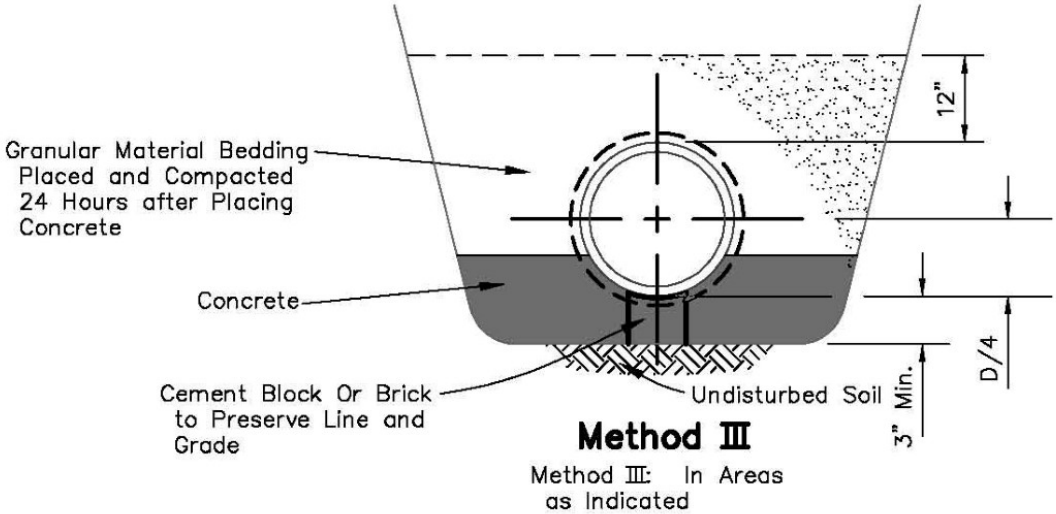
Method I

Method I: Areas of Unconsolidated Soils (Sand, Gravel & Etc.)



Method II

Method II: Areas of Consolidated Soils (Clay, Hardpan, Rock & Etc.)



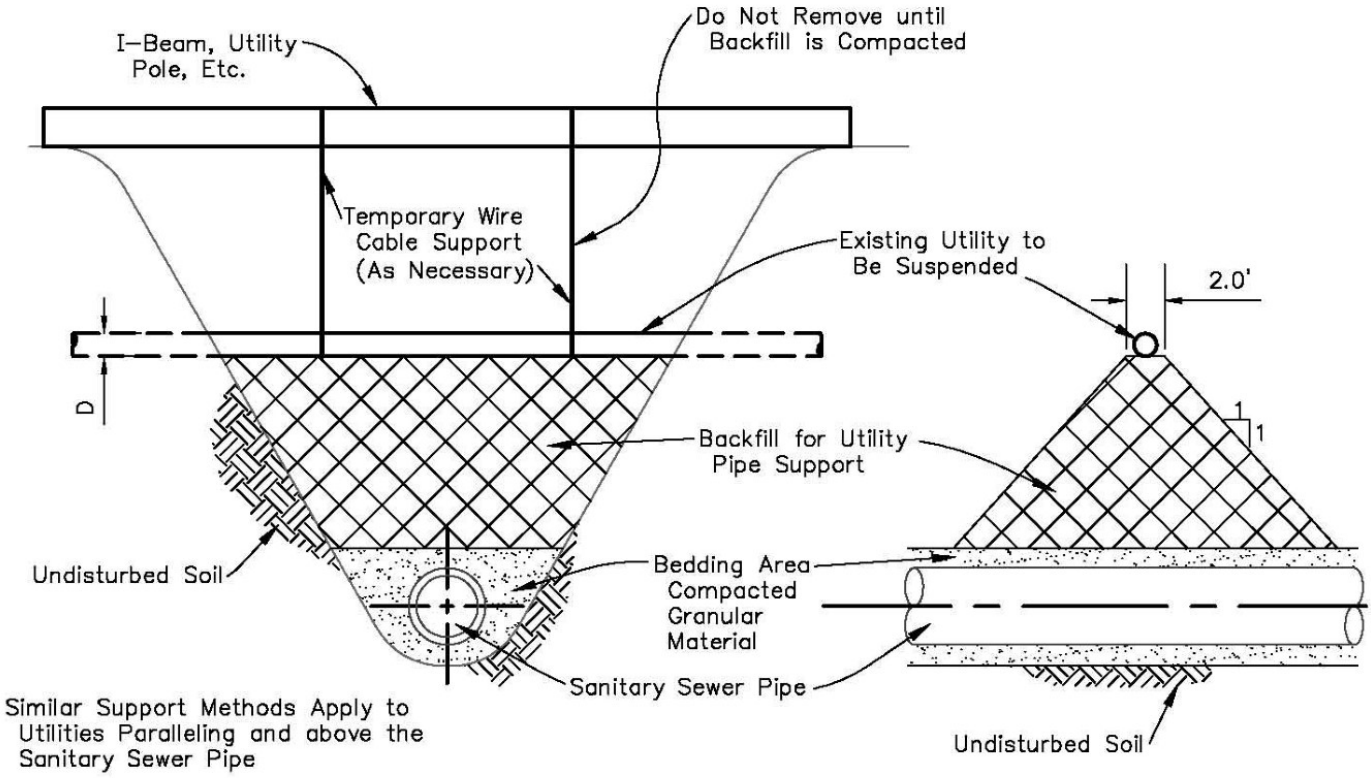
Method III

Method III: In Areas as Indicated

METHODS OF BEDDING PIPE

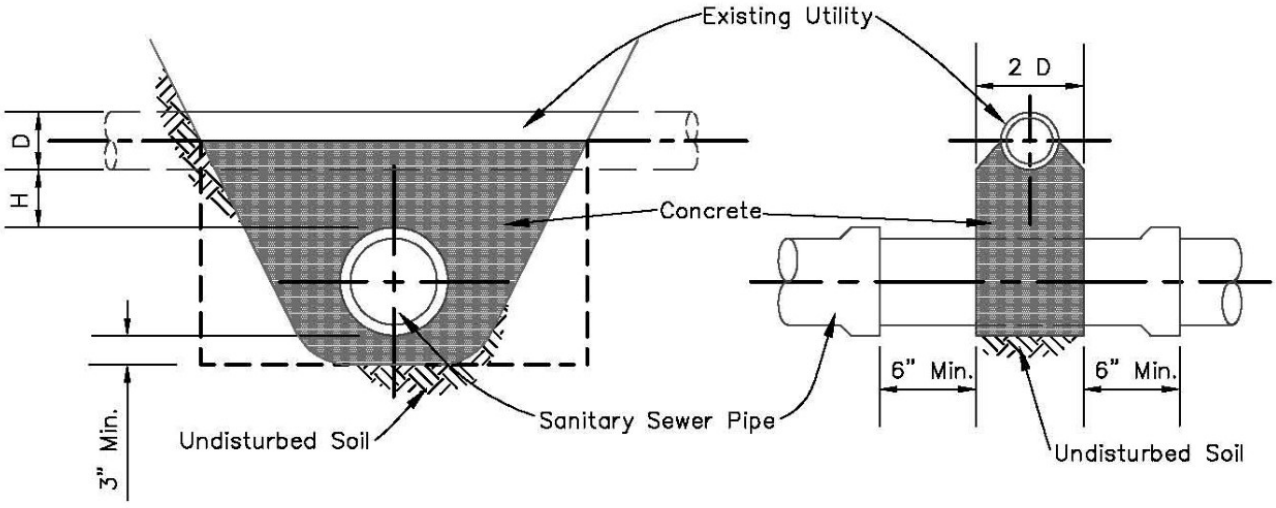
No Scale

3.05 SCHEDULES



SPECIAL SUPPORTS FOR EXISTING UNDERGROUND UTILITIES

No Scale



Not Required When Existing Utility Is 2" Or Smaller

Saddle Requirements	
H	D
0" to 3"	Less than 15"
0" to 6"	18" thru 36"
0" to 12"	42" and Over

PIPE SADDLES

No Scale

3.05 SCHEDULES

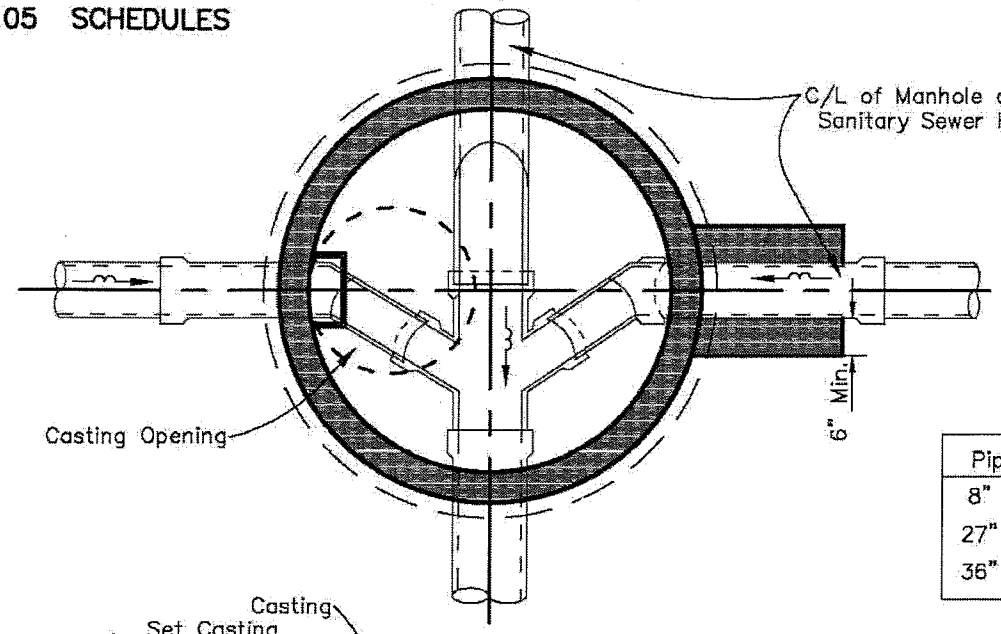
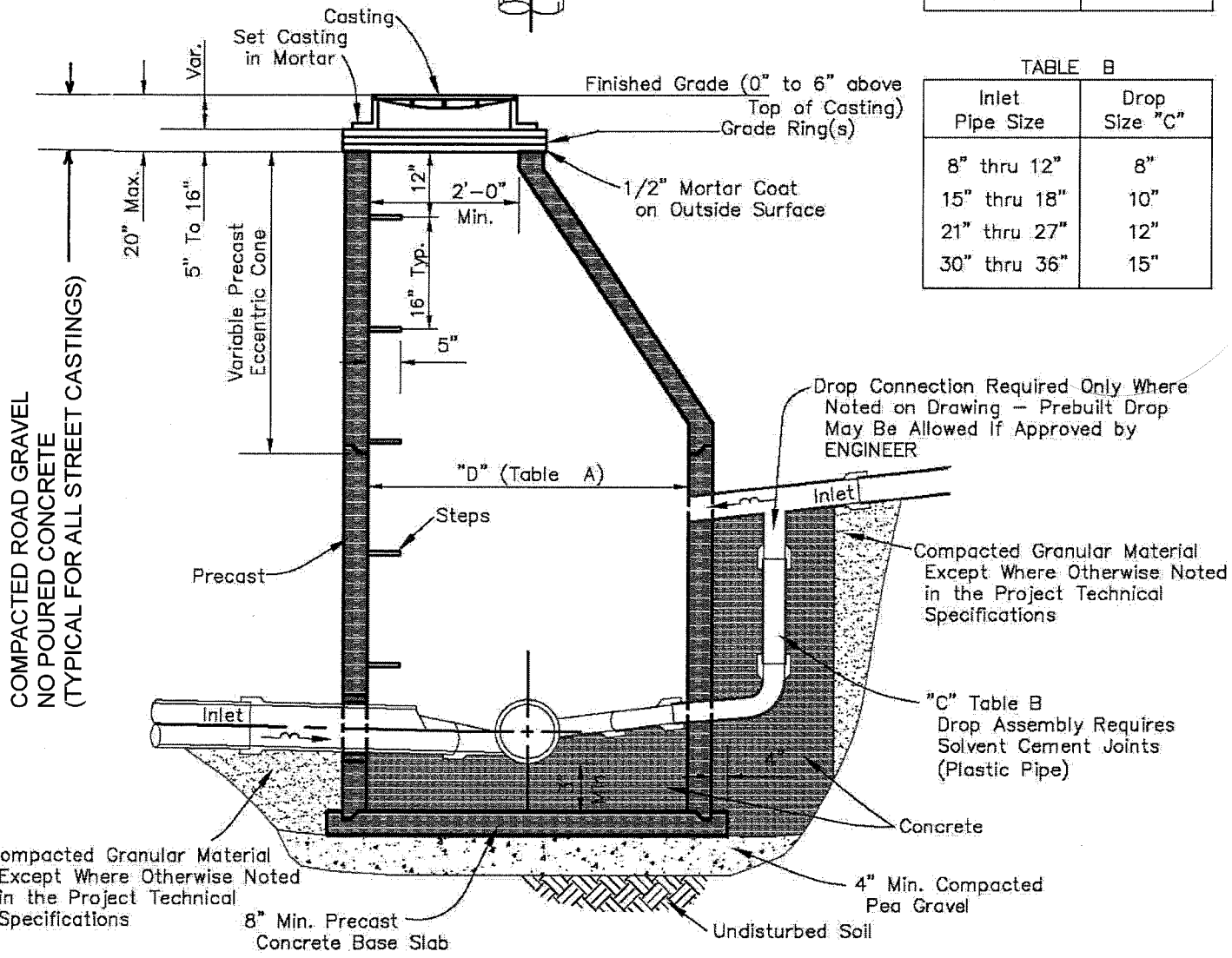


TABLE A

Pipe Size	Size "D"
8" to 24"	4'-0"
27" to 33"	5'-0"
36" to 42"	6'-0"

TABLE B

Inlet Pipe Size	Drop Size "C"
8" thru 12"	8"
15" thru 18"	10"
21" thru 27"	12"
30" thru 36"	15"

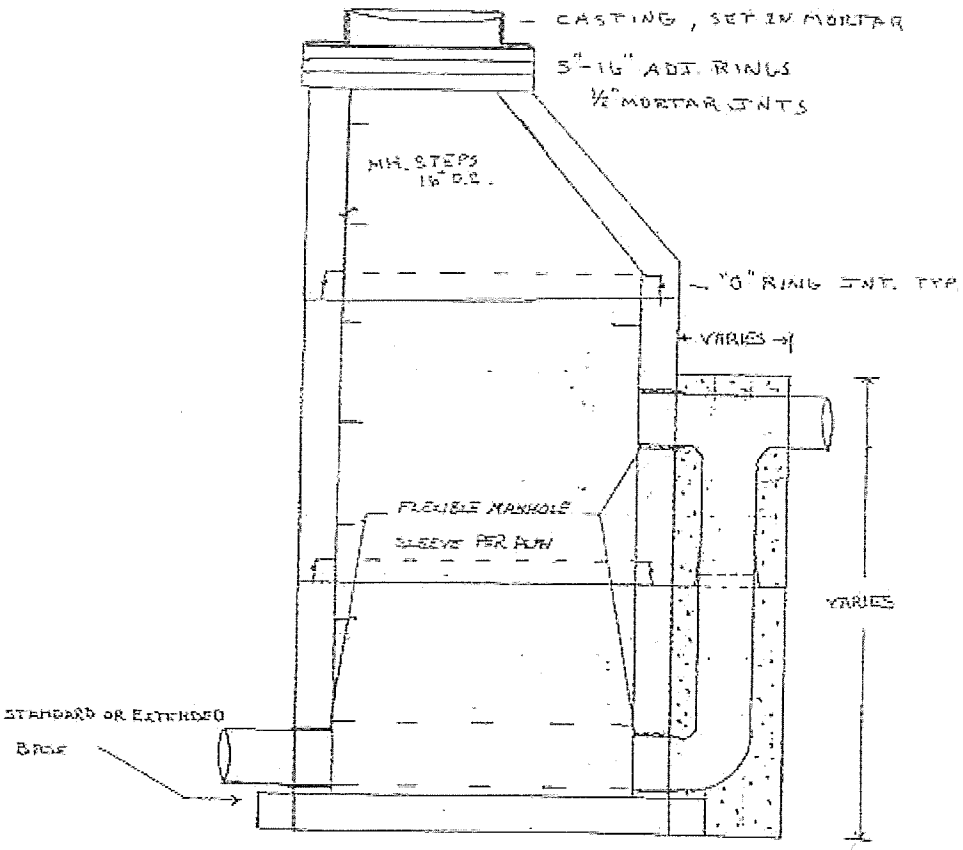


STANDARD SANITARY SEWER MANHOLE

No Scale

3.05 SCHEDULES

SECTION 02722

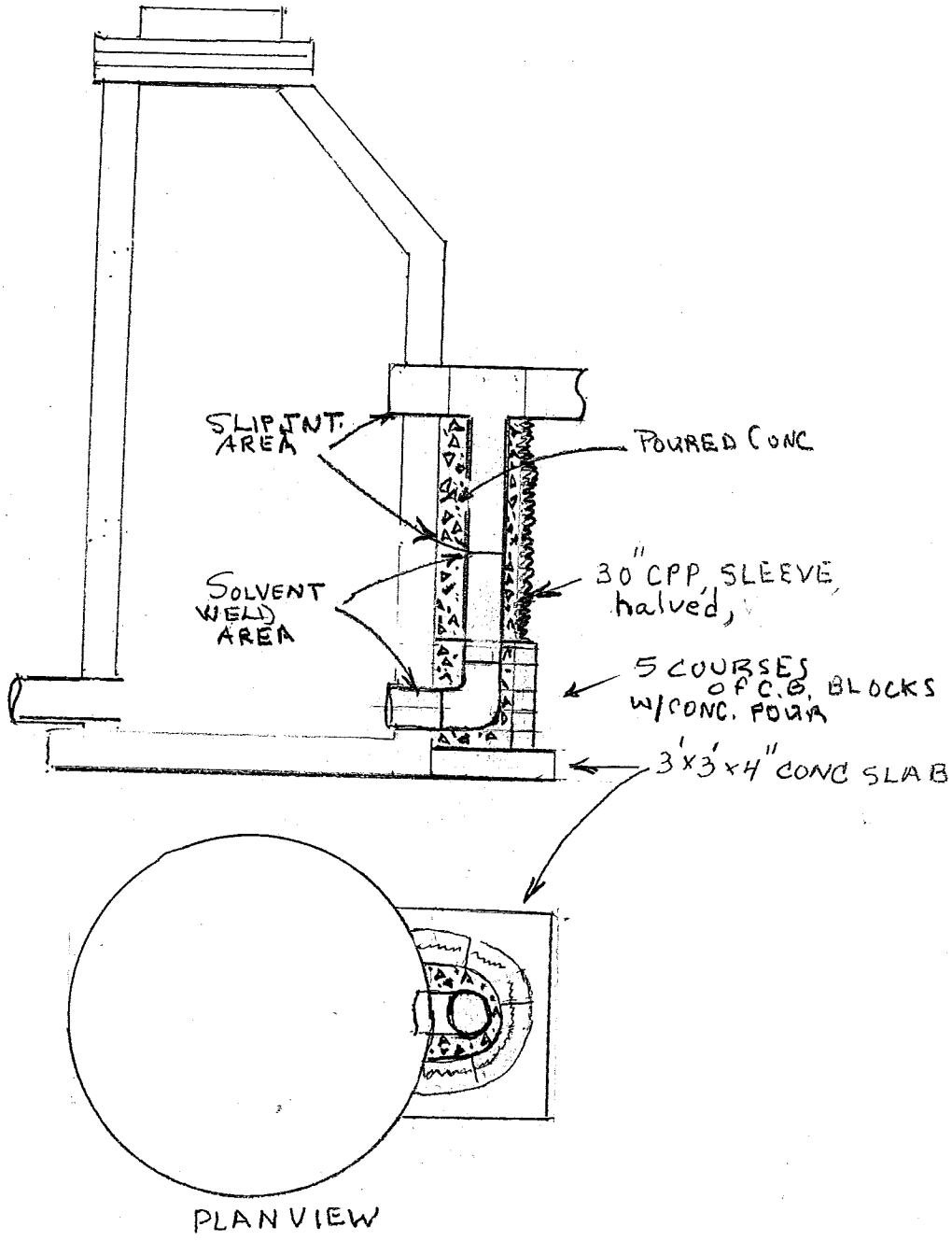


48" DIA. PRECAST SANITARY MANHOLE
SHOWN WITH PRECAST DROP
A.S.T.M. C-478

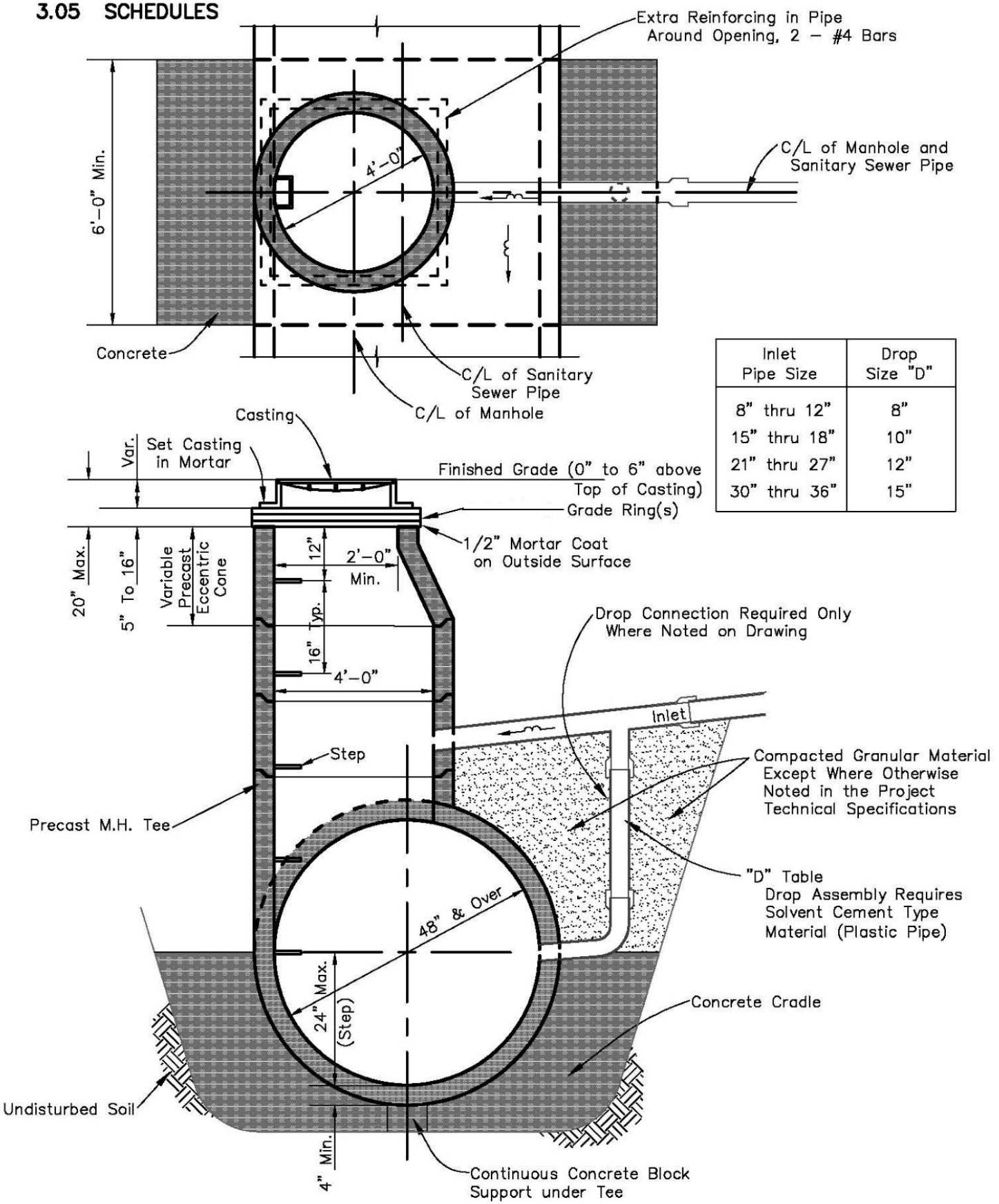
3.05 SCHEDULES

SECTION 02722

EXTERNAL DROP AT EXISTING MANHOLE



3.05 SCHEDULES

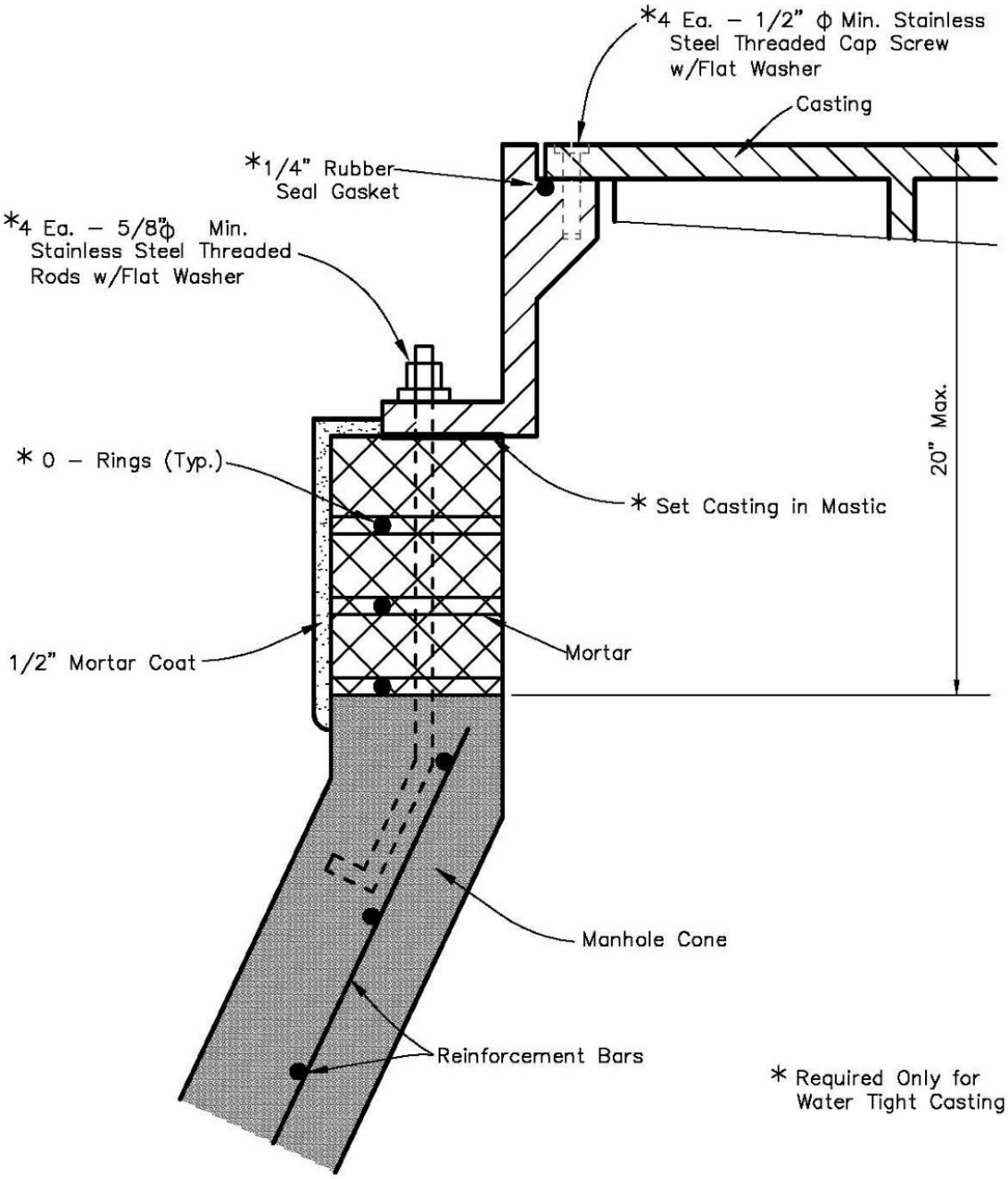


Inlet Pipe Size	Drop Size "D"
8" thru 12"	8"
15" thru 18"	10"
21" thru 27"	12"
30" thru 36"	15"

STANDARD SANITARY SEWER TEE MANHOLE

No Scale

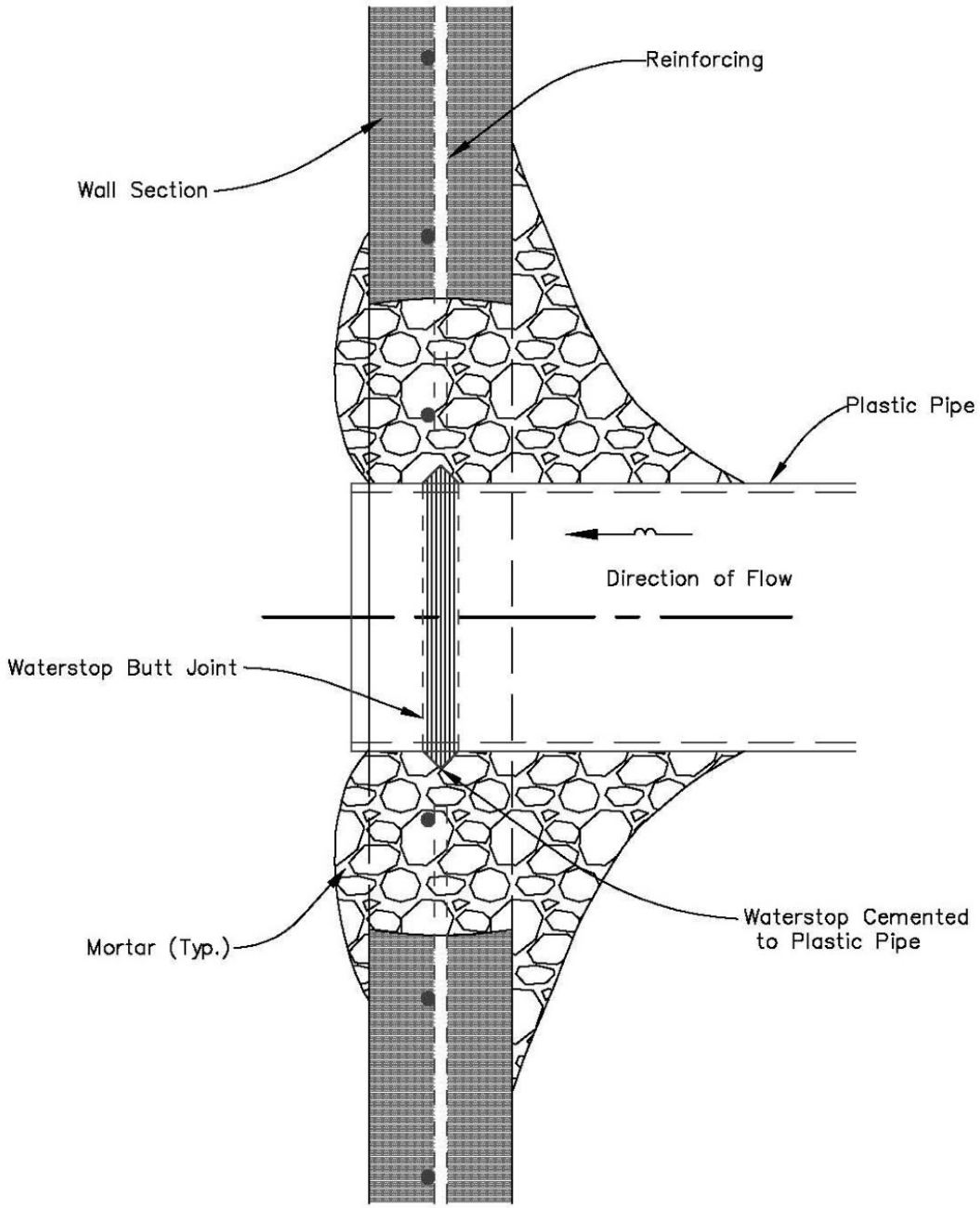
3.05 SCHEDULES



WATER TIGHT AND BOLT DOWN MANHOLE CASTING

No Scale

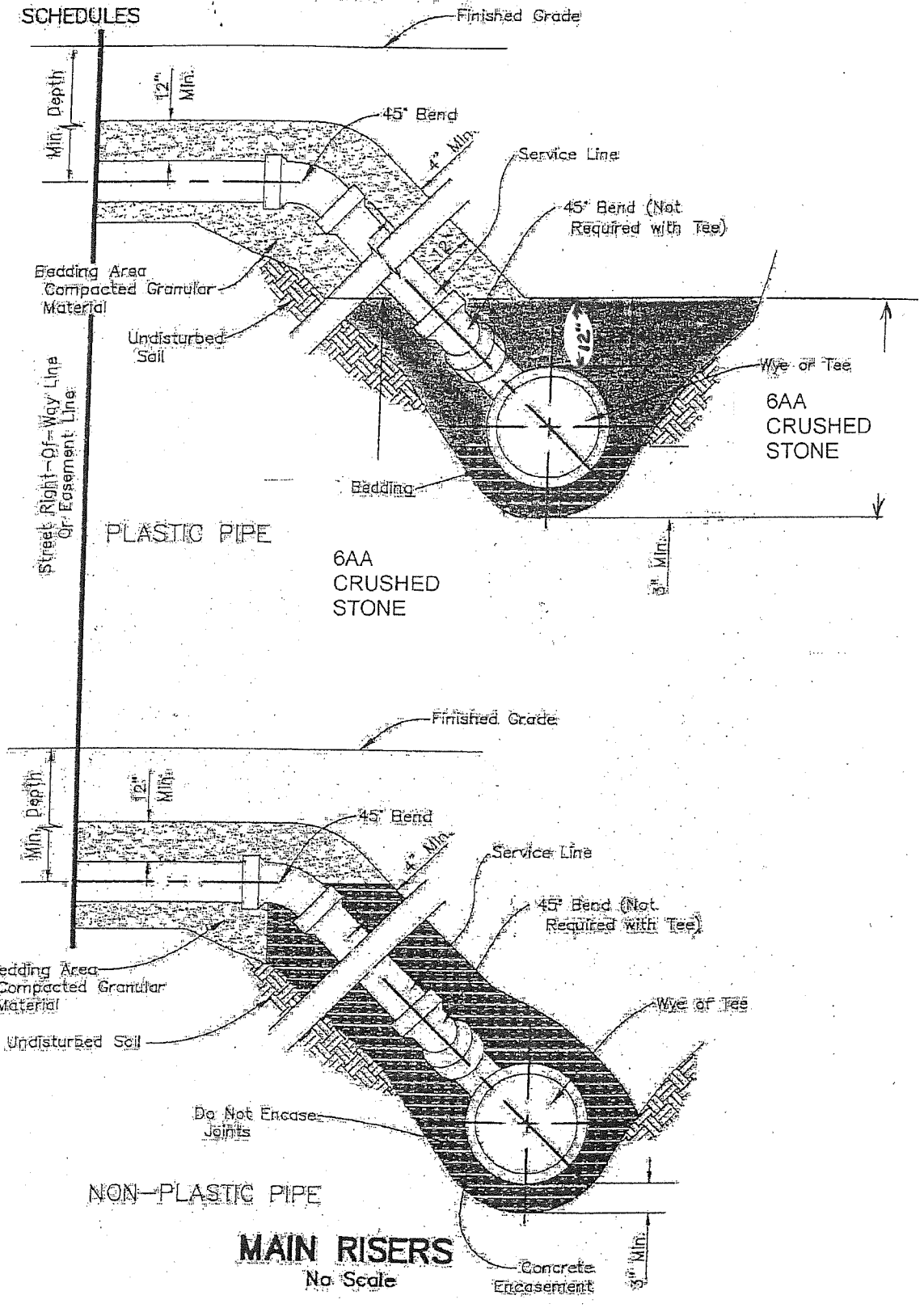
3.05 SCHEDULES



PLASTIC PIPE CONNECTION TO EXISTING MANHOLE

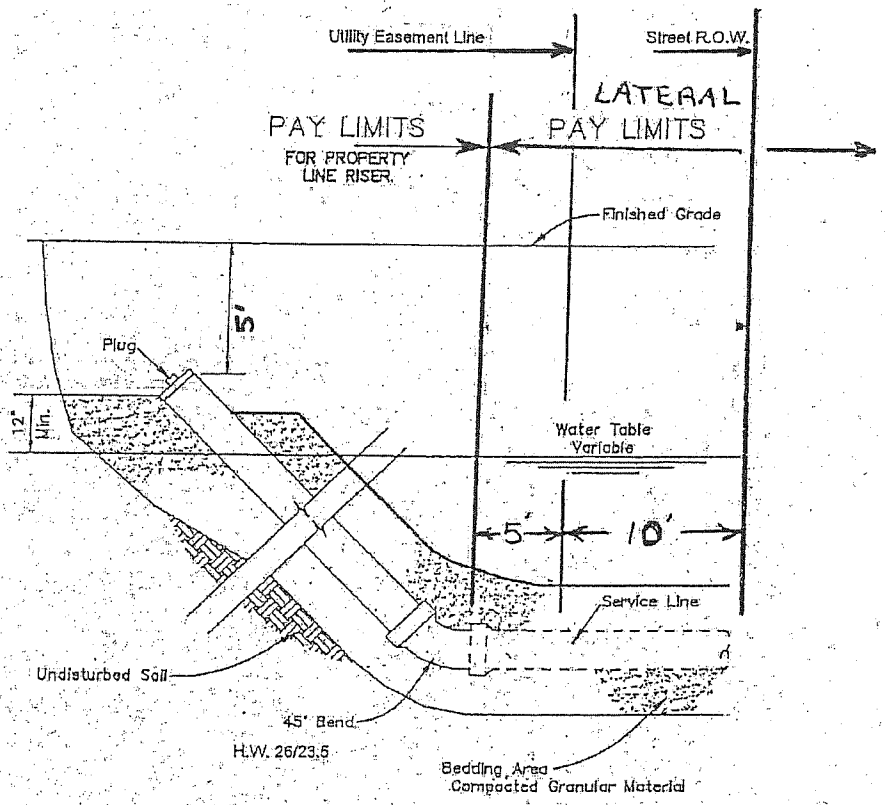
No Scale

3.05 SCHEDULES



MAIN RISERS

No Scale



PROPERTY LINE RISER
No Scale

SECTION 02722

3.05 SCHEDULES

SANITARY SEWAGE COLLECTION PIPE DESIGN CLASSIFICATION

		DEPTH CLASSIFICATION*			
PIPE SIZE	MATERIAL	D1	D2	D3	D4
6 inch	Clay	Extra Strength	Extra Strength	Extra Strength	Extra Strength
	Ductile Iron	Class 52	Class 52	Class 52	Class 52
	Plastic (ABS)	SDR 26 SDR	SDR 26 SDR	SDR 26 SDR	SDR 23.5
	Plastic (PVC)	26	26	26	SDR 23.5
8-14 inch	Clay	Extra Strength	Extra Strength	Extra Strength	Extra Strength
	Ductile Iron	Class 52	Class 52	Class 53	Class 54
	Plastic Composite	ASTM D2680	ASTM D2680	ASTM D2680	ASTM D2680
	Plastic (PVC)	SDR 26	SDR 26	SDR 26	SDR 23.5
15 inch	Clay	Extra Strength	Extra Strength	Extra Strength	xxxx
	Plastic Composite	ASTM D2680	ASTM D2680	ASTM D2680	ASTM D2680
	Plastic (PVC)	SDR 26	SDR 26	SDR 26	SDR 23.5
16-21 inch	Clay	Extra Strength	Extra Strength	Extra Strength	xxxx
	Ductile Iron	Class 52	Class 52	Class 54	Class 56
	Plastic (PVC)	ASTM F679	ASTM F679	ASTM F679	ASTM F679
24 inch	Clay	Extra Strength	Extra Strength	Extra Strength	xxxx
	Ductile Iron	Class 52	Class 55	xxxx	xxxx
	Plastic (PVC)	ASTM F679	ASTM F679	ASTM F679	ASTM F679
27-36 inch	Clay	Extra Strength	Extra Strength	Extra Strength	xxxx
	Plastic (PVC)	ASTM F679	ASTM F679	ASTM F679	ASTM F679

*D1 to 12' depth
D2 12' to 16' depth
D3 16' to 20' depth
D4 20' and over depth

Note: Creek and drain crossings should be CL53/54 DI with Epoxy Protection 401 interior.
Any DI interior that is not completely charged will create the atmosphere for corrosion.

TABLE 1 – PVC and DI Pipe

Pipe Diameter, in.	Minimum Time, min:s	Length for Minimum Time, ft	Time for Longer Length, s	Specification Time for Length (L) Shown, min:s							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

TABLE 2 – VCP and Concrete Pipe

Pipe Diameter, in.	Minimum Time, min:s	Length for Minimum Time, ft	Time for Longer Length, s	Specification Time for Length (L) Shown, min:s							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	597	0.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	0.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	0.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926 L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23

Note: Table to be used when testing one diameter only.
When testing two sizes of pipe simultaneously, time shall be computed by the ratio of lengths involved.

$$\text{Time} = \frac{\text{Length 1} \times \text{Time1} + \text{Length 2} \times \text{Time 2}}{\text{Length 1} + \text{Length 2}}$$

SECTION 02724

FORCE LINE AND PRESSURE LINE SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work Included:

1. This Section encompasses the work required for all force line and pressure line systems.
2. All work necessary for completion, but not specifically listed as a pay item, will be deemed to be included in one or more of the Bid Form items.

B. Definitions:

1. Fitting: Bend, reducer, increaser, wye, sleeve, plug and adaptor.
2. Anchoring coupling: Considered as force line or pressure line.
3. Witnesses: Horizontal measurements to 3 permanent surface features.

C. Method of Measurement and Basis of Payment:

1. Force line and pressure line: Will be measured on the surface along the centerline of utility and paid for by the linear foot.
2. Force line or pressure line through casing: Will be measured on the surface along the centerline of utility and paid for by the linear foot.
3. Valve and box or chamber: Will be counted as a unit and paid for by the unit.
4. Cleanout and chamber: Will be counted as a unit and paid for by the unit.
5. Air release valve and chamber: Will be counted as a unit and paid for by the unit.
6. Air and vacuum valve and chamber: Will be counted as a unit and paid for by the unit.
7. Fitting: Will be counted and paid for by the unit.
8. Polyethylene encasement: Will be measured on the surface along centerline of utility and paid for by the linear foot.
9. Trace wire/test stations. Incidental to force main

1.02 SUBMITTALS:

A. Valve Drawings:

1. DIVISION 1 SUBMITTALS.

B. Valve and Cleanout Witnesses:

1. Valve box and chamber casting: Report on record Drawings.

C. Pressure and Leakage Test Procedures:

1. Equipment and method: Approval required.

1.03 JOB CONDITIONS:

A. Activating New System:

1. Notification: To ENGINEER after completing tests.

B. Scheduling:

1. Clean-up: Promptly following backfilling operations.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. General: All materials shall be American or Canadian made unless otherwise allowed in the Project Technical Specifications
B. Pipe:
    1. General: Any of the following materials except where specific materials are indicated on the drawings or in the Project Technical Specifications.
    2. Ductile iron: ANSI/AWWA C151/A21.51
        a. Thickness: ANSI/AWWA C150/A21.50, Class 52
    3. Plastic (PVC):
        a. ASTM D2241: Standard dimension rate: 26 or 21
        b. AWWA C900: dimensions ratio: 18 or 14
        c. Color: white
C. Anchoring Coupling and Pipe:
    1. Ductile iron: ANSI/AWWA C151/A21.51
        a. Thickness: ANSI/AWWA C150/A21.50, Class 52
        b. Clow Corporation #F-1211, #F-1215, #F1216 or equal
D. Valve:
    1. Resilient wedge gate valve open right
    2. Air release: Multiplex Manufacturing Company, Crispin S20B with backflushing kit, or equal
        a. Inlet size: 2 inches
        b. Outlet size: ½ inch
        c. Orifice size: 5/16 inch
    3. Air and vacuum: Multiplex Manufacturing Company, Crispin S20AB with backflushing kit, or equal.
        a. Inlet size: 2 inches
        b. Outlet size: 2 inches
        c. Orifice size: 5/16 inch
E. Valve Box:
    1. Gate valve: Ford Meter Box Company, Inc. B-22 series, or equal
    2. Lid: Imprinted with the word SEWER
F. Fitting:
    1. Ductile iron and plastic pipe:
        a. Cast iron: ANSI/AWWA C110
            (1) Pressure rating: 3 thru 12 inch, 250 pounds per square inch (psi); 14 inch and larger, 150 psi
        b. Ductile iron: ANSI/AWWA C110
            (1) Pressure rating: 3 thru 12 inch, 350 psi; 14 inch and larger, 250 psi
G. Cement Lining:
    1. Ductile iron pipe and cast iron and ductile iron fittings: ANSI/AWWA C104/A21.4
H. Joints:
    1. Pipe
        a. Ductile iron:
            (1) Mechanical: ANSI/AWWA C111/A21.11
            (2) Push-on: ANSI/AWWA C111/A21.11
        b. Plastic: Rubber ring integral bell; ASTM D2241 and AWWA C900
        c. Restraint schedule: See water main specs 02713 “Products”
    2. Valve:
        a. Ductile iron pipe: mechanical
        b. Plastic pipe: mechanical
    3. Fittings:

a. Ductile iron pipe: mechanical
b. Plastic pipe: mechanical

I. Valve and Cleanout Chamber:
1. Concrete: Class B, Division 3 Cast-in-Place concrete
2. Brick: Concrete, ASTM C55, Grade S-II
3. Grade ring: ASTM C478
4. Wall section: precast, ASTM C478
a. Joint: Rubber O-ring; ASTM C443
5. Base slab: precast
6. Mortar: ASTM C270, Type S
7. Chamber steps:
a. Deleted
b. Plastic: reinforced with 3/8" steel rod and dimensioned as cast iron
8. Chamber casting:
a. Cover: imprinted with the GT logo sanitary
b. Standard: EJIW 1045, Typ C cover
c. Watertight and bolt down: EJIW 1045 PT

J. Polyethylene Encasement:
1. Tubing: ANSI/AWWA C105/A21.5 Class C
2. Closing tape: 2 inch wide Poly Ken #900 and Scotchwrap #50

K. Miscellaneous Concrete:
1. Class B, Division 3 Cast-in-Place concrete

L. Witness Marker:
1. Wood sake: Full 2"x2" green oak or 2x4 wolmanized

M. Trace Wire/Test Stations
1. Tracer wire shall be placed with the pipe in the trench.
a. The tracer wire shall be #12 AWG high strength locater wire with a minimum break load of 1150 lbs.
b. Protective coating shall be minimum of 45 mil. High Molecular Weight, High Density Polyethylene (HMW-HDPE).
c. Wire connectors shall be watertight and shall be provided for electrical continuity.
2. The Marking Post shall be a Rhino TriViewTM Marking System post or approved equal with a test station similar to Rhino TriViewTM or approved equal shall be supplied at termination of tracer wire locations and shall be colored green and have Force Main labels. The post shall be buried per manufacturer's recommendations.
3. Tracer wire shall terminate at a marking post test station every 500 feet along the main line or as directed by the Township.

PART 3 – EXECUTION

3.01 PREPARATION

A. Alignment and Grade:
1. Deviations: Notify engineer and obtain instructions where there is a grade discrepancy or an obstruction not shown on drawings

B. Bedding:
1. Method: Article 3.05 SCHEDULES
2. Bedding area backfill: DIVISION 2 EXCAVATION AND BACKFILL FOR UNDERGROUND UTILITIES
3. Bearing: Support entire length of pipe barrel evenly

C. Cleaning Pipe and Fittings:
1. General: Interior free of foreign material and joint surfaces free of lumps and blisters

3.02 INSTALLATION:

A. Laying Pipe:
   1. General:
      a. Placement: Pipe length and bedding as a unit in a frost-free, dry trench.
      b. Special supports and saddles: Article 3.04 SCHEDULES.
   2. Joint deflection: Manufacturer's recommendation.
   3. Utility through casing:
      a. Pull utility through casing on wooden skids as recommended by manufacturer.
         (1) Skids: Thick enough to prevent utility joints from contacting casing and notched so that straps or wires do not contact casing.
         (2) Lubricating: Casing or skids.
      b. Fill void between casing and utility with granular material and plug ends of casing with masonry.

B. Cutting Pipe:
   1. Ductile iron: Power saw.
   2. Plastic: Power or hand saw.

C. Jointing:
   1. Mechanical:
      a. Lubricating: Vegetable soap.
      b. Bolting: Tighten evenly to 75 to 90 foot-pounds.
   2. Push-on:
      a. Lubricating: Manufacturer's recommendations.
      b. Beveling: Shape to manufacturer's recommendations.
   3. Rubber ring integral bell:
      a. Lubricating: Manufacturer’s recommendations.
         (1) Spigot end only.
      b. Beveling: Shape to manufacturer’s recommendations.

D. Setting Valve and Box:
   1. Valve: Plumb.
      a. Positioning: Center and plumb over operating nut.
      b. Lid:
         (1) Permanent pavement and lawn areas: Finished grade.
         (2) Aggregate areas: 4 to 6 inches below finished grade.
         (3) Nonpavement and nonlawn areas: Finished grade.

E. Cleanout and Valve Chamber:
   1. General: Article 3.04 SCHEDULES.
   2. Base slab: On a minimum of 4 inches of pea gravel with full and even bearing.
   3. Wall section: Fill joint completely with mortar and trowel.
   4. Casting setting:
      a. Permanent pavement and lawn areas: Finished grade.
      b. Aggregate areas:
         (1) Gate valve and cleanout: 4 to 6 inches below finished grade.
            (a) Protect casting with an 8 mil thick polyethylene sheet before covering with aggregate.

(2) Air release valve and air and vacuum valve: finished grade
c. Nonpavement and nonlawn areas: finished grade

F. Reaction Backing:
1. Placement: Article 3.04 SCHEDULES
2. Bearing area: Listed in Table, Article 3.04 SCHEDULES

G. Polyethylene Encasement:
1. Corrosive soils: install around ductile iron system and appurtenances and taped seams

H. Witness Marker:
1. Dimensions:
a. Section: full 2x2 green oak or 2x4 wolmanized
2. Locations:
a. End of force line and pressure line: extend vertically from end to 3 feet above finished grade
b. Valve box, valve chamber, cleanout chamber, and bend: extend from 3 feet below to 3 feet above finished grade

I. Trace Wire/Test Stations
1. Refer to Division 4, Section 0400, Trace Wire Specifications

3.03 QUALITY CONTROL

A. Testing and Inspection:
1. General:
a. Observation: by ENGINEER
b. Notification: Pretest and then arrange with ENGINEER for inspection and test
c. Required water: provide
2. Pressure:
a. Conditions: Air and air-water methods of applying pressure prohibited
b. Procedure: Article 1.02 SUBMITTALS
(1) Fill system slowly, expel air at high points and apply pressure
c. Range: 100 to 110 pounds per square inch at lowest elevation
d. Duration: 1 hour minimum and until completion of inspection
e. Inspection: examine system for leaks and movement
f. Corrections: repair defects, visible leaks and repeat test until acceptable
3. Leakage:
a. Sequence: following pressure test
b. Procedure: Article 1.02
(1) Filling: As in pressure test
(2) Supplying make-up water: measurable source
(3) Leakage: quantity of water supplied to maintain test pressure at beginning of test
c. Average test pressure: within pressure test range
d. Duration: 2 hours
e. Allowable: Less than;

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

, where

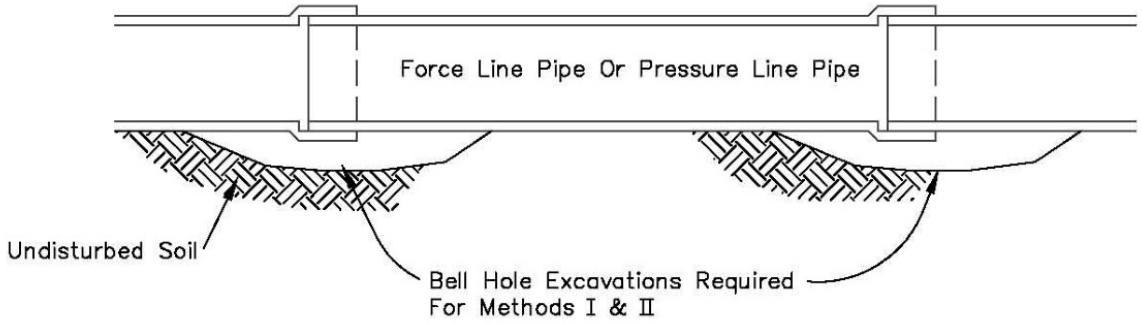
L= allowable leakage, in gallons per hour (gph)
S= length of pipe tested, in feet
D= nominal pipe diameter, in inches
P= average test pressure, in pounds per square inch (psi) gauge
Note: Formula results in allowable leakage of 10.00 gallons per day per mile per inch nominal diameter at a pressure of 110 psi

f. Corrections: Repair defects and repeat test until acceptable.

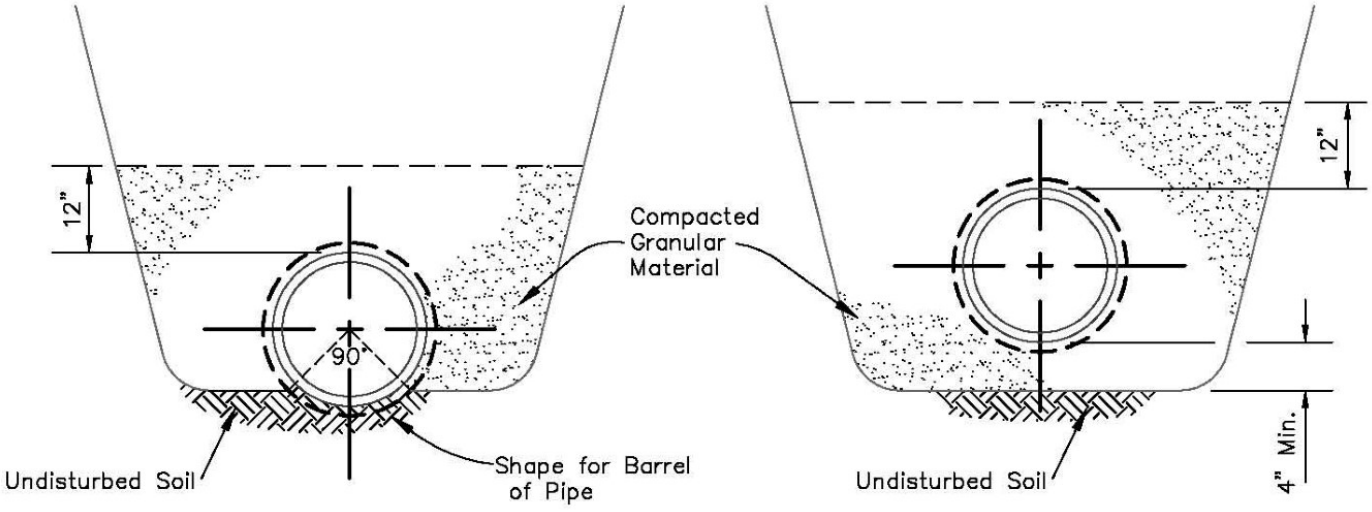
3.04 SCHEDULES:

A. Standard details:
   1. Methods of bedding pipe
   2. Special supports for underground utilities
   3. Pipe saddles
   4. Standard cleanout and chamber
   5. Standard valve and chamber
   6. Watertight and bolt down manhole casting
   7. Deleted
   8. Pipe restraint schedule
      a. Refer to schedule in Section 02713

3.05 SCHEDULES



EXCAVATION FOR BELLS



Method I

Method I: In Areas of Unconsolidated Soils (Sand, Gravel & Etc.)

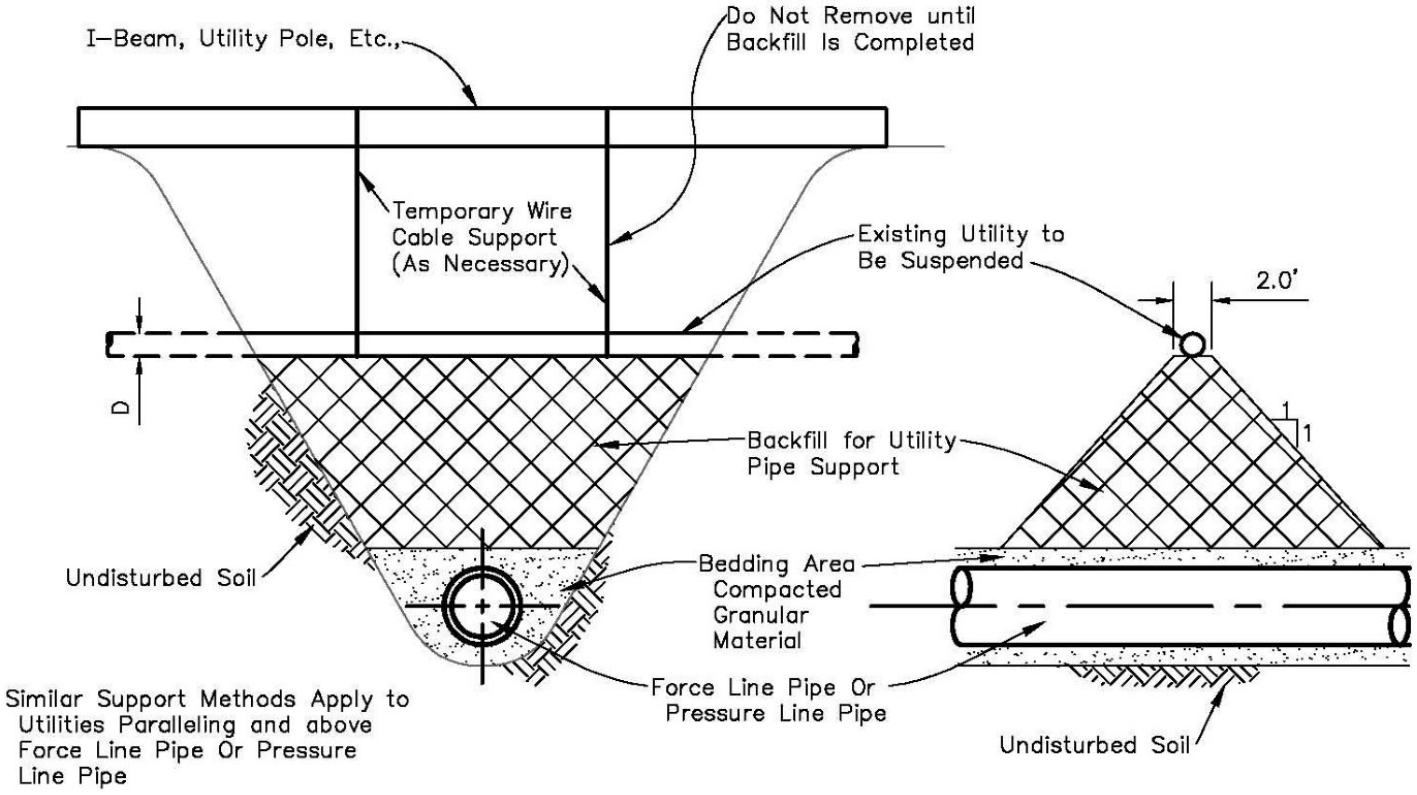
Method II

Method II: In Areas of Consolidated Soils (Clay, Hardpan, Rock & Etc.)

METHODS OF BEDDING PIPE

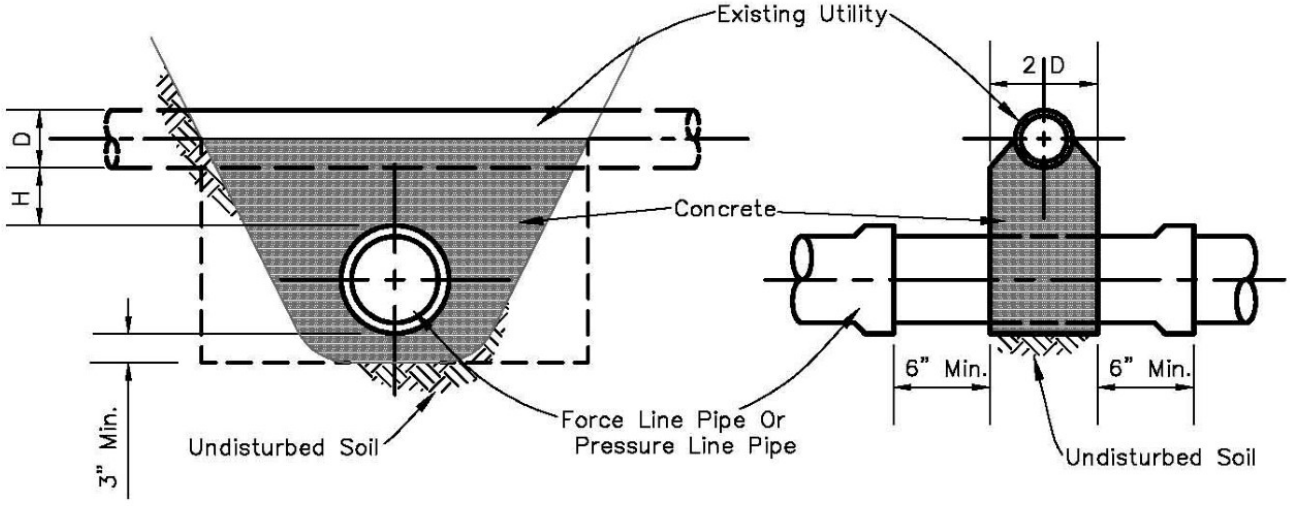
No Scale

3.05 SCHEDULES



SPECIAL SUPPORTS FOR EXISTING UNDERGROUND UTILITIES

No Scale



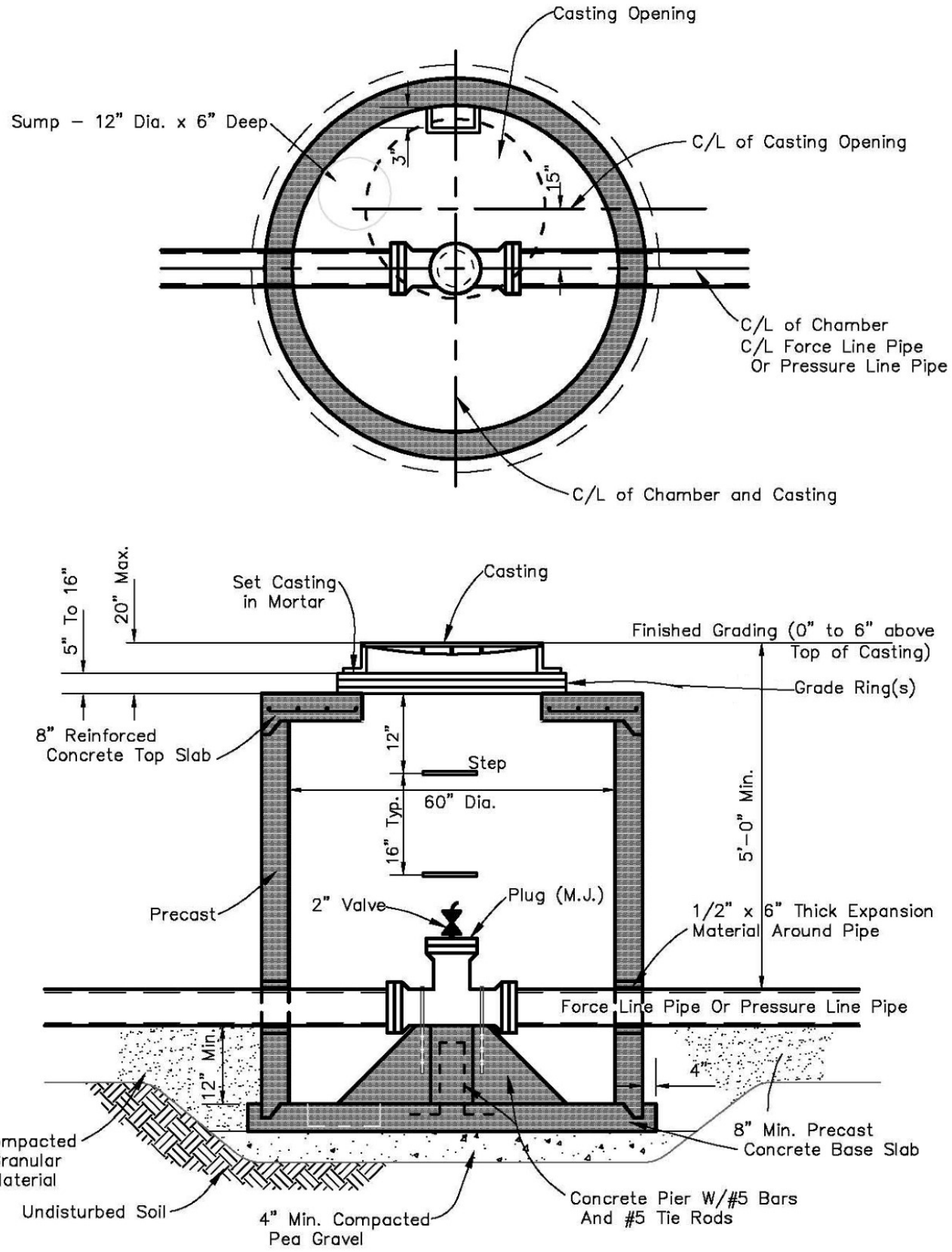
Not Required When Existing Utility Is 2" Or Smaller

Saddle Requirements	
H	D
0" to 3"	Less than 15"
0" to 6"	18" thru 36"
0" to 12"	42" and Over

PIPE SADDLES

No Scale

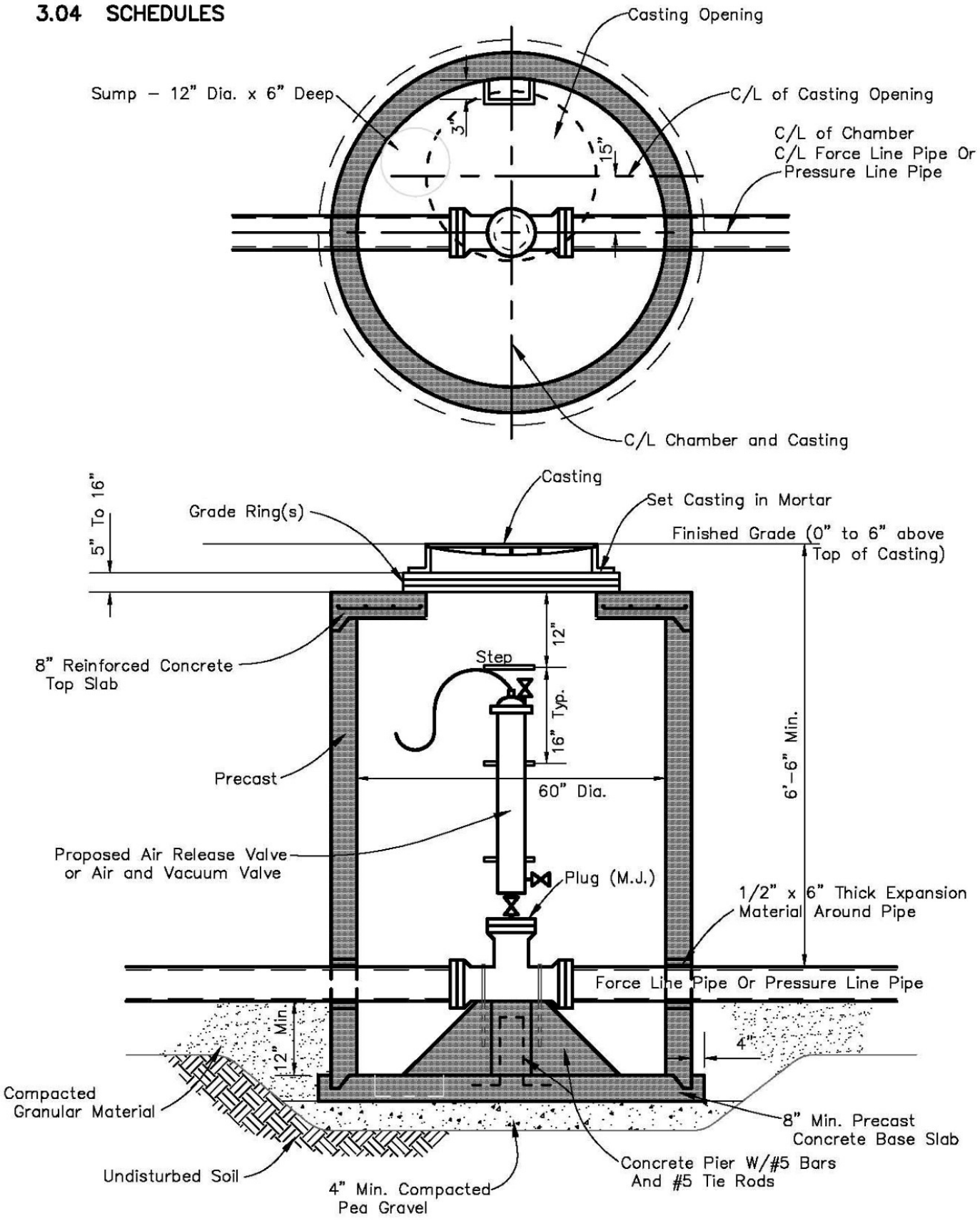
3.04 SCHEDULES



STANDARD FORCE LINE AND PRESSURE LINE CLEANOUT AND CHAMBER

No Scale

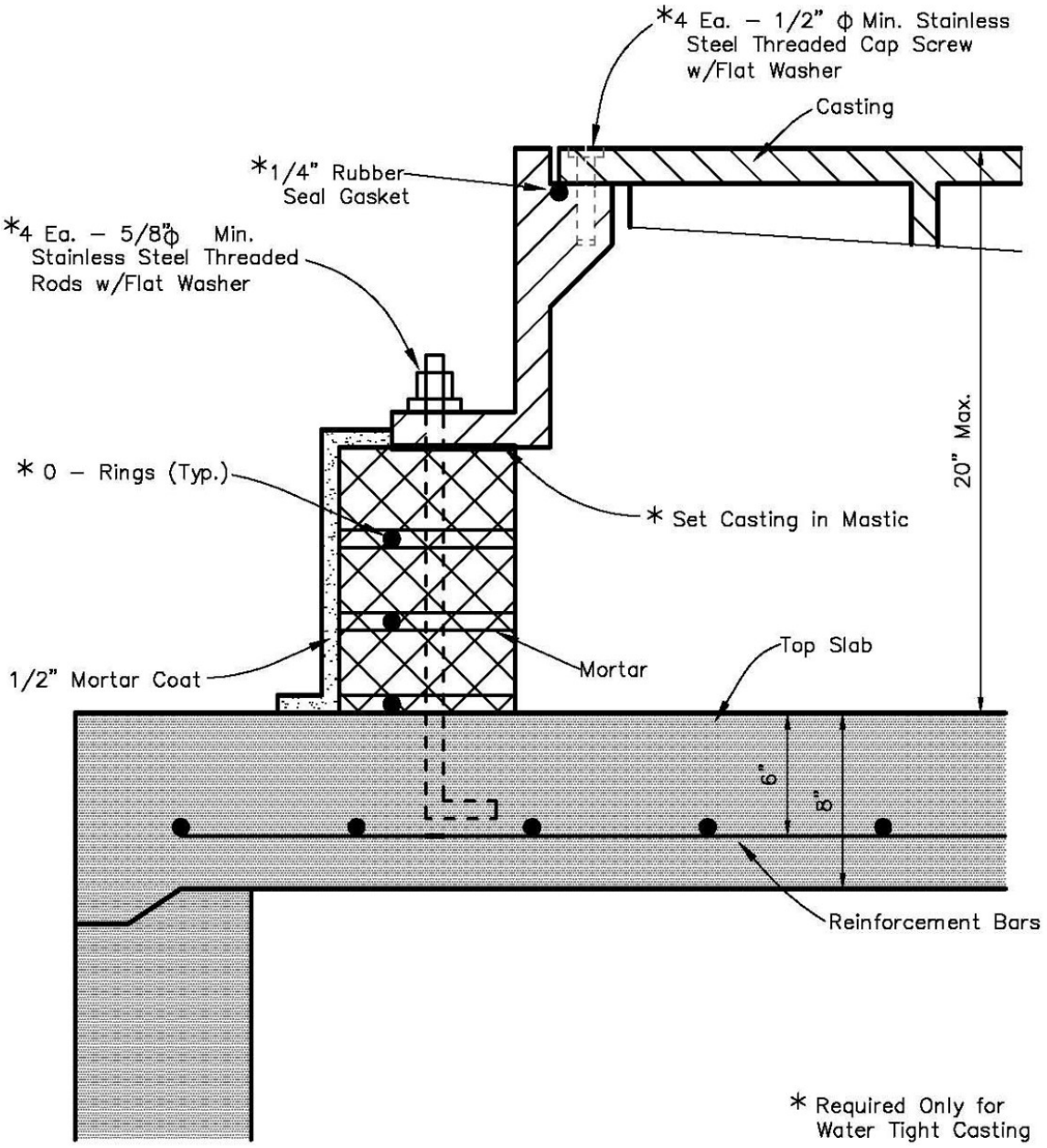
3.04 SCHEDULES



STANDARD FORCE LINE AND PRESSURE LINE VALVE AND CHAMBER

No Scale

3.05 SCHEDULES



WATER TIGHT AND BOLT DOWN MANHOLE CASTING

No Scale

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work Included:

1. This Section encompasses the work required for all cast-in-place concrete.
2. All work necessary for completion, but not specifically listed as a pay item, will be deemed to be included in one or more or the Bid Form items.

1.02 SUBMITTALS:

A. Shop Drawings for Concrete Reinforcement:

1. DIVISION 1 SUBMITTALS.
2. Approval: Required.
3. Time of submittal: 14 days prior to need for approval.
4. Data required: ACI 301 5.1.

B. Mix Design:

1. Approval: Required.
2. Time of submittal: 14 days prior to need for approval.
3. Data required: Furnish dry weight proportions of all materials together with complete previous job strength performance records (ACI 301 3.9.1) or current 3 point curve representing relationship between water content and average 28 day compressive strength prepared by independent testing laboratory (ACI 3.9.2).

C. Material Certification:

1. DIVISION 1 QUALITY CONTROL.

D. Curing Compound:

1. Guarantee of compatibility with specified surface materials: Required.
2. Guarantee of non-toxicity of potable water: Required.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Concrete Forms:

1. ACI 301 Chapter 4.

B. Joints and Embedded Items:

1. ACI 301 Chapter 6.

C. Concrete Reinforcing:

1. ACI 301 Chapter 5.

a. Storage: On support and covered.

b. Labels: Weatherproof tags.

D. Concrete Ingredients:

1. Ready-mixed: ACI 301 7.1.
2. Site-mixed: ACI 301 7.2.

E. Discharge:

1. Limitation: Place within 1½ hours from first mixing.

F. Conveying:
1. Aluminum chutes and pipes: Prohibited.

1.04 JOB CONDITIONS:

A. Cold Weather Concreting:
1. ACI 301 7.6.1.
a. Heating materials: Required when temperature is below 40 degrees Fahrenheit (F) or likely to fall below 40 degrees F during the 24 hour period after placing the concrete.
b. Frozen materials: Prohibited.
c. Mixing water temperature: Maximum 140 degrees F.
d. Plastic concrete temperature: 50 to 90 degrees F.

B. Hot Weather Concreting:
1. ACI 301 7.6.2.
a. Plastic concrete temperature: Maximum 90 degrees F.

C. Scheduling:
1. Clean-up:
a. Formwork: Promptly following removal.
b. Expansion and contraction joints: Promptly following installation.
c. Reinforcement: Promptly following installation.
d. Concrete: Promptly following placement of concrete.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Concrete Forms:
1. ACI 301 Chapter 4.

B. Concrete Form Ties:
1. Subjected to hydrostatic pressure: Water seal snap form ties with minimum 1 inch diameter steel or neoprene water tight collar affixed at midpoint.

C. Joints and Embedded Items:
1. ACI 301 Chapter 6.
a. Expansion joint filler: Extend full depth of slab or wall.
(1) Exterior: ASTM D1751 asphalt impregnated fiberboard.
(2) Interior: ASTM D1752 self expanding corkboard.
b. Waterstop: Polyvinyl chloride multi-rib cross-section.

D. Concrete Reinforcing:
1. Bars: ASTM A615, Grade 40.
2. Welded wire fabric: ASTM A185.
3. Accessories (spacers, chairs, ties, etc.): CRSI standards.
4. Aluminum items in concrete: Prohibited.

E. Cement:

1. ASTM C150, Type I.
2. Exposed concrete: Same brand and mill.

F. Admixtures:
1. Calcium chloride: Prohibited.
2. Fly ash:
a. ASTM C618: Permitted when extended strength attainment time is available.

G. Curing Compounds:
1. For concrete not receiving further surface application: ASTM C309, Type I.
2. For concrete receiving surface applications: ASTM C309 moisture retention.

2.02 MIXES:

A. Proportioning of Materials:
1. Selection of proportions: ACI 301 3.8 to attain the following properties:
a. Maximum size coarse aggregate: ACI 301 3.6.
b. Strength and slump: By class as follows;

Concrete Class	Minimum Compressive Strength in Psi	Maximum Slump in Inches
AA	4000	4
A	3500	4
B	3000	4

c. Air entrainment:
(1) Exposed concrete: ACI 301 3.4.1.
(2) Floor topping and surface dust coats: Maximum 3 percent.

B. Concrete Production:
1. Ready-mixed: ACI 301 7.1.
2. Site-mixed: ACI 301 7.2.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Concrete Forms:
1. ACI 301 4.2.

B. Joints and Embedded Items:
1. Expansion joint: ACI 301 6.2.
2. Construction joint: ACI 301 6.1.
a. Shrinkage: Minimum 24 hours between adjacent castings.
b. Horizontal slab: Maximum 25 feet apart.
3. Waterstop: ACI 301 6.3.
a. Weight: Minimum 1.25 pounds per liner foot.

b. Dimensions: Minimum ¼ inch thick by 6 inches wide.

4. Keyway: Wood formed, beveled with thickness 1/3 width.

C. Concrete Reinforcement:

1. ACI 301 5.4 and 5.5.

a. Noncorrosive accessories: Required for exposed underside surfaces.

2. Field welding:

a. Bars: Prohibited.

3.02 INSPECTION:

A. Concrete:

1. Preparatory requirements: ACI 301 8.1.

2. Consistency: Article 3.04 QUALITY CONTROL.

3.03 PERFORMANCE:

A. Placement:

1. Size of single casting: Controlled by construction oj ints.

2. Cold joint: Prohibited; ACI 301 8.3.1.

3. Depth of horizontal layers: maximum 24 inches

4. Free drop: Maximum 4 feet.

5. Retempering: Prohibited.

6. Consolidation: ACI 301 8.3.4.

7. On hardened concrete: ACI 301 8.5.3.

B. Finishing:

1. Formed surfaces:

a. Exposed concrete:

(1) As-cast finish: ACI 301 10.2.1.

(2) Fins: Exceeding 1/8 inch shall be chipped or rubbed off.

2. Slabs:

a. Sidewalk and driveway:

(1) Broom or belt finish: ACI 301 11.7.4.

b. All other flatwork:

(1) Floated finish: ACI 301 11.7.2.

(2) Troweled finish: Where indicated; ACI 301 11.7.3.

C. Curing and Protection:

1. ACI Chapter 12.

a. Method: Approval required.

b. Continuous moist condition: Maintain.

(1) Normal strength: 5 days after placement.

(2) High early strength: 2 days after placement.

3.04 QUALITY CONTROL:

A. Testing and Inspection:

1. General:
    a. Performance: By ENGINEER.
    b. Acceptance testing: DIVISION 1 QUALITY CONTROL.
2. Waterstop leakage: Acceptable method.
    a. Repairs: Acceptable permanent method.
3. Repair of defective concrete areas: ACI 301 Chapter 9.

3.05 REMOVAL:

A. Concrete Forms:
    1. ACI 301 4.5.
        a. Concrete strength at removal: 75 percent of mix design strength.

3.06 ADJUST AND CLEAN:

A. Reshoring:
    1. ACI 301 4.6.
B. Cleaning Forms:
    1. ACI 301 4.4.

SECTION 04000

TRACE WIRE/TEST STATION SPECIFICATIONS

1.01 TEST STATION PRODUCTS

1.02 SEWER/WATER UTILITY – TRACE WIRE SPECIFICATIONS

COPPERHEAD INDUSTRIES LLC
SnakePit
MAGNETIZED TRACER BOXES

SNAKEPIT TEST STATIONS!

MAKES LOCATING YOUR UNDERGROUND UTILITY EASY

SnakePit Test Station

Copperhead's SnakePit makes locating your underground utility easy! The SnakePit offers an insulated direct connection point for your locate transmitter that attaches easily to your tracer wire. Our exclusive encapsulated magnet system makes finding the access point simple. Anti-corrosion technology and a locking cover will give you peace of mind. Secure it, cover it, and don't worry about it. SnakePit's cast iron covers are color-coded according to the American Public Works Association (APWA) standards. What does this mean for you? Instant recognition of the underground utility you are tracing.

The **Lite Duty** and **Lite Duty Adjustable** are designed for yards and ditches.

Our **Lite Duty XL** features Posi-Lock pull out restraint & anti-sink flange adaptor where shifting soil may be an issue.

Concrete/Driveway Boxes have a 6" flange perfect for driveway applications.

Roadway Boxes are the strongest of all SnakePits and can take the constant pounding of heavy traffic.

Cobra T3 Test Station

The Cobra T3 provides convenient above ground access to connect your locating equipment while protecting your tracer wire. The Cobra T3 can handle up to three terminals plus optional shorting jumpers to give complete flexibility for many field configurations.

Configuration examples:

- ✓ 1 terminal - Single wire connection, easy access connection for a locator.
- ✓ 2 terminals with a jumper - Single wire connection plus an anode connection offers an excellent locate signal with the jumper connected. With the jumper connected, the anode protects the wire and provides an excellent locate signal from other locations.
- ✓ 3 terminals with jumpers - Two wire connections plus an anode offer an excellent locate signal in two directions with the jumpers disconnected. With the jumpers connected, you'll have great protection for the wires and an excellent locate signal from other locations.

The Cobra T3 offers the following features:

- ✓ Made of polypropylene material – maintenance-free, long life, durable
- ✓ 1"NPT or ¾" NPT threads
- ✓ All hardware including jumpers are stainless steel – standard
- ✓ APWA color coded for easy identification of underground utilities
- ✓ Easily installed in any application – Wall Mount, 24" Rigid PVC, or 24" Flexible PVC conduit to protect the wires

COPPERHEAD TEST STATIONS

SnakePit's exclusive Encapsulated Magnet System makes locating your access boxes easier by magnifying the ferromagnetic signal!

Copperhead SnakePit and Cobra Test Stations

Product Name	Part Number	Application	Description	Case Quantity	Color
Lite Duty	LD14*TP	Non-roadway applications	Light duty box, 14" length	20	YEL, BLU, GRN, PUR, ORN, RED, BLK
Lite Duty - Adjustable	LD14*TP-ADJ	Non-roadway applications	Light duty adjustable, 18 5/8" - 24"	20	YEL, BLU, GRN, PUR, ORN, RED, BLK
Lite Duty -XL	LDXL36*TP	Non-roadway applications	Light duty box, 36" length	10	YEL, BLU, GRN, PUR, ORN, RED, BLK
Concrete/Driveway	CD14*TP	Low traffic drives and driveways	Concrete/driveway box, 14" length	10	YEL, BLU, GRN, PUR, ORN, RED, BLK
Roadway	RB14*TP	High traffic roadways	Roadway box, 14" length	5	YEL, BLU, GRN, PUR, ORN, RED, BLK
Cobra T3	T1-*01	Above grade	One terminal; 1" conduit	5	YEL, BLU, GRN, PUR, ORN, RED, BLK
Cobra T3	T1-*75	Above grade	One terminal; 3/4" conduit	5	YEL, BLU, GRN, PUR, ORN, RED, BLK
Cobra T3	T2-*01	Above grade	Two terminals with jumper; 1" conduit	5	YEL, BLU, GRN, PUR, ORN, RED, BLK
Cobra T3	T2-*75	Above grade	Two terminals with jumper; 3/4" conduit	5	YEL, BLU, GRN, PUR, ORN, RED, BLK
Cobra T3	T3-*01	Above grade	Three terminals with jumper; 1" conduit	5	YEL, BLU, GRN, PUR, ORN, RED, BLK
Cobra T3	T3-*75	Above grade	Three terminals with jumper; 3/4" conduit	5	YEL, BLU, GRN, PUR, ORN, RED, BLK

*Denotes Color: B=Blue, G=Green, P=Purple, N=Orange, R=Red, W=White, Y=Yellow, K=Black

Made in U.S.A

Rhino

TriView™ Test Station

A test station that performs like a line marker

RHINO TOUGH 100% RECYCLABLE

The TriView Test Station is the most durable and flexible test station on the market today. It will protect tracer wire from mowers while warning potential excavators to make a one-call. Made from RhinoPoly™, the TriView Test Station will help cut costs by serving as a pipeline marker and by outlasting the competition.

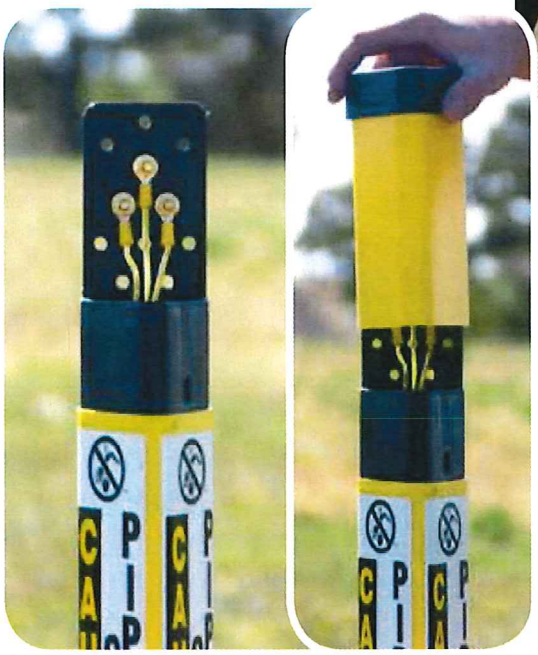
Easy access

The TriView Test Station's removable cap protects terminals from the elements. Adding an optional locking cap prevents vandals from accessing wires and hardware located inside.

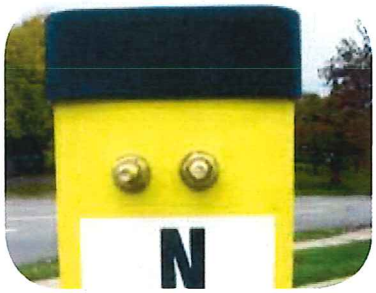
Option Locking Cap

Familiar configuration

The TriView Test Station has the industry standard 11 hole terminal board, or you can choose up to 3 external terminals. Shunts, jumps, or custom hardware is available.



External Terminals



SCAN FOR TEST STATION INFORMATION

shopRhinomarkers.com

800.522.4343 | 20+ Years of Innovation

Sanitary Force Main –

M. Tracer Wire / Test Stations

1. Tracer wire shall be placed with all pipe installation.
    a. The tracer wire shall be #12 AWG high strength locater wire with a minimum break load of 1150 lbs.
    b. A minimum of two (2) tracer wires shall be installed with the pipe in all construction cases, including open cut and horizontal directional drilling.
    c. Protective coating shall be minimum of 45 mil. High Molecular Weight, High Density Polyethylene (HMW-HDPE)
    d. The tracer wire shall be attached to the pipe (regardless of material type) at approximately five (5) foot intervals using tape or other suitable methods to assure that the wire is not dislocated during pipe installation and backfilling.
2. Connectors
    a. All mainline tracer wires shall be interconnected at intersections, mainline tees, and mainline crosses. At tees, the three wires shall be joined using a single three-way SnakeBite Locking Connector (LSC1230C) or approved equal. At crosses, the four wires shall be joined using (2) LSC1230C three-way locking connectors (or approved equal) with a short jumper wire between them.
    b. Direct bury wire connectors shall include three-way lockable Copperhead SnakeBite Locking Connectors (LSC1230C), Copperhead Mainline-to-Service Connectors (3WB-01) or approved equals that are specifically manufactured for use in underground tracer wire installation.
    c. Connectors shall be dielectric silicone filled to seal out moisture and corrosion and shall be installed in a manner as to prevent any uninsulated wire exposure.
    d. Non-Locking, friction fit or taped connectors are prohibited.
3. Marking Post and Test Station
    a. The Marking Post shall be Rhino TriViewTM Marking System post or approved equal with the Rhino TriView TM test station or approved equal.
    b. The Marking Post shall be colored green and have Force Main labels.
    c. The post shall be buried per manufacturer's recommendations.
    d. Tracer wire shall be affixed to a marking post test station every 500 feet along the force main line or as directed by the township.
    e. Tracer wire shall be installed with 2 feet of slack on either side of all connection points.
    f. Marker posts shall be installed directly on top of the respective utility unless the utility is located entirely under a paved surface, in which the marker post shall be installed in the nearest unpaved right-of-way/easement with the location as determined by the township.
4. Acceptance Testing
    a. The contractor shall complete continuity and conductivity testing of the tracer wire with the township present prior to final paving or acceptance of the system.
    b. At any areas in which conductivity and/or continuity are compromised, the contractor shall excavate, repair, and retest the tracer wire at no cost to the township.
    c. Conductivity testing shall involve using typical low frequency (512 HZ or similar) line locating equipment.

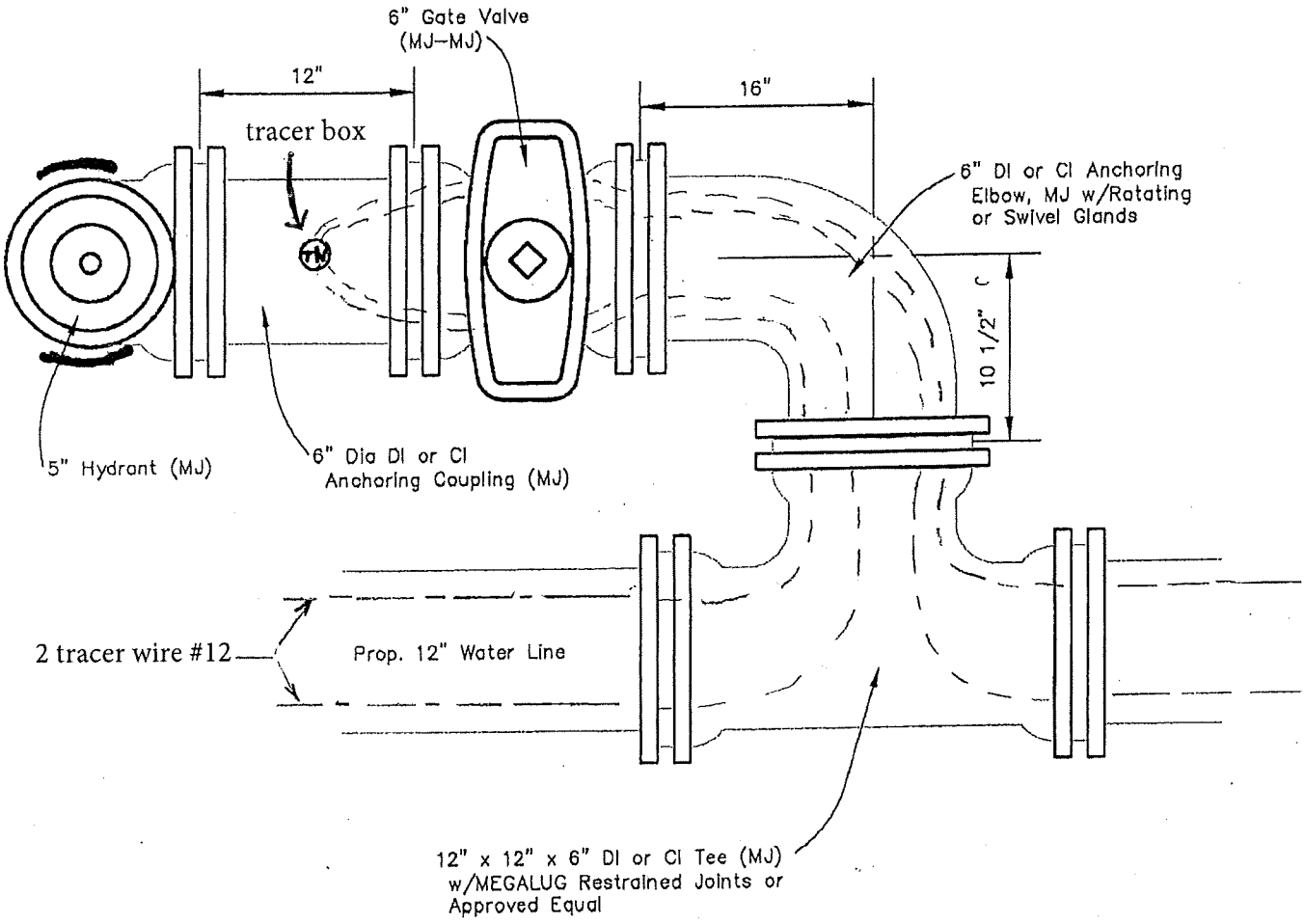
Water Main –

S. Tracer Wire / Test Stations

1. Tracer wire shall be placed with all pipe installation.
    a. The tracer wire shall be #12 AWG high strength locater wire with a minimum break load of 1150 lbs.
    b. A minimum of two (2) tracer wires shall be installed with the pipe in all construction cases, including open cut and horizontal directional drilling.
    c. Protective coating shall be minimum of 45 mil. High Molecular Weight, High Density Polyethylene (HMW-HDPE)
    d. The tracer wire shall be attached to the pipe (regardless of material type) at approximately five (5) foot intervals using tape or other suitable methods to assure that the wire is not dislocated during pipe installation and backfilling.
2. Connectors
    a. All mainline tracer wires shall be interconnected at intersections, mainline tees, and mainline crosses. At tees, the three wires shall be joined using a single three-way SnakeBite Locking Connector (LSC1230C) or approved equal. At crosses, the four wires shall be joined using (2) LSC1230C three-way locking connectors (or approved equal) with a short jumper wire between them.
    b. Direct bury wire connectors shall include three-way lockable Copperhead SnakeBite Locking Connectors (LSC1230C), Copperhead Mainline-to-Service Connectors (3WB-01) or approved equals that are specifically manufactured for use in underground tracer wire installation.
    c. Connectors shall be dielectric silicone filled to seal out moisture and corrosion and shall be installed in a manner as to prevent any uninsulated wire exposure.
    d. Non-Locking, friction fit or taped connectors are prohibited.
3. Test Station
    a. Copperhead Lite Duty LD14*TP-ADJ Test Station or approved equal shall be shall be colored blue and supplied at ground level between the hydrant and the hydrant valve.
    b. Tracer wire shall be affixed to a test station at every hydrant or as directed by the Township.
    c. Tracer wire shall be installed with 2 feet of slack on either side of all connection points to the test station.
4. Acceptance Testing
    a. The contractor shall complete continuity and conductivity testing of the tracer wire with the township present prior to final paving or acceptance of the system.
    b. At any areas in which conductivity and/or continuity are compromised, the contractor shall excavate, repair, and retest the tracer wire at no cost to the township.
    c. Conductivity testing shall involve using typical low frequency (512 HZ or similar) line locating equipment.

3.05 SCHEDULES:

Wheep Hole Protection
2-8" C.P.P. x 6" length
halved/taped to base
prior to poly-wrap with 4" slit at wheep holes



TYPICAL HYDRANT ASSEMBLY

Rev. 1–22–03

SECTION 05000

ELECTRONIC DRAWING FILES

1.01 RECORD PLAN DIGITAL SUBMISSION REQUIREMENTS

RECORD PLAN DIGITAL SUBMISSION REQUIREMENTS

A. The engineer shall deliver their record plans in either AutoCAD (.dwg, .dxf) or Esri (Shapefile or File Geodatabase) format. Standard transfer media will be accepted. This media includes CD, DVD, email, ftp, online file sharing site or portable storage device.

B. The completed record plans at a minimum must contain all new and altered infrastructure including but not limited to water, storm and sewer mains, sanitary cleanouts, sanitary sewer service lateral ends, sanitary manholes, water hydrants, water valves, and water curb stops as well as pertinent background location information such as back of curb, sidewalks, nearby structures and existing utilities. It is not necessary to include background information such as logos or title blocks in the drawings.

C. The positional accuracy of all new structures including sanitary cleanouts, sanitary valves, sanitary air releases, sanitary sewer service lateral ends, sanitary sewer manholes, storm sewer manholes, storm sewer catch basins, storm sewer outfalls, water hydrants, water pipe bends, water fittings, water valves, and water curb stops shall not exceed 0.5' horizontally and 0.1' vertically from a structure's constructed position. If desired, the engineer may submit the X, Y, Z coordinates of these structures in a separate comma delimited text file.

C. Drawing files shall be submitted in the following coordinate system and datum:

Coordinate System: State Plane Michigan South 2113
Ellipsoid: GRS 80
Horizontal Datum: NAD 83 (2011)
Vertical Datum: NAVD 88
Geoid: Geoid 12
Units: International Feet

ELECTRONIC PLOT FILES

A. The engineer shall deliver one scanned or exported set of approved record plans in Adobe PDF format. The record plan sets shall be complete and include the title sheet, plan/profile sheets, cross-sections, and details. Each individual sheet contained in the printed set of the drawings shall be included in the electronic submittal as a separate PDF document. The plan sheets shall be scanned or exported at a minimum of 300 dpi resolution to maintain legibility of each drawing. These drawings will assist in the process of performing quality control and quality assurance. The drawings will be reviewed for format and completeness.

B. Only drawings relevant to the project's completion shall be included. For example, do not include "Bid Set" drawings in a record plan submittal. Also, do not include documents that would not normally be included in the set of imaged drawings.

C. Include a label on the media or digital file indicating project name and number, consultant name, project manager and telephone number, type of submittal, subdivision name, date of submittal, and file format.