Standard Sewer Specifications

CITY OF MOUNT PLEASANT, TENNESSEE

MAYOR	**JAMES L. BAILERY, JR.**
VICE MAYOR	**BILL WHITE**
COMMISSIONER	**DELORES BLANKENSHIP**
COMMISSIONER	**MIKE DAVIS**
COMMISSIONER	**JACQUELINE GRANDBERRY**

Approved By:

Donny Groves 5/1/17

Donny Groves, Director of Public Works **Date**

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211 Commerce Street, Suite 600
Nashville, Tennessee 37201-1811
(615)254-1500

BWSC Barge Waggoner Sumner & Cannon, Inc.

ENGINEERS ARCHITECTS PLANNERS LANDSCAPE ARCHITECTS SURVEYORS

DOCUMENT 00001

DESIGN GUIDANCE

SEWER SYSTEM DESIGN STANDARDS

TECHNICAL SPECIFICATIONS

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END OF DOCUMENT

SECTION 01090

REFERENCE STANDARDS

PART 1 - GENERAL

1.1 Section Includes

A. Quality Assurance.

B. Schedule of References.

C. Abbreviations.

1.2 Quality Assurance

A. For products or workmanship specified by association, trade or Federal standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date of Contract Documents except when a specific publication date is specified.

C. Should specified reference standards conflict with Contract Documents request clarification from the Engineer before proceeding.

D. The contractual relationship of the parties to the contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

E. Unless otherwise noted, all equipment shall be of current modifications, which have been in successful regular operation under comparable conditions for a period of at least two years. This time requirement however, does not apply to minor details or thoroughly demonstrated improvements in design or in material of construction. Work shall be done and completed in a thorough and workman like manner.

1.3 Schedule of References

AA	Aluminum Association 818 Connecticut Avenue, N.W. Washington, DC 20006
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, N.W. Washington, DC 20001

ACI	American Concrete Institute Box 19150 Reford Station Detroit, MI 48219
AI	Asphalt Institute Asphalt Institute Building College Park, MD 20740
AISC	American Institute of Steel Construction 400 North Michigan Avenue Eighth Floor Chicago, IL 60611
AISI	American Iron and Steel Institute 1000 16th Street, N.W. Washington, DC 20036
ANSI	American National Standards Institute 1430 Broadway New York, NY 10018
APA	American Plywood Association Box 11700 Tacoma, WA 98411
AREA	American Railroad Engineering Association 2000 "L" Street, N.W. Washington, DC 20036
ARI	Air-Conditioning and Refrigeration Institute 1501 Wilson Boulevard Arlington, VA 22209
ASTM	American Society for Testing and Materials 1916 Race Street Phildelphia, PA 19103
AWS	American Welding Society 550 LeJeune Road, N.W. Miami, FL 33135
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
BIA	Brick Institute of America 11490 Commerce Park Drive Reston, VA 22091

CLFMI	Chain Link Fence Manufacturers Institute 1101 Connecticut Avenue, N.W. Washington, DC 20036
CRSI	Concrete Reinforcing Steel Institute 933 Plum Grove Road Schaumburg, IL 60195
DHI	Door and Hardware Institute 7711 Old Springhouse Road McLean, VA 22102
EJCDC	Engineers' Joint Contract Documents Committee American Consulting Engineers Council 1015 15th Street, N.W. Washington, DC 20005
FHWA	Federal Highway Administration Federal Building, U.S. Courthouse Nashville, TN 37202
FS	Federal Specifications General Service Administration Specifications and Consumer Information Distribution Center (WFSIS) Washington Navy Yard Bldg. 197 Washington, DC 20407
MBMA	Metal Building Manufacturer's Association 1230 Keith Building Cleveland, OH 44115
MIL	Military Specifications Naval Publications and Form Center 5801 Tabor Ave. Philidelphia, PA 19120
NASSCO	National Association of Sewer Service Companies 101 Wymore Road, Suite 521 Altamonte, FL 32714
NSWMA	National Solid Wastes Management Association 1730 Rhode Island Ave., N.W. Washington, DC 20036

PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077
PCI	Prestressed Concrete Institute 201 North Wells Street Chicago, IL 60606
SDI	Steel Deck Institute P.O. Box 9506 Canton, OH 44711
SJI	Steel Joist Institute 1205 48th Avenue North Suite A Myrtle Beach, SC 29577
TDOT	Tennessee Department of Transportation James K. Polk Building 505 Deaderick Street Nashville, TN 37219
TOSHA	Tennessee Department of Labor Occupational Safety and Health 501 Union Building 3rd Floor Nashville, TN 37246-0659
UL	Underwriter's Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062

1.4 Abbreviations

CY	Cubic Yard
EA	Each
FT	Feet
MFBM	One Thousand Feet Board Measure
LBS	Pounds
LF	Linear Feet
M	One Thousand
PVC	Polyvinyl Chloride
MJ	Mechanical Joint
B & S	Bell and Spigot
T & G	Tongue and Groove
ES	Extra Strength
SF	Square Feet
SS	Standard Strength
VC	Vitrified Clay
RC	Reinforced Concrete
MH	Manhole

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01410

TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 Section Includes

A. Selection and Payment.

B. Quality Control.

C. Laboratory Responsibilities.

D. Laboratory Reports.

E. Limits of Testing Laboratory Authority.

F. Contractors Responsibilities.

G. Schedule of Inspection and Tests.

1.2 Related Sections

A. Section 01340 - Shop Drawings, product data and samples.

B. Section 01700 - Contract Closeout: Project Record Documents.

C. Individual Specification Sections: Inspections and tests required, and standards for testing.

1.3 References

A. ANSI/ASTM D3740 practice for evaluation of agencies engaged in testing and/or inspection of soil and rock as used in Ownering design and construction.

B. ANSI/ASTM E329 recommended practice for inspection and testing agencies for concrete, steel, and bituminous materials as used in construction.

1.4 Selection and Payment

A. Contractor shall employ and pay for services of an independent testing laboratory to perform specified inspection and testing.

B. Employment of Testing Laboratory shall in no way relieve Contractor of obligations to perform work in accordance with requirements of Contract Documents.

C. Contractor shall submit selected Testing Laboratory qualifications to the Owner for approval.

1.5 Quality Assurance

A. Comply with the requirements of ANSI/ASTM E 329 and ANSI/ASTM D 3740.

B. Laboratory: Authorized to operate in state in which project is located.

C. Laboratory Staff: maintain a full time registered Owner on staff to review services.

D. Testing equipment calibrated at reasonable intervals with devices or an accuracy traceable to either National Bureau of Standards (NBS) Standards or accepted values of natural physical constants.

1.6 Contractor Submittals

A. Prior to start of work, submit testing laboratory name, address, telephone number and names of the full time registered Owner and responsible officer.

B. Submit copy of report of laboratory facilities inspection made by materials reference laboratory of National Bureau of Standards (NBS) during the most recent tour of inspection, with memorandum of remedies of any deficiencies reported by the inspection.

1.7 Laboratory Responsibilities

A. Test samples of mixes submitted by Contractor.

B. When requested provide qualified personnel at site. Cooperate with the Owner and Contractor in performance of services.

C. Perform specified inspection, sampling, and testing of products in accordance with specified standards.

D. Ascertain compliance of materials and mixes with requirements of Contract Documents.

E. Promptly notify the Owner and Contractor of observed irregularities or non-conformance of Work or products.

F. Perform additional inspections and tests required by the Owner.

1.8 Laboratory Reports

A. After each inspection and test, promptly submit one copy each for the Owner, Owner, Contractor, and record documents file.

B. Each report shall include (on format approved by the Owner).

1. Date issue.
2. Project title and number.
3. Name of inspector.
4. Date and time of sampling or inspection.
5. Identification of product and specification section.
6. Location in the project.
7. Type of inspection or test.
8. Date(s) of test.
9. Results of test.
10. Conformance with Contract Documents.

C. When requested by the Owner, provide interpretation of test results.

1.9 Limits on Testing Laboratory Authority

A. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.

B. Laboratory may not approve or accept any portion of the Work.

C. Laboratory may not assume any duties of the Contractor.

D. Laboratory has no authority to stop the Work.

1.10 Contractors Responsibilities

A. Deliver to laboratory at designated location, adequate samples of material proposed to be used which require testing, along with proposed mix designs.

B. Cooperate with the laboratories personnel, and provide access to the Work.

C. Provide incidental labor and facilities to provide access to Work to be tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, storage and curing of test samples.

D. Notify the Owner and laboratory 24 hours prior to expected time for operations requiring inspection and testing services.

E. The Owner has retained a separate laboratory to perform any of the above testing whenever there is a problem with the results. The cost for this service will be paid by Owner if the tests pass, but by the Contractor if the test fails.

1.11 Schedule of Inspections and Tests

A. Inspections and Testing are specified in individual specification sections.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 Section Includes

A. Closeout Procedures.

B. Final Cleaning.

C. Adjusting.

D. Project Record Documents.

E. Operation and Maintenance Data.

F. Warranties.

1.2 Related Sections

A. Section 01340 - Shop Drawings, Product Data, and Samples; Manufacturers instructions and manufacturers certificates.

B. Section 01710 - Cleanup and Restoration.

C. Section 01720 - Project Record Documents.

1.3 Closeout Procedures

A. When Contractor considers the entire Work ready for its intended use, the Contractor shall notify the Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by the Contractor as incomplete) and request that the Engineer issue a certificate of Substantial Completion.

B. Within a reasonable time thereafter, Engineer will make an inspection of the Work to determine the status of completion.

C. If the Engineer does not consider the Work substantially complete, he will notify the Contractor in writing, giving the reasons therefore. The Contractor shall correct the noted deficiencies and request another inspection by the Engineer.

D. If the Engineer considers the Work substantially complete, he will prepare and deliver to the Owner a tentative certificate of Substantial Completion which will fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment.

E. After Contractor has completed all corrections to the satisfaction of the Engineer and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance required certificates of inspection, marked up record documents required and other documents, he may make application for final payment following the procedure for progress payments.

F. The Final Application for Payment shall be accompanied (except as previously delivered) by:

1. All documentation called for by the Contract Documents.
2. Consent of surety, if any, to final payment.
3. Complete and legally effective releases or waivers of liens.

G. When the Engineer is satisfied that the Work has been competed and the Contractor's obligations under the Contract Documents have been fulfilled, he will, within 15 days after receipt of the Final Application for Payment, indicate in writing his recommendation of payment and present the application to the Owner for payment.

1.4 Cleanup and Restoration

A. See Section 01710 - Cleanup and Restoration.

1.5 Adjusting

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

1.6 Project Record Documents

A. See Section 01720 - Project Record Documents.

1.7 Warranties

A. Provide two notarized copies of warranties and bonds required for specific products individual Specification Sections.

B. Execute and assemble documents from subcontractors, suppliers, and manufacturers.

C. Bind in commercial quality 8 1/2 x 11 inch three ring side binders with hardback cleanable plastic covers.

1. Label cover of each binder with typed or printed title "Warranties and Bonds" with title of project, name, address, and telephone numbers of Contractor, and name of responsible principal.
2. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual with each item identified with the number

and title of the specification section in which specified and the name of the product or work item.

3. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. List subcontractor, supplier, and manufacturer with name, address, and telephone number of responsible principal.

D. Submittal Time

1. For items put into service during construction (with the Owners permission) submit documents to Engineer after acceptance.
2. Make other submittals to Engineer after date of Substantial Completion, prior to Final Application for Payment.
3. For items of Work delayed beyond date of Substantial Completion submit documents to Engineer after acceptance, listing the date of acceptance as the beginning of the warranty period.

E. Final Guaranty

All work shall be and is guaranteed by the Contractor for a period of two (2) years from and after the date of final acceptance of all the Work by the Owner.

If, within said guaranty period, repair or changes are required in connection with guaranteed work which, in the opinion of the Engineer is rendered necessary as the result of the use of materials, equipment or workmanship which are inferior, defective, or not in accordance with the terms of the Contract, the Contractor shall, promptly upon receipt of notice from the Owner and without expense to the Owner:

1. Place in satisfactory condition in every particular all of such guaranteed work, correct all defects therein, and
2. Make good all damage to the building or site, or equipment or contents thereof, which in the opinion of the Engineer, is the result of the use of materials, equipment or workmanship which are inferior, defective, or not in accordance with the terms of the Contract, and
3. Make good any work or materials, or the equipment and contents of building, structure or site disturbed in fulfilling any such guarantee.

If the Contractor, after notice, fails within ten (10) days to proceed to comply with the terms of this guaranty, the Owner may have the defects corrected; and the Contractor and his surety shall be liable for all expense incurred, provided, however, that in case of an emergency where, in the opinion of the Engineer, delay would cause serious loss or damage, repairs may be made without notice being given to the Contractors; and the Contractor shall pay the cost thereof.

If in order to make required repairs, it is considered necessary by the Contractor that the repairs be made at a manufacturers factory, the Contractor shall pay the cost of removing, crating, shipping, repairing, and reinstalling.

All special guarantees or warranties applicable to specific parts of the Work as may be stipulated in the Specifications or other papers forming a part of this

contract shall be subject to terms of this paragraph during the first two years of the life of each such guarantee.

1.8 Adjustment of Accounts

A. Submit a final statement to Engineer indicating, all adjustments to the Contract Sum. Include the following:

1. Original Contract Sum
2. Previous Change Orders
3. Changes under Allowances
4. Changes under unit prices
5. Deductions for uncorrected work
6. Penalties and Bonuses
7. Deductions for Liquidated Damages
8. Deduction for re-inspection fees
9. Other adjustments to Contract Sum
10. Total Contract Sum, as adjusted
11. Previous Payments
12. Sum Remaining Due:

B. If required, a Final Change Order will be prepared reflecting approved adjustments to the Contract Sum which were not previously made on Change Orders.

1.9 Final Application for Payment

A. Submit Final Application for Payment in accordance with procedures and requirements of the Conditions of the Contract.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01710

CLEANUP AND RESTORATION

PART 1 - GENERAL

1.1 Section Includes

A. This item shall include the requirements for cleaning and restoring areas and facilities disturbed by construction operations.

B. This item identifies work that may be required on temporary surfacing, or permanent pavement replacement of any public street or roadway disturbed during construction operations. This work will be performed and payment made in accordance with other sections of these Specifications.

1.2 Related Sections

A. Section 01700 - Contract Closeout Procedures: Final Cleaning.

B. Section 02730 - Sanitary Sewerage Systems.

C. Section 02765 - Sanitary Sewer Manhole Rehabilitation

D. Section 02766 - Relining Sanitary Sewers

1.3 Requirements

A. The Contractor shall not allow the site(s) of the Work to become littered with trash and waste material, but shall maintain the same in a neat and orderly condition throughout the construction period. The Engineer shall determine what is or is not waste material and the time, place and manner of the disposal of the same.

B. The Contractor's method for disposal of trash and waste shall not cause damage or create a nuisance to other public or private property.

C. The Contractor shall keep the construction site(s) clean and remove surplus and discard materials, temporary structures, stumps, and portions of trees and debris of any kind. He shall leave the site of the Work in a neat and orderly condition, similar or equal or equal to that prior to construction.

D. Cleanup and Restoration operation shall be concurrent with the construction operation and shall be completed before final acceptance by the Owner. The Contractor shall replace with like and kind any trees, shrubbery, fences, culverts, bridges, houses, or buildings and all water, sewer, gas, telephone and electrical lines thereto, and all other private and public property along or adjacent to the Work.

E. The Contractor shall topsoil, rake, fertilize, seed and straw all lawns and grass areas disturbed by construction operations.

F. All private and public property along or adjacent to the Work disturbed by construction operations shall be restored to a condition similar or equal to that existing prior to construction.

G. Before final acceptance by the Owner, the Contractor shall replace and/or restore any water, sewer, drain, and gas lines and appurtenances, electrical, telephone, telegraph conduits and wire, both underground and above ground, and appurtenances; traffic signals, fire and police alarm systems and appurtenances; sidewalks, curb & gutters, drainage ditches and pavements and all other public utility facilities and appurtenances along or adjacent to the Work that may have been disturbed by construction operations.

H. All public utility facilities and appurtenances along or adjacent to the Work disturbed by construction operations shall be restored to a condition similar or equal to that existing prior to construction.

I. Temporary pavement of public streets and roads shall be installed, and additional pavement shall be made as specified in Section 02575 - Pavement Repair.

J. Permanent pavement replacement of public streets and roads shall be installed and additional payment shall be made as specified in Section 02575 - Pavement Repair.

K. Gravel, Bituminous and/or concrete driveway and/or parking, parking areas and concrete sidewalks and/or ramp replacement shall be installed; and additional payment shall be made as specified in Section 02575 Pavement Repair.

L. Contractor's attention is called to the fact that no additional payment will be allowed under this contract for maintaining the gravel shoulder with crusher stone once the trench has been completely gravel refilled and prior to the shoulder being shot and chipped. Also, no additional payments will be allowed for that portion of the shoulder beyond the trench limits disturbed by construction.

M. Restoration of areas and facilities disturbed by construction operations shall be properly and regularly maintained in a condition similar or equal to that prior to construction during a period of two (2) years after the final acceptance of the Work by the Owner. Any repairs required because of unsatisfactory backfill or defective materials, and workmanship shall be at the expense of the Contractor. Maintenance measures made necessary by ordinary wear and tear shall not be at the expense of the Contractor.

N. Cleanup and restoration of areas and facilities disturbed by construction operations shall be considered and integral part of the excavation or construction work and no separate payment will be allowed therefor except as herein specified.

O. Waste removed from the Project site shall be disposed of in sites permitted by the Tennessee Department of Environment and Conservation (TDEC) for the acceptance of type of waste being disposed in accordance with Rules of TDEC Solid Waste Management, including Chapter 0400-11-01. Landfill types include

1. Class I Landfills - municipal solid waste, household waste, shredded/waste tires
2. Class II Landfills - industrial waste
3. Class III Landfills - farming wastes, landscaping and land clearing wastes
4. Class IV Landfills - construction and demolition waste

P. Exceptions to Paragraph E are as follows:

1. Certain other wastes (such as medical/infectious waste, dead animals, sludges, pesticides wastes, hazardous wastes, asbestos) require special waste approval prior to disposal. See the TDEC Environmental Permitting Handbook for more information.
2. Hazardous waste shall be disposed of in accordance with Rules of TDEC Solid Waste Management, including but not limited to Chapter 0400-12-01 and the rules and regulations of the United States Environment Protection Agency (EPA).
2. Asbestos-containing waste shall also be handled and disposed in accordance with TCA 68-201-101 et seq, Rules of the Tennessee Department of Health, and TDEC Bureau of Environmental Health Services, Division of Air Pollution, including Chapter 1200-3-11-.02 and 40 CFR 61.
3. Excess earth material and excess excavated rock material may be placed on sites for which the Contractor provides to the Owner a signed affidavit from the property owner that the placement of such material is acceptable to the property owner. The Contractor and property owner shall be responsible for all permitting of such disposal.

Q. No waste shall be placed at a transfer station facility.

R. The Contractor shall maintain records related to all waste removed from the Project site so as to allow the Owner or the Engineer to readily determine the following:

1. Date waste removed from Project site.
2. Name of hauler (company and driver) transporting such waste.
3. General description of waste transported.
4. “Truck tickets” indicating the waste disposal site and amount of waste disposed therein.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 Section Includes

A. Items Required.

B. Quality Assurance

C. Maintenance.

D. Submittals.

1.2 Related Sections

A. Section 01340 - Shop Drawings, Product Data and Samples.

B. Section 01700 - Contract Closeout Procedures.

1.3 Items Required

A. The Contractor shall maintain a record copy of the following items at the site for the Engineer's review:

1. Drawings (modified to suit As-Built Condition).
2. Specifications and schedules (with modifications noted).
3. Addenda.
4. Change orders and other documents which modify the original documents.
5. Approved shop drawings, product data and samples including documentation of all submittal transmittals.
6. Records of all changes made during construction.
7. Field Test Records.
8. Manufacturers Certificates.
9. Equipment Manuals.
10. Inspection Certificates.

1.4 Quality Assurance

A. For sanitary sewer construction, the Contractor shall employ a currently registered surveyor to prepare the Record Drawings from a post-construction, field run survey. The Record Drawings shall provide elevations to the nearest 0.01 foot for all manhole inverts, manhole frames and other pertinent items constructed by the Contractor. The Record Drawings shall provide dimensions, distances, and coordinates to the nearest 0.01 foot and horizontal angles to the nearest 10 seconds.

1.5 Maintenance

A. Store record documents and samples in the field office, apart from the documents used for construction.

1. Provide files, racks and secure storage for record documents and samples.

B. Label and file record documents in sequence with section number listings in Table of Contents of the Project Manual.

1. Label each document "Project Record" in the lower right hand corner.

C. Maintain Record Documents in a clean, dry, legible condition.

1. Do not use Record Documents for Construction purposes.

D. Keep Record Documents and Samples available for inspection by Engineer.

E. Documenting Changes

1. Record information concurrently with construction progress. Do not conceal work until information has been recorded.
2. Contract Drawings and Shop Drawings: legibly mark each item to record actual construction including the following:

a. Actual elevations of footings, slabs and tops of walls.

b. Actual horizontal location of building corners and openings.

c. Actual horizontal and vertical location of piping and utilities corners, values, etc. above and below ground. Reference to building exterior lines or other permanent objects. Show direction of flow in pipe and elevation.

d. Field change of dimensions and detail.

e. Changes made by contract modification.

f. Added details not on the original contract.

3. Project Manual: Legibly mark to record actual construction, including the following:

a. On appropriate pages, record changes made by addenda, change orders and other modifications.

b. On appropriate pages, enter trade name, manufacturer, catalog number, and name of supplier of each product and item actually installed, if different from that specified.

c. Other items installed but not originally specified.

4. All information shall be recorded neatly and legibly. Use separate colors for recording information about each major system. Establish a code to denote the color for each trade and indicate by a schedule placed on the front sheet of the Record Drawings.

1.6 Submittals

A. At Contract closeout, deliver Record Documents and Samples, including Record "As Built" drawings, to Engineer.

B. Submit Record Documents under cover of a transmittal letter containing:

1. Date.
2. Project Title and number.
3. Contractor's and Subcontractor's names and addresses.
4. Title and number of each Record Document.
5. Certification that each document submitted is complete and accurate.
6. Signature of Contractor or his authorized Representative.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 02220

EXCAVATION, BACKFILLING, COMPACTION

PART 1 - GENERAL

1.1 Section Includes

A. Excavation for building foundations.

B. Excavation for paving and landscaping.

C. Excavation for site structures.

D. Excavation for Mechanical/Electrical Work: Excavation and backfill required in conjunction with underground mechanical and electrical utilities, and buried mechanical and electrical appurtenances.

E. Backfilling of trenches.

F. Building perimeter and site structure backfilling to subgrade elevations.

G. Site filling and backfilling.

H. Fill under slabs-on-grade and paving.

I. Fill over over-excavation.

J. Consolidation and compaction.

K. Sheet vapor retardant and cover over crawl space and fill.

1.2 Reference Standards

A. Abbreviations and acronyms for reference standards are defined in Section 01090-Reference Standards.

B. ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.

C. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. Rammer and 12 inch Drop.

D. ANSI/ASTM D2922 - Test Method for Density of Soil in Place by the Nuclear Method.

E. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. Rammer and 18 inch Drop.

F. ASTM D2478 - Soil Classification.

1.3 Quality Assurance

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Employ, at Contractor's expense, testing laboratory to perform soil testing and inspection service for quality control testing during earthwork operations.

1.4 Submittals

A. Test Reports-Excavating: Submit following reports directly to Owner from the testing services, with copy to Contractor:

1. Test reports on borrow material.
2. Verification of each footing subgrade.
3. Field density test reports.
4. One optimum moisture-maximum density curve for each type of soil encountered.
5. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.

1.5 Job Conditions

A. Test borings and other exploratory operations may be made by Contractor at no cost to Owner.

B. Verify that survey benchmark and intended elevations for the Work are as indicated.

C. Existing Utilities: Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.

D. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

E. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, during occupied hours, except when permitted in writing by Owner and then only after acceptable temporary utility services have been provided.

1. Provide minimum of 48-hour notice to Owner, and receive written notice to proceed before interrupting any utility.

F. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.

1.6 Use of Explosives

A. Any material that is encountered within the limits of the required excavation that cannot be removed except by drilling and/or blasting, including rock, boulders, masonry, hard pan, chert, shale, street and sidewalk pavements, and/or similar materials, shall be considered as unclassified excavation, and no separate payment will be made therefor.

B. Where blasts are made, cover the excavation with enough excavation material and/or timber or steel matting to prevent danger to life and property. The Contractor shall secure, at his own expense, all permits required by law for blasting operations and the additional hazard insurance required. Observe all applicable laws and ordinances pertaining to blasting operations.

C. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

D. Operate warning lights as recommended by authorities having jurisdiction.

E. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

PART 2 - PRODUCTS

2.1 Soil Materials

A. Geotechnical Engineer and testing service to be on-site to determine satisfactory and unsatisfactory soils materials.

B. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100% passing a 1-1/2" sieve and not more than 5% passing a No. 4 sieve.

C. Backfill and Fill Materials: Satisfactory soil materials of clay, rock or gravel not larger than 2" in any dimension, free of debris, waste, frozen materials, vegetable and other deleterious matter.

D. Type A - Crushed Stone/Gravel: Graded in accordance with T.D.O.T. Section 303.01.

E. Type B - Natural stone; free of clay, shale, organic matter; graded in accordance with ANSI/ASTM C136, to the following:

1. Minimum Size: 1/4 inch.
2. Maximum Size: 5/8 inch.

F. Type C - Sand: free of silt, clay, loam, friable or soluble materials, or organic matter; graded in accordance with ANSI/ASTM C136.

G. Concrete: Structural concrete with a compressive strength of 2000 psi.

2.2 Common Fill Materials

A. Subsoil: Reused; or imported; excavated material free of gravel larger than 3 inch size, and debris.

2.3 Accessories

A. Soil Stabilization Fabric: A woven fabric composed of a stable network of polypropylene yarns. The fabric shall be inert to biological degradation and naturally encountered chemicals, alkalies, and acids. The fabric shall conform to the following minimum property values:

1. Resistance to Installation and Damage:
2. Grab Tensile Strength - 200 lb. - ASTM D1682-64.
3. Grab Tensile Elongation - 35% - ASTM D1682-64.
4. Burst Strength - 400 psi - ASTM D3786-80a.
5. Trapezoidal Tear Strength - 110 lb. - ASTM D1117-80.
6. Puncture Resistance - 70 lb. - ASTM D3787-80.
7. Performance Criteria During Service Life:
8. Modulus (load at 10% elongation) - 105 lb. - ASTM D1682-64.
9. Coefficient or Permeability.001 cm/sec.

PART 3 - EXECUTION

3.1 Examination

A. Verify fill materials to be reused are acceptable.

B. Verify foundation perimeter drainage installation has been inspected.

C. Verify underground tanks are anchored to their own foundation to avoid floatation after backfilling.

3.2 Preparation

A. Identify required lines, levels, contours, and datum.

B. Generally, compact subgrade to density requirements for subsequent backfill materials.

C. Cut out soft areas of subgrade not capable of insitu compaction. Backfill with Type B fill and compact to density equal to or greater than requirements for subsequent backfill material at the directions of Geotechnical Engineer.

D. Prior to placement of aggregate base course material at paved areas, compact subsoil to 95 percent of its maximum dry density in accordance with ANSI/ASTM D1557.

E. Protect plant life, lawn, rock outcropping and other features remaining as a portion of final landscaping.

F. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.

G. Protect above and below grade utilities which are to remain.

3.3 Excavation

A. Excavation is Unclassified, and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered. It shall be understood that any reference to rock, earth, or any other material on the drawings is not to be taken as an indication of classified excavation or the quantity of either rock, earth, or any other material involved.

B. The bidder shall draw his own conclusions as to the conditions to be encountered.

C. Underpin adjacent structures which may be damaged by excavation work, including utilities and pipe chases.

D. Excavation cut shall not interfere with normal 45 degree bearing splay of foundation.

E. Hand trim excavation and remove loose matter.

F. Remove lumped subsoil, boulders, and rock up to 1/3 cu. yd. measured by volume.

G. Notify Owner of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

H. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by Owner.

1. Removal of unsuitable material and its replacement as directed will be paid on basis of contract conditions relative to changes in work.

I. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Owner. Unauthorized excavation, as well as remedial work directed by Owner, shall be at Contractor's expense.

1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to

excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Owner.

2. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Owner.

J. Stability of Excavations: Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

1. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

K. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Remove water to prevent softening of subgrade foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

L. Material Storage: Stockpile satisfactory excavated materials until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

M. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

N. Dispose of excess soil material and waste materials as herein specified.

O. Excavation for structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10', and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

1. In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. For pile foundations, stop excavations from 6" to 12" above bottom of footing before piles are placed. After piles have been driven, remove loose and displaced material, and excavate to final grade, leaving solid base to receive concrete pile caps.

P. Excavation for Pavements: Cut surface under pavements to comply with cross-sections, elevations and grades as shown.

Q. Excavation for Trenches: Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide 6" to 9" clearance on both sides of pipe or conduit.

1. Excavate trenches to depth indicated or required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.
2. Where rock is encountered, carry excavation 6" below required elevation and backfill with a 6" layer of crushed stone or gravel prior to installation of pipe.
3. For pipes or conduit 5" or less in nominal size and for flat-bottomed multiple-duct conduit units, do not excavate beyond indicated depths. Hand excavate bottom cut to accurate elevations and support pipe or conduit on undistributed soil.
4. For pipes or conduit 6" or larger in nominal size, tanks and other mechanical/electrical work indicated to receive subbase, excavate to subbase depth indicated or, if not otherwise indicated, to 6" below bottom of work to be supported.
5. Except as otherwise indicated, excavate for exterior water-bearing piping (water, steam, condensate, drainage) so top of piping is not less than 1'-6" below finished grade.
6. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe.

3.4 Backfill and Fill

A. General: Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.

1. In excavations, use satisfactory excavated or borrow material.
2. Under grassed areas, use satisfactory excavated or borrow material.
3. Under walks, steps and pavements, use crushed stone.
4. Under building slabs, use drainage fill material.
5. Under piping and conduit, use bedding material where bedding is indicated under piping or conduit; shape to fit bottom 90 degrees of cylinder.

B. Backfill trenches with concrete where trench excavations pass within 18" of column or wall footings and which are carried below bottom of such footings, or which pass under wall footings. Place concrete to level of bottom of adjacent footing. Backfill trenches within structure and paved areas with crushed stone.

1. Do not backfill trenches until tests and inspections have been made and backfilling authorized by Owner. Use care in backfilling to avoid damage or displacement of pipe systems.

C. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
2. Inspection, testing, approval, and recording locations of underground utilities.
3. Removal of concrete formwork.
4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
5. Removal of trash and debris.
6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

D. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break-up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface. All areas shall be proofrolled at the direction of the Soils Owner to determine soft areas.

E. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

F. Placement and Compaction: Place backfill and fill materials in layers not more than 8" in loose depth for material compacted by heavy compaction equipment, and not more than 4" in loose depth for material compacted by hand-operated tampers.

G. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

H. Place backfill and fill materials evenly adjacent to structures, piping or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping or conduit to approximately same elevation in each lift.

I. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

J. Employ a placement method that does not disturb or damage foundation perimeter drainage, conduit duct in trench.

K. Maintain optimum moisture content of backfill materials to attain required compaction density.

L. Service renewal excavations in roadway shall be backfilled or steel plated within 24 hours of excavation.

M. Service renewal excavations outside of roadway shall be backfilled within 7 days of excavation.

N. Slope grade away from building minimum 6 inches in 10 ft., unless noted otherwise.

O. Make grade changes gradual. Blend slope into level areas.

3.5 Compaction

A. General: Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below.

B. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture density relationship (cohesive soils) determined in accordance with ASTM D 1557.

1. Structures, Building Slabs and Steps, Pavements: Compact top 12" of subgrade and each layer of backfill or fill material at 95% maximum density.
2. Lawn or Unpaved Areas: Compact top 6" of subgrade and each layer of backfill or fill material at 90% maximum density.
3. Walkways: Compact top 6" of subgrade and each layer of backfill or fill material at 95% maximum density.

C. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.

D. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

E. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

3.6 Tolerances

A. Top Surface of Backfilling: Under Paved Areas: Plus or minus one inch from required elevations.

B. Top Surface of General Backfilling: Plus or minus one inch from required elevations.

3.7 Field Quality Control

A. Field inspection and testing will be performed under provisions of Section 01410 - Testing Laboratory Services.

B. Tests and analysis of fill material will be performed in accordance with ANSI/ASTM D1557 and with Section 01410 - Testing Laboratory Services.

C. Compaction testing will be performed in accordance with ANSI/ASTM D1557 and with Section 01410 - Testing Laboratory Services.

D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

E. Quality Control Testing During Construction: Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed.

F. Footing Subgrade: For each strata of soil on which footings will be placed, conduct at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata, when acceptable to Owner.

G. Paved Areas and Building Slab Subgrade: Make at least one field density test of subgrade for every 2000 sq. ft. of paved area or building slab, but in no case less than 3 tests. In each compacted fill layer, make one field density test for every 2000 sq. ft. of overlaying building slab or paved area, but in no case less than 3 tests.

H. Foundation Wall Backfill: Take at least 2 field density tests, at locations and elevations as directed.

3.8 Protection

A. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.

B. Protect bottom of excavations and soil adjacent to and beneath foundation, from freezing.

C. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris. Provide temporary drainage swales or other structures to prevent ponding of water within construction limits.

D. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

E. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

F. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.9 Disposal of Excess Waste Materials

A. Removal from Owner's Property:

1. Remove waste materials, including unacceptable excavated material, trash and debris, and dispose of it off Owner's property.

END OF SECTION

SECTION 02222

UNDERGROUND UTILITY PROTECTION

Part 1 – SCOPE

1.1. This section pertains to the protection of all existing underground utilities that exist within and adjacent to work zones. “Paint Marks” or “Flags” as provided by Local One Call (811) or other utility locate services shall NOT be accepted as exact or definitive. It shall be the responsibility of the Contractor to physically verify all Paint Marks and/or Flags.

1.2. It shall be the responsibility of the Contractor to physically locate any and all existing utilities within and adjacent to the work zone prior to initiating work.

Part 2 – GENERAL

2.1. All utilities within 30 inches of the planned work zone MUST be found and visually located prior to the start of any excavation operations.

2.2. Potholing shall be performed to verify the location and depth of the existing utilities.

2.3. Backhoes, trenchers or other type of mechanical equipment shall not be used to find underground utilities within 30 inches of a planned installation.

2.4. At no time shall picks, round pointed shovels, or any other type of sharp tool be used for locating utilities.

2.5. Only square blunt non-sharp tools may be used for hand digging.

2.6. Vacuum Excavation shall be allowed with the use of high pressure water (up to 4,000 psi) with an approved non-cutting nozzle. Zero degree nozzles are not allowed.

2.7. Vacuum Excavation may also be allowed utilizing high pressure air (with dust containment system) or dry vacuum.

Part 3 – EXECUTION

3.1. Contractor shall contact One Call (811) utility locate service (in writing) at least 48 hours in advance to order locates within and adjacent to the work zone.

3.2. Contractor shall notify all other known utility companies (those not affiliated with One Call) at least 48 hours in advance to order locates within and adjacent to the work zone.

3.3. All utility crossings are to be exposed (using methods described in Part 2 above) prior to any excavation.

3.4. All existing utilities running parallel and within 5 feet of either side of the intended work shall be physically located.

3.5. Contractor shall not assume that utilities found will continue on the same line and grade.

3.6. Underground utility pothole spacing and frequency shall be as follows:

A. Gas & Electric lines within 25 feet of the work zone shall be potholed and marked every 25 feet to verify the line has not changed directions.
B. Gas & Electric lines greater than 25 feet from the work zone shall be potholed at least once on each end of the limits of excavation.
C. Fiber-Optic lines shall be potholed every 25 feet within the work zone.
D. Telephone & Cable Television lines shall be potholed every 50 feet within the work zone.
E. Water, Sewer & Reuse Utilities (less than 8" in diameter) shall be potholed every 25 feet within the work zone.
F. Water, Sewer & Reuse Utilities (8" through 24" in diameter) shall be potholed every 50 feet within the work zone.
G. Water, Sewer & Reuse Utilities (greater than 24" in diameter) shall be potholed every 100 feet within the work zone.
H. At least two (2) potholes shall be obtained for each utility within the work zone regardless of the size of the work zone.

3.7. Material returned to the inspection hole shall be compacted back in place.

3.8. All inspection holes shall be returned to original surface condition.

Part 4 – PERMITTING & SAFETY

4.1. It shall be the responsibility of the Contractor to ensure that all applicable permits for underground work have been obtained prior to commencement of work.

4.2. All work shall be performed by licensed underground contractors.

4.3. Contractor shall prepare and follow a written safety plan. This safety plan shall be provided to the permitting agency and shall be made available on-site.

4.4. Safety plan shall include a site map and show all known existing utilities and shut-off valves.

4.5. Shut-off valve handles (for all existing water, sewer, reuse, gas & electric utilities) are to be in place through the duration of the work for immediate operation if needed.

END OF SECTION

SECTION 02480

LANDSCAPE WORK

PART 1 - GENERAL

1.1 Description of Work

A. Extent of landscape development work is as required for restoration.

B. Subgrade Elevations: Excavation, filling and grading required to establish elevations shown on drawings are not specified in this section. Refer to earthwork sections.

1.2 Quality Assurance

A. Subcontract landscape work to a single firm specializing in landscape work for planting work or restoration in excess of 1 acre (single site).

B Source Quality Control:

1. General: Ship landscape materials with certificates of inspection required by governing authorities. Comply with regulations applicable to landscape materials.

2. Do not make substitutions. If specified landscape material is not obtainable, submit proof of non-availability from a minimum of 6 suppliers to Engineer, together with proposal for use of equivalent material.

C. Analysis and Standards: Package standard products with manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with method established by the Association of Official Agriculture Chemists, wherever applicable.

1.3 Submittals

A. Certification: Submit certificates of inspection as required by governmental authorities. Submit manufacturer's or vendors certified analysis for soil amendments and fertilizer materials. Submit other data substantiating that materials comply with specified requirements.

1. Submit seed vendor's certified statement for each grass seed mixture required, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed for each grass seed species.

B. Planting Schedule: Submit proposed planting schedule, indicating dates for each type of landscape work during normal seasons for such work in area of site. Correlate with specified maintenance periods to provide maintenance from

date of substantial completion. Once accepted, revise dates only as approved in writing, after documentation of reasons for delays.

C. Maintenance Instructions: Submit typewritten instructions recommending procedures to be established by Owner for maintenance of landscape work for one full year. Submit prior to expiration of required maintenance period(s).

1.4 Delivery, Storage And Handling

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery, and while stored at site.

1.5 Job Conditions

A. Proceed with the complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required.

B. Utilities: Determine location of underground utilities and perform work in a manner, which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.

C. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Engineer before planting.

D. Planting Time: Plant or install materials during normal planting seasons for each type of landscape work required. Correlate planting with specified maintenance periods to provide maintenance from date of substantial completion.

E. Planting Schedule: Prepare a proposed planting schedule. Schedule dates for each type of landscape work during normal seasons for such work in area of site. Correlate with specified maintenance periods to provide maintenance from date of substantial completion. Once accepted, revise dates only as approved in writing, after documentation of reasons for delays.

F. Coordination with Lawns: Plant trees and shrubs after final grades are established and prior to planting of lawns, unless otherwise acceptable to Engineer. If planting of trees and shrubs occurs after lawn work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.

1.6 Special Project Warranty

A. Warranty lawns through specified lawn maintenance period, and until final acceptance.

PART 2 – PRODUCTS

2.1 Topsoil

A. Topsoil for landscape work may not available at site in sufficient quantity and must be furnished as specified.

B. New topsoil shall be fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones, and other extraneous or toxic matter harmful to plant growth. Topsoil shall a have minimum of 2% organic material established by a laboratory burn test.

1. Obtain topsoil from local sources or from areas having similar soil characteristics to that found at project site. Obtain topsoil only from naturally, well-drained sites where topsoil occurs in a depth of not less than 4"; do not obtain from bogs or marshes.

2.2 Soil Amendments

A. Lime: Natural limestone containing not less than 85% of total carbonates, ground so that not less than 90% passes a 10-mesh sieve and not less than 50% passes a 100-mesh sieve. Apply if pH of soil is less than 6.0.

B. Peat Humus: FS Q-P-166 and with texture and ph range suitable for intended use. Well shredded.

C. Superphosphate: Soluble mixture of treated minerals; 20% available phosphoric acid. Apply if soil test indicates a phosphorous deficiency.

D. Sand: Clean, washed sand, free of toxic materials.

E. Manure: Well rotted, unleached stable or cattle manure containing not more than 25% by volume by straw, sawdust or other bedding materials and containing no chemicals or ingredients harmful to plants.

F. Mulch: Organic mulch free from deleterious materials and suitable for top dressing of trees, shrubs, or plants and consisting of one of the following:

1. Ground or shredded bark.

G. Commercial Fertilizer: Complete fertilizer of neutral character, with some elements derived from organic sources and containing following percentages of available plant nutrients:

1. For trees and shrubs, provide fertilizer with not less than 5% total nitrogen 10% available phosphoric acid and 10% soluble potash.

2. For lawns, provide fertilizer with percentage of nitrogen required to provide not less than 1 lb. of actual nitrogen per 100 sq. ft. of lawn area

and not less than 4% phosphoric acid and 2% potassium. Provide nitrogen in a form that will be available to lawn during initial period of growth; at least 50% of nitrogen to be organic form.

H. Topsoil Mix: Topsoil mix shall be a clean uniform mixture of the following composition:

1. 60% sand
2. 30% topsoil
3. 10% peat humus, manure, or other approved dampened organic matter.
4. Topsoil mix is intended for trees, shrubs, ground cover, and planting beds only. Seeded areas shall receive topsoil only.

I. Add 3 lbs. of 5-10-10 fertilizer to each cubic yard of topsoil mix and blend in thoroughly.

2.3 Grass Materials

A. Grass Seed: Provide fresh, clean, new-crop seed complying with tolerance for purity and germination established by Official Seed Analysts of North America. Provide seed mixture composed of grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed, as specified.

B. Grass Seed Mixture by Weight: Kentucky 31 tall Fescue - 75%; Sericea Lespedeza, Common (Scarified) - 15%; Ledino White Clover - 5%; Kenstar Red Clover - 5%.

PART 3 - EXECUTION

3.1 Preparation

A. Preparation of Planting Lawns:

1. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.

2. Mix fertilizers with topsoil at rates specified. Delay mixing of fertilizer if planting will not follow placing of planting soil within a few days.

B. For pit and trench type backfill, mix planting soil prior to backfilling, and stockpile at site.

C. For planting beds mix planting soil either prior to planting or apply on surface of topsoil and mix thoroughly before planting.

1. Mix lime with dry soil prior to mixing of fertilizer if pH of soil is less than 6.0.

2. Prevent lime from contacting roots of acid-loving plants.

D. Preparation for Planting Lawns:

1. Loosen subgrade of lawn areas to a minimum depth of 4". Remove rocks, stones, sticks, roots, rubbish, and other extraneous matter. Limit preparation to areas, which will be planted promptly after preparation.

2. Spread topsoil to mixture to minimum depth required to meet lines, grades, and elevations shown, after light rolling and natural settlement. Add specified soil amendments and mix thoroughly into upper 4" of topsoil.

3. Place approximately 1/2 of total amount of planting topsoil required. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil. Add specified soil amendments and mix thoroughly into upper 4" of topsoil.

4. Fine grade lawn areas to smooth, even surface with loose, uniformly fine texture. Roll, rake and drag lawn areas, remove ridges and fill depressions, as required to meet finish grades. Limit fine grading to areas which can be planted immediately after grading.

5. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.

6. Restore lawn areas to specified condition if eroded or otherwise disturbed after fine grading and prior to planting.

E. Preparation of Planting Beds:

1. Loosen subgrade of planting bed areas to a minimum depth of 6" using a cultimulcher or similar equipment. Remove stones over 1-1/2" in any dimension, and sticks, stones, rubbish and other extraneous matter.

2. Spread topsoil mixture to minimum depth required to meet lines, grades, and elevations shown, after light rolling and natural settlement. Place approximately 1/2 of total amount of planting soil required. Work into top of loosened subgrade to create a transition layer, then place remainder of the planting soil.

3.2 Seeding New Lawns

A. Schedule seeding operation for August 15 - October 15 or February 20 - April 15 if possible for the project duration.

B. Do not use wet seed or seed which is moldy or otherwise damaged in transit or storage.

C. Sow seed using a spreader or seeding machine. Do not seed when wind velocity exceeds 5 mi. per hr. Distribute seed evenly over entire area by sowing equal quantity in 2 directions at right angles to each other.

D. Sow not less than 4 lbs. of seed mixture per 1,000 square feet.

E. Rake seed lightly into top 1/8" of soil, roll lightly, and water with a fine spray.

F. Protect seeded areas against erosion by spreading specified lawn mulch after completion of seeding operations. Spread uniformly to form a continuous blanket not less than 1-1/2" loose measurement over seeded areas.

3.3 Cleanup and Protection

A. During landscape work, keep pavements clean and work area in an orderly condition.

B. Protect landscape work and materials from damage due to landscape operations, operations by other contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

3.4 Inspection and Acceptance

A. When landscape work is completed, including maintenance, Engineer will, upon request, make an inspection to determine acceptability.

B. Where inspected landscape work does not comply with requirements, replace rejected work and continue specified maintenance until reinspected by Engineer and found to be acceptable. Remove rejected plants and materials promptly from project site.

END OF SECTION

SECTION 02500

PAVING AND SURFACING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Work shall consist of furnishing and placing one (1) or more courses of aggregates and additives if required on a prepared subgrade in accordance with TDOT Standard Specifications Section 303 and this Section and in reasonably close conformity with the lines, grades, thickness, and typical cross sections shown in the plans or established by the Engineer. Mineral aggregates base shall be type A or type B whichever is shown in the plans and called for in the bid schedule.

B. This Work shall consist of a foundation composed of a hot mixture of aggregate and asphalt prepared in a hot bituminous mixing plant. It shall be constructed in one (1) or more layers on a prepared subgrade, granular subbase, or base in accordance with TDOT Standard Specifications Section 307 and this Section and in reasonably close conformity with the lines, grades, thicknesses, and typical cross sections shown in the plans or as directed by the Engineer.

C. This Work shall consist of an application of bituminous material and cover material if required on a designated base in accordance with the requirements in TDOT Standard Specifications Section 402 and this Section and in reasonably close conformity with the lines shown in the plans or established by the Engineer.

D. This Work shall consist of furnishing and applying bituminous material to a previously prepared base or surface to provide a bond for a superimposed course in accordance with the requirements in TDOT Standard Specifications Section 403 and this Section.

E. This Work shall consist of a bituminous mat composed of mineral aggregate bonded with bituminous material. It shall be constructed on a designated surface in accordance with TDOT Standard Specifications Section 404 and this Section and in reasonably close conformity with the lines, grades, and cross sections indicated in the plans or established by the Engineer.

F. This Work shall consist of an application of bituminous material followed by an application of cover material in accordance with TDOT Standard Specifications Section 405 and this Section and in reasonably close conformity with the lines, grades, and cross section shown in the plans or established by the Engineer.

G. TDOT Standard Specifications Section 407 and this Section include general requirements that are applicable to all types of bituminous pavements of the plant mix type irrespective of gradation of aggregate, kind and amount of bituminous material, or pavement used. Deviations from these general requirements will be indicated in the specific requirements for each type.

H. This Work shall consist of one (1) or more courses of bituminous mixture constructed on the prepared foundation in accordance with TDOT Standard Specifications Section 407 and this Section and the specific requirements of the type under CONTRACT and in reasonably close conformity with the lines, grades, typical cross sections, and rate of application or thickness shown in the plans or established by the Engineer.

I. This Work shall consist of an asphaltic concrete pavement composed of a mixture of coarse aggregate, fine aggregate, mineral filler if specified or required, and asphalt cement constructed on a prepared roadbed in accordance with TDOT Standard Specifications Section 411 and this Section and in reasonably close conformity with the lines, grades, typical cross section, and rate of application shown in the plans or established by the Engineer. The provisions in TDOT Standard Specifications Section 407 and this Section shall apply to this construction unless otherwise stipulated.

J. This Work shall consist of cold planing an existing bituminous plant mix pavement in accordance with the requirements in TDOT Standards Specifications Section 415 and this Section and in reasonably close conformity with the lines and grades shown in the plans or established by the Engineer.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section 01340 - Shop Drawings, Product Data, and Samples
Section 01410 - Testing Laboratory Services
Section 02220 – Excavation, Backfilling, and Compaction
Section 03300 - Cast-In-Place Concrete

1.3 APPLICABLE SPECIFICATIONS

"STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION", Latest Revision, Tennessee Department of Transportation (TDOT)

"SUBDIVISION SPECIFICATIONS FOR STREETS AND ROADS", Latest Revision, (City of Mount Pleasant standards as applicable)

1.4 APPLICABLE REFERENCES

"American Association of State Highway and Transportation Officials" (AASHTO), Latest Revision

"American Society for Testing and Materials" (ASTM), Latest Revision

PART 2 - MATERIALS

2.1 MINERAL AGGREGATE BASE

A. The mineral aggregate shall meet the requirements in TDOT Standard Specifications Subsection 903.05 for Class A or Class B aggregates depending upon whether type A or type B base is required in the construction. Type A base

will require the use of Class A aggregate grading D. Either Class A or Class B aggregate may be used for type B base.

1. When the stationary plant method for mixing is used, the aggregate will be accepted for gradation immediately following mixing or immediately prior to mixing based on periodic samples taken from the pugmill output or from the belt feeding the pugmill.
2. When two (2) or more materials are blended on the road by means of mechanical mixers the aggregate will be accepted for gradation after mixing and before compaction based on samples taken from each layer of base material. Aggregate that does not require blending will be accepted for gradation at the aggregate production plant based on samples taken from stockpiles of plant production immediately prior to delivery to the road.

B. Calcium chloride shall meet the requirements in TDOT Standard Specifications Subsection 918.02 for type 1, type 2, or calcium chloride liquor.

C. Sodium chloride shall meet the requirements in TDOT Standard Specifications Subsection 918.03.

2.2 BITUMINOUS PLANT MIX BASE (HOT MIX)

A. The materials used in this construction shall conform to the requirements in TDOT Standard Specifications Subsections 903.06, 918.09 (B), and 904.01.

B. The specific grading of aggregate to be used will be specified in the CONTRACT or shown in the plans. Mineral aggregate, bituminous material, and the plant mix will be accepted as provided for in TDOT Standard Specifications Subsection 407.02.

2.3 PRIME COAT

A. Materials shall meet the requirements in TDOT Standard Specifications Subsections 903.13, 904.02, and 904.03.

B. The ranges of application temperatures in degrees Fahrenheit shall be as shown in TDOT Standard Specifications Subsection 402.02.

2.4 TACK COAT

Bituminous materials shall conform to the requirements in TDOT Standard Specifications Subsections 904.01 through 904.03 and 918.09 (B).

A. The ranges of application temperatures in degrees Fahrenheit shall be as shown in TDOT Standard Specifications Subsection 403.02.

B. When emulsified asphalt is used water as approved by the Engineer may be added to the asphaltic emulsion and thoroughly mixed therewith in such proportion not to exceed thirty (30) percent by volume of added water that the resulting

mixture will give the desired cover of residual bitumen. The exact quantity of added water will be established by the Engineer.

2.5 DOUBLE BITUMINOUS SURFACE TREATMENT

A. Materials used in this construction shall meet the requirements in TDOT Standard Specifications Subsections 903.14, 904.02, and 904.03.

B. The ranges of application temperatures in degrees Fahrenheit shall be as shown in TDOT Standard Specifications Subsection 404.02.

2.6 BITUMINOUS SEAL COAT

A. Materials used in this construction shall meet the requirements in TDOT Standard Specifications Subsections 903.13 and 904.01 through 904.03.

B. Application temperatures for bituminous materials in degrees Fahrenheit shall be as shown in TDOT Standard Specifications Subsection 405.02.

2.7 BITUMINOUS PLANT MIX PAVEMENTS (GENERAL)

The individual materials shall meet the applicable requirements in TDOT Standard Specifications.

A. Aggregates shall meet the applicable requirements in TDOT Standard Specifications Section 903.

B. Mineral filler shall meet the requirements in TDOT Standard Specifications Subsection 903.16.

C. Bituminous materials shall meet the applicable requirements in TDOT Standard Specifications Section 904.

D. Chemical additive shall meet the requirements in TDOT Standard Specifications Subsection 918.09 (B).

E. Aggregate shall be separated into coarse and fine aggregate stockpiles. When coarse aggregate is stockpiled by means causing segregation it shall be separated into coarse and medium coarse stockpiles.

F. Each size and type of aggregate shall be stocked in a separate pile, bin, or stall. The storage yard shall be maintained in an orderly condition with a walkway between stockpiles that are not separated by partitions. The stockpiles shall be readily accessible for sampling.

G. The mineral aggregate will be conditionally accepted for quality in the stockpile at the producer's site. The bituminous material may be conditionally accepted at the asphalt terminal. Acceptance of the aggregate gradation and asphalt cement content shall be determined from hot bin samples or sample(s) taken from the

completed mix at the asphalt plant after it has been loaded onto the trucks for transport to the project as specified herein.

H. Where anti-stripping additive other than hydrated lime as described in TDOT Standard Specifications Subsection 918.09 (B) and this Section is required it shall be added by approved on line blending equipment at the Contractor's mixing plant. The dispenser shall be capable of adding heat stable anti-stripping additive within a tolerance of ten (10) percent of the specified rate.

2.8 ASPHALTIC CONCRETE SURFACE (HOT MIX)

A. Materials used in this construction shall meet the requirements in TDOT Standard Specifications Subsections 903.11, 903.16, 904.01, and 918.09 (B).

B. The mineral aggregate, bituminous material, and plant mix will be accepted as provided for in TDOT Standard Specifications Subsection 407.02.

PART 3 - EQUIPMENT

All equipment necessary for the satisfactory performance of this construction shall be on the project and approved before Work will be permitted to begin. The equipment used for this construction shall meet the requirements specified in TDOT Standard Specifications Subsections 303.05, 307.04, 402.03, 403.03, 404.03, 405.03, 407.04 through 407.08, 411.04, and 415.02.

PART 4 - EXECUTION

4.1 MINERAL AGGREGATE BASE

Mineral aggregate base shall conform in general construction requirements, mixing, spreading, shaping and compaction, maintenance, thickness requirements, and surface requirements to the requirements in TDOT Standard Specifications Subsections 303.06 through 303.12.

4.2 BITUMINOUS PLANT MIX BASE (HOT MIX)

Bituminous plant mix base (hot mix) shall conform in composition of mixtures, general construction requirements, preparation of subgrade, subbase, or surface, and thickness and surface requirement to the requirements in TDOT Standard Specifications Subsections 307.03 and 307.05 through 307.07.

4.3 PRIME COAT

Prime coat shall conform in limitations, preparation of surface, application of prime, application of cover material, and maintenance and protection to the requirements in TDOT Standard Specifications Subsections 402.04 through 402.08.

4.4 TACK COAT

Tack coat shall conform in preparation of surface and application of bituminous material to the requirements in TDOT Standard Specifications Subsections 403.04 and 403.05.

4.5 DOUBLE BITUMINOUS SURFACE TREATMENT

Double bituminous surface treatment shall conform in limitations, preparing designated surface, applications of bituminous material and mineral aggregate, rolling and curing, shoulders, and maintenance and protection to the requirements in TDOT Standard Specifications Subsections 404.04 through 404.09.

4.6 BITUMINOUS SEAL COAT

Bituminous seal coat shall conform in limitations, preparing the designated surface, application of bituminous material, spreading and rolling aggregate, shoulders, and maintenance and protection to the requirements in TDOT Standard Specifications Subsections 405.04 through 405.09.

4.7 BITUMINOUS PLANT MIX PAVEMENT (GENERAL)

Bituminous plant mix base (hot mix) shall conform in composition of mixtures (includes Contractor's quality control system), weather limitations, conditioning of existing surface, preparation of bituminous material, preparation of aggregates, mixing, spreading and finishing, compaction (includes density requirements and test strips), joints, pavement samples, and surface requirements to the requirements in TDOT Standard Specifications Subsections 407.03 and 407.09 through 407.18.

4.8 ASPHALTIC CONCRETE SURFACE (HOT MIX)

Asphaltic concrete surface (hot mix) shall conform in composition of mixtures, general construction requirements, preparing the designated surface, mixing, and surface requirements to the requirements in TDOT Standard Specifications Subsections 411.03 and 411.05 through 411.08.

4.9 COLD PLANING OF BITUMINOUS PLANT MIX PAVEMENTS

Cold planing of bituminous plant mix pavements shall conform in general requirements and surface requirements to the requirements in TDOT Standard Specifications Subsections 415.03 and 415.04.

4.10 PAVEMENT REPAIR

Where trenches have been opened in any roadway or street that is a part of the State highway system surfaces shall be restored in accordance with the requirements of the Tennessee Department of Transportation. All other restoration shall be done in accordance with this Section and Public Works details.

A. Excavation in the pavement area shall require that pavement surfaces be cut and brought to a neat line by use of an air hammer, saw, or other suitable equipment.

B. Upon completion of installation of utility backfill fill the trench with mineral aggregate type A, grading D (crusher run stone) and temporary asphalt patch with two (2) inches of cold mix or hot bituminous seal coat until such time that the permanent pavement patch is constructed.

C. Complete the pavement restoration for the various types of roadway typical sections in conformance with Public Works details and this Section.

D. Concrete curb or combined curb and gutter, driveways, median pavement, and sidewalks shall be restored as required to match existing construction. Replace damaged sections with complete new sections or squares. Patching of damaged sections will not be permitted.

E. Maintain restored sections and surfaces as part of this CONTRACT for a period of one (1) year following the date of final acceptance.

F. The minimum width to be trimmed on each side of the trench line as seen in the section may be waived or amended upon approval of the Inspector however a minimum width of replacement shall be four (4) feet to allow for a roller.

G. All excavations made within public right-of-way will require excavation and street closure permits from the Department of Public Works prior to commencing Work.

H. Flowable fill shall meet the requirements in TDOT Standard Specifications Section 204 except as modified in Pubic Works Technical Specifications Section 02225 latest revision.

I. When a manhole top or other utility casting requires adjustment to an elevation one (1) inch or more above the existing pavement grade and is exposed to traffic before final paving is completed a temporary ramp shall be constructed by feathering bituminous concrete for three hundred sixty (360) degrees around the manhole or utility casting. A taper slope of not less than two (2) feet per one (1) inch shall be used. During the paving operation but prior to the placement of the topping course the bituminous concrete taper shall be removed from around the manhole to a minimum depth of one (1) inch below the top of manhole.

PART 5 - MEASUREMENT AND PAYMENT

5.1 METHOD OF MEASUREMENT

A. Mineral Aggregate Base.

Mineral aggregate for mineral aggregate base, type A or type B will be measured by the ton in accordance with the provisions in TDOT Standard Specifications Section 109.

1. When mixing is performed in a stationary plant the weight of all surface moisture on the aggregate at the time of weighing in excess of eight (8) percent will be deducted. No direct payment for water will be made.

2. When mixing is performed on the road the weight of surface moisture on the aggregate at the time of weighing in excess of eight (8) percent will be deducted. Water added to the materials on the road at the direction of the Engineer will be measured for payment.
3. Water measured for payment as provided in TDOT Standard Specifications Subsection 303.13 and above will be measured by the M.G. (1000 gallons) by means of calibrated tanks or distributors or by means of accurate water meters.
4. Sodium chloride will be measured by the ton in accordance with the provisions in TDOT Standard Specifications Section 109.
5. Calcium chloride will be measured by the ton.
6. Calcium chloride received in liquid form will be weighed as provided for in TDOT Standard Specifications Section 109. The weight of liquid calcium chloride will be converted to tons by using the following formulae:

32% solution:

$$\frac{((\text{total tons of } 32\% \text{ solution}) \times 0.32)}{(0.94)} = \text{tons}$$

38% solution:

$$\frac{((\text{total tons of } 38\% \text{ solution}) \times 0.38)}{(0.94)} = \text{tons}$$

7. When calcium chloride liquor in a solution of 32% or more but less than 38% is used it will be paid for as a 32% solution. A solution of 38% or greater will be paid for as a 38% solution.

B. Bituminous Plant Mix Base (hot mix).

Aggregate and asphalt cement for bituminous plant mix base (hot mix) will be measured by the ton in accordance with the provisions in TDOT Standard Specifications Subsection 407.19 and subparagraph 5.1 G below. Materials for prime or tack coat if specified will be measured as prescribed in TDOT Standard Specifications Sections 402 or 403 and subparagraphs 5.1 C and D below.

1. If recycled mix is used the completed mix including new mineral aggregate, planings, asphalt cement, and additive shall be measured by the ton in accordance with TDOT Standard Specifications Section 109. For bidding purposes the asphalt cement content of the specified mixes shall be as shown in the Contract Documents. In the event that the Engineer sets an asphalt content other than that stated in the Contract Documents a price adjustment will be made based on the asphalt content set by the Engineer and the invoice price of the asphalt cement F.O.B. the asphalt plant. The price adjustment will be calculated according to the formula in the Contract Documents.
2. The liquid anti-strip additive will be measured by the gallon and paid as outlined in TDOT Standard Specifications Subsection 307.09 and subparagraph 5.2 B below. Hydrated lime will be measured by the ton and

paid as outlined in TDOT Standard Specifications Subsection 307.09 and subparagraph 5.2 B below.

3. No direct payment will be made for polymer or latex additives and cost thereof shall be included in the Contract Unit Bid Price for the modified asphalt cement or modified mixture.

C. Prime Coat.

Bituminous material and cover material will be measured by the ton in accordance with the provisions in TDOT Standard Specifications Section 109. Net certified weights may be used as a basis of measurement for cover material aggregate subject to correction for aggregate that is lost, wasted, or otherwise not incorporated in the Work. Water used at the direction of the Engineer to dampen the base prior to applying bituminous materials shall be measured by the M.G. (1000 gallons) by means of calibrated tanks or distributors or by means of accurate water meters.

D. Tack Coat.

Bituminous material for tack coat will be measured by the ton in accordance with the provisions in TDOT Standard Specifications Section 109. Water used for dilution of asphalt emulsion will not be measured for payment.

E. Double Bituminous Surface Treatment.

Mineral aggregate and bituminous material will be measured by the ton in accordance with the provisions in TDOT Standard Specifications Section 109. Net certified weights may be used as a basis of measurement for mineral aggregate subject to correction for aggregate that is lost, wasted, or otherwise not incorporated in the Work.

F. Bituminous Seal Coat.

Mineral aggregate and bituminous material will be measured by the ton in accordance with the provisions in TDOT Standard Specifications Section 109. Net certified weights may be used as a basis of measurement for mineral aggregate subject to correction for aggregate that is lost, wasted, or otherwise not incorporated in the Work.

G. Bituminous Plant Mix Pavements (general).

Chemical additives or modifiers when required will not be measured for payment but will be considered as part of the asphalt cement.

1. Mineral filler will not be measured separately for payment but will be included in mineral aggregates.
2. Asphalt cement and mineral aggregate including mineral filler when required will be measured by the ton.

3. Where the mix is loaded from a storage or surge bin the quantities will be determined by weighing the completed mix on truck scales meeting the requirements in TDOT Standard Specifications Section 109 and calculating the weight of asphalt cement and mineral aggregate based on percentages measured into the mix by the appropriate scales or meters described in TDOT Standard Specifications Subsection 407.04.
4. Where the mix is loaded directly into the hauling equipment from a batch plant asphalt cement and mineral aggregate will be measured in batch quantities by scales or scales and meters as described in TDOT Standard Specifications Subsection 407.04 (b).
5. Where a continuous mix plant is used bituminous material for bituminous plant mix pavement will be measured by the ton in accordance with the provisions in TDOT Standard Specifications Section 109. The mineral aggregate including mineral filler when required will be determined by weighing the bituminous pavement mixture on truck scales meeting the requirements in TDOT Standard Specifications Section 109 and deducting the weight of the bituminous material from the weight of total mixture accepted.
6. When the Work described under TDOT Standard Specifications Subsection 407.10 is required the removal and disposal of existing surface (concrete) will be measured by the square yard in accordance with the provisions in TDOT Standard Specifications Section 109. Such measurement shall include the removal of bituminous overlay.
7. The removal and disposal of existing surface (bituminous) will be measured by the cubic yard in accordance with the provisions in TDOT Standard Specifications Section 109. Such measurement shall include the removal of base material except concrete as directed by the Engineer.
8. Removal of unsatisfactory subgrade material where existing pavement has been removed will be measured by the cubic yard in accordance with the provisions in TDOT Standard Specifications Subsection 203.09 and these specifications. Material used to replace such undercutting will be measured and paid for in accordance with the specification for the type of material used.
9. Bituminous mixtures used to fill openings left by pavement removal will be measured for payment in accordance with the provisions in TDOT Standard Specifications Subsection 407.19 and subparagraph 5.2 G. Base materials used to fill openings left by base removal will be measured as provided for in the respective TDOT Standard Specifications sections for each type specified.
10. Adjustment of catch basin grates and frames, water valve boxes, gas valve boxes, and manhole covers and frames shall be measured per each when required.

H. Asphaltic Concrete Surface (hot mix).

Mineral aggregate including mineral filler when required and asphalt cement for asphaltic concrete surface (hot mix) will be measured as prescribed in TDOT Standard Specifications Subsection 407.19 and subparagraph 5.1 G above. Mineral filler when required will not be measured for payment separately but will be included as mineral aggregate.

1. Asphaltic concrete surface (hot mix) (shoulders) including new mineral aggregate, planings, asphalt cement, and additive shall be measured by the ton in accordance with TDOT Standard Specifications 109. For bidding purposed the asphalt cement content of the specified mix shall be as shown in the Contract Documents for 411 E used as a surface on the shoulders. In the event that the Engineer sets an asphalt content other than that stated in the Contract Documents a price adjustment will be made based on the asphalt content set by the Engineer and the invoice price of the asphalt cement F.O.B. the asphalt plant. The price adjustment will be calculated according to the formula shown in the Contract Documents.
2. The liquid anti-strip additive will be measured by the gallon and paid as outlined in TDOT Standard Specifications Subsection 411.10 and subparagraph 5.2 G below. Hydrated lime will be measured by the ton and paid as outlined in TDOT Standard Specifications Subsection 411.10 and subparagraph 5.2 G below.
3. No direct payment will be made for polymer or latex additives and cost thereof shall be included in the Contract Unit Bid Price for the modified asphalt cement or modified mixture.

I. Cold Planing of Bituminous Plant Mix Pavements.

Cold planing of bituminous pavement will be measured by the ton of material removed, by the cubic yard of material removed, or by the square yard of planed pavement. The method of measurement will depend upon the pay item designated in the proposal.

1. Where payment is by the ton the material removed from areas acceptably planed will be measured by the ton in accordance with TDOT Standard Specifications Section 109.
2. Where payment is by the cubic yard the material removed from areas acceptably planed will be measured by the cubic yard in accordance with TDOT Standard Specifications Section 109.
3. Where payment is by the square yard the pavement acceptably planed will be measured by the square yard in accordance with TDOT Standard Specifications Section 109.
4. Unless otherwise specified water used to control dust will not be measured for separate payment but will be considered incidental to the planing operation.
5. Salvage value of cold planings will be measured in the same units and by the same method as cold planing of bituminous pavement.

5.2 BASIS OF PAYMENT

A. Mineral Aggregate Base.

1. The accepted quantities of mineral aggregate base of the type specified will be paid for at the Contract Unit Bid Price per ton for mineral aggregate, per ton for calcium chloride, per ton for sodium chloride and per M.G. (1000 gallons) for water complete in place.

2. The Work required for preparation of subgrade as provided for under TDOT Standard Specifications Subsection 303.06 and this Section will be measured and paid for in accordance with the provisions in the applicable TDOT Standard Specifications Sections or Subsections and Public Works Technical Specifications Section under which the Work is performed.

B. Bituminous Plant Mix Base (hot mix).

The accepted quantities of bituminous plant mix base (hot mix) complete in place will be paid for at the Contract Unit Bid Price per ton for the aggregate and/or the asphalt cement. Accepted quantities of prime coat or tack coat will be paid for in accordance with the provisions in TDOT Standard Specifications Sections 402 or 403 respectively and this Section.

1. In cases where the combined specific gravity of the mineral aggregate exceeds two and eighty-hundredths (2.80) the tonnage of mineral aggregate will be adjusted for payment by multiplying the tonnage of mineral aggregate used by a specific gravity of two and eighty-hundredths (2.80) and dividing by the higher specific gravity.
2. The Work required for preparation of subgrade, subbase, base, or surface as provided for under TDOT Standard Specifications Subsection 307.06 and this Section will be measured and paid for in accordance with the provisions in the applicable TDOT Standard Specifications Sections or Subsections and Public Works Technical Specifications Section under which the Work is performed.
3. If recycled mix is used the accepted quantities of bituminous plant mix base (hot mix) complete in place will be paid for at the Contract Unit Bid Price per ton of the total mix which will include mineral aggregate, planings, asphalt cement, and additive. Payment will be made to the Contractor for additional asphalt cement as provided for in TDOT Standard Specifications Section 307 and this Section at the purchase price F.O.B. the asphalt mixing plant as verified by invoice and no compensation will be allowed for further handling or processing. The Department of Public Works will be reimbursed from monies due the Contractor for a decrease in asphalt cement content in the amount equal to the purchase price F.O.B. the asphalt plant.
4. The liquid anti-strip additive will be paid for based on certified invoices of material cost not to exceed fifteen (15) dollars per gallon. Hydrated lime anti-strip additive will be paid for based on certified invoices of material cost not to exceed ninety (90) dollars per ton. This payment shall be full compensation for all labor, materials, equipment, and other incidentals incurred in utilizing the anti-strip additive.

C. Prime Coat.

The accepted quantities of prime coat will be paid for at the Contract Unit Bid Price per ton for bituminous material, per ton for cover material, and per M.G. (1000 gallons) for water complete in place.

D. Tack Coat.

1. The accepted quantities of tack coat will be paid for at the Contract Unit Bid Price per ton for bituminous material complete in place.
2. The Work required for preparing the designated surface as provided for under TDOT Standard Specifications Subsection 403.04 and this Section will be measured and paid for in accordance with the provisions in the applicable TDOT Standard Specifications Sections or Subsections and Public Works Technical Specifications Section under which the Work is performed.

E. Double Bituminous Surface Treatment.

1. The accepted quantities of double bituminous surface treatment will be paid for at the Contract Unit Bid Price per ton for bituminous material and per ton for mineral aggregate complete in place.
2. The Work required for preparing the designated surface as provided for under TDOT Standard Specifications Subsection 404.05 and this Section will be measured and paid for in accordance with the provisions in the applicable TDOT Standard Specifications Sections or Subsections and Public Works Technical Specifications Section under which the Work is performed.

F. Bituminous Seal Coat.

1. The accepted quantities of bituminous seal coat will be paid for at the Contract Unit Bid Price per ton for bituminous material and per ton for mineral aggregate complete in place.
2. The Work required for preparing the designated surface as provided for under TDOT Standard Specifications Subsection 405.05 and this Section will be measured and paid for in accordance with the provisions in the applicable TDOT Standard Specifications Sections or Subsections and Public Works Technical Specifications Section under which the Work is performed.

G. Bituminous Plant Mix Pavements (general).

All Work performed and measured as prescribed in TDOT Standard Specifications Section 407 and this Section will be paid for as provided in the respective TDOT Standard Specifications sections for each type specified. Acceptance of the mixture, defective materials, acceptance procedures, additional tests, and acceptance for mix density on the roadway will be paid for as described in TDOT Standard Specifications Subsection 407.20.

H. Asphaltic Concrete Surface (hot mix).

The accepted quantities of asphaltic concrete surface (hot mix) will be paid for at the respective Contract Unit Bid Price per ton for mineral aggregate and asphalt cement.

1. Asphaltic concrete surface (hot mix) (shoulders) containing recycled

material complete in place will be paid for at the Contract Unit Bid Price per ton of the total mix which will include mineral aggregate, planings, asphalt cement, and additive. Payment will be made to the Contractor for additional asphalt cement as provided for in TDOT Standard Specifications Section 411 and this Section at the purchase price F.O.B. the asphalt mixing plant as verified by invoice and no compensation will be allowed for further handling or processing. The Department of Public Works will be reimbursed from monies due the Contractor for a decrease in asphalt cement content in the amount equal to the purchase price F.O.B. the asphalt plant.

2. The liquid anti-strip additive will be paid for based on certified invoices of material cost not to exceed fifteen (15) dollars per gallon. Hydrated lime anti-strip additive will be paid for based on certified invoices of material cost not to exceed ninety (90) dollars per ton. This payment shall be full compensation for all labor, materials, equipment, and other incidentals incurred in utilizing the anti-strip additive.
3. In cases where the combined specific gravity of mineral aggregate exceeds two and eighty-hundredths (2.80) the tonnage of mineral aggregate will be adjusted for payment by multiplying the tonnage of mineral aggregate used by a specific gravity of two and eighty-hundredths (2.80) and dividing by the higher specific gravity.
4. The Work required for preparing the designated surface as provided for under TDOT Standard Specifications Subsection 411.06 and this Section will be measured and paid for in accordance with the provisions in the applicable TDOT Standard Specifications Sections or Subsections and Public Works Technical Specifications Section under which the Work is performed.
5. When the approved job mix formula includes a mixture of limestone with gravel, granite, slag, quartzite, or gneiss tests for the percent loss on ignition of the limestone aggregate in the asphalt paving mix shall be performed according to the provisions in TDOT Standard Specifications Subsection 407.03.
6. In the event the percent of loss on ignition in the aggregate differs by more than plus or minus two (□2) percent from the loss on ignition indicated in the job mix formula a deduction in payment in the Contract Unit Bid Price for the mix shall be made not as a penalty but as liquidated damages. The percent of total payment to be deducted shall be five (5) times the percent that the loss on ignition exceeds the job mix formula tolerance of plus or minus two (□2) percent.
7. All mix produced with aggregate tested and found to have a loss on ignition that differs more than plus or minus six (□6) percent from the loss on ignition indicated in the job mix formula shall be replaced or overlaid at the expense of the Contractor.
8. For the purpose of determining the deduction lots of approximately five thousand (5000) square yards will be used. The sampling and testing to establish the loss on ignition will be performed in accordance with the Department of Public Works sampling and testing procedures. In event the initial tests indicates a variation in the loss on ignition of greater than plus or minus two (□2) percent than the value shown on the mix design the additional sampling necessary to establish the loss on ignition of the

aggregate in each lot shall be performed by the Contractor with the cost of the sampling being included in the Contract Unit Bid Price for the paving items.

9. Any deduction for excess variation in loss on ignition shall be made under item 411-03.40.

I. Cold Planing of Bituminous Plant Mix Pavements.

1. The accepted quantity of cold planed bituminous pavement will be paid for at the Contract Unit Bid Price which payment shall be full compensation for all labor, materials, equipment, hauling, and incidentals necessary to plane the pavement, control dust, and dispose of the cuttings.
2. The Contract Unit Bid Price for salvage value of cold planing will be deducted from monies due the Contractor to compensate the City of Mount Pleasant Department of Public Works for the removed material.

END OF SECTION - 02500

SECTION 02514

PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.1 Section Includes

A. Extent of Portland cement concrete paving is as required for restoration, including curbs, gutters, walks and pavement.

1.2 Quality Assurance

A. Codes and Standards: Comply with local governing regulations if more stringent than herein specified.

1.3 Reference Standards

A. ASTM A184 - Specifications for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.

B. ASTM A185 - Specifications for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

C. ASTM A307 - Specifications for Carbon Steel Bolts and Studs, 6,000 psi Tensile.

D. ASTM C615 - Specifications for Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

E. ASTM C33 - Specifications for Concrete Aggregates.

F. ASTM C150 - Specifications for Portland Cement.

G. ASTM C309 - Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.

1.4 Submittals

A. Furnish samples, manufacturer's product data, test reports, and materials' certifications as required to demonstrate compliance with specifications.

1.5 Job Conditions

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Utilize flagmen, barricades, warning signs and warning lights as required.

PART 2 - PRODUCTS

2.1 Materials

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

B. Use flexible spring steel forms or laminated boards to form radius bends as required.

C. Coat forms with a non-staining form release agent that will not discolor or deface surface of concrete.

D. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A 185.

1. Furnish in flat sheets, not rolls, unless otherwise acceptable to Engineer.

E. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 60.

F. Fabricated Bar Mats: Welded or clip-assembled steel bar or rod mats, ASTM A184. Use ASTM A615, Grade 60 steel bars, unless otherwise indicated.

G. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.

H. Metal Expansion Caps: Furnish for one end of each dowel bar in expansion joints. Design caps with one end closed and a minimum length of 3" to allow bars movement of not less than 1", unless otherwise indicated.

I. Hook Bolts: ASTM A 307, Grade A bolts, internally and externally threaded. Design hook bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

J. Concrete Materials:

1. Portland Cement: ASTM C150, Type 1, unless otherwise acceptable to Engineer.
2. Normal Weight Aggregates: ASTM C33 except, local aggregates not complying with ASTM C33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Engineer.
3. Water: Potable.
4. Admixtures: As authorized by Engineer.

K. Expansion Joint Materials: Pre-formed asphalt impregnated fiberboard or felt expansion joint filler, ½ inch thick. Locations are as shown on drawings, or as otherwise specified. Install in accordance with manufacturer’s recommendations for intended use.

L. Anti-Spalling Compound: 50% (by volume) boiled linseed oil and 50% (by volume) mineral spirits, complying with AASHTO M-233.

M. Liquid-Membrane Forming Curing Compound: Complying with ASTM C-309, Type I, Class A unless other type acceptable to Engineer. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. ft./gal.

1. Products: Subject to compliance with requirements, provide one of the following:

a) "Masterseal"; Master Builders.
b) "A-H 3 Way Sealer"; Anti-Hydro Waterproofing Co.
c) "Ecocure"; Euclid Chemical Co.
d) "Clear Seal"; A.C. Horn.
e) "J-20 Acrylic Cure"; Dayton Superior.
f) "Sure Cure"; Kaufman Products Inc.
g) "Spartan-Cote"; The Burke Co.
h) "Sealkure"; Toch Div. - Carboline.
i) "Kure-N-Seal"; Sonneborn-Contech.
j) "Polyclear"; Upco Chemical/USM Corp.
k) "L&M Cure"; L & M Construction Chemicals.
l) "Klearseal"; Setcon Industries.
m) "LR-152"; Protex Industries.
n) "Hardtop"; Gifford - Hill.

N. Bonding Compound: Polyvinyl acetate or acrylic base, rewettable type.

1. Products: Subject to compliance with requirements, provide one of the following:

a) "J-40 Bonding Agent"; Dayton Superior Corp.
b) "Weldcrete"; Larsen Products.
c) "Everbond"; L & M Construction Chemicals.
d) "EucoWeld"; Euclid Chemical Co.
e) "Hornweld"; A.C. Horn
f) "Sonocrete"; Sonneborn-Contech.
g) "Acrylic Bondcrete"; The Burke Co.

O. Epoxy Adhesive: ASTM C-881, two component material suitable for use on dry or damp surfaces. Provide material "Type", "Grade", and "Class" to suit project requirements.

1. Products: Subject to compliance with requirements, provide one of the following:

a) "Epoxtite"; A.C. Horn.
b) "Edoco 2118 Epoxy Adhesive"; Edoco Technical Prod.
c) "Sikadur Hi-Mod"; Sika Chemical Corp.
d) "Euco Epoxy 463 or 615"; Euclid Chemical Co.

e) "Patch and Bond Epoxy"; The Burke Co.
f) "Sure-Poxy"; Kaufman Products Inc.

2.2 Concrete Mix, Design and Testing

A. Comply with requirements of applicable sections for concrete mix design, sampling and testing, and quality control, and as herein specified.

B. Design mix to produce normal-weight concrete consisting of Portland cement, aggregate, water-reducing or high-range water reducing admixture (super-plasticizer), air-entraining admixture and water to produce the following properties:

1. Compressive Strength: 3500 psi, minimum at 28 days, unless otherwise indicated.
2. Slump Range: 8" for concrete containing HRWR admixture (super-plasticizer); 3" for other concrete.
3. Air Content: 5% to 8%.

PART 3 - EXECUTION

3.1 Surface Preparation

A. Remove loose material from compacted subbase surface immediately before placing concrete.

B. Proof-roll prepared subbase surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

3.2 Form Construction

A. Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

B. Check completed formwork for grade and alignment to following tolerances:

1. Top of forms not more than 1/8" in 10'.
2. Vertical face on longitudinal axis, not more than 1/4" in 10'.

C. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

3.3 Reinforcement

A. Locate, place and support reinforcement as specified in these specifications and on the Drawings, unless otherwise indicated.

3.4 Concrete Placement

A. Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

B. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.

C. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

D. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2-hour, place a construction joint.

E. When adjacent pavement lanes are placed in separate pours, do not operate n concrete until pavement has attained sufficient strength to carry loads without injury.

F. Fabricated Bar Mats: Keep mats clean and free from excessive rust, and handle units to keep them flat and free of distortions. Straighten bends, kinks, or other irregularities or replace units as required before placement. See mats for a minimum 2" overlap to adjacent mats.

G. Place concrete in 2 operations; strike-off initial pour for entire width of placement and to the required depth below finish surface. Lay fabricated bar mats immediately in final position. Place top layer in concrete, strike-off and screed.

1. Remove and replace portions of bottom layer of concrete which has been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to Engineer.

H. Curbs and Gutters: Automatic machine may be used for curb and gutter placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results which meet or exceed minimums specified. Machine placement must produce curbs and gutters to required cross-section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified.

3.5 Joints

A. General: Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

B. When joining existing structures, place transverse joints to align with previously placed joints, unless otherwise indicated.

C. Weakened-Plane (Contraction) Joints: Provide weakened-plane (contraction) joints, sectioning concrete into areas as shown on drawings. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness, as follows:

1. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.
2. Sawed Joints: Form weakened-plane joints using powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.
3. Inserts: Use embedded strips of metal or sealed wood to form weakened-plane joints. Set strips into plastic concrete and carefully remove strips after concrete has hardened.

D. Construction Joints: Place construction joints at the end of placements and at locations where placement operations are stopped for a period of more than 1/2 hour, except where such placements terminate at expansion joints.

1. Construct joints as shown or, if not shown, use standard metal keyway-section forms.
2. Where load transfer-slip dowel devices are used, install so that one end of each dowel bar is free to move.

E. Expansion Joints: Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects, unless otherwise indicated.

1. Locate expansion joints at 50' o.c. for each pavement lane, unless otherwise indicated.

F. Extend joint fillers full-width and depth of joint, and not less than 1/2" or more than 1" below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.

G. Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together.

H Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.

I. Fillers and Sealants: Comply with the requirements of applicable sections for preparation of joints, materials, installation, and performance.

3.6 Concrete Finishing

A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

B. After floating, test surface for trueness with a 10' straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

C. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2" radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

D. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

1. Broom finish, by drawing a fine-hair broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide a fine line texture.

E. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Engineer.

3.7 Curing

A. Use membrane-forming curing and sealing compound or approved moist-curing methods in accordance with manufacturer's recommendations.

B. Do not use liquid membrane-forming materials where anti-spalling treatment will be applied.

C. Anti-Spalling Treatment: A second coat of curing and sealing compound may be used or an anti-spalling compound applied over concrete cured by continuous moist curing methods. Apply compounds to concrete surfaces no sooner than 28 days after placement, to clean, dry concrete free of oil, dirt, and other foreign material. Apply curing and sealing compound at a maximum coverage rate of 300 sq. ft./gallon. Apply anti-spalling compound in two sprayed applications. First application at rate of 40 sq. yds. per gal.; second application, 60 sq. yds. per gallon. Allow complete drying between applications.

3.8 Repairs and Protections

A. Repair or replace broken or defective concrete, as directed by Engineer.

B. Drill test cores where directed by Engineer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory

pavement areas with Portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Sweep concrete pavement and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

3.9 Concrete Restoration

A. Replace the concrete which is disturbed, damaged or removed by the Contractor's operations to the nearest joint and full width, unless otherwise approved by the Engineer.

B. Replace the concrete with similar material, section, and dimensions to match existing, except that the new concrete shall meet the requirements of this section as a minimum.

END OF SECTION

SECTION 02575

PAVEMENT REPAIR

PART 1 - GENERAL

1.1 Description of Work

Provide the necessary plant, labor, materials and equipment to restore and maintain the various streets and driveway surfaces of all type, shoulders, pavement and driveway bases, curbs, curb and gutter, and sidewalks disturbed, damaged or demolished during the performance of the work.

1.2 Applicable Specifications

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

B. Tennessee Department of Transportation, Standard Specifications for Road and Bridge Construction (TDOT).

1.3 Applicable Reference

A. American Association of State Highway and Transportation Officials (AASHTO).

1.4 Permits

Before performing any work, secure the required excavation and temporary lane/road closure permits to work within City or State right-of-way.

PART 2 - MATERIALS

2.1 The quality of materials and workmanship used in the restoration of existing roadway pavements and driveways shall produce a surface equal to or better than the condition before the work began.

2.2 The quality of materials and workmanship used in the restoration of driveways shall produce a like surface equal to or better than the condition before work began.

2.3 Concrete shall be Class A air-entrained Portland cement type as specified in Section 02514. Flowable fill shall conform to TDOT Specifications - Section 204.-06.

2.4 Mineral Aggregate Base: Class A, Grading D crushed stone (TDOT Specifications, Section 303, Subsection 903.05).

2.5 Bituminous Prime coats: Emulsified Asphalt RS-2 AE-P (TDOT Specifications, Section 402, Subsections 904.02 and 904.03).

2.6 Crushed Stone Chips: Size 6 or size 7 (TDOT Specifications, Subsection 903.14).

2.7 Double Bituminous Surface: For both courses, Grade RS-2 (TDOT Specifications, Subsections 904.02 and 904.03).

2.8 Asphaltic Concrete Binder: Grading B, BM, BM-2, or CW as directed by the Engineer (TDOT Specifications, Section 307).

2.9 Bituminous Tack Coat: Grade SS-1 (TDOT Specifications, Section 403, Subsection 904.03).

2.10 Asphaltic Concrete Surface: Grading D or E, as directed by the Engineer, (TDOT Specifications, Section 411).

2.11 Quick Dry Traffic Marking Paint (White and Yellow), or Thermo-Plastic depending on existing markings and loops.

PART 3 - EXECUTION

3.1 General Notes

A. Where trenches have been opened in any roadway or street that is a part of the State of Tennessee highway system, restore surfaces in accordance with the requirements of TDOT. All other restoration shall be done in accordance with the City of Mount Pleasant Standards, these specifications, and the Construction Standards.

B. Excavation in the pavement area shall require that pavement surface edges be saw-cut or cold plane milled to provide a straight and smooth edge.

C. Upon completion of installation of utility or other work, placement of compacted backfill, mineral aggregate base, asphaltic concrete binder, and asphaltic concrete surface shall be placed as shown on City of Mount Pleasant Standard Drawings.

D. Upon completion of installation of utility or other work and a temporary patch is to be used, placement of compacted backfill or mineral aggregate base and temporary asphalt patch shall be placed until such time that the permanent repair will be constructed as shown on City of Mount Pleasant Public Works Standard Drawings.

E. In addition to this section, all pavement restoration for the various types of streets shall be in conformance with Construction Standards of the City of Mount Pleasant Department of Public Works.

F. Curb and gutter, sidewalks, and shoulders, shall be restored as required to match existing construction. Replace damaged sections with complete new sections. Patching will not be permitted.

G. Restored sections and surfaces shall be maintained and warranted for period of one year following the date of acceptance.

H. When manhole top or other utility casting requires adjustment to an elevation one inch or more above the existing pavement grade a temporary ramp shall be constructed by feathering bituminous concrete 360 degrees around the casting. A taper slope of not less than two feet per inch shall be used. Taper shall be removed prior to placement of bituminous concrete surface course.

I. Full lane or roadway width milling and/or paving shall be required where successive or continuous excavations are planned so as not to "checkerboard" the restoration and to provide a smooth riding surface. The lengths of full width milling and/or paving shall be from manhole centerline to manhole centerline, or from the first excavation point to the last. If the excavation segment is within 300 feet of an intersection, the restoration limits shall be extended to the radius point of the intersection. If the segment is in or within 300 feet of a cul-de-sac, the full area of the cul-de-sac shall be restored. Where milling is required, the milling shall be performed after the asphaltic binder is placed.

J. Asphaltic concrete surface courses shall not be placed for a minimum of 42 days after the trench binder is placed. However, due to seasonal limitations, or other factors deemed appropriate, the Engineer, in consultation with Metro Public Works, may grant variances to this requirement on a case by case basis.

K. All repairs shall include full lane width resurfacing.

L. All repairs shall utilize a 2-foot cutback on all sides except the edge of pavement.

M. New utility cuts will be milled and paved to any existing utility cut within 10-feet. If the existing cut is less than 10-feet in length, the existing cut shall also be milled and paved.

N. All repairs will have a 2-year warranty.

O. The City of Mount Pleasant Public Works Department will need to be notified, when repairs are finished, to start warranty period.

3.2 Subgrade

A. Before any mineral aggregate base material is installed, compact the subgrade of the area to be paced to 95% of optimum density as determined by ASTM D 698 (Standard Proctor).

B. The backfill material shall contain no topsoil or organic matter. For all areas where subgrade has been prepared, test for uniformity of support by driving a loaded dump truck at a speed of 2 to 3 mph over the entire surface. Make further improvements on all areas that show a deflection of 1 inch or more. When completed, the finished subgrade shall be hard, smooth, stable, and constructed in reasonably close conformance with the lines and grades that existed prior to the beginning of construction.

3.3 Mineral Aggregate Base

A. Install a mineral aggregate base of the type specified sections 4.2B and 4.2C in accordance with Section 303 of the TDOT Specifications. The maximum compacted thickness of any one layer shall be 6 inches, and the total thickness of the base shall be that indicated by the standard drawings shown in the Subdivision Regulations of the Department of Public Works.

B. When a base course is compacted, cut back the surface course of the existing pavement a minimum of 1 foot beyond the limit of the joint between the old and new base course. Take special care to ensure good compaction of the new base course at the joint. Apply and compact the surface to conform to the existing pavement so that it will have no surface irregularity.

C. Where flowable fill is required it shall conform to TDOT Specifications Section 204.06 Backfill material. Typical 28 day compressive strength shall be 100 to 500 psi depending on particular location as determined by the Engineer or his representative. Refer to City of Mount Pleasant Public Works Standard Drawings for proper placement.

3.4 Seal Coat Surface

Uniformly apply a bituminous prime coat of emulsified asphalt, Grade AE-P over the entire width of the area to be surfaced at a rate of 0.3 gallon per square yard. Immediately after application, uniformly cover the entire area with Size 7 crushed stone chips at a rate of 12 pounds per square yard.

3.5 Double Bituminous Surface

A. Apply the first course at a rate of 0.38 to 0.42 gallon per square yard with either emulsified asphalt, Grade RS-2 and then immediately cover with Size 6 crushed stone chips at a rate of 33 to 37 pounds per square yard. After this is rolled, apply the second course at a rate of 0.30 to 0.35 gallons per square yard, and at once uniformly cover with Size 7 chips at a rate of 20 to 25 pounds per square yard. Then roll the entire area.

B. After the application of the cover aggregate, lightly broom or otherwise maintain the surface for a period of 4 days, or as directed by the Engineer. Maintenance of the surface shall include the distribution of cover aggregate over the surface to absorb any free bitumen and cover any areas deficient in aggregate. Sweep excess material from the entire surface with rotary brooms. Sweep the surface at the time determined by the Engineer.

3.6 Asphaltic Concrete Binder

A. Apply a bituminous prime coat of emulsified asphalt, Grade AE-P at a rate of 0.38 to 0.42 gallon per square yard. Take care to prevent the bituminous material's splashing on exposed faces of curbs and gutters, walls, walks, trees,

etc.; if such splashing does occur, remove it immediately. After the prime coat has been properly cured, apply an asphaltic concrete binder to the thickness shown on the standard drawings in the Subdivision Regulations of the Department of Public Works, or in the contract drawings.

B. Carefully place the material to avoid segregation of the mix. Broadcasting of the material will not be permitted. Remove any lumps that do not readily break down.

C. If milling of the street is required, the thickness of the binder course as specified by the Engineer shall be maintained after milling.

3.7 Asphaltic Concrete Surface

If the asphaltic concrete surface is to be placed directly on the mineral aggregate base, place the bituminous prime coat as described above. If, however, the surface course is to be placed on a binder course, then apply a bituminous tack coat of the sort specified above under MATERIALS at a rate of 0.05 to 0.10 gallon per square yard. Take care to prevent splashing of the bituminous material on the exposed faces of curbs, gutters, walls, walks, trees, etc.; if such splashing does occur, the material shall be removed. After the prime or tack coat has been properly cured, apply the asphaltic concrete surface to the thickness shown on the drawings in the Subdivision Regulations of the Department of Public Works, or in the contract drawings. Apply the surface course as described above for the asphaltic concrete binder course, Sections 4.5B and 4.5C. After placement of asphaltic surfaces full width in non-curbed sections, furnish and install crushed stone shoulders per Public Works details and specifications in the paved limits under this contract.

3.8 Smoothness

The finished surfaces shall conform to the lines and grades that existed prior to construction. No deviations, variations, or irregularities exceeding 1/4 inch in any direction when tested with 12 foot straightedge will be permitted in the finished work, nor will any depressions that will not drain properly. All defects shall be corrected.

3.9 Sampling And Testing

The City of Mount Pleasant Public Works Department may require that tests be made on the completed elements of the pavement to ascertain the compacted thickness of the base and surface courses. If sections with deficient thickness are found, the full section for a reasonable distance on each side of the deficiency shall be refused. All such sections shall be removed and reinstalled. All test holes in connection with thickness tests shall be patched.

END OF SECTION

SECTION 02730

SANITARY SEWERAGE SYSTEM

PART 1 - GENERAL

1.1 Summary

Work under this section includes the providing of all labor, material, equipment, tools and services required for the furnishing, installation, construction and testing of all gravity sewers, pressure pipelines and appurtenances thereto required. Work also includes grouting of abandoned sewers.

1.2 Related Sections

A. Section 02220: Excavation, Backfilling and Compaction

B. Section 03300: Concrete

1.3 Unit Prices

A. Polyvinyl Chloride (PVC) Sanitary Sewers

Measurement for payment of gravity sewers will be made horizontally along the centerline of the sewer in place for sewer inside roadways and outside roadways. No deductions in length will be made for manholes. Measurement will be made from the center of the manhole where construction begins to the center of the manhole where construction ends. Plugging of abandoned lines, manholes and filling with lean concrete shall be considered incidental to new sewer line construction as shown on the Contract Drawings.

1. Sewers Outside Roadway

It is called to the Contractor's attention that the unit price bid for gravity sewer shall include the cost of all excavation (including trench backfill with satisfactory excavated materials) necessary for the complete installation of the gravity sewer and appurtenances, and no separate payment shall be allowed therefore. It shall not include the removing and disposing of all unstable materials necessary to establish satisfactory foundations and install crushed stone refill. It shall also not include tee branches, manhole bases, manhole sidewall, frames and covers and other units of work specifically set out in the Proposal and Contract Agreements, but will be paid separately under items listed.

2. Sewers Inside Roadway

The unit price bid for gravity sewer shall include the cost of all excavation including crushed stone backfill inside roadways, driveways, gravel driveways, asphalt and/or concrete driveways, and parking areas or as directed by the Engineer during construction.

It shall not include the removing and disposing of all unstable materials necessary to establish satisfactory foundations and install crushed stone refill. It shall also not include tee branches, manhole bases, manhole sidewall, frames and covers and other units of work specifically set out in the Proposal and Contract Agreements, but will be paid separately under items listed.

B. Ductile Iron Gravity Sewers

Measurement for payment of ductile iron gravity sewers will be made horizontally along the centerline of the sewer in place for sewers inside roadways and outside roadways. No deductions in length will be made for manholes. Measurement will be made from the point of beginning of ductile iron gravity sewer construction to the point where said construction ends. If said construction begins or ends at a manhole, the measurement shall be taken to the centerline of said manhole.

1. Ductile Iron Sewers Outside Roadway

It is called to the Contractor's attention that the unit price bid for ductile cast iron pipe gravity sewer shall also include the cost of all excavation (including trench backfill with satisfactory materials) necessary for the complete installation of the ductile cast iron pipe gravity sewer and appurtenances, and no separate payment shall be allowed therefore. It shall not include the removing and disposing of all unstable materials necessary to establish satisfactory foundations and install crushed stone refill. It shall also not include tee branches, manhole bases, manhole sidewall, frames and covers and other units of work specifically set out in the Proposal and Contract Agreements, but will be paid separately under items listed.

2. Ductile Iron Sewers Inside Roadway

The unit price bid for ductile cast iron pipe gravity sewer shall include the cost of all excavation including crushed stone backfill inside roadways or as directed by Engineer during construction. It shall not include the removing and disposing of all unstable materials necessary to establish satisfactory foundations and install crushed stone refill. It shall also not include tee branches, manhole bases, manhole sidewall, frames and covers and other units of work specifically set out in the Proposal and Contract Agreements, but will be paid separately under items listed.

C. Reinforced Concrete Pipe Gravity Sewers

Measurement for payment of reinforced concrete pipe gravity sewers will be made horizontally along the centerline of the sewer in place for sewers inside roadways and outside roadways. No deductions in length will be made for manholes. Measurement will be made from the point of beginning of reinforced concrete pipe gravity sewer construction to the point where said construction ends. If said construction begins or ends at a manhole, the measurement shall be taken to the centerline of said manhole.

1. Reinforced Concrete Pipe Sewers Outside Roadway

It is called to the Contractor's attention that the unit price bid for reinforced concrete pipe gravity sewer shall also include the cost of all excavation (including trench backfill with satisfactory materials) necessary for the complete installation of the reinforced concrete pipe gravity sewer and appurtenances, and no separate payment shall be allowed therefore. It shall not include the removing and disposing of all unstable materials necessary to establish satisfactory foundations and install crushed stone refill. It shall also not include tee branches, manhole bases, manhole sidewall, frames and covers and other units of work specifically set out in the Proposal and Contract Agreements, but will be paid separately under items listed.

2. Reinforced Concrete Pipe Sewers Inside Roadway

The unit price bid for reinforced concrete pipe gravity sewer shall include the cost of all excavation including crushed stone backfill inside roadways or as directed by Engineer during construction. It shall not include the removing and disposing of all unstable materials to establish satisfactory foundations and install crushed stone refill. It shall not include tee branches, manhole bases, manhole sidewall, frames and covers and other units of work specifically set out in the Proposal and Contract Agreements, but will be paid separately under items listed.

D. Six-Inch (6") Tee Connections for House Services

Payment will be made at the Contract unit price for each six-inch (6") tee connection ordered by the Engineer to be installed. The laying length of the tee joint will not be deducted from measurement for payment of sanitary sewer pipe. The sewer pipe for house services will be paid for as specified under paragraph 1.3-D of this Section.

E. Six-Inch (6") House Sewer Services

Measurement for payment of 6" sewer pipe for house service, including riser pipes and gravel backfill, will be made parallel to the centerline of the sewer in place. Measurement will be made from the wall of the main sewer where connection is made to the end of the to the property line or to the point of reconnection.

All cost involved in placing riser pipes for 6" house sewers, including necessary bends and concrete blocking, shall be merged in the Contract unit price for 6" house sewer services.

F. Service Reconnections

Payment will be made at the Contract unit price for each reconnection of a "live" sanitary service, including installation of clean out assembly and, transition coupling, and plugging the existing connection at the storm sewer. The six-inch tee connection and the six-inch house service to the point of reconnection are not included in this pay item.

G. Manholes and Appurtenances

1. Manhole 0' to 6' in Depth, with Base for 48" Internal Diameter Manholes

Payment for manhole 0' to 6' in depth with base for 48" internal diameter manholes shall be made at the Contract unit price per each manhole as set out in the bidding schedule. The quantity to be paid shall be the actual number of manholes 0' to 6' in depth with manhole base installed. No separate payment will be made for manhole bases.

The cost for manhole bases shall be merged into the unit price bid for each manhole 0' to 6' in depth. This unit price shall include excavation, backfill, manhole fillet (invert), manhole steps, pipe resilient connectors, stubouts and plugs, and sealing, and no separate payment will be allowed therefore.

2. Additional Manhole Sidewall

Payment for additional manhole sidewalls shall be made at the Contract unit price per vertical foot that exceeds the six-foot (6') manhole depth for the various sizes of manholes as set out in the bidding schedule.

The Contractor will be paid separately for each additional vertical foot of manhole sidewall on all manholes that exceed the six-foot (6') manhole depth, under the bid items for Additional Manhole Sidewall.

Measurement of 48" internal diameter manhole sidewall used in standard type manholes will be made vertically in place from the invert of the outlet sewer pipe to the bottom side of the frames and cover in place.

The first six (6) feet of sidewall shall not be included for payment under this pay item, but shall be merged into the unit price bid for manhole 0' to 6' in depth, with base.

3. Standard and/or Watertight Manhole Frame and Cover

Payment for manhole frames and covers shall be at the Contract unit price per each for the various types as set out in the bidding schedule of the Contract. The quantity to be paid shall be the actual number of manhole frames and covers of each type installed.

4. Standard Manhole Drop Assembly

Payment for Standard drop pipe assemblies shall be made at the Contract unit price for each of the various types installed, complete and in place as set out in the bidding schedule. Where drop assemblies are required on existing manholes, Contractor shall satisfy himself as to the type and shape of the existing manhole base and sidewall.

5. Vent Pipe Assembly

Payment for manhole vent pipe assemblies will be made at the Contract unit price for each vent pipe assembly installed complete in place as set out in the bidding schedule.

H. Concrete Encasement, Cradle and/or Cap

Payment for Concrete Encasement, Cradle and/or Cap shall be made at the Contract Unit price per cubic yard installed as set out in the bidding schedule. Concrete for cradle and/or encasement shall be computed by multiplying the allowable cross-section of each shown on the Contract Drawings, times the actual horizontal lineal feet of encasement and/or cradle ordered to be installed by the Engineer. The pipe area shall be deducted from the cross section.

I. Unclassified Excavation for Sanitary Sewers

Excavation will be unclassified, and the cost shall be merged into the unit price bid for other items of work under this Contract. No distinction shall be made between rock or dirt excavation, and no separate payment will be allowed therefore, except as stated below:

1. Bid Item-Unclassified Excavation - 0' to 10' Deep

This item includes payment for excavation where ordered by the Engineer. Payment will be on an unclassified basis and no distinction made between rock and earth excavation insofar as payment is concerned. This item will include payment for additional excavation from 0-10 feet deep in the event a grade change is required during construction. Payment width will be 4/3 outside diameter plus 24 inches for pipe and outside diameter plus 36 inches for manholes.

No additional excavation will be computed for payment where the grade change is one foot or less. Where the grade is raised more than one foot, 85% of the resultant reduction in excavation will be computed for credit to the Owner by the Contractor. Payment for unclassified excavation, 0 to 10 feet deep, will be made at the Contract unit price for this item.

The furnishing and installing of additional backfill material for inside or outside roadway shall be considered an integral part of this bid item, and no separate payment will be allowed therefore.

2. Bid Item-Unclassified Excavation 10' to 20' Deep

This item includes payment for excavation where ordered by the Engineer. Payment will be on an unclassified basis and no distinction made between rock and earth excavation insofar as payment is concerned. This item will include payment for additional excavation from 10' to 20' deep in the event a grade change is required during construction. Payment width will be 4/3 outside diameter plus 24 inches for pipe and outside diameter plus 36 inches for manholes.

No additional excavation will be computed for payment where the grade change is one foot or less. Where the grade is raised more than one foot, 85% of the resultant reduction in excavation will be computed for credit to the Owner by the Contractor. Payment for unclassified excavation, 10' to 20' deep, will be made at the Contract unit price for this item.

The furnishing and installing of additional backfill material for inside or outside roadway shall be considered an integral part of this bid item, and no separate payment will be allowed therefore.

3. Bid Item-Unclassified Excavation-20 and Over Deep

This item includes payment for excavation where ordered by the Engineer. Payment will be on an unclassified basis and no distinction made between rock and earth excavation insofar as payment is concerned. This item will include payment for additional excavation from 20' and over deep in the event a grade change is required during construction. Payment width will be 4/3 outside diameter plus 24 inches for pipe and the outside diameter plus 36 inches for manholes.

No additional excavation will be computed for payment where the grade change is one foot or less. Where the grade is raised more than one foot, 85% of the resultant reduction in excavation will be computed for credit to the Owner by the Contractor. Payment for unclassified excavation, 20' and over deep will be made at the unit price for this item.

The furnishing and installing of additional backfill material for inside or outside roadway shall be considered an integral part of this bid item, and no separate payment will be allowed therefore.

J. Crushed Stone Refill for Sanitary Sewers

Measurement for payment for crushed stone refill made for the construction of sewers and pipe lines shall be computed from the formula: "trench depth" x "trench width" x "trench length" = allowable volume for payment expressed in cubic yards. Each dimension shall be as defined below:

1. "Trench depth" for refill shall equal the vertical line depth from a point 6 inches below the pipe installed in dirt excavation or 6" below the pipe installed in rock excavation to the bottom of the trench ordered by the Engineer below the aforesaid limit.

2. "Trench width" shall be determined by the formula 4/3 "d" plus twenty-four (24) inches in which "d" equals the nominal internal diameter of the pipe installed in inches.

3. "Trench length" shall equal the actual horizontal measurement along the centerline of the trench less the allowable horizontal dimensions of manholes and other appurtenances as specified below.

Where use of crushed stone refill is directed by the Engineer, it shall be paid for per cubic yard of refill placed. Crushed refill placed at the discretion of the Contractor and not at the direction of the Engineer will not be paid for.

The crushed stone bedding to eight (8) inches above the pipe, as required elsewhere, shall not be measured for payment under this unit of work, but shall be merged in the unit prices for other units of work of this Contract; and no separate payment shall be allowed therefore.

1.4 Reference Standards

A. American Water Works Association (AWWA)

C-210	Ductile Iron Coal-Tarepoxy Coating
C-302	Reinforced Concrete Pipe (Non-Cylinder)
C-500	Gate Valves 3" through 48" for Water and Sewerage Systems
C-600	Installation of Ductile-Iron Water Mains

B. American National Standards Institute (ANSI)

A-21.4	Cement Mortar Lining for Ductile Iron and Gray Iron Pipe and Fittings for Water
A-21.10	Ductile-Iron and Gray Iron Fittings, 3"-48" for Water and Other Liquids
A-21.11	Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe Fittings

A-21.51 Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids

C. American Society of Testing Materials (ASTM)

A-48	Ductile Iron Castings
C-39	Compressive Strength of Cylindrical Concrete Specimens
C-76	Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
C-172	Concrete Testing
C-361	RCP Low Head Pressure Pipe
C-443	Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
C-478	Precast Reinforced Concrete Manhole Sections
C-497	Testing Concrete Pipe, Sections, or Tile
C-923	Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes
C-1214	Concrete pipe sewer lines by negative air pressure (vacuum)
D-3034	Type PSM Poly(vinyl chloride)(PVC) Sewer Pipe and Fittings
D-3212	Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

Where materials and methods are indicated in these specifications as being in conformance with a standard specification, it shall refer in all cases to the latest edition of the specifications and shall include all interim revisions. Listing of a standard specification without further reference indicates that the particular material or method shall conform with such listed specification.

1.5 Submittals

A. Shop Drawings

The Contractor shall submit, for the Engineer's approval, descriptive details and shop drawings covering full details of pipe, fittings, specials, joints and the assembly thereof, joint materials and details thereof and full details and cuts of all castings to be incorporated within the work under this Contract. (Refer to Section 01300).

B. Material Test Requirements

The attention of the Contractor is directed to the provisions of the Conditions of the Contract requiring the inspection and testing of materials to be incorporated in the work included under this Contract. The required tests shall be done by an independent testing laboratory, selected by the Contractor and approved by the Engineer. All such tests shall be at the expense of the Contractor, and no separate payment will be allowed therefore.

Where the total quantity of sanitary sewer pipe required on this Contract, including all pipe sizes, is less than one thousand (1,000) feet, the pipe shall be visually inspected by the Engineer at the site for conformance to the required specifications.

Where the quantities for reinforced concrete pipe, including all sizes, exceeds the above, tests shall be by independent laboratory for conformance with the required specifications. Test shall be made on one-half of one percent (0.5%) of the number of pipe, of each size required, but in no case less than two (2) specimens of each size. Mill certification will be required for any quantity of D.I.P. and PVC pipes.

The number and manner of tests for sewer pipe joints for conformance to the required specifications shall be the same as required for the sewer pipe.

All materials to be incorporated in the construction of gravity sewers and appurtenances required under this Contract shall be subject to inspections and tests as follows:

1. Ductile Cast Iron Gravity Sewer Pipe and Fittings

   Where the total quantity of ductile cast iron gravity and pressure sanitary sewer pipe and fittings on this Contract, including all sizes, is less than two hundred (200) tons, each piece shall bear the manufacturer's serial number and shall be certified by the manufacturer for conformance with ANSI A21-51 AWWA C-151 and ANSI A21.10 AWWA C-110.

   Where the quantity on this Contract, including all pipe sizes, exceeds the above, tests shall be by independent laboratory for conformance with ANSI A21-51 AWWA C-151 and ANSI A21.10 AWWA C-110.

2. Polyvinyl Chloride (PVC) Sewer Pipe 6” thru 30”

   The polyvinyl chloride (PVC) pipe shall be in conformance with ASTM Specification D3034, SDR35 thru 15” and F-794, F-949 or F-679 for 18” thru 30” of the latest revision. Pipe jointing shall be accomplished by the use of flexible elastomeric gaskets conforming to ASTM Specification D-3212.

   Acceptance of all PVC pipe and joints shall in part be based on the receipt of a written certification. This certification shall consist of a copy of the manufacturer's test report or a statement by the seller, accompanied by a copy of the test results, that the material has been sampled, tested, and inspected in accordance with the provisions of applicable ASTM standards. Each certification so furnished shall be signed by an authorized agent of the seller or manufacturer. The Contractor shall secure this certification from the manufacturer and furnish to the Engineer. The quantity of PVC pipe and joints to be tested shall not be less than that specified in "Test Requirements", paragraph B of this Section of these Specifications.

3. Reinforced Concrete Pipe

Reinforce concrete pipe shall be conformed to ASTM C-76, Class III or IV, Wall B or C, with inside of pipe coal tar epoxy coated in accordance with AWWA - C210, and shall be furnished with minimum laying lengths of 12 feet pipe with steel end ring joints, and 8 feet for pipe with compressive type joints, unless otherwise approved by the Engineer.

Joints for reinforced concrete sewer pipe 30” and larger in diameter shall be of the steel end ring type conforming to the latest AWWA C-302 specification. Joints to be reinforced concrete sewer pipe 15” through 24” in diameter shall be of the compressive type, in accordance with ASTM Specifications C-361, Type R-4 (Bell and Spigot) with resilient seals capable of meeting the testing requirements as set forth in ASTM C-1214 Latest Revisions. All rubber gaskets shall be extruded or molded and cured in such a manner that any cross section will be dense, homogenous, and free of porosity, blisters, pitting, and other imperfections. The basic polymer shall be EPDM hydrocarbon rubber. The compound shall conform to the following requirements: EPDM material shall meet ASTM C-443 with the exception of the 40-60 duro hardness; and, resilient interlocked end seals shall have a hardness duro A of 0 to 70 + - 5. The rubber gasket compound shall also conform to AWWA C-302

4. Concrete

For each separate class of concrete of twenty-five (25) cubic yards placed, two (2) standard six-inch (6”) concrete cylinders shall be made and tested.

The cylinders of each set shall be molded from the same sample of concrete and tested at seven (7) and twenty-eight (28) days.

Sampling of concrete for test purposes shall be per ASTM C-172. Testing of specimens shall be per ASTM C-39.

5. Miscellaneous Materials

All material used on this project shall be visually inspected by the Engineer at the site for conformance to the required specifications.

Where reasonable doubt exists that said material fails to meet the specifications, the Engineer may require certified mill test, samples and/or test by independent laboratory, or other suitable form of verification that the material meets the required specifications.

1.6 Product Delivery, Storage And Handling

A. Materials delivered to site shall be inspected for damage, unloaded and stored with the minimum of handling. Store materials on site in enclosures or

under protective coverings. Store plastic piping and rubber gaskets under cover and protect from exposure to direct sunlight. Store materials above ground. Interior of pipe and fittings shall be kept free of dirt and debris.

B. Pipe, fittings, valves, hydrants and other accessories shall be handled to insure delivery to the point of installation in sound undamaged condition. If coatings or linings of pipe or fittings are damaged, such pipe or fittings shall be removed from the site and new materials furnished at no extra cost. Pipe shall not be left in the sunlight, but shall be stored under cover and protected from exposure to direct sunlight.

PART 2 - PRODUCTS

2.1 General

All material and equipment shall be furnished by an established and reputable manufacturer or supplier. All materials and equipment shall be new and shall be first-class ingredients and construction, designed and guaranteed to perform the service required and shall conform with the following specifications or shall be the product of the listed manufacturer or equal thereto as approved by the Engineer.

2.2 Material

A. Polyvinyl Chloride(PVC) Sanitary Sewers

1. PVC Sewer Pipe

The sanitary sewer pipe furnished and installed on this project shall be PVC conforming to the following specifications, unless shown otherwise on the Contract Drawings or in the Contract.

a. PVC Sewer Pipe

Polyvinyl chloride (PVC) sewer pipe furnished and installed on this project shall be in conformance with the requirements of ASTM Specification D3034 for SDR35 pipe. Laying lengths shall be regular commercial lengths not to exceed twenty (20) feet.

b. Pipe Markings

All PVC pipe shipped to the project shall bear the mark of an approved testing laboratory showing that such pipe was tested and approved by the testing laboratory at the site of the manufacturer's plant. Testing of PVC pipe shall conform to ASTM D3034. Certified test reports shall be furnished to the Engineer.

The quantity of PVC pipe to be tested shall not be less than that specified in "Test Requirements", paragraph 1.5-B of this Section of the Specifications.

2. Joint Material for PVC Sewer Pipe

The Contractor shall furnish the Engineer with complete technical and construction data on the jointing material he proposes to use on this Project and shall obtain the Engineer's approval prior to incorporating the jointing material into the work.

The jointing material furnished and installed on this Project for use on PVC sewer pipe shall be flexible, elastomeric type, push-on joints conforming to the requirements of ASTM D-3212. These joints shall be field assembled in conformance with the manufacturer's recommendations.

The testing and certification requirements for sewer pipe joints shall be similar to those described for sewer pipe, and shall be in conformance with the applicable ASTM standards. The minimum number of joints to be tested shall be specified in "Test Requirements", paragraph 1.5-B of this Section of the Specifications.

B. Ductile Iron Gravity and/or Pressure Line Sewers

1. Ductile Iron Sewer Pipe

The ductile iron pipe and fittings furnished and installed on this project shall conform to the requirements of ANSI 21.51/AWWA C-151 and ANSI A21.10/AWWA C-110, respectively. Pipe Class shall be 52 unless otherwise indicated on the Drawings. Pressure rating for fittings in sizes 4" through 24" shall be 350 psi minimum for ductile iron. Pipe Class to be visibly cast or stamped on the outside of pipe.

All Ductile Iron pipe and fittings shall be delivered to the application facility without asphalt, cement lining, or any other lining on the interior surface. Because complete removal of old linings may not be possible, the intent of this specification is that the entire interior of the Ductile Iron pipe and fittings shall not have been lined with any substance prior to the application of the specified lining material and no coating shall have been applied to the first six inches of the exterior of the spigot ends.

All ductile iron pipe and fittings shipped to the project shall bear the mark of an approved testing laboratory showing that such pipe was tested and approved by the testing laboratory at the site of the manufacturer's plant. Testing shall conform to all requirements of ANSI 21.51/AWWA C-151 and ANSI A21.10/AWWA C-110. Certified test reports shall be furnished to the Engineer.

The quantity of ductile iron pipe and fittings to be tested shall not be less than that specified in "Test Requirements", paragraph 1.5-B of this Section of these Specifications.

2. Joint Material for Ductile Iron Gravity Sewers

The joints used for the pipe furnished under this Contract shall be the slip-type, single gasket joints and shall conform to all requirements of ANSI, A21.11 and AWWA C-111. The joints shall be good for 150 pounds per square inch of operating pressure.

The joint material furnished and installed on this Project for use on ductile iron gravity and/or pressure line sewers shall be the gasket type push-on joint equal to "Bell-Tite", "Fast-Tite", or "Tyton" fittings. Mechanical type fittings may be used on short sections of ductile iron gravity sewers if approved by the Engineers. Fittings shall not be lighter than the pipe for which they are used and shall be field assembled in conformance with the manufacturer's directions.

Ductile iron gravity sewers shall not be connected to concrete or clay gravity sewers except by means of a manhole or by other methods approved by the Engineer.

3. Lining Material

The ductile iron pipe and fittings shall be lined with PROTECTO 401 Ceramic Epoxy. The material shall be an amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment.

A. A permeability rating of 0.00 when tested according to the procedure described in Method A of ASTME 96, Procedure A with a test duration of 30 days.

B. The following tests must be run on coupons from factory lined Ductile Iron pipe.

1. ASTM B 117 Salt Spray (scribed panel)
   Results to equal 0.0 undercutting after two years.

2. ASTM G 95 Cathodic Disbondment (1.5 volts at 77ºF)
   Results to equal no more than 0.5 mm undercutting after 30 days.

3. Immersion Testing
   Rated using ASTM D 714.

   a. 20% Sulfuric Acid
      No effect after two years.
   b. 140ºF 25% Sodium Hydroxide

No effect after two years.

c. 160ºF Distilled Water (scribed panel)
No effect after two years.

d. 120ºF Tap Water (scribed panel)
0.0 undercutting after two years with no effect.

C. Abrasion Resistance

Less than .075 mm (3 mils) loss after one million cycles on a ±22.5º sliding aggregate slurry abrasion tester using a sharp natural siliceous gravel with a particle size between 2 mm and 10 mm (European Standandard SN598).

4. Application of Ductile Iron Lining Material

A. Applicator

The lining shall be applied by a certified firm with a successful history of applying linings to the interior of Ductile Iron pipe and fittings.

B. Surface Preparation

Prior to abrasive blasting, the entire area to receive the protective compound shall be inspected for oil, grease, etc. Any areas where oil or grease is present, or any substance which can be removed by solvent, shall be solvent cleaned to remove these substances. After the surface has been made free of grease, oil or other substances, all areas to receive the protective compounds shall be abrasive blasted using compressed air nozzles with sand or grit abrasive material. The entire surface to be lined shall be struck with the blast media so that all rust, loose oxides, etc., are removed from the surface. Only slight stains and tightly adhering oxide may be left on the surface. Any area where rust reappears before lining must be reblasted.

C. Lining

After surface preparation, the interior of the pipe shall receive 40 mils nominal dry film thickness of PROTECTO 401. No lining shall be applied when the substrate or ambient temperature is below 40°F. The surface also must be dry and dust free. If flange pipe or fittings are included in the project, the lining shall not be used on the face of the flange.

D. Coating of Bell Sockets and Spigot Ends

Due to the tolerances involved, bell interior and spigot exterior up to 6 inches back from the end of the spigot end must be coated with 6 mils nominal, 10 mils maximum PROTECTO Joint Compound. The Joint Compound shall be applied by brush to ensure coverage. Care

should be taken that the Joint Compound is smooth without excess buildup in the gasket seat or on the spigot ends. Coating of the gasket seat and spigot ends shall be done after the application of the linings.

E. Number of Coats

The number of coats of lining material applied shall be as recommended by the lining manufacturer. However, in no case shall this material be applied above the dry thickness per coat recommended by the lining manufacturer in printed literature. The maximum or minimum time between coats shall be that time recommended by the lining material manufacturer. No material shall be used for lining which is not indefinitely recoatable with itself without roughening of the surface.

F. Touch-Up & Repair

PROTECTO Joint Compound shall be used for touch-up or repair in accordance with manufacturer's recommendations.

5. Inspection and Certification of Ductile Iron Lining Material

A. Inspection

1. All Ductile Iron pipe and fitting linings shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC PA-2 Film Thickness Rating.
2. The interior lining of all pipe and barrels and fittings shall be tested for pinholes with a nondestructive 2,500 volt test. Any defects found shall be repaired prior to shipment.
3. Each pipe joint and fitting shall be marked with the date of application of the lining system along with its numerical sequence of application on that date and records maintained by the applicator of his work.

B. Certification

The pipe or fitting manufacturer must supply a certificate attesting to the fact that the applicator met the requirements of this specification and that the material used was as specified.

C. Handling

PROTECTO 401 Lined Pipe and Fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. shall be placed inside the pipe and fittings for lifting, positioning, or laying.

D. Six-Inch (6”) Tee Connections for House Services

Construction, Installation and material of pipe containing tee openings and the joint materials for the same shall be in conformance with the requirements of the specifications for PVC or DIP sewer where installed. All tees on concrete pipe shall be manufactured by coring the reinforced concrete pipe and cement epoxying a PVC hub on the pipe for full depth of the pipe wall using a “Kor-N-Tee” resiliant compressive fitting.

E. Six-Inch (6") House Services

The furnishing, constructing and installing of all materials and/or methods used in the construction of six-inch (6") house sewer services shall be as specified in the applicable provisions of paragraph 3.2-D of this Section of the Contract Specifications and as shown on Drawing.

F. Service Reconnections

The furnishing, constructing and installing of all materials and/or methods used in the construction of reconnecting all "live" sanitary services shall be as specified in paragraph 3.2-E of this Section of the Contract Specifications and as shown on Drawing.

G. Polyvinyl Chloride Sewer Cleanout Assemblies

Polyvinyl Chloride (PVC) sewer pipe and fittings furnished and installed on this project for cleanout assemblies shall be in conformance with Paragraph 2.2 - A of this section using flexible joints if replaced from the main. If a cleanout assembly is inserted into an existing lateral, the PVC pipe and fittings may conform to 2.2-A or ASTM D1785, Schedule 40 PVC1120 with D2466 solvent welded fittings per City of Mount Pleasant Plumbing Code.

H. Manholes and Appurtenances

1. Standard Manhole Sidewall

Standard manhole sidewall shall be constructed of concrete of the following types:

a. Precast concrete rings
b. Precast concrete manhole sidewalls with base
c. Precast concrete monolithic manhole sidewall
d. Precast concrete monolithic manhole with base
e. Poured-in-place concrete monolithic manhole sidewall.

Concrete for precast or poured-in-place concrete manhole sidewall shall be Class "C" as specified in Section 03300.

All precast concrete manhole sidewall shall conform to the requirements of ASTM C-478.

All concrete for precast or poured-in-place manholes shall include Xypex Admix C-1000 or approved equal. Xypex Admix or approved equal shall be added to the concrete mix at time of batching. The manhole manufacturer shall submit specifications and the procedures for adding the Admix to the concrete. The Admix shall have a red-tinted coloring.

2. Concrete Manhole Bases and Fillets

Concrete manhole bases and fillets may be precast with the manhole sidewall or poured-in-place conforming to the following requirements:

a. Precast Manhole Bases and Fillets

All materials and methods used to precast manhole bases and/or fillets shall conform to the applicable provisions for precast manhole sidewall as set out in these Specifications.

b. Poured-in-Place Manhole Bases and Fillets

Concrete for poured-in-place plain concrete base and fillets shall be Class "A" as specified hereinafter and conforming to the requirements of P.C.A. Specifications for Plain and Reinforced Concrete.

Class of Concrete	"A"
Gals. Water per sack of cement	5.5
Min. bags cement per cubic yard of concrete	5.75
Min. 28 day strength 1 cylinder lbs./sq.inch	2,800
Min. 28 day strength average for 5 cylinders lbs/sq. inch	3,500
Slump in inches	2-4

3. Manhole Frames and Covers

Manhole frames and covers shall be made of cast iron conforming to the details shown on the Contract Documents and meeting the requirements of ASTM A-48, Class 30.

All casting shall be made accurately to the required dimensions and shall be sound, smooth, clean and free from blisters and other defects. Defective castings which have been plugged or otherwise treated to remedy defects shall be rejected. Contact surfaces of frames and covers shall be machined so that the covers rest securely

in the frames with no rocking and with the covers in contact with the frames for the entire perimeter of the contact surface.

4. Manhole Drop Pipe Assembly

Pipe, specials and fittings used in the construction of the manhole drop assembly shall conform to the details shown on the Contract Documents and meet the requirements of that portion of the main sewer where installed.

The support for the outside drop assembly shall be concrete and shall conform to the details shown on the Contract Documents and the requirements as specified hereinafter.

Concrete for the base and support of the drop assembly shall be Class "A" as specified in these Specifications.

Inside drop assembly shall be constructed and supported as detailed on the Contract Documents.

5. Pipe Resilient Connectors to Manholes

Resilient connectors between the manhole and pipes such as Kor-N-Seal or A-Lok shall be installed in the precast or cored opening manhole wall. Sealing material shall be installed in the precast or cored opening. The resilient connector shall meet the requirements set forth in ASTM C-923. An external bond made entirely of corrosion resistant stainless steel shall be used to effect the seal around the pipe.

6. Sealant and Coatings

a. Sealant to be used in joints and where specified shall be Ram-Nek or an approved flexible plastic gasket.

b. A penetrant coating, similar to Durpal, that is an inorganic polymer penetrating solution shall be applied to manhole side walls and where specified.

c. Sealant similar to Drycon Grey and Drycon White which consists of Portland cement and finely graded mineral fillers and inorganic co-polymer additives and an inorganic polymer solution similar to Duripal-H having a non-silicone base shall be used to coat manhole sidewalls.

7. Stubouts

Stubouts shall be the "bell" or "hub" end of a joint of pipe conforming to the requirements of the main sewer or PVC.

8. Manhole Steps

Manhole steps shall be inserted and securely embedded in the manhole sidewall and shall be non-skid design, plastic coated steel or aluminum alloy.

Aluminum alloy manhole steps shall be Alcoa aluminum-magnesium silicide type alloy conforming to Federal Specifications QQ-A-200/8, or approved equal.

Plastic coated steel manhole steps shall be constructed of 1/2" steel reinforcing rods encapsulated in polypropylene plastic.

9. Vent Pipe Assemblies

The pipe shall be Schedule 40 steel pipe or Class 52, ductile cast iron pipe, cement mortar lined. Ductile iron pipe and fittings shall be commercial blast cleaned (SSPC-SP6) and shop primed with one coat of red primer, Inertol #621.

I. Concrete Encasement and/or Cradle

Concrete for concrete encasement and/or cradle shall be Class "B" as specified in Section 03300.

J. Grouting of Abandoned Sewers with Flowable Fill

Existing water and/or sewer lines to be abandoned shall be cut and plugged unless otherwise noted on the plans. When noted on the plans, lines shall be abandoned by filling with flowable concrete fill material. Flowable fill mixtures shall be as follows:

1. 107 lb.....cement
2. 427 lb..... fly ash
3. 2,554 lb…….sand
4. 5,17l lb..... water

or approved equal (100psi minimum - 150 psi maximum)

Cost for flowable fill material shall be merged into the total price bid. No additional payments will be made.

K. Tracer Wire

Tracer wire shall be a #12 AWG (minimum) copper conductor, insulated with a minimum 30 mil, high-density, high molecular weight polyethylene (HDPE) insulation, and rated for direct burial use. HDPE insulation shall be RoHS compliant and utilize virgin grade material.

PART 3 - EXECUTION

3.1 Installation

A. Polyvinyl Chloride (PVC), Ductile Iron (DIP), High Density Polyethylene (HDPE) Gravity Sanitary Sewers

1. General

The Contractor shall be responsible for setting all grade stakes, lines and levels and preparation of cut sheets. The Contractor shall provide level, level rod and tripod on the job site at all times for the purpose of checking grades, as deemed necessary by the Engineer.

All grade and alignment stakes for construction under this project shall be set by a land surveyor registered to practice in the State, and all costs thereof shall be borne by the Contractor. The requirement for this work to be accomplished by a registered land surveyor may be waived by the Engineer in the event the Contractor desires to utilize his own personnel who are qualified to set the grade and alignment stakes. The Contractor shall assume all responsibility for the correctness of the grade and alignment stakes.

The Contractor may use batter boards or a properly calibrated beam device. No claim for extra work will be allowed for alleged inaccuracy of the laser beam device. Grade hubs for laser beams shall not exceed 100 feet apart with centerline hubs every 50 feet to check laser and grade between manholes.

If the Contractor elects to use batter boards, he shall provide and maintain on the work at all times a gauge rod of sufficient length to reach from the invert of the sewer pipe being laid to the top line strung on the three batter boards. The gauge rod shall be graduated and numbered each foot of its entire length. The gauge rod shall be equipped with either a plumb line or two spirit levels and the utmost care used to insure a truly vertical gauge rod at the time a reading is taken and pipe is being set.

One week prior to the commencement of trench excavation, the Contractor shall prepare and submit to the Engineer for review four (4) copies of detailed Cut Sheets showing the beginning and ending manholes; the distance between manholes; the grade, size and type of line; the depth of cut; etc. The form of Cut Sheet shall be provided to the Contractor. All expense for the preparation of Cut Sheets shall be borne by the Contractor and be included in the unit price bid per foot of pipe.

Cut Sheets must be reviewed by the Engineer in writing before trenching operations may be permitted. It shall be the responsibility

of the Contractor to prepare Cut Sheets (one week) in advance of his anticipated trenching schedule.

The junction of two or more sewers shall be made in strict conformance with the Contract Drawings. The cost of all connections shall be included in the Contract price for the new sewers unless specifically provided in the Contract.

New sewer connections with existing sewers shall be made within a manhole. Where an existing manhole is the point of connection for new a sewer, it shall be repointed and any loose bricks or blocks in the walls of the old existing manhole shall be relaid. The Contractor shall reconstruct fillet (invert) of the manhole to accommodate the new connection. The cost of such work shall be included in the Contract price for new main sewer unless other payments are specifically provided for in these specifications.

Outside manhole drop assemblies shall be constructed should they be necessary to connect a new sewer to an existing manhole. Manhole drop assemblies to be constructed for existing manholes shall be per Paragraph 2.2-G.4 of this Section, and as detailed in the Contract Documents.

Where no manhole exists at the point of connection, a new manhole shall be constructed of the size and type shown on the Contract Drawings. Payment for such additional manholes will be made at the unit price in the Contract for new manholes, which price shall include all work necessary to make the connection.

Connections of new sewers to existing sewers when encountered in construction and not shown on the Contract Drawings shall be made where ordered by the Engineer. Such connections shall be made within a manhole, except for house sewer and drain connections. When such sewer connections are made within an existing manhole, any added work involved will be paid for in accordance with the procedure outlined in the Conditions of the Contract. If the Engineer orders such connections be made in a new manhole, such new manhole will be paid for at the prices established in the Contract, which price shall include all work necessary to make the connections.

When connections are made with sewers carrying sewerage or water, special care must be taken that no part of the work is built under water; a flume or dam must be installed and pumping maintained if necessary to keep the new work in the dry until completed and concrete or mortar has set up.

Junctions for future sewer connections indicated on the Contract Drawings on precast concrete manholes shall be provided with a 2' - 0" long stubout connected to the manhole with a pipe resilient

connector. The stubout shall be sealed by means of an approved stopper.

2. Pipe Laying

Installation of PVC pipe should conform to ASTM D-2321 and these Specifications. In case of a conflict between these specifications and the above Standards, the more stringent requirements shall apply. Each pipe shall be laid on an even, firm bed, so that no uneven strain will come to any part of the pipe. Particular care shall be exercised to prevent the pipes bearing on the sockets. Bell holes for bell and spigot pipe shall be dug at each point as hereinbefore specified. Each pipe shall be laid in the presence of the inspector. The bell end of the pipe shall be laid upgrade.

The foundation under, the bedding around and over, and the backfill within the trench of the sewer pipe shall be as specified in these specifications under Section 02223 - "Backfilling".

The interior of the sewer shall, as the work progresses, be cleaned of all dirt, jointing material and superfluous materials of every description. On small pipe sewers where cleaning after laying must be difficult, a swab or drag shall be kept inside the pipe line and pulled forward past each joint immediately after its completion.

Proper and suitable tools and equipment for the safe and convenient handling and laying of the pipes and fittings shall be used. Great care shall be taken to prevent the pipe coating from being damaged, particularly on the inside of the pipes and fittings.

All pipe shall be completely shoved home.

B. Six-Inch (6”) Tee Connections for House Services

This item shall include the furnishing and installing six-inch (6”) tee connections for house services at locations shown on the Contract Drawings or as specified by the Engineer during construction.

Construction, installation and material of pipe containing tee openings and the joint materials for the same shall be in conformance with the requirements of the specifications for that portion of the main sewer where D.I.P. or PVC’s installed. Where provided for future house sewer service connections and as directed by the Engineer, the sewer service line shall be extended a minimum of 4 feet and capped as specified under paragraph 3.1-D of this Section of these Specifications.

C. Six-Inch (6") House Sewer Services

This item shall include furnishing and installing six-inch (6") house sewer service sanitary sewers at the locations as shown on the Contract Drawings

or as directed by the Engineer during construction. It shall also include bends, caps and joint material as specified herein.

The furnishing, construction and installing of all materials and/or methods used in the construction of six-inch (6") house sewer services shall be as specified in the applicable provisions of paragraph 3.1-A of this Section and paragraph 3.1-B of this section of the Contract Specifications and as shown on Drawing, except as herein provided.

The location of all six-inch (6") house sewer services shall be as directed by the Engineer during construction. It will not be necessary that said sewers be laid with a batter line, but in no case shall it be less than one-eighth-inch (1/8") per foot.

The pipe material and method of jointing shall be the same as specified for the main sewer.

Where directed by the Engineer for future house sewer services, the Contractor shall saw off the bell of the last joint of 6" sewer pipe laid on each service line and cap the end of each service line with a Quik Cap flexible (PVC) cap (Fernco or approved equal) with an external band made entirely of corrosion-resistant stainless steel to effect the seal around the pipe. No additional payment will be allowed for cutting and capping the service pipe.

D. Service Reconnections

1. General

This item shall include the furnishing of all materials and doing all work necessary to reconnect each "live" sanitary sewer service to the new sanitary sewer collector lines. It shall be the responsibility of the Contractor to determine whether a service is "live' and whether it is sanitary sewer. No payment will be made for reconnecting a "dead" service. After separation of the storm and sanitary sewers, the Owner reserves the right to sample and test the storm water discharges. If tests reveal fecal coliform, which would be an indication of a sanitary sewer connection(s) remaining on the storm sewer, the onus is on the Contractor to show all "live" sanitary reconnections have been made regardless of the level of effort necessary to so prove.

2. Cleanout Assembly

Each reconnected service shall be provided with a six-inch (6") single cleanout assembly as per details shown on the Contract Drawings. Cleanout shall be complete as shown on detail.

3. Reconnection

Reconnections of dissimilar pipes shall be made with a corrosion resistant coupling with stainless steel hose clamps (Fernco or approved equal). Reconnection shall be as per details shown on the Contract Drawings.

E. Manholes and Appurtenances

This item shall include the furnishing of all materials and doing all work necessary for the complete construction of standard and/or special manholes of the types, sizes, shapes, dimensions and at the locations shown on the Contract Documents.

1. Manhole Bases and Fillets

a. Precast Manhole Bases

The Contractor shall install the precast concrete manhole base upon a crushed stone (No. 67, 57 or approved equal) bed that is a minimum of six (6) inches thick. This bed shall be carefully brought to the required grade. Care shall be taken that the bed is level and even so that when the precast unit is set in place, the manhole sidewall will be installed plumb and the concrete manhole base is in full contract upon the gravel base.

The precast manhole base shall be a minimum of six (6) inches in thickness, for 48" diameter manholes and 8" for 60" and 72" diameter manholes. For units that require the fillets to be poured-in-place, a minimum of two (2) inches shall be allowed from the inside of the base to the invert of the downstream pipe for the construction of the fillet.

Backfilling operations, as specified herein, may begin after the installation of the precast manhole sidewall with base has been completed. Upon completion of the backfilling operations, traffic may be allowed on the structure.

b. Poured-In-Place Manhole Bases and Fillets

All concrete shall be adequately protected from injurious action of the sun by keeping it wet, covering with water-saturated cover, or other methods approved by the Engineer.

In cold weather concrete shall be mixed and placed only when the temperature is at forty degrees (40^{O})F. or above, and rising, unless specifically authorized by the Engineer, in which event all materials shall be heated in a manner approved by the Engineer. In freezing weather, suitable means shall be provided for maintaining the concrete at a temperature of at

least fifty degrees (50^{O})F. for a period not less than seventy-two (72) hours after placing, or until the concrete has hardened. Salt, chemicals or other foreign materials shall not be mixed with the concrete for the purpose of preventing freezing, unless approved by the Engineer.

The poured-in-place manhole bases shall be allowed to set a minimum of twenty-four (24) hours before installing the manhole sidewall.

The monolithic concrete or the lower section of the precast ring sidewall shall be installed on the manhole base with a bond of cement mortar.

The bond shall be prepared by placing a "bead" of cement mortar, a minimum of three (3) inches thick, upon the manhole base and lowering the sidewall unit onto the mortar. The mortar forced from beneath the sidewall shall not be removed, but shall be troweled to the manhole sidewall to form a fillet or chamfer around the base of the sidewall.

Care shall be taken to insure that the manhole sidewall is installed plumb and truly vertical. To this end the Contractor shall take care, when pouring the concrete manhole base, to finish it to a horizontal surface.

When approved by the Engineer, the manhole sidewall may be set on concrete block supports and the required base poured up to and around the manhole sidewall. The base shall then be allowed to set for twenty-four (24) hours. Care shall be taken to prevent concrete being poured up to or around the resilient pipe line connector.

c. Fillets

Except as otherwise specified, fillets in manholes shall be tapered uniformly between the inverts of the inlet pipe and the outlet pipe. Fillets in junction manholes shall be constructed with curved channels for side streams so as to minimize turbulence as shown on detail. Fillets in end manholes shall be shaped to drain to the discharge pipe.

In cases where the invert of the inlet pipe(s) is six (6) inches or more above the invert of the outlet pipe, the flow line of the fillet at the inlet side shall not be greater than six (6) inches above the invert of the outlet pipe so as to provide clearance for maintenance or testing equipment.

Fillets shall be neatly and uniformly shaped, shall have a brushed finish, and shall be constructed of concrete as

specified herein. No cement mortar shall be used to obtain the required shape or finish.

All cost of manhole fillets shall be included in the Contract unit price, and no separate payment will be allowed therefore.

The area on the inside of the manhole around the juncture of the sidewall and the fillet shall be waterproofed as specified in the following Specifications.

2. Manhole Sidewall

a. Precast manhole sidewall

1. The Contractor shall carefully order the precast manhole sidewall to meet the required field conditions. The height of the unit in place shall be such so as to allow a adjusting rings to be placed on top of the manhole transition section prior to setting the casting. A minimum of two (2) inches and/a maximum of ten (10) inches of precast concrete adjustment rings will be allowed. The maximum distance from top of casting to the start of corbell section shall be 18”. A precast concrete adjusting ring must be used for this purpose.

2. The "corbell" section of the manhole sidewall shall be cast in the shape of a concentric cone.

3. At all joints of precast manhole sidewall, Ram-Nek or an approved equal shall be applied to the joint surface prior to the placement of the next manhole section. Sufficient gasket material shall be used to fill the void in the joint.

4. The Contractor shall take care while backfilling that the backfill material shall be brought up all around the manhole sidewalls in equal levels simultaneously.

5. All pipe line connections to the manhole sidewall shall be made with resilient connectors as specified hereinafter.

b. Poured-in-Place concrete monolithic sidewall

1. The Contractor shall carefully place the forms so the manhole casting may be set accurately to match the finished grade of the adjacent street and/or ground line with allowance of one 2” adjustment ring.

2. The "corbell" section of the manhole sidewall shall be cast in the shape of a concentric cone.

3. For each day's pour, two test cylinders should be made and tested in compliance with ASTM C-173, ASTM C-31 and ASTM C-39. These testings shall be done by a testing laboratory selected, employed and paid for by the Contractor.

   The Contractor shall submit to the Engineer and the Owner his choice of a testing laboratory for their approval. The Contractor shall instruct the testing laboratory to forward copies of the test reports to the Engineer and the Owner.

4. The maximum depth of manholes shall not exceed twenty feet. The minimum wall thickness for 4'-0' inside diameter manholes shall be 6 inches. The minimum wall thickness for 5' and 6' inside diameter manholes shall be 8 inches.

5. The base concrete shall be Class "C" as stated above, vibrated on firm sub-grade foundation of suitable crushed stone bedding. The base shall have a minimum diameter 8 inches greater than the outside diameter of the manhole and a minimum thickness of 8 inches.

   The first placement of base concrete shall consist of approximately 1/2 cubic yard of concrete deposited evenly around the walls and vibrated until there is a minimum slope of 60 degrees from the bottom of the forms to the bearing surface both inside and outside of the manhole. Additional concrete must be deposited in evenly distributed layers of 18 inches with each layer vibrated to bond to the preceding layer. The wall spacers must be raised as the placements are made with the area from which the spacer is withdrawn being carefully vibrated.

6. Should a cold joint become necessary, a formed groove and reinforcing dowels (#5 bars 36 inches long and 12 centers) will be required in the top of the first placement for shear protection. Immediately before the second placement is made, the surface of the cold joint shall be thoroughly cleaned and wetted with a layer of mortar being deposited on the surface.

7. The forms may be removed 24 hours after placement.

8. The monolithic manholes shall be backfilled to same level simultaneously all around. The manholes shall be backfilled until they reach 75% of the specified design strength. A select gravel backfill material shall be placed adjacent to the manholes in areas where swelling clays exist.

9. A resilient connector shall be utilized to connect pipe to manhole sidewall.

3. Manhole Frames and Covers

The manhole frame for the cover shall be set on the manhole sidewall in a full cement mortar bed, at the required elevation. Where manholes are constructed in paved areas or fill slopes, the surface of the frame and cover shall be tilted so as to conform to the exact slope, crown and grade of the existing pavement or area adjacent thereto. Vertical adjustments to new and existing manhole frames and covers will be exclusively with concrete adjustment rings in available heights or mortar when adjustments below two (2) inches are required.

4. Manhole Drop Pipe Assembly

Where the difference in invert elevations of an entering sewer and a discharging sewer, intercepting in the same manhole, is two (2) feet or more, a drop manhole assembly shall be constructed on the entering sewer in accordance with Paragraph 2.2-G.4 of this Section specifications and per details shown on the Contract Drawings.

All cost of furnishing, constructing and installing manhole bases, fillets, sidewalls, castings and all other work necessary for a complete creek bottom manhole to the details as shown on the Contract Documents shall be included in the Contract unit price for Creek Bottom Manholes, and no separate payment will be allowed therefore.

5. Pipe Resilient Connectors to Manholes

All connections of pipe to manhole sidewall shall be made with resilient connectors. Openings in the manhole sidewall for the pipe shall be precast or cored to provide required size and location. The hole shall be manufactured to allow for lateral and vertical movement, as well as angular adjustments through 20 degrees. A resilient connector between the manhole and pipes such as Kor-N-Seal or A-Lok shall be installed in the precast or cored openings. Seals shall be installed in the precast or cored opening. The resilient connector shall meet the requirements set forth in ASTM C-923. The insulator ring provided by manhole supplier must be used to prevent mortar used for cosmetic dressing to set up inside resilient connector creating an adverse rigid connection. An external band made entirely

of corrosion resistant stainless steel shall be used to effect the seal around the pipe. A torque wrench, as specified by the manhole supplier or approved equal, must be used to seat resilient connector to pipe.

As shown on the detail for resilient connectors, the void between the pipe and the connector shall be filled with an approved flexible gasket material.

Resilient connectors shall be considered an integral part of the manhole sidewall, and no separate payment will be allowed therefore.

6. Sealing

The sealing of the joints in the manhole sidewall and inverts of the manhole shall conform to the following specifications for waterproofing and sealing. Safety regulations and precautions set out by the paint manufacturer and OSHA shall be strictly observed.

All joints between sections of precast manhole sidewall shall be sealed with Ram-Nek or an approved equal which shall be applied to the joint surface prior to the placement of next manhole section. Sufficient gasket shall be used to fill the void in the joint.

On all manholes installed on a poured-in-place base, after completion of manhole fillet, the area where the inside manhole sidewall joins the manhole fillet shall be waterproofed by applying a sealant. This will not be required on manholes where the base is precast or poured-in-place monolithicly with the manhole sidewall.

The area to be waterproofed shall extend up the manhole sidewall and out onto the manhole fillet approximately six (6) inches from the juncture of the sidewall and the fillet.

When specified a penetrating coating, similar to Durpal, that is an inorganic polymer penetrating solution, shall be applied to these areas. It can be applied by brushing or spraying. This material shall act as a prime coat and as a surface stabilizer.

After a reasonable curing time (one hour), the above areas shall then be coated with at least two coats of sealant: one grey coat and one white coat of Portland cement slurry, similar to Drycon Grey and Drycon white, which consists of Portland Cement and finely graded mineral fillers and inorganic co-polymer additives that will prevent seepage of water through manhole wall under hydrostatic pressure. These two coats must be applied by brush to the dampened surface to be served and be able to withstand a hydrostatic pressure of 7 psi (16 feet of water).

A final coat will be inorganic polymer solution similar to Duripal-H having a non-silicone base. This final coat will be applied by spraying or brushing the liquid over the final white coat of sealant to provide resistance against chemical attack.

Sealing shall be considered an integral part of the manhole sidewall, and no separate payment will be allowed therefor.

7. Stubouts

Provisions for future sewers will be provided by installing a 24" long stubout to the size, line and grade indicated. Such "stubouts" shall be the "bell" or "hub" end of a joint of pipe, conforming to the requirements of the main sewer. The "bell" or "hub" shall be plugged with a disk stopper of the same material and sealed in place with the same joints as specified for the main sewer. All cost involved in placing the "stubouts" shall be included in the Contract unit price for manhole sidewall, and no separate cost will be allowed therefor.

8. Manhole Steps

Manhole steps shall be inserted and securely embedded in the manhole sidewall. Manhole steps shall be considered as an integral part of the manhole sidewall, and no separate payment will be allowed therefore.

9. Vent Pipe Assemblies

The vent pipe shall be located out of a travel way, in back of a curb or sidewalk, or as called for on the plans. The pipe is to be painted with one coat read lead primer, Phenolic Resin Varnish Base, Inertol #621, and followed by two (2) coats of epoxy ester intertol ponkote enamel. Primer shall be allowed to dry 72 hours in good weather and shall be thoroughly dry before recoating. Top coat of paint shall be dark green.

The top of the vent pipe shall not be less than nine (9) feet above the existing ground line or set to the elevation as indicated on the Contract Drawings.

Concrete foundation for manhole vent pipe assemblies shall be Class "A" concrete as specified in these Specifications. Forms will not be required unless the foundation is located in backfill materials.

F. Concrete Encasement and/or Cradle

Concrete for concrete encasement and/or cradle shall be Class "B" as specified herein and conforming to the requirements of P.C.A. Specifications for Plain and Reinforced Concrete.

All concrete shall be adequately protected from injurious action of the sun by keeping it wet, covering with water-saturated covering, or other methods satisfactory to the Engineer.

Concrete shall be mixed and placed only when the temperature is at forty degrees (40^{O})F. or above and rising, unless specifically authorized by the Engineer, in which event all materials shall be heated in a manner approved by the Engineer. In freezing weather, suitable means shall be provided for maintaining the concrete at a temperature of at least fifty degrees (50^{O})F. for a period not less than seventy-two (72) hours after placing, or until the concrete has hardened. Salt, chemicals, or other foreign materials shall not be mixed with the concrete for the purpose of preventing freezing, unless approved by the Engineer.

Concrete shall be placed before initial set has occurred and in no event after it has contained its water content for more than thirty (30) minutes.

All concrete shall be placed in the dry, upon clean, damp surfaces, free from water, and never upon soft mud or dry earth.

Freshly placed concrete shall be protected from wash by rain, flowing water, mud deposits and other injurious conditions.

Care shall be taken when placing concrete cradle and/or encasement that the sewer pipe is not moved from its proper grade and alignment.

Imperfect or damaged work, or any material damage before final acceptance, shall be satisfactorily replaced by the Contractor at his own expense. Removal and/or replacement of concrete work shall be done in a manner that will not impair its strength.

3.2 Construction Testing

A. General

It is the intent of these specifications to secure pipe lines with a minimum amount of leakage. All gravity pipe lines shall be tested for infiltration; and, if designated in the Specifications, also for exfiltration.

B. Testing of Gravity Sewers

1. Visual Tests

Upon completion of the construction, or earlier if the Engineer deems advisable, the Engineer will make a visual inspection of the sewer and construction site. The Contractor shall immediately repair all leaks and defects found by such inspection.

In addition to general cleanup and leakage, the following standards shall be used to determine failure or defects of this project.

Sewers must be built so as to remain true to line and grade. The inclining grade of the bottom of the sewer after completion shall be such that after flooding the flood water will drain so that no remaining puddle of water will be deeper than one-half (1/2) of an inch on pipe thirty-six (36) inches internal diameter or smaller, and three-quarters (3/4) of an inch on pipe larger than thirty-six (36) inches internal diameter. Any section of pipe that does not comply with the specifications at any time previous to final acceptance of the work shall be replaced or relaid at the Contractor's expense.

The Contractor will be held strictly responsible that all parts of the work shall bear the load of the backfill. If cracks one-hundredth (1/100) of an inch or larger develop in the reinforced concrete pipe within one year from the date of final acceptance of the work, the Contractor will be required to correct, at his expense, all such pipe defects. Correction may include replacement or installation of internal pipe lining material.

2. Low Pressure Air Tests

a. Positive Pressure Test

Upon completion of construction, or earlier if the Engineer deems advisable, the Contractor will provide the necessary equipment and labor to perform low positive pressure air tests in accordance with the provisions of ASTM C 924 or ASTM C1103.

This test shall be performed in the presence of the Engineer and shall be performed on all types of gravity sewer pipe materials. This test shall also include the house sewer services to the cleanout assembly and service lines from manholes. It is imperative that plugs be installed and braced to prevent blowouts. A 6 psi pressure relief device must be used. No one will be allowed in or near the manholes during pressurization, testing, or depressurization.

b. Negative Pressure Test

Upon completion of construction, or earlier if the Engineer deems advisable, the Contractor will provide the necessary equipment and labor to perform low negative pressure air tests in accordance with the provisions of ASTM C1214. This test shall be performed in the presence of the Engineer and shall be performed on all types of gravity sewer pipe materials. This test shall also include the house sewer services to the cleanout assembly and service lines from manholes. It is imperative that plugs be installed and braced to prevent blowouts. A 6 psi pressure relief device must be used. No

one will be allowed in or near the manholes during pressurization, testing, or depressurization.

3. Infiltration Tests

Ground water above the pipe will reduce air loss. If the section of line under test shows significant infiltration, the Contractor, at no added compensation over the Contract price for the sewers, shall furnish, install and maintain a V-notch sharp crested weir in a wood frame tightly secured at the low end of each sewer lateral and at locations on the main sewers directed by the Engineer. Infiltration testing procedures shall follow ASTM C-969 except that maximum allowable infiltration shall be 25 gallons per mile per inch of diameter of sewer per 24-hour day at any time. The joints shall be tight, and visible leakage in the joints or leakage in excess of that specified above shall be repaired at the Contractor's expense by any means found to be necessary.

When infiltration is demonstrated to be within the allowable limits, the Contractor shall remove such weirs.

Infiltration tests may be required for the complete line or any portion thereof. Failure of any part of the line to pass an infiltration test shall be sufficient reason to require additional work by the Contractor to reduce the amount of infiltration in such portion of the line tested.

The passing of an infiltration test shall in no way relieve the Contractor of any responsibility to repair visible leaks found during the visual inspection.

4. Internal TV Inspection

The Owner may conduct an internal inspection of the sewer with a Television instrument at no cost to the Contractor. The Contractor will be responsible for correcting all deficiencies discovered by this TV inspection at no additional cost to The City of Mount Pleasant.

5. Deflection Tests

No pipe will be accepted that has deflected more than 5%.

All polyvinyl chloride (PVC) sewer pipe shall pass a go/no-go, mandrel inspection sized as shown in the table below. The test shall be conducted after the pipe is in place and not less than thirty (30) days after the pipe has been completely backfilled. To insure accurate testing, the sewer lines shall be thoroughly cleaned before testing. Any section that fails to pass shall be repaired by rebedding or replacement of the pipe and retested to satisfaction of the Engineer. The mandrel will be provided by the Owner or the Contractor may provide a mandrel approved by the Engineer. The

mandrel shall be pulled by hand freely through the sewer pipe from manhole to manhole.

PVC Pipe Nominal Size Inches	Mandrel Size Inches
8	7.28
10	9.08
12	10.79
15	13.20
18	16.15
24	21.48
30	26.95

C. Testing of Ductile Iron Gravity Sewers

Testing of ductile iron gravity sewers shall be in accordance with paragraph 3.2-B-1, 2, 3 of this Section of these Specifications except that the allowable infiltration and exfiltration shall not exceed 10 gallons per mile per inch of diameter of sewer per 24-hour day at any time.

D. Testing of Six-Inch (6") House Sewer Services

All service connections and service lines shall be included in and must satisfy all tests specified to be performed in paragraph 3.2-B of this Section of these Specifications.

E. Manhole Vacuum Test

It will be required that all new manholes installed on pipelines with a diameter of 30-inches (30”) or less be subjected to a vacuum test of at least 10" Hg. prior to acceptance by the Owner. The test shall be conducted to include the manhole casting (frame) and will be considered acceptable if the vacuum remains at 10" Hg. or drops to no less than 9" Hg. within one (1) minute. If the manhole fails the initial test, the Contractor shall locate the leak and make appropriate repairs, acceptable to the Engineer, in preparation for additional tests.

It is also called to the Contractor's attention that he will be required to furnish all equipment necessary for this test including the manhole sealing apparatus, gauges, pump, plugs and operating personnel.

The cost of this work shall be merged into the unit price bid for manholes, and no additional payment will be allowed.

F. Large Manhole Visual Inspection

The 9-foot (9') square manholes to be installed on the existing 66-inch (66") trunk sewer shall be visually inspected for leaks but shall not be required to be air tested.

3.3 Maintenance

Immediately upon completion of each individual sewer line or a 1,500' segment of this sewer line constructed under this Contract, the Contractor shall begin and prosecute to completion the cleanup and property restoration for this particular line. This shall be done prior to the start of another line, unless a written permission is obtained from the Owner and/or Engineer to begin another line. This permission will only be given if the following conditions and situations exist:

The Contractor maintains a sufficient cleanup crew on the project at all times, weather permitting, and that the progress shall be at least equal to the pipe laying progress on the project. The cleanup must be maintained not more than one line or 1,500 feet, whichever is least, behind the pipe laying crew. This shall be subject to weather and ground conditions.

Conditions permitting, property cleanup and restoration shall begin and be prosecuted to completion on a timely basis as set forth herein. Failure by the Contractor to prosecute and complete property cleanup and restoration on a timely basis will result in the withholding of 15% of the payment due for that part of the completed pipe sewer for which cleanup and property restoration has not been accomplished. This 15% withholding constitutes payment for work not completed. This amount shall be in addition to the retained percentage for work completed. This withholding of 15% will continue on subsequent payment estimates until such time as cleanup and property restoration is in compliance.

Cleanup and restoration of areas and facilities disturbed by construction operations shall be considered an integral part of the excavation work, and no separate payment will be allowed therefore except as herein specified.

END OF SECTION

SECTION 02762

SANITARY SEWER CLEANING AND INSPECTION

PART 1 - GENERAL

1.1 Section Includes

A. Sewer line cleaning to remove foreign materials from the lines and restore the sewer to a minimum of 95% of the original carrying capacity, for proper seating of pipe lining, or as required for other specified rehabilitation.

B. Closed-circuit television inspection of lines cleaned.

PART 2 - PRODUCTS

2.1 Cleaning Equipment

A. High-Velocity Jet (Hydrocleaning) Equipment: All high-velocity sewer cleaning equipment shall be constructed for ease and safety of operation. The equipment shall have a selection of two or more high-velocity nozzles. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees in all size lines designated to be cleaned. Equipment shall also include a high-velocity gun for washing and scouring manhole walls and floor and produce at least 2000 psi pressure. The gun shall be capable of producing flows from a fine spray to a solid stream. The equipment shall carry its own water tank, auxiliary engines, pumps, and hydraulically driven hose reel.

B. Vacuum Cleaning Equipment: Sewer vacuum cleaning equipment may be provided as a combination machine with a high-velocity jet (as in paragraph A), or be separately mounted. The vacuum system shall have sections of vacuum pipe which can be linked together to allow a continuous lift to a storage tank. The vacuum system shall have sufficient power and suction lift to raise rocks and pieces of brick a vertical distance of 30 feet. The lift may be accomplished by suction or air velocity in the vacuum system.

C. Mechanically Powered Equipment: Bucket machines shall be in pairs with sufficient power to perform the work in an efficient manner. Machines shall be belt operated or have an overload device. Machines with direct drive that could cause damage to the pipe will not be allowed. A power rodding machine shall be either a sectional or continuous rod type capable of holding a minimum of 750 feet of rod. The rod shall be specifically heat-treated steel. To insure safe operation, the machine shall be fully enclosed and have an automatic safety clutch or relief valve.

2.2 Television Inspection Equipment

A. The television camera used for the inspection shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear color picture of the entire periphery of the pipe. The camera shall be capable of a 360º viewing area. The television system shall be equipped with a device that indicates the camera travel distance in feet by display on the video viewing screen. Backup camera shall be available on the project site. The camera shall be operative in 100% humidity conditions. The camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction of the Owner's Representative; and if unsatisfactory, equipment shall be removed and no payment will be made for an unsatisfactory inspection.

PART 3 - EXECUTION

3.1 Cleaning

A. Cleaning Precautions: During sewer cleaning operations, satisfactory precautions shall be taken in the use of cleaning equipment. When tools which retard the flow in the sewer line are used, precautions shall be taken to insure that the water pressure created does not damage or cause flooding of public or private property being served by the sewer. When additional water from fire hydrants is necessary to avoid delay in normal work procedures, the water shall be conserved and not used unnecessarily. No fire hydrant shall be obstructed in case of a fire in the area served by the hydrant.

B. Sewer Cleaning: The designated sewer manhole sections shall be cleaned using high-velocity jet, or mechanically powered equipment. Selection of the equipment used shall be based on the conditions of lines at the time the work commences. The equipment and methods selected shall be satisfactory to the Owner's Representative. The equipment shall be capable of removing dirt, grease, rocks, sand, and other materials and obstructions from the sewer lines and manholes. If cleaning of an entire section cannot be successfully performed from one manhole, the equipment shall be set up on the other manhole and cleaning again attempted. If, again, successful cleaning cannot be performed or the equipment fails to traverse the entire manhole section, it will be assumed that a major blockage exists and the cleaning effort shall be repeated with other types of equipment.

C. Root Removal: Roots shall be removed from sections designated to be relined. Special attention shall be used during the cleaning operation to assure complete removal of roots from the joints. Procedures may include the use of mechanical equipment such as rodding machines, bucket machines and winches using root cutters and porcupines, and equipment such as high-velocity jet cleaners.

D. Material Removal: All sludge, dirt, sand, rocks, grease, and other solid or semisolid material resulting from the cleaning operation shall be removed at the downstream manhole of the section being cleaned. Passing material from manhole section to manhole section, which could cause line stoppages,

accumulations of sand in wet wells, or damage pumping equipment, shall not be permitted.

E. Disposal of Materials: All solids or semisolids resulting from the cleaning operations shall be removed from the site and disposed of at a site designated by the Owner. All materials shall be removed from the site no less often than at the end of each workday. Under no circumstances will the Contractor be allowed to accumulate debris, etc., on the site of work beyond the stated time, except in totally enclosed containers and as approved by the Owner.

F. Internal Service Reinstatements/Renewals: All sewer service reinstatements and/or renewals by internal means shall be inspected with camera equipment having a 360° view.

G. Final Acceptance: Acceptance of sewer line cleaning shall be made upon the successful completion of the television inspection and shall be to the satisfaction of the Owner's Representative. If TV inspection shows the cleaning to be unsatisfactory, the Contractor shall be required to reclean and reinspect the sewer line until the cleaning is shown to be satisfactory. In areas where television inspection is not performed, the Owner's Representative may require the Contractor to pull a double squeegee (with each squeegee the same diameter as the sewer) through each manhole section as evidence of adequate cleaning. If lining is to follow the television inspection, particular attention should be given to the adequacy of the cleaning to insure that proper seating of the lining can be achieved.

3.2 Sewer Flow Control

A. When sewer line depth of flow at the upstream manhole of the manhole section being worked is above the maximum allowable for testing, television inspection, or pipe lining; the flow shall be reduced to the level shown below by operation of pump stations, plugging or blocking of the flow, or by pumping and bypassing of the flow as specified.

B. Depth of flow shall not exceed that shown below for the respective pipe sizes as measured in manhole when performing television inspection.

1 Maximum Depth of Flow.....Television Inspection

6" - 10" Pipe	20% of pipe diameter
12" - 24" Pipe	25% of pipe diameter
27" & up Pipe	30% of pipe diameter

C. Plugging or Blocking: A sewer line plug shall be inserted into the line upstream of the section being worked. The plug shall be so designed that all or any portion of the sewage can be released. During TV inspection, testing and sealing operations, flow shall be reduced to within the limits specified above. After the work has been completed, flow shall be restored to normal.

D. Pumping and Bypassing: When pumping and bypassing is required the Contractor shall supply the pumps, conduits, and other equipment to divert the

flow of sewage around the manhole section in which work is to be performed. The bypass system shall be of sufficient capacity to handle existing flow plus additional flow that may occur during a rainstorm. The Contractor will be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing system. If pumping is required on a 24-hour basis, engines shall be equipped in a manner to keep noise to a minimum.

E. Flow Control Precautions: When flow in a sewer line is plugged, blocked, or bypassed; sufficient precautions must be taken to protect the sewer lines from damage that might result from sewer surcharging. Further, precautions must be taken to insure that sewer flow control operations do not cause flooding or damage to public or private property being served by the sewers involved.

3.3 Television Inspection

A. After cleaning, the manhole sections shall be visually inspected by means of closed-circuit television. The inspection will be done one manhole section at a time and the flow in the section being inspected will be suitably controlled as specified (see Article Sewer Flow Control).

B. The camera shall be moved through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition. In no case will the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. If, during the inspection operation, the television camera will not pass through the entire manhole section, the Contractor shall set up his equipment so that the inspection can be performed from the opposite manhole. If, again, the camera fails to pass through the entire manhole section, the inspection shall be considered complete and no additional inspection work will be required.

C. When manually operated winches are used to pull the television camera through the line, telephones or other suitable means of communication shall be set up between the two manholes of the section being inspected to insure good communications between members of the crew.

D. The importance of accurate distance measurements is emphasized. Measurement for location of defects shall be above ground by means of a meter device. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape, or other suitable device, and the accuracy shall be satisfactory to the Owner's Representative.

E. Documentation of the television results shall be as follows:

1. Television Inspection Logs: Printed location records shall be kept by the Contractor and will clearly show the location in relation to an adjacent

manhole of each infiltration point observed during inspection. In addition, other points of significance such as locations of building sewers, unusual conditions, roots, storm sewer connections, broken pipe, presence of scale and corrosion, and other discernible features will be recorded and a copy of such records will be supplied to the Owner.

2. Photographs: Instant developing, 35 mm, or other standard-size photographs of the television picture of problems shall be taken by the Contractor upon request of the Owner's Representative, as long as such photographing does not interfere with the Contractor's operations.
3. Video Recordings: The purpose of video recording shall be to supply a visual and audio record of problem areas of the lines before rehabilitation and after rehabilitation that may be replayed. The video recording shall be in Windows Media Video (WMV) file format and transferred or made on a standard DVD video disc. If proprietary software is used by the contractor for making and viewing the video disc record, then the contractor shall provide the software and license to the owner as part of the final work product. Any costs associated with the proprietary software are not separate from the contract and shall be merged into the overall price for this part of the work. The video recording shall include, at a minimum, a display of the footage meter and a display of the manhole segment number being televised. Where appropriate, comments should be included by concurrent audio recording on the disc or electronic display. Video recording playback shall be at the same speed that it was recorded. Slow motion or stop-motion playback features may be supplied at the option of the Contractor. The original recording shall remain with the Contractor; however, the Owner will be supplied with all of the disc recordings at the completion of the project or as designated by the Owner’s representative in the case of “fast-track” or design-build sewer rehabilitation projects. The Contractor shall have all video recordings and necessary playback equipment readily accessible for review by the Owner during the project. The video discs will be provided by the Contractor to the Owner prior to final acceptance of the Work.

END OF SECTION

SECTION 02763

GRAVITY SEWER REHABILITATION

PART 1 - GENERAL

1.1 Section Includes

A. Replace certain portions of the existing sewer system, including collection lines, service lines, and service connections, or else lay new lines, wherever the bidding instruments indicate that this is to be done. Control the existing flow in the line segment being replaced whenever necessary during replacement. The pipe used for replacement shall be either PVC pipe or ductile iron pipe, as set forth in the Bid Form and as specified below.

B. Pipe and fitting material shall be PVC unless the Bid Form or drawings show otherwise, except that replacement pipe for any existing cast iron or ductile iron pipe shall be ductile iron.

PART 2 - PRODUCTS

2.1 Standards

A. All materials shall be in strict compliance with the required standards and specifications of ASTM, ANSI, and/or AWWA.

2.2 PVC Pipe

A. Pipe and fittings shall meet or exceed the requirements of ASTM D3034, SDR 35.

B. All pipe shall be suitable for use as a gravity sewer conduit. Provisions must be made for contraction and expansion at each joint with a rubber ring. Standard lengths shall be 20' and 12.5' plus or minus 1".

C. All fittings and accessories shall be manufactured and furnished by the pipe supplier, or approved equal, and have bell and/or spigot configurations identical to that of the pipe.

D. Pipe shall be designed to pass all tests at 73 degrees F (plus or minus 3 degrees F).

E. The minimum pipe stiffness at 5% deflection shall be 46 psi for all sizes when tested in accordance with ASTM D2412 regarding external loading properties of plastic pipe by parallel plate loading.

F. There shall be no evidence of splitting, cracking, or breaking when the pipe is tested as follows:

1. Flatten a specimen of pipe 6" long between parallel plates in a suitable press until the distance between the plates is 40% of the outside diameter of the pipe. The rate of loading shall be uniform and such that the compression is complete within 2 to 5 minutes.
2. A 6" long section of pipe shall be subjected to impact from a free falling tup (20 pound Type A) in accordance with ASTM D2444. No shattering or splitting shall be evident; denting is not a failure.
3. After 2 hours of immersion in a sealed container of anhydrous acetone (99.5% pure), a 1" long sample ring shall show no visible spalling or cracking when tested in accordance with ASTM D2152; swelling or softening is not a failure.
4. PVC pipe shall have a minimum envelope of 6" of granular material around the pipe. All other bedding and backfill requirements remain the same as for other pipe material.

2.3 Ductile Iron Pipe

A. Ductile iron pipe shall conform to the specifications of ASTM A746. Unless otherwise shown by the drawings or the Bid Form, the wall thickness shall be Class 52 for all sizes of pipe.

2.4 Tees, Cleanouts, And Stoppers Or Plugs

A. Unless otherwise specified or noted on the drawings, tees, cleanouts, and stoppers or plugs shall be of the same material used to repair the main sewer and have an inside diameter of the same size as the existing line, except that it shall in no case have a diameter smaller than 4". The stopper and installation shall be able to withstand all test pressures involved without leakage.

2.5 Joints and Jointing Materials

A. PVC Pipe: Pipe shall be of the bell and spigot type with a rubber ring suitable to meet all test requirements of these specifications.

B. Ductile Iron Pipe: Gasket type joints for bell and spigot ductile iron pipe shall be similar to U.S. Tyton, Clow Super Bell-Tite, or equal, and be designed to meet the infiltration requirements of these specifications.

C. Jointing of Ductile Iron Pipe: Jointing of ductile iron shall comply with the applicable provisions of ANSI A21.11.

2.6 Compression Couplings

A. When dissimilar pipe materials like PVC and concrete pipe are joined, use reinforced compression couplings as manufactured by Fernco or approved equal, that are resistant to the corrosive action of soils and sewage and that will provide a permanent watertight joint. The compression couplings shall meet the physical test and joint leak requirements specified by ASTM C594, and the bands for attaching the couplings to the dissimilar pipes shall be of

stainless steel conforming to ASTM C594. Each coupling shall bear the manufacturer's identifying mark and an indication of its size.

2.7 Testing of Materials

A. All testing of clay and concrete pipe and materials shall be made by a commercial testing laboratory. Before starting work, furnish the name of the pipe materials supplier to the Owner. No pipe shall be delivered to the job site which does not bear the testing laboratory's stenciled or otherwise marked sign of acceptance. Furnish 2 certified copies of the testing laboratory's report of inspection, test, and acceptance on all pipe and specials to the Owner.

B. For PVC and ductile iron pipe, furnish a certificate from the pipe manufacturer indicating that the pipe meets all applicable requirements of these specifications.

PART 3 - EXECUTION

3.1 Sewer Line Replacement And/Or Repairs

A. The Contractor shall locate all existing underground utilities before beginning excavation for line and service connection from the manhole of reference as shown in the drawings or elsewhere in these specifications.

B. The Contractor shall provide for flow of sewage around the section or sections of pipe as specified in Section 02767 - Sewer Flow Control.

C. Unless the construction of lines by tunneling, jacking, or boring is called for by the drawings or specifically authorized by the Owner, make excavation for pipelines in open cut and true to the lines and grades of the existing pipeline being replaced or repaired shown on the drawings or established by the Owner on the ground. Cut the banks of trenches between vertical parallel planes equidistant from the pipe centerline. The horizontal distance between the vertical planes (or, if sheeting is used, between the inside faces of that sheeting) shall vary with the size of the pipe to be installed, but shall not be more than the distance determined by the following formula: 4/3d + 15", where "d" represents the internal diameter of the pipe in inches. When approved in writing by the Owner, the banks of trenches from the ground surface down to a depth not closer than 1' above the top of the pipe may be excavated to nonvertical and nonparallel planes, provided the excavation below that depth is made with vertical and parallel sides equidistant from the pipe centerline in accordance with the formula given above. Any cut made in excess of the formula 4/3d + 15" shall be at the expense of the Contractor and may be cause for the Owner to require that stronger pipe and/or a higher class of bedding be used at no cost to the Owner.

D. Take reasonable care during the initial excavation of the defective pipe so as not to disturb existing pipe that is still acceptable. Where the specifications require the material from excavation to be wasted and the trench backfilled

with crushed stone, load this material directly into trucks during excavation; do not pile on the street. After defective pipe has been exposed, uncover as much additional pipe as is necessary to allow space for workmen and the installation of the new pipe. Cut out the defective pipe in such a way that the ends are straight and smooth and free of chips or cracks. Remove the defective pipe from the trench, and excavate the former bedding material of any nature of that pipe to 6" below the pipe grade. All excavation is to be done in accordance with applicable portions of Section 02220 - Excavation, Backfilling, Compaction. Then fill the bottom of the trench with 6" of 1/2" to 3/4" crushed stone.

E. Lay no pipe except in the presence of an inspector representing the Owner.

F. Before placing sewer pipe in position in the trench, carefully prepare the bottom and sides of the trench, and install any necessary bracing and sheeting as specified in Section 02220 - Excavation, Backfilling, Compaction.

G. Wherever necessary to provide a satisfactory bearing surface, place concrete cradles as shown on the drawings or as directed by the Owner. Cradles shall be of concrete and shall conform to the dimensions shown on the drawings. Concrete placed outside the dimensions shown shall be at the Contractor's expense.

H. Tightly stretch a mason's line or wire above ground level, parallel to and directly above the axis of the pipe to be installed. This line is to be supported at intervals not exceeding 50' on sewers being laid on a grade of 2% or more than not exceeding 25' on grades of less than 2%. Determine the exact line and grade for each section of pipe by measuring down this line to the invert of the pipe in place. Accurately place each pipe to the exact line and grade called for on the drawings. Furnish all labor and materials necessary for erecting batterboards.

I. Lasers may be used after the type and procedures are approved by the Owner. When lasers are used, set reference points for both line and grade at each manhole. Where grades are 0.6% or less, check the elevation of the beam each 100' with an offset point or engineer's level.

J. Do not allow water to run or stand in the trench while pipe laying is in progress or before the trench has been backfilled. Do not at any time open up more trench than available pumping facilities are able to dewater.

K. If trench bottoms are found to be unsuitable for foundations after pipe laying operations have started, correct and bring them to exact line and grade as required by Section 02220 - Excavation, Backfilling, Compaction.

L. Carefully inspect each piece of pipe and special fitting before it is placed, and lay no defective pipe in the trench. Pipe laying shall proceed upgrade, starting at the lower end of the grade and with the bells upgrade. When pipe laying is not in progress, keep the ends of the pipe tightly closed with a temporary plug approved by the Owner.

M. Bell holes shall be large enough to allow ample room for pipe joints to be properly made. Cut out bell holes not more than 2 joints ahead of pipe laying. Carefully grade the bottom of the trench between bell holes so that each pipe barrel will rest on a solid foundation for its entire length. Lay each pipe joint to form a close concentric joint with adjoining pipe and so as to avoid sudden offsets or inequalities in the flow line.

N. Before constructing or placing any joints, complete at least one sample joint in order to demonstrate to the Owner that the methods employed conform to the specifications and will provide a watertight joint, and further that the workmen intended for use on this phase of the work are thoroughly familiar and experienced with the type of joint proposed.

O. Wherever pipe materials are joined, cut the replacement pipe to a length 1" less than the overall length of the section being replaced. Then place the pipe in the trench, thoroughly clean the ends of existing and replacement pipe, and install the compression couplings. After installation, check the work to ensure that the replacement pipe is vertically and horizontally aligned with the existing pipe and that the compression couplings are tight and evenly fitted.

P. As the work progresses, thoroughly clean the interior of the pipe in place. After each line of pipe has been laid, carefully inspect and remove all earth, trash, rags, and other foreign matter from the interior.

Q. After the joints have been completed, they shall be inspected before they are covered. The pipe shall meet the test requirements for watertightness; immediately repair any leak or defect discovered at any time after completion of the work. Take up any pipe that has been disturbed after joints were formed, clean and remake the joints, and relay the pipe; this shall be done at the Contractor's expense. Carefully protect all pipe in place from damage until backfill operations have been completed.

R. Do not begin the backfilling of trenches until the pipe in place has been inspected and approved by the Owner.

3.2 Deflection Testing For PVC Pipe

A. On new sewer or complete replacements of full line segments, test the deflection of the pipe by passing a vertical floating pin go/no-go mandrel sized to 95% of the pipe diameter of the actual pipe used with the pipe in place and covered. Make this acceptance test after backfill consolidation has occurred.

3.3 Service Lines

A. If the work consists of constructing a new sewer to replace an existing sewer, renew all existing service lines to the new line and install an inspection tee at the property line or easement line.

B. Replace service lines from the sewer line to the property line or easement line of the structure being served by the lines as shown in the drawings. If the entire service line is to be replaced, do so with PVC pipe of the same diameter as the existing line. Lay new service line in conformance with the standard drawings.

C. When replacing service line and/or service connections to the main line, the replacement line and/or service connection shall be of the same size as the existing line and service connection.

D. Install tee branches in any sanitary sewer lines designated by the Owner. If such branches are not to be used immediately, close them with stoppers approved by the Owner that are held in place to prevent infiltration and meet all test requirements.

E. To repair or replace a service connection which, in the judgment of the Owner, is the source of the leak, properly connect the service in conformance with the pipe manufacturer's recommendations and specifications and applicable ASTM specifications for the service connection and the installation of same. The material of the connection shall be similar to the sewer pipe it will connect to.

3. 4 Crossing Above Water Lines

A. Where sewers cross above water lines, encase the sewer pipe with concrete for a distance of 10' on each side of the crossing.

3.5 Connections

A. Make connections to all existing sewer lines as shown on the drawings or as directed by the Owner. Make connections by removing a section of the sewer from the existing line and inserting a tee branch of proper size into the space; adding a saddle; or by constructing a manhole, junction box, regulator chamber, or other structure as shown on the drawings.

B. Make connections to existing manholes or inlets by cutting a hole in the wall of the existing structure, inserting a length of sewer pipe into the hole, filling around the pipe with non-shrink concrete or mortar, and troweling the inside and outside surfaces of the joint to a neat finish. Place a manhole coupling or gasket on the pipe before mortaring around the pipe. Shape or reshape the bottom of the manholes as necessary to fit the invert of the sewer pipe in the manner specified elsewhere.

3.6 Pipe Protection

A. Provide sewers that, when completed, have less than 3 feet of cover, with concrete protection or concrete cap as shown on the drawings or as directed by the Owner. When such pipe protection is not shown on the drawings, place it in accordance with the typical section shown on the standard drawings.

3.7 Existing Utilities

A. Carefully protect all existing sewers, water lines, gas lines, sidewalks, curbs, gutters, pavements, electric lines, or other utilities or structures in the vicinity of the work from damage at all times. Where it is necessary for the proper accomplishment of the work to repair, remove, and/or replace any such utility or structure, do so in accordance with the provisions set forth in the General and Special Conditions of these specifications. Any such work to be done at the Contractor's expense shall be considered incidental to the construction of sewers, and no additional payment will be allowed therefore.

3.8 Field Judgment

A. At any time during a repair, the Owner may make field judgment that shall govern over the repair until such time that the specifications will again prevail.

3.9 Testing Sewer Lines That Have Been Replaced

A. All lines will be tested by air testing.

B. Furnish all equipment and facilities and all personnel for conducting the test. The test shall be observed by a representative of the Owner.

C. Make the air test after backfilling has been completed and compacted.

D. Conduct the air test on entire sewer line replacements on new sewer lines, and on lined sewer lines.

E. Plug all tees and ends of sewer services with flexible joint plugs, or securely fasten caps, to withstand the internal test pressures. Such plugs or caps shall be readily removable, and their removal shall provide an end suitable for making a flexibly jointed lateral connection or extension.

F. Before testing, check the pipe to see that it is clean. If not, clean it by passing a full gauge squeegee through the pipe. It shall be the Contractor's responsibility to have the pipe clean and determine the ground water level.

G. Immediately following this check or cleaning, test the pipe installation with low pressure air. Slowly supply air to the plugged pipe installation until the internal air pressure reaches 4.0 psi greater than the average back pressure of any ground water that may submerge the pipe. Allow at least 2 minutes for temperature stabilization.

H. The pipeline shall be considered acceptable when tested at an average pressure of 3.0 psi greater than the average back pressure of the ground water that may submerge the pipe if (1) the test of air loss from any section tested in its entirety between manholes does not exceed 2.0 cfm, or (2) the section under test does not lose air at a rate greater than 0.0030 cfm per square foot of internal pipe surface.

I. The pipeline shall be considered acceptable if the time required in seconds for the pressure to decrease from 3.5 to 2.5 psi greater than the average pressure of any ground water that may submerge the pipe is equal to or greater than that shown in the Allowable Time Table below.

ALLOWABLE TIME TABLE

Pipe Size	Minimum Time/100 ft. Seconds
8"	72
10"	90
12"	108
15"	126
18"	144
21"	180
24"	216
27"	252
30"	288

J. If the pipe installation fails to meet these requirements, the Contractor shall determine at his own expense the source or sources of leakage and repair or replace all defective materials or workmanship. The completed pipe installation shall meet the requirements of this test before being considered acceptable.

K. Recommended Procedures for Conducting Acceptance Test:

1. Clean pipe that is to be tested.
2. Plug all pipe outlets with suitable test plugs. Brace each plug securely.
3. Increase gauge pressure by the amount of ground water pressure at the crown of the pipe being tested.
4. Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psi greater than the average back pressure above the crown of the pipe.
5. After the above internal pressure is obtained, allow at least 2 minutes for the air temperature to stabilize, adding only the amount of air required to maintain pressure.
6. After the 2-minute period, disconnect air slowly.
7. When the pressure decreases to 3.5 psig, start the stopwatch. Determine the time in seconds that is required for the internal air pressure to reach 2.5 psig. This time interval should then be compared with the time shown in the Allowable Time Table, above. If the time is more than that shown in the table, the test will be assumed to be acceptable.

L. Safety Provisions: Securely brace the plugs used to close the sewer pipe for

the air test in order to prevent the unintentional release of a plug, which can become a high velocity projectile. Locate gauges, air piping manifolds, and valves at the top of the ground. No one shall be permitted to enter a manhole where a plugged pipe is under pressure: 4 pounds (gauge) air pressure develops a force against the plug in a 12" diameter pipe of approximately 450 pounds. DO NOT air test pipes larger than 21" in diameter because of the

difficulty of adequately blocking the plugs. Provide a safety release device set to release at 10 psi between the air supply and the sewer under test.

M. Repairs: Regardless of outcome of any test, repair any noticeable leak.

3.10 Cleanup

A. After completing each section of the sewer line, remove all debris and construction materials and equipment from the site of the work; grade and smooth over the surface on both sides of the line; and leave the entire construction area in a clean, neat, and serviceable condition.

END OF SECTION

SECTION 02765

SANITARY SEWER MANHOLE REHABILITATION (LEVEL “C”)

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sanitary sewer manhole rehabilitation including:

1. Rehabilitation and leak-proofing of manholes by lining with spray applied or centrifugally cast lightweight structural reinforced concrete, for preparation in conjunction with spray applied urethane or epoxy resin systems.
2. Rehabilitation and leak-proofing of manholes by lining with spray applied urethane or epoxy resin systems – Level C.
3. The repair and sealing of the manhole base, invert, walls, corbel/cone, and chimney of brick, block, or precast manholes, including the removal of any unsound material.
4. The inspection and testing of the various types of work to insure compliance.

B. All existing manholes identified on existing sewers shall receive a minimum of Level C rehabilitation.

1.2 LINING SYSTEMS

A. The lining system used shall result in a monolithic structure to the shape and contour of the interior of the existing manhole. The lining system shall be completely water tight and free of any joints or openings other than pipe inlets, pipe outlets and the rim opening. The junction of the lining material with the pipe material at the inlets and outlets shall be watertight.

B. Lining system shall be of the type that allows rehabilitation of a concentric, eccentric or flat top manhole without removing the manhole ring and top section or corbel.

1.3 SUBMITTALS

A. Submit the following as required in Section 01340 at least 14 days prior to starting manhole rehabilitation:

1. Manufacturers’ Certificate of Compliance certifying compliance with the applicable specifications and standards. The certifications shall list all materials furnished under this Section.
2. Certified copies of test reports of factory tests required by the applicable standards, the manufacturer, and this Section.
3. Manufacturer's handling, storage, and installation instructions and procedures.

4. Recommended lining thickness design to withstand groundwater pressure as specified in Part 3 of this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. The materials used shall be designed, manufactured and intended for sewer manhole rehabilitation and the specific application in which they are used. The materials shall have a proven history of performance in sewer manhole rehabilitation. The materials shall be delivered to the job site in original unopened packages and clearly labeled with the manufacturer's identification and printed instructions. All materials shall be stored and handled in accordance with recommendations of the manufacturer. All materials shall be mixed and applied in accordance with the manufacturer's written instructions.
2. The Contractor shall warrant and save harmless the Owner and his Engineer against all claims for patent infringement and any loss thereof.
3. Handle and store all materials and dispose of all wastes in accordance with applicable regulations.
4. Each lining system shall be designed for application over wet surfaces (but not active running water) without degradation of the final product and/or the bond between the product and the manhole surfaces.

B. Stopping active leaks in concrete and masonry manholes:

1. A premixed fast-setting, volume-stable waterproof cement plug consisting of hydraulic cement, graded silica aggregates, special plasticizing and accelerating agents. It shall not contain chlorides, gypsum's, plasters, iron particles, aluminum powder or gas-forming agents, or promote the corrosion of steel it may come in contact with. Set time shall be approximately 1 minute. Ten-minute compressive strength shall be approximately 500 psi.
2. A siliconate-based liquid accelerator field mixed with neat Portland cement. The set time shall be approximately 1 minute.
3. The elastomeric polyurethane resin-soaked method, using dry twisted jute oakum, or resin-rod with polyurethane resin (water activated).
4. Chemical grouts injected through the manhole wall or from the ground surface to the exterior for stopping very active infiltration in accordance with manufacturers recommendations.

C. Patching, repointing, filling, and repairing nonleaking holes, cracks, and spalls in concrete and masonry manholes:

1. A premixed nonshrink cement-based patching material consisting of hydraulic cement, graded silica aggregates, special plasticizing and accelerating agents, which has been formulated for vertical or overhead use. It shall not contain chlorides, gypsums, plasters, iron particles, aluminum powder, or gas-forming agents or promote the corrosion of steel it may come into contact with. Set time (ASTM C-191) shall be less than 30 minutes. One-hour compressive strength (ASTM C-109) shall be a minimum of 200 psi and the ultimate compressive strengths (ASTM C-882-Modified) shall be a minimum of 1700 psi.

D. Spray applied urethane or epoxy resin system manhole lining (Level C):

1. The material sprayed onto the surface of the manhole shall be a urethane (similar to Spraywall) or epoxy resin (similar to Warren Environmental Systems M-201 and S-301) system formulated for application within a sanitary sewer environment. The resin will exhibit suitable corrosion resistance and enhance the structural integrity of the existing manhole.
2. The cured urethane or epoxy resin or hybrid polyurea system shall conform to the following minimum structural standards:

CURED PRODUCT	TEST METHOD	URETHANE RESULTS	EPOXY RESULTS
Tensile Strength	ASTM D-638	7,000 psi	7,000 psi
Flexural Strength	ASTM D-790	12,000 psi	11,000 psi
Flexural Modulus	ASTM D-790	550,000 psi	500,000 psi
Compressive Strength	ASTM D-695	10,500 psi	12,000 psi

PART 3 - EXECUTION

3.1 REHABILITATION OF MANHOLE STRUCTURE

A. General Procedures:

1. Safety: The Contractor shall perform all work in strict accordance with all applicable OSHA, TOSHA, and manufacturer's safety standards. Each method of manhole rehabilitation in this Section requires some degree of manhole entry by workers. Particular attention is drawn to those safety requirements regarding confined space entry and respiratory protection from airborne particulate materials during cleaning and product mixing and application.
2. Cleaning: All concrete and masonry surfaces to be rehabilitated shall be clean. All grease, oil, laitance, coatings, loose bricks, mortar, unsound brick or concrete and other foreign materials shall be completely removed. Water blasting utilizing a 210^{o} F steam unit and proper nozzles shall be the primary method of cleaning; however, other methods such as wet or dry

sandblasting, acid wash, concrete cleaners, degreasers or mechanical means may be required to properly clean the surface. All surfaces on which these methods are used shall be thoroughly rinsed, scrubbed, and neutralized to remove cleaning agents and their reactant products. Debris resulting from cleaning shall be removed from the manhole and not allowed to be carried downstream.

3. Stopping Infiltration: After surface preparation and prior to the application of mortars and coatings, infiltration shall be stopped either by plugging with a water stop compound or chemical grout sealing. No separate payment will be made for stopping infiltration.
4. Patching: All large holes or voids around steps, joints or pipes, all spalled areas and all holes caused by missing or cracked brick shall be patched and all missing mortar repointed using a nonshrink patching mortar. All cracked or disintegrated material shall be removed from the area to be patched or repointed, exposing a sound subbase. All cracks not subject to movement and greater than 1/16 inch in width shall be routed out to a minimum width and depth of 1/2 inch and patched with nonshrink patching mortar.
5. Flow Control: The Contractor shall be responsible for plugging or diverting the flow of sewage as needed for repair and lining of manhole inverts and benches. Sewer flow shall be maintained in accordance with Section 02767 of these Specifications.
6. Remove all loose grout and rubble from existing channel. Rebuild channel if required by reshaping, repairing slope of shelves or benches. Work shall include aligning inflow and outflow ports in such a manner as to prevent the deposition of solids at the transition point. All inverts shall follow the grades of the pipe entering the manhole. Changes in direction of the sewer and entering branch or branches shall have a true curve of as large a radius as the size of the manhole will permit, but will be shaped to allow easy entrance of maintenance equipment including buckets, T.V. camera, etc.
7. Manhole steps: Inspect all manhole steps prior to rehabilitation. Report to the Engineer any steps which appear loose, deteriorated, broken, or otherwise unsafe. Unless directed otherwise, cut all loose, deteriorated, broken, or otherwise unsafe steps from the manhole.
8. Each lining system shall be installed in accordance with the manufacturer's recommendation to withstand groundwater pressures. For manholes greater than 12 feet in depth, the lining shall withstand the pressures associated with a groundwater depth equal to the manhole depth. Linings for all other manholes shall withstand the pressures associated with groundwater depth of 12 feet. Measure groundwater depth from manhole bench to top of ground surface.
9. Application of products shall be by factory certified applicators.

3.2 SPRAY APPLIED URETHANE RESIN SYSTEM (LEVEL C)

A. The urethane shall be sprayed onto the surfaces of the manhole walls, the benches, and invert to produce a smooth coating and yield the required structural integrity and corrosion resistance. A depth gauge shall be used during application at various locations to verify the required thickness.

B. The urethane resin shall be applied to a minimum thickness of 0.25 inches at the top of the manhole and gradually thickened, in accordance with manufacturer's recommendations, to withstand groundwater pressures.

C. The sloped surface of the manhole bench shall be made non-skid by broadcasting aluminum oxide, or sand into the surface prior to gelatin/set.

D. The Level C system shall be applied down to the low water line of the early a.m. flow depth in the invert for all sewers greater than 16-inch in diameter unless there are visible invert leaks. Visible invert leaks shall be stopped using chemical grout injection to the exterior as specified by paragraph 2.01 B. 4. of this Section. For sewers smaller than 16-inch in diameter or all manholes with invert leaks, the invert shall be fully applied.

3.3 SPRAYED APPLIED EPOXY RESIN SYSTEM (LEVEL C)

A. The epoxy resin shall be sprayed onto the surfaces of the manhole walls, the benches, and invert to produce a smooth coating and yield the required structural integrity and corrosion resistance. A depth gauge shall be used during application at various locations to verify the required thickness.

B. The epoxy resin shall be applied to a minimum thickness of 0.250 inches at the top of the manhole and gradually thickened, in accordance with manufacturer's recommendations, to withstand groundwater pressures. The application shall have a minimum of three hours cure time before being subjected to active flow.

C. The sloped surface of the manhole bench shall be made non-skid by broadcasting aluminum oxide, or sand into the surface prior to gelatin/set.

D. The Level C system shall be applied down to the low water line of the early a.m. flow depth in the invert for all sewers greater than 16-inch in diameter unless there are visible invert leaks. Visible invert leaks shall be stopped using chemical grout injection to the exterior as specified by paragraph 2.01 B. 4. of this Section. For sewers smaller than 16-inch in diameter or all manholes with invert leaks, the invert shall be fully applied.

3.4 MANHOLE REHABILITATION ACCEPTANCE

A. Test all rehabilitated manholes by observation during high groundwater conditions, following the manufacturer's recommendations for proper and

safe procedures. Any visible leakage in the manhole or structure, before, during, or after the test shall be repaired regardless of the test results.

B. If the manhole or structure fails the observation test, the Contractor shall perform additional repairs and repeat the test procedures until satisfactory results are obtained.

C. After the manhole rehabilitation work has been completed, the manhole shall be visually inspected by the Contractor in the presence of the Owner's Representative and the work shall be accepted if found satisfactory to the Owner's Representative. The finished surface shall be free of blisters, "runs" or "sags" or other indications of uneven lining thickness. No evidence of visible leaks shall be allowed. All manholes shall be inspected for final acceptance with color sewer television equipment and video taped (or CD or DVD) for full depth and circumference. All pipe openings shall be panned. A minimum of 30 days shall have elapsed from rehabilitation. In addition, at the Owner's request, the Contractor may be required within two years to visually inspect the manholes that were rehabilitated. Any work that has become defective within the two year period shall be redone by the Contractor at no additional expense to the Owner.

END OF SECTION

SECTION 02766

RELINING SANITARY SEWERS

PART 1 - GENERAL

1.1 Section Includes

A. Restoration of existing sanitary sewers by installation of a resin impregnated flexible felt tube into the existing sewer line utilizing a vertical inversion standpipe and hydrostatic head and curing by circulating hot water or other approved means to produce a hard, impermeable pipe.

1.2 References

A. Codes, Specifications, and Standards:

1. Codes, specifications, and standards referred to by number or title shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply, unless otherwise shown or specified.
2. All pipe materials incorporated in the project shall be approved by the Tennessee Department of Environment and Conservation for the application to be used, prior to receipt of bids.

B. American Society for Testing and Materials (ASTM) Standards:

D638 Test Method for Tensile Properties of Plastics.
D790 Test Methods for Flexural Properties of Un-reinforced and Reinforced Plastics and Electrical Insulating Materials.
D-2122 Determining Dimensions of Thermoplastic Pipe and Fittings.
D-2837 Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
F-1216 Rehabilitation of Existing Pipelines and Conduits by Inversion and Curing of a Resin-Impregnated Tube.
F-1743 Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe.

1.3 Submittals

A. Submit the following:

1. Manufacturer's Certificate of Compliance certifying compliance with the applicable specifications and standards.
2. Certified copies of test reports of factory tests required by the applicable standards and this Section.
3. Manufacturer's installation instructions and procedures.
4. Contractor's procedures and materials for service renewal including time and duration of sewer service unavailability.
5. Data, measurements, assumptions and calculations for sizing liners.

6. Field measurements (diameter, depth, ovality) at upstream and downstream manholes for sewers 21 inches and greater.
7. Sampling procedures and locations for obtaining representative samples of the finished liner.

B. A final certificate of compliance with this specification shall be provided by the manufacturer for all lining material furnished. Tests for compliance by an independent laboratory shall be made according to the applicable ASTM specification and the manufacturer's quality control program.

C. Furnish an extended warranty for liner materials from the Contractor and liner manufacturer for a total of 5 years from date of Final Completion.

1.4 Delivery, Storage, And Handling

A. The Contractor shall be responsible for the delivery, storage, and handling of products. No products shall be shipped to the job site without the approval of the Owner's Representative.

B. Keep products safe from damage. Promptly remove damaged products from the job site. Replace damaged products with undamaged products.

PART 2 - PRODUCTS

2.1 GENERAL

A. The finished pipe liner in place shall be fabricated from materials which when complete are chemically resistant to and will withstand internal exposure to domestic sewage having a pH range of 5 to 11 and temperatures up to 150ºF.

B. Take all necessary field measurements of the existing pipe (including diameter, ovality and length) prior to manufacturing liners.

C. The minimum length shall be that deemed necessary by the Contractor to effectively span the distance from the inlet to the outlet of the respective manholes unless otherwise specified. The Contractor shall verify the lengths in the field before manufacturing.

D. The liner thickness shall be sized for a minimum hydrostatic and earth load of 8.0 feet. The earth load and hydrostatic load shall be increased to the manhole depth for bury depths in excess of 8.0 feet unless otherwise noted as shown on the plans.

E. Unless specified otherwise, the liner shall be structurally designed for a minimum service life of 50 years; fully deteriorated host pipe/direct bury condition; prism loading; soil loading of 120 pcf; factor of safety of 2.0; 2% ovality; maximum deflection of 5%; soil modulus of 1000 psi; lining enhancement factor of 7 maximum; H-20 live loading; 50% long-term modulus reduction factor; and hydrostatic load at 27.4% of depth to invert.

1. For brick sewers, use 5% ovality or the actual ovality measured in the field, whichever is greater.
2. For sewer larger than 18-inches a partially deteriorated host pipe condition and an averaged full hydrostatic load to depth of invert.

F. The installed liner shall be furnished to the following minimum thickness:

Pipe Diameter (inch)	Depth of Sewer Invert (ft)	Cured-In-Place ASTM F1216 [1] Min. Thickness (mm)
6-inch [2]	0 to16’	3.0
8-inch	0 to 20’	6.0
10-inch	0 to 20’	6.0
12-inch	0 to 12’	6.0
12-inch	12 to 20’	7.5
15-inch	0 to 12’	7.5
15-inch	12 to 20’	9.0
18-inch	0 to 8’	7.5
18-inch	8 to 12’	9.0
18-inch	12 to 16’	10.5
18-inch	16 to 20’	12.0

[1] Based upon initial CIP modulus of 250,000 psi with 0.50 creep reduction factor.
[2] For services only.

G. The Contractor shall submit the structural design of the liner for sewers 21-inches in diameter and larger, subject to review by the Engineer.

1. Design may be based on material properties of the liner that exceed the minimum values specified in ASTM F1216. However, the initial flexural modulus used in structural design calculations shall not exceed 400,000 psi.
2. All other design criteria, loads, and conditions shall remain as specified in this section.

2.2 Cured-In-Place Liner

A. All cured-in-place lining products shall comply with ASTM F-1216 or ASTM F-1743 or intent thereof as determined by the Engineer, minimum finished liner thickness 6mm (except for services).

B. The flexible tube shall be fabricated to a size that when installed will neatly fit (minimum 99.75%) the internal circumference of the existing sanitary sewer lines (including services). Allowance shall be made for circumferential stretching during insertion so that the final cured product is snug against the wall of the host pipe.

C. Unless otherwise specified, the Contractor shall furnish a general purpose, unsaturated, polyester or thermosetting vinyl ester resin and catalyst system

compatible with the reconstruction inversion process that provides cured physical strengths specified herein.

2.3 Expanding Hydrophilic Rubber Joint Seal

A. The rubber joint seal shall be an extended hydrophilic rubber compounded from chloroprene (Neoprene) rubber and a hydrophilic resin, which expands upon contact with water.

B. The rubber joint seal shall be bonded with adhesive on one face to hold it in place during assembly.

C. On contact with water, the rubber shall swell up to 8 times its original volume if necessary and mold itself to completely fill any gaps and exert pressure evenly to ensure the seal. High compression or bolt up forces shall not be necessary to effect a complete and watertight seal.

D. The Contractor may propose alternative sealing materials or products in lieu of a hydrophilic rubber joint seal. This is provided the alternative will result in a positive seal between the liner and the existing host sewer pipe to ensure no groundwater tracking through the annulus space into a manhole. Any alternative must be approved by the Engineer prior to installation.

PART 3 - EXECUTION

3.1 Preparation

A. The following installation procedures shall be adhered to unless otherwise approved by the Owner's representative.

1. The Contractor shall carry out his operations in strict accordance with all OSHA, TOSHA and manufacturer's safety requirements. Particular attention is drawn to those safety requirements involving entering confined spaces.
2. It shall be the responsibility of the Contractor to remove all internal debris and clean the existing sewer line prior to installation of the liner. Cleaning and disposal of material shall be performed in conformance with Section 02762 - Sanitary Sewer Cleaning and Inspection.
3. The Contractor shall mark the live sewer connections on the surface with paint and/or stakes and determine if surface obstructions conflict with excavation and renewal. Advise the Owner minimum 24 hours prior to lining to determine potential relocation of the opening. Openings in conflict with surface obstructions reinstated and not approved by the Owner's site representative may be required to be internally patched at the Contractor's expense if relocated as directed by the Owner to avoid conflict.
4. Inspection of existing sewer lines shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by closed circuit television. The interior of the line shall be carefully inspected to determine the location of any conditions that may prevent

proper installation of the liner pipe into the lines, and such conditions shall be noted so they can be corrected. A video and suitable log shall be kept for later reference by the Owner as specified in Section 02762 - Sanitary Sewer Cleaning and Inspection.

5. The Contractor shall provide for the flow of sewage around the section or sections of pipe designated for lining as specified in Section 02767 - Sewer Flow Control.
6. The Contractor shall clear the line of obstructions such as solids, dropped joints, protruding service connections or collapsed pipe that will prevent the insertion of the liner pipe, as noted on the Drawings and TV Logs attached. If inspection reveals an obstruction that cannot be removed by conventional sewer cleaning equipment, the Contractor shall make a point repair excavation to uncover and remove or repair the obstruction prior to lining. Pre-lining point repairs will be paid for at the unit prices bid.
7. Hydrophilic rubber joint seals shall be installed around the liner at all manhole connections for all lining products.
8. Do not install liner if ground water temperatures and/or ambient temperatures are excessive for the product installation procedures.

B. If not previously rehabilitated, all manholes connected to sewer segments being relined shall be rehabilitated in accordance with Section 02765 - Sanitary Sewer Manhole Rehabilitation.

C. All services connected to a manhole that is rehabilitated shall be renewed.

D. Where practicable, liners can be installed in continuous runs through manholes where there are two or more continuous sewer segments, especially to connect several short segments with a continuous lining.

3.2 INSTALLATION

A. General:

1. Alternative methods of liner insertion, pressurization, and processing may be used for products and processes approved by the State of Tennessee Department of Environment and Conservation and when the final liner product meets the intent of ASTM installation procedures as determined by the Engineer. Installation shall be in accordance with manufacturer's recommendations, which shall be available for verification by the inspector.
2. Install hydrophilic rubber joint seal around all liners at all manhole inlet and outlet connections.
3. Seal the area where the line enters or leaves each manhole. Finish the inside of the manhole with a quick set cement grout to raise the invert to the grade of the liner pipe. Also use this grout to dress up around the end of the liner. This space may be sealed with a mechanical seal, chemical seal, or combination of both. The chosen method must be approved by the Engineer.

4. If the pipe liner fails to make a tight seal due to broken or misaligned pipe at the manhole wall or other reason, the Contractor shall apply a seal at that point. The seal shall be approved by the Engineer.
5. The temperature of water discharged to the sewer system from processing liners shall not exceed 150°F maximum or the level allowed by State or local standards.
6. After the liner has been installed, all active, existing services shall be temporarily reinstated to 95% of the original opening. This shall be done without excavation in pavement areas, and in the case of non-man-entry pipes, from the interior of the pipeline by means of a 360° television camera and a cutting device that re-establishes the service connection. When a remote cutting device is used and a cleanout is available, then a mini-camera down the service shall also be used to assist the operator in cutting or trimming.
7. At all points where the liner pipe has been excavated and exposed (e.g., in access shafts, service connections, etc.), prepare for the placement of a crushed stone backfill by removing all debris and creating a void below and around the pipe. The width of this void shall not exceed 4/3 of the liner's outside diameter plus 15", or 4/3 of the service line's outside diameter plus 15". Use a minimum of 6" of ½" to ¾" crushed stone to provide bedding for the liner and service line. Then place a backfill of crushed stone to a height of 6" above the liner and service line. Provide the rest of the backfill from 6" above the pipe to grade as specified in Section 02220 - Excavation, Backfilling, Compaction. Replace pavement removed during excavation in accordance with the requirements of Section 02514 - Portland Cement Concrete Paving and Section 02575 - Pavement Repair as applicable.

B. Cured-In-Place Liner:

1. The Contractor shall designate a location where the reconstruction tube will be vacuum impregnated prior to installation. The Contractor shall allow the Owner to inspect the materials and "wet out" procedure. A catalyst system compatible with the resin and reconstruction tube shall be used. Sufficient excess resin will be provided to insure a mechanical bond with the host pipe after curing.
2. The wet out reconstruction tube shall be inserted through an existing manhole or other approved access by means of an inversion process and the application of a hydrostatic head sufficient to fully extend it to the next designated manhole or termination point. The reconstruction tube shall be inserted into the vertical inversion standpipe with the impermeable plastic membrane side out. At the lower end of the inversion standpipe, the reconstruction tube shall be turned inside out and attached to the standpipe so that a leak-proof seal is created. The inversion head will be adjusted to be of sufficient height to cause the impregnated tube to invert from manhole to manhole and hold the tube tight to the pipe wall, produce dimples at side connections and flared ends at the manholes. The use of a lubricant is recommended. Care shall be taken during the elevated curing temperature so as not to overstress the felt fiber.

3. After inversion is completed the Contractor shall supply a suitable heat source and water recirculation equipment. The equipment shall be capable of delivering hot water throughout the section by means of a prestrung hose to uniformly raise the water temperature above the temperature required to effect a cure of the resin. This temperature shall be determined by the resin/catalyst system employed.
4. The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing water supply. Another such gauge shall be placed between the impregnated reconstruction tube and the pipe invert at the remote manhole to determine the temperatures during cure. Water temperature in the line during the cure period shall be recommended by the resin manufacturer.
5. Initial cure shall be deemed to be completed when inspection of the exposed portions of cured pipe appear to be hard and sound and the remote temperature sensor indicates that the temperature is of a magnitude to realize an exotherm. The cure period shall be of a duration recommended by the resin manufacturer, as modified for the cured-in-place inversion process, during which time the recirculation of the water and cycling of the heat exchanger to maintain the temperature continues.
6. The Contractor shall cool the hardened pipe to a temperature below 100° F before relieving the static head in the inversion standpipe. Cool-down may be accomplished by the introduction of cool water into the inversion standpipe to replace water being drained from a small hole made in the downstream end discharging to the sewer. Care shall be taken in the release of the static head so that a vacuum will not be developed that could damage the newly installed pipe.

C. Service Lateral Renewal

1. Renew all service laterals to the property or easement line per method shown on the Drawings. Trenchless service lateral lining shall be similar to and compatible with the cured-in-place mainline. Excavated and replaced services shall be replaced with approved epoxied-on-saddle and 6" PVC pipe per Section 02763 - Gravity Sewer Rehabilitation.
2. Renewed service laterals shall consist of continuous lining or manufactured PVC pipe with bell and spigot joints.
3. If existing conditions for services under pavement areas prohibit trenchless service lateral lining, services may be renewed by excavation, only if approved by the Engineer on an individual basis.
4. If an existing, active sanitary sewer service lateral cannot be relined or replaced, internally reinstate the service opening to 100% after the mainline liner has fully cured. The finished opening shall be smooth with no ragged edges and shall prevent clogging or blockages. Install a internal seal "top hat", short service liner, or approved liner to seal the service a distance from the main. No cleanout will be required.

3.3 Post Installation

A. Where liners of any type are installed in two or more continuous manhole segments, the liner invert through the intermediate manholes shall be left intact.

Final finishing of the installation in those intermediate manholes shall require removal of the top of the exposed liner and neat trimming of the liner edge where it touches the lip of the manhole bench.

B. Portions of any piece of liner material removed during installation shall be available for inspection and retention by the Owner or the Engineer.

C. Reinstate openings for all drop assemblies after relining mainline sewer. All outside drop assemblies shall be lined with a cured-in-place liner compatible with the mainline liner, unless existing conditions prohibit lining the full length of the drop assembly. The vertical pipe shall be lined, at a minimum. Drop assemblies inside of manholes are not required to be relined, unless directed by the Engineer.

D. Each line segment lined shall be TV inspected as soon as practical after processing to assure complete curing or reforming. Segments not fully conforming to these Specifications must be immediately brought to the Engineer's attention with a proposed method of correction.

E. Each relined service shall be televised within 2 hours of lining with a mini-camera through the inspection tee to verify full opening, and no liner collapse.

3.4 Testing

A. After completing lining, service renewals, and manhole rehabilitation/replacement, every liner and manhole shall be TV inspected in accordance with Section 02762 as soon as practical to verify proper installation.

B. After installation, perform a test on the sewer line to determine if it is watertight, including renewed services to the inspection tee.

1. Furnish all necessary equipment to conduct the test. An acceptable method is a low-pressure air test, conducted as follows:
2. Pressurize the test section to 4.0 psi and hold above 3.5 psi for not less than 2 minutes. Add air if necessary to keep the pressure above 3.5 psi. At the end of this 2-minute stabilization period, note the pressure (must be 3.5 psi minimum) and begin the timed period. If the pressure drops 0.5 psi in less than the time given in the table below, the section of pipe shall have failed the test.

Sewer Size (Inches)	Minimum Test Time/100 ft. (Seconds)
8	72
10	90
12	108
15	126
18	144
21	180
24	216

3. When the prevailing groundwater is above the sewer being tested, test pressure shall be increased 0.43 psi for each foot that the water table is above the invert of the sewer.
4. If the time for the pressure to drop 0.5 psi is 125 percent or less of the time given in the table, the line shall immediately be re-pressurized to 3.5 psi and the test repeated.
5. Services reinstated before the air test shall be considered part of the pipe to which they are connected and no adjustment of test time shall be allowed.
6. The pressure gage used shall be supplied by the Contractor and have minimum divisions of 0.10 psi and be oil filled.
7. CIPP lined services on liners installed under other contracts or unlined segments may be individually air tested for acceptance on main sewers 8-inch to 18-inch in diameter. CIP lined services on liners installed under other contracts or unlined segments on main sewers greater than 18-inch in diameter may be visually inspected only from the main and through the service, if groundwater is present over the main sewer. Individually tested services must encompass the full "seating" area of any CIPP service in the main. The pressure shall be 3.5 PSI for one minute after a thirty-second stabilization period at 3.5 PSI. Payment for individual service testing shall be merged into the unit price for trenchless service installation.

C. For sewers 21 inches to 36 inches in diameter, an alternative testing method may be used, as specified below.

1. After the liner is fully cured and completely cooled to ambient temperature, plug both ends of the liner and fill with water. All air shall be bled from the line.
2. Fill the liner with water to at least 2 feet above the sewer crown or 2 feet above existing groundwater, whichever is higher. Hold the water level constant for at least 30 minutes, adding water as necessary. Measure and record duration and quantity of water added.
3. The allowable water exfiltration rate shall not exceed 25 gallons per day per inch-diameter per mile of sewer.
4. Submit written records to the Engineer documenting the results of the exfiltration test for each segment. The record shall show, at a minimum, sewer size, manhole numbers, sewer length, duration of test, quantity of water added, and the measured exfiltration rate in gpd/inch - diameter/mile.
5. In addition, provide a high quality color video of the completed liner. The video shall clearly show the full internal circumference of the liner and shall be made with flow in the line less than 2 inches deep.

D. The Owner shall have an independent testing lab analyze finished liner samples taken from manhole cutoffs, service coupons, etc. Samples shall be furnished directly to the Engineer within 24 hours (or less) after installation.

1. A minimum of 2 samples shall be taken of the first segment installed.

2. A sample shall be taken for each liner insertion or inversion on the project. Multiple segment insertions/inversions from one manufacturing lot require one (1) sample unless in excess of 1,200-feet for which two (2) must be taken.
3. A minimum of 6 samples per project shall be taken for each type of liner furnished.
4. Tests in accordance with ASTM standards for Tensile Properties, Flexural Modulus and wall thickness shall be conducted.
5. The Contractor shall determine sampling location and procedures to ensure representative samples are obtained from the finished liner, subject to approval by the Engineer.
6. The Contractor shall furnish removable sizing sleeves to collect liner samples, which accurately replicate the host pipe diameter.

3.5 Acceptance

A. It is the intent of these specifications that the completed liner with all appurtenances shall be essentially equivalent in final quality and appearance to new sewer installation.

B. The finished liner shall be continuous over the entire segment between manholes and homogenous throughout.

C. The finished liner shall be fully rounded and as free as commercially practicable from visible defects, including but not limited to damage, deflection, holes, delamination, ridges, cracks, uncured resin, foreign inclusions or other objectionable defects.

D. There shall be no visible infiltration through the liner, around the liner at manhole connections, at service connections, in services, or in cleanouts. Contractor shall repair any visible leaks, regardless of the results of leakage testing.

E. Where a defect in the liner requires removal of a section of the liner, in the Engineer's opinion, the Contractor shall make all repairs as required by the Engineer and shall install a segmental liner, compatible with the liner, to accomplish a continuous finished liner. No separate payment will be made for such defect repair or for the post-repair segmental liner.

3.6 Clean-Up and Restoration

A. The Contractor shall not allow the site of the work to become littered with trash and waste material, but shall maintain the site in a neat and orderly condition throughout the construction period.

B. On or before completion, the Contractor shall clean and remove from the site of the work all surplus and discarded materials, temporary structures, stumps and portions of trees, and debris of any kind. He shall leave the site of work in a neat and orderly condition, similar or equal to that prior to construction.

C. Upon completion of cleanup and backfill operations and before final acceptance by the Owner, the Contractor shall replace and/or restore any trees, shrubbery, fences, driveways, sidewalks, culverts, bridges, houses or buildings and all water, sewer, gas, telephone and electrical lines thereto, and all other private and public property along or adjacent to the work that may have been disturbed by construction operations.

D. All private and public property along or adjacent to the work disturbed by construction operations shall be restored to a condition similar or equal to that existing prior to construction.

E. Before final acceptance by the Owner, the Contractor shall replace and/or restore any water, sewer, drain, and gas lines and appurtenances; electrical, telephone, telegraph conduits and wires, both underground and aboveground, and appurtenances; traffic signals, fire and police alarm systems and appurtenances; sidewalks, curbs, gutter, drainage ditches and pavements and all other public utility facilities and appurtenances along or adjacent to the work that may have been disturbed by construction operations.

F. Any repairs required because of unsatisfactory backfill operations shall be at the expense of the Contractor.

G. Immediately upon completion of each individual sewer line, the Contractor shall begin and prosecute to completion the sanitary service renewals, manhole rehabilitation, testing, and the cleanup and property restoration for this effort. This shall be done prior to the start of another line, unless a written permission is obtained from the Owner or Engineer to begin another line. This permission will only be given if the following conditions and situations exist.

   The Contractors maintain a sufficient cleanup crew on the project at all times, weather permitting, and that the progress shall be at least equal to the pipe lining and service renewal progress on the project.

H. Conditions permitting, property cleanup and restoration shall being and be prosecuted to completion on a timely basis as set forth herein.

3.7 Patents

A. The Contractor shall warrant and save harmless the Owner and Engineer against all claims for patent infringement and any loss resulting therefrom.

3.8 Private service line shutdown

A. When it is necessary to shutdown a private sewer service line while work is in progress and before the service lines are reconnected, the residents are to be notified by the Contractor at least one week prior to the shutdown. No sewer or water service is to remain shutdown for more than a period of eight (8) hours unless the Contractor provides substitute services for the residents. Commercial sewer services shall be maintained at all times that the business is open. No sewage from the services or main line shall be allowed to be discharged on the

ground or in waterways. Holding pits or tanks are not allowed unless permitted by TDEC.

3.9 Prosecution of Work

A. The Contractor is cautioned that only those sewer services that are live and active shall be repaired or reinstated after the sewer main has been lined or replaced.

B. The Contractor shall note that not all sewer lines segments have been televised in their entirety due to obstructions blocking further entry, etc. These obstructions shall be cleared to allow TV viewing of the entire segment length before lining is commenced.

C. The number of service connections on some sewer segments may exceed the number of buildings actually served. It is the Contractor's responsibility to determine through dye testing, or other acceptable methods, the services that are live and require reinstatement prior to commencing lining of the sewer main. Services that are confirmed to be inactive shall not be reconnected. Services that are inactive, but reinstated, shall be plugged at the Contractor's expense.

D. Inactive services to vacant parcels shall not be renewed, unless directed by the Engineer.

END OF SECTION

SECTION 02767

SEWER FLOW CONTROL

PART 1 - GENERAL

1.1 General

A. Sewer flow control may be required to conduct the sewer line replacement, television inspection, sewer line testing, and sewer line sealing operations effectively. In general, flow control will be required when sewer line flows are more than 1/3 of the pipe diameter.

B. The Contractor shall ensure:

1. All temporary sewer bypass pumping activities for the work are completed in full compliance with the local, state and federal requirements, and no water quality or quantity compliance issues are encountered.

2. No illicit pollutant discharges to (or to a location that would create contaminated water runoff to) a storm sewer, a stormwater conveyance, or a water body shall occur.

3. All temporary sewer bypass pumping activities for the work are completed in full compliance with state and U.S. EPA regulations, and no water quality or quantity compliance issues are encountered.

C. No discharge of sewage or debris shall be released to the environment. Should the Contractor's actions cause a sewage or debris overflow or bypass to the environment, site cleanup will be the Contractor's responsibility consistent with regulatory requirements. All overflow or bypass environmental cleanup activities shall be immediately commenced and prosecuted continuously by the Contractor. Any associated fines or penalties enacted by local or state regulatory agencies, the U.S. EPA, and/or any other regulatory groups or programs will be borne solely by the Contractor.

1.2 Quality Assurance

A. Perform leakage and pressure tests on discharge piping using clean water, before operation. Notify Engineer 24 hours prior to testing.

B. Maintain and inspect temporary pumping system every two hours. Responsible operator: on site when pumps are operating.

C. Keep and maintain spare parts for pumps and piping on site, as required.

D. Maintain adequate hoisting equipment and accessories on site for each pump.

PART 2 - PRODUCTS

2.1 Materials

A. Discharge and Suction Pipes: Approved by Engineer.

1. Discharge piping: Determined according to flow calculations and system operating calculations.

2. Suction piping: Determined according to pump size, flow calculations, and manhole depth following manufacturer's specifications and recommendations.

B. Polyethylene Plastic Pipe:

1. High density solid wall and following ASTM F714 Polyethylene (PE) Plastic Pipe (SDR-DR) based on Outside Diameter, ASTM D1248 and ASTM D3550, with a minimum pressure rating of 2.5 times the total dynamic pump head.

2. Homogenous throughout, free of visible cracks, discoloration, pitting, varying wall thickness, holes, foreign material, blisters, or other deleterious faults.

3. Defective areas of pipe: Cut out and joint fused as stated herein.

4. Assembled and joined at site using couplings, flanges or butt-fusion method to provide leak proof joint. Follow manufacturer's instructions and ASTM D 2657.

a. Threaded or solvent joints and connections are not permitted.
b. Fusing: By personnel certified as fusion technicians by manufacturer of HDPE pipe and/or fusing equipment.
c. Butt-fused joint: True alignment and uniform roll-back beads resulting from use of proper temperature and pressure.
d. Allow adequate cooling time before removal of pressure.
e. Fused joints shall be watertight and have tensile strength equal to that of pipe.

5. Use in streams, storm water culverts and environmentally sensitive areas.

C. Flexible Hoses and Associated Couplings and Connectors.

1. Abrasion resistant.

2. Suitable for intended service.

3. Rated for external and internal loads anticipated, including test pressure.

a. External loading design: Incorporate anticipated traffic loadings, including traffic impact loading.
b. When subject to traffic loading, compose system, such as traffic ramps or covers.
c. Install system and maintain H-20 loading requirements while in use.

D. Valves and Fittings: Determined according to flow calculations, pump sizes previously determined, and system operating pressures.

E. Plugs: Selected and installed according to size of line to be plugged, pipe and manhole configurations, and based on specific site.

1. Additional plugs: Available in the event a plug fails. Plugs will be inspected before use for defects which may lead to failure.

F. Aluminum “irrigation type” piping or glued PVC piping will not be permitted.

G. Discharge hose will only be allowed in short sections when approved by Engineer. Hoses shall have no leaks, and all couplings shall be quick connecting with gaskets.

2.2 Equipment

A. All equipment used for bypass pumping shall be specifically designed for intended purpose. All piping, pumps, etc. in contact with sanitary sewage shall be manufactured with materials designed for use in a sewage environment.

B. All pumps used shall be fully automatic self-priming units which do not require foot valves or vacuum pumps in the priming system.

C. The pumps shall be electric, hydraulic, or diesel powered. Gasoline powered pumps may be used for bypass pumping of short segments for a limited duration (10 hours or less).

D. All pumps used shall be constructed to allow dry running for long time periods to accommodate cyclical nature of wastewater flows.

E. Above-ground pumps and/or power units shall be located inside a temporary portable berm to contain any fuel or sewage that may spill during the normal course of operation.

F. The multiple pump header system shall have check valves to facilitate pump removal, service, and/or replacement while the system remains operational.

G. All above ground pumps and/or power units shall be equipped with sound attenuation measures which reduce noise levels to 75-decibels maximum at a 30-foot distance from the equipment during all operation periods. If equipment is operated between 8:00 PM and 6:00 AM, this equipment shall also be provided with a sound attenuation 3-sided enclosure including a roof constructed of 2 x 4 lumber frame with 1/2-inch plywood sheathing and 2inch extruded polystyrene foam panels attached to the inside of the entire enclosure. The enclosure shall be portable to allow the enclosure to be moved when bypass pumping

equipment is moved.

H. The discharge location (the point where the bypass main reenters the gravity sewer system) shall be constructed with adequate sealant materials to minimize sewer gas and odor release to the maximum extent possible.

2.3 Design Requirements

A. Provide bypass sewage pumping, as required, around the section in which work is to be performed. Bypass pumping shall be the Contractor's full responsibility. The bypass system shall be a sufficient capacity to handle 2.0 times the peak flow, as provided by Owner for trunk lines, of the pipeline section being bypassed. Bypass pumping systems shall be designed to operate 24 hours per day.

B. Provide pipeline plugs and pumps of adequate size to handle peak flow, and temporary discharge piping to ensure total flow of main can be safely diverted around section to be repaired.

PART 3 - EXECUTION

3.1 Plugging or Blocking

A. Insert a sewer line plug into the line at a manhole upstream from the line segment that is to be inspected, tested, and sealed. The plug shall be designed so that a portion of the sewage flow can be released. During the inspection portion of the operation, shut off or substantially reduce flows so that the pipe can be properly inspected. During the sewer line testing and/or sealing, restore flows to normal, or to not more than 1/3 of the pipe diameter.

3.2 BYPASS PUMPING

A. When bypass pumping is required to ensure the completion of the replacement, inspection, testing, and sealing work, furnish pumping equipment, conduit, etc. Conduct pumping operations from manhole to manhole, and discharge no flow on the surface or in natural waterways.

B. At least 4 weeks prior to the desired start date of construction requiring bypass pumping, submit a detailed description of the method proposed for bypass pumping to the Owner for review and approval. The description shall include all materials and equipment to be used, personnel, spare equipment, and sketches showing proposed pump-around setups. No work shall commence until the Owner approves.

C. Bypass pumping equipment shall include pumps, conduits, engines, and related equipment necessary to divert sewage flow around the section in which work is to be performed. Backup pumps shall be online and isolated from the primary system by valves. Include 100% mechanical redundancy installed online with a float or ultrasonic type system to switch to the standby system automatically if the primary system fails.

D. Piping redundancy may be required for relatively long bypass piping lengths or large diameter bypass pipes as deemed necessary by the Owner. Special design considerations shall be made for pump suction lifts greater than 23 feet.

E. Make all arrangements for bypass pumping when the main is shut down for any reason. The system shall overcome any existing force main pressure on discharge.

F. Suction and discharge points shall only be located at manholes.

G. If at any time the Contractor is unable to properly bypass pump the sewage, construction will be stopped until the Contractor can continue work in an acceptable manner. Additional contract time for delays caused by improper equipment, labor, or breakdowns will not be considered.

H. Service shall be maintained at all times. Surcharges due to plugging the sewer line for bypass pumping shall be maintained to prevent service backups and overflows at any point in the system.

I. For rehabilitation projects, hose may be used for short runs with the Engineer's approval. If the anticipated bypass time exceeds 48-hours, use hard piping only. If using hose and the bypass time reaches 48-hours, the Contractor may either install hard piping to accomplish the bypass or restore flow until an approved bypass method can be employed. No modifications to the bypass system shall be made without Owner's approval.

J. The bypass or diversion pumping system shall be able to pump all the sewage in the existing line under all weather and seasonal conditions. All pumping equipment to be used shall be submitted to the Engineer for review and approval.

K. Bypass pumping systems are required to be operated and continuously monitored 24-hours per day for flow diversion.

L. For mains being lined, the bypass pumping must be done one manhole upstream and continue for one manhole downstream of the line being rehabilitated in order to use flow through plugs at the insertion and end points. The liner bag may not be used as part of the bypass pumping system or as a plug in the line.

M. For bypass or diversion pumping in overnight operations greater than 2 days, provide and maintain portable lighting systems as needed for monitoring and operation activities at the bypass pumping site(s).

N. The temporary diversion pumping system shall be placed in operation prior to the commencement of work in the areas being bypassed. Minimum times of operation prior to the commencement of work are 1 hour for small diameter CIPP lining and 4 hours for any other major system work such as trunk sewer diversion, large diameter sewer lining, or pumping station work.

O. Protect the bypass lines from damage in the areas of backhoe and excavation operations.

P. Provide the necessary stop/start controls and a visual alarm indicating a pump malfunction for each pump. Each pump shall have a 0-30 inch Hg vacuum gauge on the inlet and a 0-60 psi pressure gauge on the outlet.

Q. Preparation

1. Determining location of bypass pipelines.

a. Minimal disturbance to existing utilities.

b. Field locate existing utilities in proposed bypass area.

2. Obtain approvals for placement within public or private property.

3. Obtain Owner's approval of location.

R. Performance Requirements

1. It is essential for operating the existing system being bypassed that no interruptions in the flow occur throughout the project's duration. Provide, maintain, and operate all temporary facilities such as dams, plugs, pumping equipment (primary and backup units as required), conduits, all necessary power, and all other labor and equipment necessary to intercept the incoming flow before it reaches the point where it would interfere with the work, carry it past the work area, and return it to the existing system downstream of the work.

2. The temporary pumping system's design, installation, and operation shall be the Contractor's responsibility. The bypass system shall meet all codes and requirements for regulatory agencies having jurisdiction.

3. Provide all necessary means to safely convey the sewage past the work area. The Contractor will not be permitted to stop or impede the sewer main flows under any circumstances.

4. No flow diversion around the work area shall be performed in a manner that will cause damage to or surcharging of the existing system. The diversion shall protect public and private property from damage and flooding.

a. Protect water resources, wetlands, and other natural resources.

S. Installation and Removal

1. Remove manhole sections or make connections to existing sewer and construct temporary bypass pumping structures at access location indicated on Drawings and as required to provide adequate suction conduit.

2. Plugging or blocking of sewage flows shall incorporate a primary and secondary plugging device. When plugging or blocking is no longer needed for performance and acceptance of work, remove in a manner that permits

the sewage flow to slowly return to normal without surge, to prevent surcharging or causing other major disturbances downstream.

3. When working inside manhole or force main, exercise caution. Follow OSHA, Local, State and Federal requirements. Take required measures to protect workforce against sewer gases and/or combustible or oxygen-deficient atmosphere.

4. Installation of Bypass Pipelines:

   a. Bypass pipeline installation is prohibited in all wetland areas.

   b. Pipeline may be placed along shoulder of roads. If in easements, the bypass pipeline shall be within the easement area acquired for the project.

      i. Do not place in streets or sidewalks.

   c. When bypass pipeline crosses local streets and private driveways, place in roadway ramps.

      i. When roadway ramps cannot be used, place bypass in trenches and cover with temporary pavement as approved by Engineer.

   d. During bypass pumping operation, protect sewer lines from damage inflicted by equipment.

   e. Upon completion of bypass pumping operations, and after the receipt of written permission from Engineer, remove piping, restore property to pre-construction condition and restore pavement.

5. Field Quality Control and Maintenance

   a. Testing: Prior to actual operation, test the bypass pumping discharge hard piping system for leaks and pressure using clean water. Bypass hard piping shall be hydrostatically tested following each setup and prior to flow diversion or bypass to a minimum pressure 2.5 times the pump(s) total dynamic head. The Engineer shall be given a 24-hour notice prior to testing.

   b. Inspection: Inspect the bypass pumping system on a continuous basis to ensure the system is working properly. A daily checklist for physically inspecting the piping shall be required. The checklist shall contain all bypass pumping system components and shall be specifically developed to address aspects for the individual project. The daily checklist shall be submitted to and approved by the Engineer. The completed daily checklists will be maintained, available for review, and on-site for the project's duration.

c. Maintenance Service: Ensure the temporary bypass pumping system is properly maintained and that a responsible operator shall be readily available at all times when pumps are operating.

d. Monitoring

i. During bypass pumping, continuously monitor all bypass pumping system components.

ii. A telemetry system or designated personnel to maintain 24-hour onsite monitoring shall be required to alert the Contractor to system malfunctions or high liquid levels in manholes.

iii. If bypass pumping activities are conducted near state waters or in other situations where a potential exists for a sewage release to potentially enter state waters by other than direct means, an in-line stream monitoring system shall be used to measure real-time conductivity and dissolved oxygen (DO) concentrations in 30-minute intervals at a minimum. The system shall be mounted in the receiving stream in the immediate downstream area(s) adjacent to the location(s) of the bypass piping system discharge to the gravity conveyance system. The system shall have web-portal capabilities with alarm functions for conductivity and DO. The alarm function shall be equipped with battery power and solar charging provisions and shall be able to send email and text messaging alarms to at least five devices.

e. Additional Materials

i. Spare parts for pumps and piping shall be kept on site as required.

ii. Adequate hoisting equipment for each pump and accessories shall be maintained on site.

iii. Keep an HDPE fusion machine on site for the duration of bypass pumping to facilitate immediate repairs to hard piping.

3.3 Liability

A. The Contractor shall be responsible for damages to private or public property that may result from his sewer flow control operations.

END OF SECTION

SECTION 02955
SANITARY SEWER PIPE BURSTING WITH
HIGH-DENSITY POLYETHYLENE PIPE

PART 1. GENERAL

1.1 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society for Testing and Materials (ASTM):

a. D1248, Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
b. D2657, Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
c. D3034, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
d. D3035, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR PR) Based on Controlled Outside Diameter.
e. D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
f. D3350, Standard Specification for Polyethylene Plastic Pipe and Fittings Materials.
g. F585, Standard Practice for Insertion of Flexible Polyethylene Pipe into Existing Sewers.
h. F714, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR PR) Based on Outside Diameter.

2. Plastic Pipe Institute (PPI).

3. Guideline for Pipe Bursting published by IPBA International Pipe Bursting Association, a Division of NAASCO (latest edition, January 2012).

1.2 DEFINITIONS

A. CCTV: Closed-circuit television.

B. DVD: Digital Video Disc.

C. SDR: Standard Dimension Ratio.

1.3 SUBMITTALS

A. Action Submittals:

1. Catalog cuts and specifications:
a. Pipe.
b. Electrofusion fittings.

c. Joining equipment.

2. Dimensioned drawings including, installation details and sketches.

B. Informational Submittals:

1. Manufacturer's Certificates:

a. Certificate of material compliance.
b. CONTRACTOR Certifications:

1) Certifications of training by pipe bursting system manufacturer stating that operators have been fully trained in the use of the pipe bursting equipment by an authorized representative of the equipment manufacturer.

2) Certification from pipe manufacturer of training in the proper method for handling and installing the new pipe.

3) Certifications of training by the pipe fusion equipment manufacturers that the operators have been fully trained in the use of the fusion equipment by an authorized representative of the equipment manufacturer.

2. Test Results: Provided by certified factory.

3. Installation Instructions:

a. Detailed construction procedures, and layout plans to include sequence of construction.
b. Locations, sizes and construction methods for the service reconnection pits.
c. Methods of construction, reconnection and restoration of existing service laterals.
d. Detailed descriptions of the methods of modifying existing manholes.
e. Detailed procedures for the installation and bedding of the new pipe in the launching and receiving pits.
f. Description of the method to remove and dispose of the host pipe, if required.

4. Sewer Bypass Plan: Methods and list of equipment to be utilized, including:

a. Emergency response plan to be followed in event of bypass pumping system failure.
b. Backup bypass pump on construction site for the main sewer and sewer service laterals.

5. Contingency Plan: Provide for the following potential conditions at a minimum:

a. Unforeseen obstruction causing burst stoppage, such as unanticipated change in host pipe material, repair section, concrete encasement or cradle(s), buried or abandoned manhole or changes in direction not depicted on Drawings provided by the OWNER.
b. Substantial surface heave occurs due to the depth of the existing pipe versus the amount of upsizing.
c. Damage to existing service connections or to the replacement pipeline's structural integrity.
d. Damage to other existing utilities.
e. Soil heaving or settlement.
f. Loss of and return to line and grade.

6. DVD Documentation:
   a. Preinstallation DVD, original.
   b. Post-installation DVD, original.

1.4 QUALITY ASSURANCE

A. The CONTRACTOR shall be certified by pipe bursting system manufacturer as a fully trained user of the pipe bursting system. Operation of the pipe bursting system shall performed by trained personnel. Such training shall be conducted by a qualified representative of the pipe bursting system manufacturer. The CONTRACTOR shall provide certificates of training for any employee directly involved in the supervision or operation of the pipe bursting system.

B. Polyethylene pipe jointing shall be performed by personnel trained in the use of butt-fusion equipment and the recommended methods for new pipe connections. Personnel directly involved with installing the new pipe shall receive training in the proper methods for handling and installing the polyethylene pipe. Such training shall be certified and conducted by a qualified representative of the pipe manufacturer.
C. Installation of other materials shall be performed by personnel qualified by the specific product manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping:

1. Markings: Pipe materials shall be legibly marked by manufacturer with the following:

   a. Name and trademark of manufacturer.
   b. Nominal pipe size.
   c. SDR.
   d. Letters PE, followed by polyethylene grade per ASTM D1248, followed by Hydrostatic Design Basis in hundreds of psi.
   e. Manufacturing standard reference.
   f. Production code from which date and place of manufacture

can be determined.

B. Acceptance at Site:

1. After unloading and before installation, inspect pipe to verify its condition. Pipe condition inspection report shall be reviewed by OWNER prior to installation.

2. Unload and store pipe to ensure that pipe is not cut, gouged, scored, or otherwise damaged. Pipe segments with pipe wall cuts exceeding 10 percent of wall thickness shall be removed from Site.

C. Storage and Protection:

1. HDPE pipe without ultraviolet inhibitor shall not be stored unprotected against outside elements.

2. Store pipe so as not to be deformed axially or circumferentially.

D. Handling: Use wide band slings for lifting and moving pipe. Use of chains is prohibited.

1.6 SITE CONDITIONS

A. Provide adequately designed pipe bursting equipment to accomplish replacement of existing pipe under adverse conditions.

B. Determine location of receiving and insertion pit excavations needed due to existing manholes that are not designated to be replaced.

1.7 SEQUENCING AND SCHEDULING

A. Upon completion of pipe insertion and installation, expedite reconnection of lateral service connections so as to minimize inconvenience to customers.

PART 2. PRODUCTS

2.1 MATERIALS

A. Pipe:

1. Materials:
   a. High molecular weight, solid wall, high-density polyethylene pipe, in accordance with ASTM F714.
   b. Virgin grade material.
   c. Plastic Pipe Institute (PPI) designation of PE 3408.
   d. Minimum cell classification of 345434C, D, or E as described in ASTM D3350.
   e. Meet requirements for Type III, Class B or C, Category 5, Grade P34 material as described in ASTM D1248.
   f. Shall contain no recycled compound except that generated

in manufacturer's own plant from resin of same specification from same raw material.

g. Pipe (excluding black colored pipe) stored outside shall not be recycled.

h. Pipe shall be manufactured by the following:

1) Performance Pipe.
2) Rinker Polypipe.
3) Uponor North America.
4) ARNCO.

2. Color:

a. Inside: Inner wall shall be light color interior (soft gray or white).

b. Outside: Outer wall black with co-extruded green cover or extruded green stripes designating use for sanitary sewer. Pipe with extruded green stripes shall have a minimum of three equally space stripes. Pipe shall have a heat indented print line containing the information required in ASTM D3035. Color print lines are not an acceptable method for designation of sewer mains.

3. SDR:

a. Nominal Size: 8 inches and larger with DIP outside diameters.

b. SDR: Minimum 17.

B. Fittings shall be HDPE butt fusion welded fittings in accordance with ASTM D3261 as modified for the specified material.

C. Joints:

1. Pipe jointing shall be by butt fusion welding, as specified in Paragraph Pipe Joining.

2. Electrofusion Couplings:

a. May be used for repairs or connecting pipe burst segments in the trench with approval of the OWNER.

b. Manufacturers:

1) Central Plastics Company; Central Electrofusion System.
2) IPEX, Inc; Friatec.

D. Service Connections:

1. Service saddles shall be butt fusion or electrofusion saddle type fitting with DIP outside dimension branch connection:

a. Specifically designed for connection to type of

HDPE being installed.

b. Manufacturers:

1) Central Plastics Company; Central Electrofusion System.
2) IPEX Inc.; Friatec.

2. Option: For HDPE pipe sizes greater than 10 inches an Inserta Tee by Inserta Fittings Company may be used.

E. Equipment:

1. Pipe Bursting: Provide equipment of sufficient size and power to accomplish the specified pipe replacement under adverse conditions. Utilize hydraulically powered constant tension static pull pipe bursting system or pneumatic hammer.

2. Joining: Capable of meeting conditions recommended by pipe manufacturer, including, but not limited to, fusion temperature, alignment, and fusion pressure.

2.2 SOURCE QUALITY CONTROL

A. Certify laboratory data confirming that said tests have been performed on sample of pipe to be provided under this Contract, or pipe from that production run, and that satisfactory results were obtained prior to shipping.

B. Pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, or other injurious defects. It shall be uniform in density and other physical properties. Pipe not meeting these criteria shall be rejected.

PART 3. EXECUTION

3.1 PREPARATION

A. Work shall be supervised by personnel experienced in installation of similar pipe and shall be onsite at all times from time of commencement to time of completion.

B. Existing pipe shall be clean and free of obstructions so as not to prohibit pipe bursting operations.

1. The CONTRACTOR shall perform a pre-installation CCTV inspection.

2. If the pre-installation CCTV inspection reveals obstructions in the existing sewer (heavy solids, dropped joints, protruding service taps or collapsed pipe) which will prevent completion of the pipe bursting process, and that cannot be removed by conventional sewer cleaning equipment, then a point repair shall be made by the CONTRACTOR, with the approval of the OWNER.

C. CCTV inspections shall be completed in accordance with Section 02541, Sewer Television Inspection.

3.2 LOCATING UTILITIES

A. The CONTRACTOR shall, prior to starting work, verify the location of all adjacent utilities. The minimum clearance from other utilities shall be approximately two feet. The OWNER may at its discretion reduce the minimum clearance with justification from the CONTRACTOR.

B. The CONTRACTOR shall expose all interfering and crossing utilities by spot excavating at the planar intersection of the pipe and removing the soil from around the utility. The cost of exposing these utilities shall be borne by the CONTRACTOR as part of the pipe bursting operation.

C. Locate existing utilities in accordance with these specifications.

3.3 SUB-SURFACE CONDITIONS

A. OWNER will furnish the CONTRACTOR with available information listed in the Contract Documents, if any are available. The CONTRACTOR shall verify this information in the field. All additional subsurface investigations deemed necessary by the CONTRACTOR to complete the work shall be included in the Contract at no additional cost to OWNER.

B. Copies of all reports and information obtained by additional subsurface investigations by the CONTRACTOR shall be provided to the OWNER.

C. The minimum depth of cover over the installed pipe shall be 4 feet for size on size pipe bursting, and shall be 8 feet for increased pipe size pipe bursting. The CONTRACTOR may request approval of the OWNER to reduce the minimum depth of cover.

D. A minimum amount of ground heaving may be allowed, as determined by the OWNER, if soil conditions are not favorable and up-sizing of the pipe is required.

E. Unless otherwise noted, settlement or heaving of the ground surface during or after construction will not be allowed. The CONTRACTOR is solely responsible for the costs for repairing any surface heaving, unless specified otherwise.

3.4 LOCATING SERVICE CONNECTIONS

A. Sewer service connections shall be identified and located by CCTV prior to start of pipe bursting operation and pipe insertion.

B. The CONTRACTOR shall locate all and expose all sewer service connections prior to pipe insertion to expedite reconnection.

C. The CONTRACTOR shall exercise due diligence in excavating the existing

pipe sufficiently to allow for uniform circumferential expansion of the existing pipe through the service connection pit. Upon commencement of the bursting process, pipe insertion shall be continuous and without interruption from one entry point to another, except as approved by the OWNER.

D. Upon completion of insertion of the new pipe, the CONTRACTOR shall conduct the reconnection of services to minimize any inconvenience to the customers.

3.5 PIPE JOINING

A. The HDPE pipe shall be assembled and joined at the Site using the butt-fusion method to provide a leak proof joint. Threaded or solvent-cement joints and connections are not permitted.

B. All equipment and procedures used in shall be in strict compliance with ASTM D2657 and with the pipe manufacturer's recommendations.

C. Fusion shall be preformed by technicians certified by a manufacturer of pipe fusion equipment.

D. Prior to pipe installation, two trial fusion welds shall be performed, and reviewed and approved by the OWNER. Full penetration welds shall provide homogeneous material across the cross section of weld. Fusion machine employed for trial welds shall be same machine utilized for project installation.

E. The butt-fused joint shall be true alignment and shall have uniform rollback beads resulting from the use of proper temperature and pressure. The joint shall be allowed adequate cooling time before removal of pressure.

F. The fused joint shall be watertight and shall have tensile strength equal to or greater than that of the pipe.

G. All joints shall be subject to acceptance by the OWNER prior to insertion.

H. The CONTRACTOR shall cut out and replace defective joints at no additional cost to OWNER.

I. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than 10 percent of the wall thickness (ASTM F585), shall not be used and shall be removed from the Site. However, a defective area of the pipe may be cut out and the joint fused in accordance with the procedures stated above.

J. Any section of the pipe having other defects such as concentrated ridges, discoloration, excessive spot roughness, pitting, variable wall thickness or any other defect of manufacturing or handling as determined by the OWNER shall be discarded and not used.

K. Terminal sections of pipe that are joined within the insertion pit shall be connected with an electrofusion coupling (e.g., Central Plastics couplings).

L. All connections shall be in conformance with the manufacturer's installation procedures.

3.6 BYPASSING OF FLOWS

A. When blocking flow in upstream sewers is not appropriate, use flow bypass pumping for reducing flow below the maximum depth or for completely bypassing flow.

3.7 PIPE INSTALLATION

A. Pipe insertion shall be continuous and without interruption from one manhole to another, except as approved by OWNER.

B. Advancement of bursting head with "chain" shall be prohibited.

C. Void created by bursting device shall be sufficient in size to accommodate HDPE pipe.

D. Rescue Shafts:

1. In the event that the pipe-bursting machine encounters an obstruction and is halted, the CONTRACTOR will be required to excavate down to the machine to free the obstruction and continue the installation.

2. The CONTRACTOR is notified that the construction of such shafts will be considered incidental to the installation by the pipe bursting construction method.

3. Any rescue shafts will be properly braced, shored, or utilize trench boxes to meet applicable Federal, State, and local requirements.

4. Backfill and compaction for such rescue shafts shall be in accordance with Section 02321, Excavation, Bedding, and Backfill for Utilities.

3.8 LUBRICATION

A. Lubrication shall be used if in the opinion of CONTRACTOR such lubrication is necessary to ensure the successful completion of the job.

B. The CONTRACTOR shall make arrangements for the injection of bentonite into the annular space behind the pipe bursting head, as the lubricant if required.

3.9 SERVICE RECONNECTION

A. The installed pipe shall be allowed the manufacturer's recommended amount of time but not less than 4 hours, for cooling and relaxation due to tensile stressing prior to any reconnection of service lines.

B. Prior to reconnecting sewer services, installed pipe shall have been

successfully tested.

C. The CONTRACTOR, after a suitable relaxation period and testing shall reconnect all service connections as approved by the OWNER.

D. Sewer service connections shall be connected to new pipe and installed in a hole drilled to the full inside diameter of the outlet. Service connections shall be an Inserta T or an electrofusion saddles per the requirements above.

E. The slope of the existing lateral toward the newly installed sewer main shall be maintained at the existing slope. For reconstructed laterals, a minimum pipe slope of 1 percent is required.

3.10 RESTORATION

A. Restoration of Manholes:

1. The CONTRACTOR shall restore all manholes and associated surface areas to their original condition.

2. Prior to restoring manholes the installed pipe shall be allowed the manufacturer's recommended amount of time, but not less than 48 hours, for cooling and relaxation due to tensile stressing prior to the sealing of the annulus or backfilling of the insertion pit.

3. Sufficient excess length of new pipe, but not less than 2 inches to 4 inches, shall be allowed to protrude into the manhole. Connections to manholes shall be per Section 02530, Manholes

B. Restoration of Pits:

1. The CONTRACTOR shall restore all lateral, launching pits and associated surface areas to their original condition.

2. Prior to backfilling lateral and launching pits the CONTRACTOR shall ensure that the new pipe is properly supported and on the required grade.

3. Backfill per Section 02220, Excavation, Backfilling and Compation for Utilities shall be used for the new pipe as support in order to avoid sagging after backfill and compaction.

3.11 POST INSTALLATION CCTV INSPECTIONS

A. The CONTRACTOR shall perform post-installation CCTV inspections in accordance with Section 02762, Sewer Television Inspection.

1. Post construction video shall be submitted to the OWNER in accordance with Section 02762.

B. From the CCTV inspection, the newly installed pipe shall be visibly free of

defects, which may affect the integrity or strength of the pipe. If in the opinion of the OWNER such defects exist, the pipe shall be repaired or replaced at the CONTRACTOR's expense.

C. If the CCTV inspection reveals a sag in the new sewer before pipe bursting has begun, the CONTRACTOR shall notify the OWNER to determine if a point repair is necessary to correct the sag. At the direction of the OWNER, the CONTRACTOR shall take the necessary measures to eliminate these sags by performing a point repair and bringing the bottom of the newly installed pipe to a uniform grade by excavating the pipe, lifting it, and placing compacted crushed stone bedding under and around the pipe to eliminate the sag.

3.12 TESTING OF GRAVITY SEWERS

A. Testing of gravity sewers shall be in accordance with Section 02730, Sanitary Sewage Systems.

3.13 FIELD QUALITY CONTROL

A. Low pressure air testing from manhole to manhole section of sanitary sewer shall be performed after the pipe has been bursted and prior to service lines being connected. Air testing shall be in accordance with ASTM F1417.

3.14 FINAL CLEANING

A. Prior to inspection and acceptance of pipe by OWNER, flush and clean system to remove accumulated construction debris, rocks, gravel, sand, silt, and other foreign material.

END OF SECTION

SECTION 03300

CONCRETE

PART 1 GENERAL

1.01 Scope

This section covers the description of materials used in concrete construction and the installation of such materials.

1.02 Reference Specifications

The following reference specifications shall govern, where applicable, work covered here:

A. ACI-211, Recommended Practice for Selecting Proportions or Concrete.
B. ACI-301, Specifications for Structural Concrete for Buildings
C. ACI-304, Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
D. ACI-308, Recommended Practice for Curing Concrete.
E. ACI-315, Manual of Standard Practice for Detailing Reinforced Concrete Structures.
F. ACI-318, Building Code Requirements for Reinforced Concrete.
G. ACI-347, Recommended Practice for Concrete Formwork.
H. CRSI, Recommended Practice for Placing Reinforcing Bars.

PART 2 MATERIALS

2.01 Form Liners

A. Forms for exposed concrete shall be faced with clean, smooth plywood. Expose concrete includes surfaces of beams, columns, and slabs; interior and exterior walls; tank, chamber, and tunnel walls, except those in contact with earth.

B. Unlined steel forms may be used where concrete will not be exposed for view.

2.02 Coatings

A. The inside of forms shall be coated with non-staining mineral oil or other Engineer approved release agent applied according to manufacturer's recommendations before setting reinforced steel. The release agent shall not affect the finish of the concrete.

2.03 Form Ties

A. Form ties shall be commercially manufactured steel rods capable of withstanding applied pressures. Wire ties are not acceptable.

2.04 Expansion Joints

A. Joint filler shall be pre-molded self-expanding cork, "Servicised" No. 4324 as manufactured by W. R. Grace and Company, "Sealtight" Type 6 by W. R. Meadows, Inc., or equal and comply with ASTM D1752 Type III.

B. Exposed edges of joint filler shall be capped with a gray polysulfide joint sealer, "Hornflex" as manufactured by A.C. Horn, Inc., "Thiotok" by Toch Brothers Corp., or equal, applied in accordance with manufacturer's recommendation.

2.05 Concrete Reinforcement

A. Steel Bar Reinforcing, ASTM A615, Grade 60. Use weldable grade where necessary.

B. Cold Drawn Steel Wire, ASTM A82.

C. Welded Steel Wire Fabric, ASTM A185.

D. Steel Bar or Rod Mats, ASTM A184.

E. Stressing Tendons, Wire ASTM A421, Strand ASTM A416.

F. Reinforcement Supports

1. Plain, wired or doweled precast concrete block reinforcement supports conforming to CRSI may be used where concrete is poured on ground. Required concrete cover of reinforcement must be maintained.

2. Where concrete is not exposed to view, bright basic conforming to CRSI Class 3 may be used.

2.06 Cast-in-Place Concrete

A. Concrete Materials

1. Cement - Portland Type II, ASTM C150 for all concrete unless otherwise noted.

2. Fine Aggregate - Standard fine aggregate, natural sand, ASTM C33.

3. Coarse Aggregate - Aggregate for Standard weight concrete shall consist of gravel, crushed gravel or crushed stone conforming to ASTM C33.

4. Water - Water shall be clean, fresh, potable and free from injurous amounts of mineral and organic substances.

5. Admixtures

a. Type - A, a water reducing admixture of the hydroxylated carboxylic acid or the hydroxylated polymer types, conforming to ASTM C494.

b. Type - D, a water reducing and retarding admixture conforming to ASTM C494.

c. Type - E, a water reducing and accelerating admixture conforming to ASTM C494.

d. Type - F, an air entraining admixture, "Darex AEA" as manufactured by W.R. Grace and Co., "Sika-AER" by Sika Chemical Corp., or equal.

e. Manufacturer's descriptive details of admixtures shall be submitted for approval.

B. Classes of Concrete

1. Class A - concrete cast against earth in slabs and footings and where used as a topping.

2. Class B - concrete in supported slabs, beams, columns and walls.

3. Class C - concrete in fillets, cradles, and where used to fill voids or for backfilling operations.

4. Class D - concrete at location specifically designated on the contract drawings.

C. Grout and Bonding Agents

1. Type I - general purpose grout, composed of two parts sand and one part cement with sufficient water for required consistency. Grout shall have a minimum compressive strength of 3,500 psi at seven days.

2. Type II - grout for machinery bases and where non-shrink grout is needed shall be a thermosetting resinous grout composed of a liquid resinous binder, a graded silica aggregate, and a chemical hardening agent. All grout components shall be furnished by the grout manufacturer. Grout shall be Carter-Waters Corp. 604 Machine Bond, Ceilcote Co. Ceilcote 648, or equal. Mix components and apply according to manufacturer's recommendations. Manufacturer's descriptive details of grout shall be submitted for approval.

3. Type III - bonding agent for anchoring bolts and reinforcing dowels into drilled or precast holes in concrete and bonding new concrete

to old shall be a component epoxy. "Thiokol LP" by Toch Brothers, "Epoxite Binder" by A.C. Horn, Inc., or equal. Mix and apply according to manufacturer's recommendations. Submit manufacturer's descriptive details of bonding agent for approval.

PART 2 EXECUTION

3.01 Proportioning Materials

A. Concrete proportions shall be based on laboratory trial batches.

1. Advance tests of each class of concrete shall be made by ASTM C39 requirements by an independent testing laboratory.

2. Four standard 6-inch compression cylinders, two tested at seven days and two at 28 days, made in accordance with ASTM C192, using the materials and proportions proposed. Aggregate tests may be combined with these tests if suitably referenced on the reports. Repeat tests if materials change or there are unsatisfactory results.

3. Class and Properties of Concrete

4. Each design mix proposed shall be approved in writing by the Engineer prior to its use in the work.

B. Aggregates

1. The ratio of sand to total aggregate shall be from 33 to 42 percent by weight based on surface dry material, unless Engineer authorized. Some minor changes in aggregate proportions may be needed to adjust for changes in aggregate gradations.

C. Admixtures

1. Type - A water reducing admixture may be used where Engineer approved. Type - D or Type - E, with Engineer's approval to provide retarding or accelerating characteristics.

2. Type - F entraining admixture shall be used for concrete work exposed to temperatures less than 40 degrees F.

3. Air content shall be three percent maximum for trowel finished concrete and 3-5 percent for other concrete.

4. The use of calcium chlorine in concrete is prohibited.

3.02 On-Site Material Storage

A. Cement shall be stored in a dry, weathertight, ventilated structure to prevent absorption of moisture.

B. Stored aggregate shall have good drainage, protection from foreign matter and kept according to gradation.

3.03 Batching and Mixing

A. Measure concrete and mortar as specified in ASTM C94.

B. Mixing Concrete

1. Mix in an approved batch mixer or in ready mix equipment conforming to ASTM C94. Do not exceed mixers rated capacity.

2. Mix concrete until materials are uniformly distributed and discharge completely before recharging the mixer. Job mixed concrete shall be mixed at manufacturer's recommended speed for at least one minute after all materials have been added. An additional 15 seconds mixing time shall be added for each additional 1/2 cubic yard of mixer capacity.

C. Cold Weather Concrete

Use cold weather concreting procedures whenever temperature is below, or is forecast to be below, 40 degrees F. within 24 hours.

1. Heat concrete materials. Use water with a temperature of less than 140 degrees F.

2. Heat aggregates by Engineer approved method. Heat uniformly and sufficiently to eliminate lumps of ice, snow or aggregates. Cover aggregates with tarpaulins to maintain uniform heat distribution. Spot aggregate temperatures shall not exceed 212 degrees F and average temperature shall not exceed 140 degrees F.

3. The temperature of concrete when placed shall not be lower than 55 degrees F. Allow for heat loss during transit.

4. Do not add calcium chloride, salt, or other chemicals to prevent concrete from freezing.

D. Hot Weather Concrete

When high air temperature, low relative humidity and/or wind velocity create hot weather conditions that tend to impair the quality of fresh or hardened concrete any or all of the following precautions shall be taken:

1. Reduce concrete mix temperature.

a. Use cold mixing water. Refrigerate or mix with ice.

b. Substitute ice for all or part of the mixing water. Use crushed, shaved or chipped ice and mix until all ice is melted.

c. Shade aggregate to keep them cool. Coarse aggregates may be sprinkled or fog sprayed. Avoid excessive surface moisture that could affect uniformity of slump. Drain aggregates to avoid free moisture.

d. Use cement with a temperature lower than 170 degrees F.

e. Use retarding and water-reducing admixtures.

f. Reduce mixing and agitating to minimum practicable.

g. Paint mixer drums white and spray outside with water before batching.

h. Coordinate truck dispatch with rate of placement to avoid delays in delivery.

3.04 Placing Concrete

A. General

1. Before placing concrete, oil forms, fasten reinforcements in place, retighten form ties at construction joints, place and anchor embedments and openings.

2. Clear debris from area where concrete is to be placed.

3. Do not place concrete under adverse weather conditions.

B. Conveying

1. Use methods to convey concrete from mixer to final location that will prevent separation or material loss. Do not exceed three feet with free fall of concrete.

2. Clean delivery equipment before use and clean at frequent intervals while placing concrete.

3. Use sufficient delivery equipment to insure a practically continuous flow of concrete. Standby equipment shall be available in case of equipment failure. Do not use aluminum delivery equipment in contact with concrete.

C. Depositing

1. Place concrete to avoid segregation. Tremies shall be used to avoid free falls of more than three feet and to keep concrete at a uniform depth during placement.

D. Consolidating

1. Spade and rod concrete to prevent pockets or honeycomb around reinforcements and fixtures. Carefully secure dense concrete around inserts.

2. Consolidate concrete with mechanical vibrating equipment and provide standby equipment. Unless approved by the Engineer, apply vibration directly to concrete. Use sufficient vibration to cause flow or settlement of concrete into place. Apply vibration at point of deposit and in freshly placed concrete. The duration shall be sufficient to accomplish compaction and embedment of reinforcement and fixtures.

3. Fork or spade by hand in corners and angles of forms and along form surfaces while concrete is plastic under vibratory action. Do not allow vibrator bottom to ride the form supporting the slab. Lay the vibrator on the concrete to prevent marring forms.

E. Bonding

1. Roughen, clean and wet concrete surfaces where new concrete is to be placed for horizontal construction joints. Apply 1 - 1/2 inches of grout before placing new concrete. The grout shall be the same mixture as the concrete without coarse aggregates.

2. Work freshly placed concrete at vertical or sloping joints to assure adequate mortar at the joint.

3. Roughen and clean existing old concrete and apply Type III bonding agent before placing new concrete to form bond.

F. Hot Weather Placing

During hot weather take any or all of the following precautions:

1. Schedule concrete delivery so placement is prompt.

2. Have enough vibration equipment to consolidate concrete quickly. Have standby equipment available.

3. If possible, place flatwork on grade after walls are up or roof is on.

4. In arid, windy conditions erect temporary windbreakers and sunshields.

5. Moisten subgrade before pouring but avoid free standing water and soft spots on surface.

6. Use water fogging to avoid excess evaporation from flatwork.

7. Place concrete in shallow lifts to assure better vibration.

8. Provide shade for equipment, paint surfaces white or cover with damp burlap.

9. Schedule pavement in late afternoon or evening to avoid high daytime temperature.

10. Apply monomolecular film evaporation retardant to concrete surface immediately after concrete is screeded, while moisture is still on the surface. Reapply evaporation retardant after each finishing operation in severe drying conditions.

11. Fog spray or spread and remove polyethylene sheeting between finishing operations on flatwork.

G. Cold Weather Placing

1. Surfaces coming in contact with fresh concrete shall be above 35 degrees F. but not necessarily higher than that of the concrete placed.

2. Remove all snow, ice and frost from spaces to be filled with concrete.

3. Thaw frozen subgrade by covering with insulation and if necessary applying heat. Recompact thawed material, if necessary. Do not place concrete on frozen subgrade material.

3.05 Tests While Placing Concrete

A. Concrete Strength

1. For each mix of concrete, make and test four standard 6 inch concrete cylinders from the same sample.

2. Test two cylinders after seven days and two at twenty-eight days. Meet specifications:

a. Sampling concrete for test purposes, ASTM C172

b. Making and curing test cylinders, ASTM C31

c. Testing of Specimens, ASTM C39

B. Slump

1. To maintain desired consistency when 25 or more cubic yards of concrete are placed, make a slump test by ASTM C143. Test for each 50 CY of concrete placed at one operation and one on each sample of concrete used in test specimens.

C. Air Content

1. Test air content of samples used for test cylinders according to ASTM C231.

D. Additional Strength Tests

If test cylinders fail to meet strength requirements, additional compression tests shall be done on cored cylinders according to ASTM C42 or load tests by ACI 318, as required by Engineer. If concrete does not meet requirements according to Engineer, the defective concrete shall be removed and replaced. Cost for retesting shall be paid by Contractor.

3.06 Curing

A. Keep concrete moist for seven days after placement. Cure by any of the following means, if approved by the Engineer.

1. Cure with burlap, cotton, or mats kept wet or keeping forms wet.

2. Use waterproof paper curing lapping four inches at seams and sealing with tape.

3. Membrane curing by power spraying with fugitive dye included. Not to be used where surfaces receive a finish treatment. Submit manufacturer's descriptive data of curing compounds for approval.

3.07 Weather Protection

A. Rain-Protect exposed surfaces from wash.

B. Cold Weather Protection

1. Use covers, insulation, enclosures, or heat to prevent concrete from freezing. Extra protection is needed at edges and corners.

2. Heat enclosures with steam, forced hot air or other Engineer approved method. Vent heater exhaust gas outside enclosure. Do not use open fire or Salamanders. Keep heat continuous.

3. When using hot air heaters, cover exposed concrete surfaces with impervious sheet material or curing compound according to ASTM C309 to prevent dehydration of concrete.

4. Maintain concrete temperature above 50 degrees F. at least 72 hours. Protect from freezing an additional 72 hours or as long as needed for proper curing.

5. Keep enclosures or covering in place a minimum of 24 hours after heating is discontinued. Allow concrete to slowly reach ambient temperature to avoid thermal cracking.

6. Protect slabs cast against earth, such as tank bottoms by covering with non-staining insulating material or by other Engineer approved means to prevent frost penetration into the subgrade.

7. Keep temperature records of concrete including when it was placed, data, weather conditions, outside air temperature and concrete temperature. Obtain a range of temperatures by different locations. Record maximum and minimum temperatures in each 24-hour periods and deliver copy of record to Engineer and Owner weekly.

C. Hot Weather Protection

1. Provide continuous water curing with saturated material in contact with concrete surface and kept wet with soaker hoses.

2. Methods and materials specified in ACI 308, Recommended Practice for Curing Concrete, are acceptable.

3.08 Concrete Finishes

A. Cast-in-Place Concrete

1. Walls

a. Rough finish shall be used on concrete surfaces below grade adjacent to earth and not exposed to view. Within 24 hours of removing forms, cut out honeycomb, aggregate pockets, voids over 1/2 inch in diameter, and holes left by form ties to solid concrete; throughly wet, brush on a neat cement coat of grout and fill with mortar of one part cement, two parts fine aggregate (passing a No. 16 sieve) and a minimum of water. Tamp mortar in place. Finish patchwork flush with adjacent surfaces and damp cure for 48 hours.

b. Smooth finish exterior concrete surfaces exposed in the finished work. Apply rough finish as above but then throughly wet and brush-coat surfaces with cement grout of one part cement to two parts fine aggregate (passing a No. 30 sieve) and mixed with water to consistency of thick paint. Fill all pits, air bubbles, and surface holes using a cork or wood float. Scrape off excess with a trowel and rub surface with burlap. Complete the finish of any area in the same day making limits at natural breaks in the surface. Exposed exterior walls of structures continue to one foot below finished grade.

2. Slabs

a. Slabs shall be true to grade with allowance of 1/8 inch/10 feet slope where drainage is required.

b. Floor surfaces exposed to view at completion shall be given a monolithic finish. Wood-float surface to a true, even plane with no coarse aggregate visible when concrete will support a man's weight. Use pressure to bring moisture to surface, then double steel trowel to produce a smooth surface.

c. Walks exterior platforms, stoops and treads shall be wood-floated to a true and even plane. Apply steel trowel and roughen surface by dragging burlap across the surface.

d. Apply three coats of floor hardener such as "Hornolith" by A.C. Horn, Inc., "Lapidolith" by Sonneborn-Contech, or equal to concrete floors, curbs or equipment pads in buildings not receiving other finishes. Apply according to manufacturer's recommendations.

3.09 Testing Wet Well

Test new wet well as follows:

A. Clean interior of debris and sweep.

B. Fill unit with liquid to operating level before backfilling.

C. Establish rate of filling.

D. Do not test until compressive strength of concrete is equal to 3,000 psi by cylinder tests.

E. If leakage is evident or level drops more than 1/4 inch in 24 hours from leakage, dewater wet well and repair leaks.

F. Repeat test until results are satisfactory. Owner accrues no cost for retests.

G. When results are satisfactory, remove liquid and dispose of it without damaging construction, the site, adjacent areas or the operation of existing facilities.

END OF SECTION

Sewer System Design Standards

The following outline and the following standard specifications reflect the general policies of the Mount Pleasant Department of Public Works with respect to the design and construction of sewer projects other than major pump stations and treatment facilities. Departure from these standards by design agents must be authorized by the Director of Public Works. Development of specifications, technical project documents and selection of equipment should reflect the standards and preferences herein. As new equipment or construction methods are evaluated, the standard specifications and outline policies will inevitably be changed as reflected in the latest individual project construction documents approved by the Director; if these changes are deemed to be in the City's best interests to become policy, this document will be revised and submitted to the State of Tennessee, Department of Environment and Conservation, Division of Water Pollution Control for review and approval. In any event at a minimum frequency the approval of these specifications will be renewed on a 5 year basis by the Division of Water Pollution Control or when there are significant changes in the Division's *Design Criteria.* Departure from the State *Design Criteria* policies or these standards must be specifically approved by the Division.

Decisions on the actual procurement of design or construction services must also comply with State law for procurement by public entities and policies of the City of Mount Pleasant.

The following areas are not addressed in these design policies or specifications:

- Plant and yard piping addressing special treatment plant and major pump station construction standards
- Flanged piping (generally above ground or within structures)

A. Documents Defining Design Standards
    a. TDEC-DWPC: Current *Design Criteria for Sewage Systems*
    b. Mount Pleasant current CMOM and Capacity Management Plan
    c. Pump Stations: Hydraulic Institute Standards
    d. Various Systems: Water Environment Federation Manuals of Practice
    e. Gravity Sewer Design: ASCE Manual 37: *Design & Construction of Sanitary and Storm Sewers*
    f. Industry Product Association Guidelines
        i. Ductile Iron: Ductile Iron Pipe Research Association (DIPRA)
        ii. HDPE: Plastic Pipe Institute (PPI)
        iii. PVC: PVC Pipe Association
    g. Individual manufacturer recommended specifications and installation instructions especially for fittings, fuse or cement welding /joining processes, and pump station equipment
    h. United Facilities General Specifications (UFGS) in the event other guidance is not available for the development of individual specifications

B. Gravity Sewers
    a. Products
        i. Pipe: No pipe smaller than 6" in diameter and only then if growth opportunities for the collection system being served is limited; normally 8" minimum.
            1. HDPE

a. Pipe:
    i. DR determined by depth of bury in accordance with PPI standards;
    ii. generally DR-27 for depths up to 12 ft
b. Joints: thermo-fused
c. Connections
    i. Service: electro-fused
    ii. Manholes/Structures:
        1. Allow for 1”/10 deg F/100 LF expansion/contraction each way with gasketed connection
d. Approved manufacturers
    i. ISCO
    ii. Performance Pipe

2. Ductile Iron
    a. Pipe: Pressure class 250 with 401 coating
    b. Joint: Push on
    c. Connections
        i. Service:
            1. new design: tee;
            2. later connection: gasketed saddle
        ii. Manholes/Structures: concrete with Kor-N-Seal type (or equal) or A-lock cast-in-place gaskets
    d. Approved manufacturers: American, US Pipe, McWane

3. PVC
    a. Pipe: SDR-27/21 or Schedule 40/80 depending on depth; thinner gasketted pipe (SDR-35) may be used for repairs when structural integrity is not an issue
    b. Joint:
        i. SDR type: push-on
        ii. Schedule 40/80: solvent weld
        iii. Frenco-type couplings with stainless steel fasteners may be used for repairs or connections at structures.
    c. Connections
        i. Service: new design: gasketed tee; later connection:
        ii. Manholes Structures: Kor-N-Seal type or A-lock gasket
    d. Approved manufacturers: API, Uni-bell approved

ii. Manholes
1. Concrete
    a. Material: ASTM standard
    b. Gaskets: ASTM standard
    c. Coatings:
        i. Xypex
        ii. Other approved to meet watertight criteria
    d. Approved manufacturers

i. Sherman-Dixie
ii. Oldcastle

2. HDPE
    a. Must meet ASTM and PPI standards
    b. Manufacturers recommendations for load bearing application must be documented and approved prior to use.
    c. Thermal expansion stress collars and thrust blocking must be installed to prevent manhole deformation; provide calculations in accordance with the PPI standards.
3. Fiberglass
    a. Maximum depth: 9 feet
    b. Ordinarily installed in locations receiving direct discharge from force main with H2S problems
    c. Coatings on standard concrete manholes shall be considered prior to use of RFG manholes.

b. Installation
    i. Trench: Class A or A-B bedding (complete rock envelope) for gravity sewers
    ii. Directional bore: HDPE casing for HDPE pipe if approved by TDOT or County Highway Supt.
    iii. Bore and Jack: Steel casing 0.18 in thickness minimum or as required by TDOT or railroad with spacers; extend 5' outside ditch line; ensure easements and ROW use approval is documented on plans prior to submission to State and funding agencies.
    iv. Test
        1. TDEC-DWPC prescribed leak and pressure tests
        2. Mandrill pull for deformation check

C. Gravity Sewer Rehab
    a. Dig and Replace: same standards as new installation
    b. Point Repairs: see standard specifications
    c. Pipe Bursting – HPDE: preferred for upsizing or with pipe with few service connections; may be preferred in areas with significant trenching obstacles
    d. Cured-in-Place (CIP)
        i. UV cured
        ii. Water cured
    e. Slip-lined – PE: used only as approved by the Public Works Director: annular space must be grouted

D. Force Mains-Small Diameter
    a. Products
        i. Pipe
            1. HPDE
                a. Pipe: DR-17/21 depending on pressure
                b. Joints: thermo-fused
                c. Connections: electro-fused
                d. Approved manufacturers: ISCO; Phillips
            2. PVC

a. Pipe: SDR-17/21 or Schedule 80/40 depending on pressure; SDR 17 or Schedule 80 or DIP for casing pipe
b. Joints: Solvent weld
c. Connections: Solvent weld
d. Approved manufacturers: Uni-bell, API

ii. Valves
1. Types
a. Ball: 3" or smaller; solvent weld when buried; true-union when in required for air release valve or pump access
b. Gate: 4" or larger: restrained MJ
c. Check: true-union; flap, not ball, check valves
d. Air Release: size in accordance with manufacturer's recommendation
i. Vacuum: Bermad or OSI
ii. Air Release: Bermad or OSI
iii. Combination Air Release: generally not used
2. Boxes: utilize concrete (any location) or composite (no load bearing location) meter boxes for valves and air release devices

b. Installation:
i. Trenching
1. Class A or A-B bedding

E. Force Mains-Domestic Wastewater
a. Products
i. Pipe
1. PVC
a. Material: SDR 17/21 depending on pressure
b. Joints: Push-on
c. Fittings: DI MJ with concrete thrust block or with Mega-lug-type restraint
d. Couplings: Rigid by Dresser or equal
e. Approved manufacturers: Uni-bell approved; API
2. Ductile Iron
a. Material: Pressure class 250 or above as required by pressure and depth of bury
b. Joints: Push-on or wedge-gasket type restrained joints with thrust blocking not used
c. Couplings: rigid by Dresser or equal
d. Fittings: MJ with concrete thrust blocking or wedge-gasket type restrained joint
e. Approved manufacturers: American; US Pipe; McWane; Clow
3. HDPE
a. Material: DR-17/21 depending on pressure and depth of burial in accordance with PPI
b. Joints: thermo-fuse weld
c. Fittings: electo-fuse weld

ii. Valves
    1. Gate: resilient seat; non-rising stem; MJ restrained or unrestrained
    2. Air Release
        a. Vacuum: on all system pumps
        b. Air Release: on all system pumps
        c. Combination Air Release: in all pipe systems at high points and in accordance with manufacturers' recommendations
        d. Approved manufacturers: ARI, APCO, Valmatic
    3. Boxes:
        a. See standard details

b. Installation
    i. See specifications and standard details

F. Pump Stations-Small Diameter
a. Grinder: dual pumps for installations larger than one house
    i. Type pumps
        1. Pseudo-progressive cavity
        2. Centrifugal
    ii. Control Panels
        1. Alarms: high level; pump failure
        2. Control function: float level control
        3. Meters: run time meters
    iii. Approved manufacturers: E-One; Myers
b. STEP: dual pumps for installation large than one house
    i. Pumps: Gould or OSI
    ii. Tanks: single pour concrete; no seam fiberglass or PE
    iii. Filters: OSI bio-filters
    iv. Control Panels
        1. Alarms: high level; pump failure
        2. Control functions: 4 float control;
        3. Meters: Run time

G. Pump Stations-Domestic Wastewater
a. Pumps
    i. General
        1. Vibration standards: Hydraulic Institute
        2. Hydraulic Institute recommended wetwell and channel configuration
        3. Hydraulic efficiency: 70% or greater
        4. Electrical efficiency: 95% or greater
        5. Lower RPM pumps are preferred
    ii. Submersible
        1. Approved manufacturers: ITT Flygt; KSB; Flowserve
    iii. Suction Lift
        1. Approved manufacturers: Gorman-Rupp; Smith and Loveless
    iv. Dry Pit Submersible
        1. Approved manufacturers: ITT Flygt; KSB; Flowserve
    v. Dry Pit: Utilize Dry-Pit Submersibles; extended shafts not authorized at this time.

b. Controls: ultrasonic or pressure transducer with float backup for level sensing; lead-lag with constant speed (soft stop with motors larger than 30 hp); constant level with variable frequency drives; station shall not be designed for pumps to start more than 75% or maximum starts per hour.
c. Telemetry: pump operations; pump failure; flow rate if meter installed; pump station level
d. Odor Control: If average daily dry weather flow has a pumping frequency less than 2 times per day nitrate addition shall be provided to control odors
e. Surge control shall be dictated by hydraulic transient analysis of the system during design. Pump control valves shall normally be specified for constant speed pumps with greater than 30 hp and 100 ftH20 head.
f. Instrumentation: flammable-explosive-hazardous gas monitors shall be provide in all confined spaces
g. Coatings: All concrete wetwells shall be coated for protection from acidic sewer gases
h. Valves
    i. Gate: resilient seated, non-rising stem
    ii. Ball/butterfly: not normally specified for wastewater pump stations
    iii. Check or Control Check: utilized on pump discharge; sized and fitted in accordance with the surge analysis
    iv. Plug: May be used for pump control valve
i. Physical handling: not normally installed since separate wet and dry pit pump stations not normally authorized for the collection system.
    i. Comminutor
    ii. Traveling Screen
    iii. Bar Screen

SECTION 330148

TEMPOARY BYPASS PUMPING SYSTEMS

Part 1 General

1.1 Description

A. This Section includes all materials, labor, and equipment required to provide bypass flow control for manhole and sanitary sewer lines construction, upgrade, or rehabilitation.

B. Furnish all power, maintenance, etc. to implement the bypass flow control and diversion pumping to divert the existing flow around the work area for the work's duration.

C. The design, installation, and operation for the temporary bypass pumping system shall be solely the Contractor's responsibility.

D. Bypass Pumping Operation Checklist

1.2 Performance and Penalties

A. The Contractor shall ensure:

1. All temporary sewer bypass pumping activities for the work are completed in full compliance with the local, state and federal requirements, and no water quality or quantity compliance issues are encountered.
2. No illicit pollutant discharges to (or to a location that would create contaminated water runoff to) a storm sewer, a stormwater conveyance, or a water body shall occur.
3. All temporary sewer bypass pumping activities for the work are completed in full compliance with state and U.S. EPA regulations, and no water quality or quantity compliance issues are encountered.

B. No discharge of sewage or debris shall be released to the environment. Should the Contractor's actions cause a sewage or debris overflow or bypass to the environment, site cleanup will be the Contractor's responsibility consistent with regulatory requirements. All overflow or bypass environmental cleanup activities shall be immediately commenced and prosecuted continuously by the Contractor. Any associated fines or penalties enacted by local or state regulatory agencies, the U.S. EPA, and/or any other regulatory groups or programs will be borne solely by the Contractor.

1.3 Quality Assurance

A. Follow national standards and as specified herein.

B. Perform leakage and pressure tests on discharge piping using clean water, before operation. Notify Engineer 24 hours prior to testing.

C. Maintain and inspect temporary pumping system every two hours. Responsible operator: on site when pumps are operating.

D. Keep and maintain spare parts for pumps and piping on site, as required.

E. Maintain adequate hoisting equipment and accessories on site for each pump.

1.4 Submittals

A. Submit in accordance with Section 01 30 00 at least 4 weeks prior to commencing work, including plugging any line, bypass pumping, or similar actions.

1. Detailed plan and description of proposed pumping system. Indicate number, size, material, location and method of installation of suction and discharge piping, size of pipeline or conveyance system to be bypassed, staging area for pumps, site access point, and expected flow.

a. Sewer plugging method and plug types

b. Size and location of manhole or access points for suction and discharge hose or piping.

c. Sections showing suction and discharge pipe depth, embedment, select fill and special backfill, if buried.

d. Temporary pipe supports and anchoring required.

e. Thrust and restraint block sizes and locations.

f. Sewer plugging method and type of plugs.

g. Bypass pump sizes, capacity, number of each size to be on site and power requirements. Pump sizing shall clearly indicate compliance with requirements in this Section.

h. Backup pump, power and piping equipment.

i. Calculations of static lift, friction losses, and flow velocity. Pump curves showing pump operating range.

j. Design plans and computation for access to bypass pumping locations indicated on drawings.

k. Calculations for selection of bypass pumping pipe size.

l. Method of noise control for each pump and/or generator.

m. Method of protecting discharge manholes or structures from erosion and damage.

n. Schedule for installation and maintenance of bypass pumping lines.

o. Procedures to monitor upstream mains for backup impacts.

p. Procedures for setup and breakdown of pumping operations.

q. Standby power generator size, location, and spill prevention and control measures

r. Emergency plan detailing procedures to be followed in event of pump failures, sewer overflows, service backups, and sewage spillage.

1) Maintain copy of emergency plan on site for duration of project.

B. Submit following Section 01 40 00.

1. Certify bypass system will meet requirements of codes, and regulatory agencies having jurisdiction.

1.5 Contractors Responsibility for Overflows and Spills

A. Schedule and perform work in manner that does not cause or contribute to incidence of overflows, releases or spills of sewage from sanitary sewer system or bypass operation.

1.6 Delivery and Storage

A. Transport, deliver, handle, and store pipe, fittings, pumps, ancillary equipment and materials to prevent damage and following manufacturer's recommendations.

1. Inspect all material and equipment for proper operation before initiating work.

B. Material found to be defective or damaged due to manufacturer or shipment.

1. When Engineer deems repairable: Repair as recommended by manufacturer.
2. When Engineer deems not repairable: Replace as directed by Engineer before initiating work.

Part 2 Products

2.1 Materials

A. Discharge and Suction Pipes: Approved by Engineer.

1. Discharge piping: Determined according to flow calculations and system operating calculations.
2. Suction piping: Determined according to pump size, flow calculations, and manhole depth following manufacturer's specifications and recommendations.

B. Polyethylene Plastic Pipe:

1. High density solid wall and following ASTM F714 Polyethylene (PE) Plastic Pipe (SDR-DR) based on Outside Diameter, ASTM D1248 and ASTM D3550, with a minimum pressure rating of 2.5 times the total dynamic pump head.

2. Homogenous throughout, free of visible cracks, discoloration, pitting, varying wall thickness, holes, foreign material, blisters, or other deleterious faults.
3. Defective areas of pipe: Cut out and joint fused as stated herein.
4. Assembled and joined at site using couplings, flanges or butt-fusion method to provide leak proof joint. Follow manufacturer's instructions and ASTM D 2657.

    a. Threaded or solvent joints and connections are not permitted.

    b. Fusing: By personnel certified as fusion technicians by manufacturer of HDPE pipe and/or fusing equipment.

    c. Butt-fused joint: True alignment and uniform roll-back beads resulting from use of proper temperature and pressure.

    d. Allow adequate cooling time before removal of pressure.

    e. Fused joints shall be watertight and have tensile strength equal to that of pipe.

5. Use in streams, storm water culverts and environmentally sensitive areas.

C. Flexible Hoses and Associated Couplings and Connectors.

1. Abrasion resistant.
2. Suitable for intended service.
3. Rated for external and internal loads anticipated, including test pressure.

    a. External loading design: Incorporate anticipated traffic loadings, including traffic impact loading.

    b. When subject to traffic loading, compose system, such as traffic ramps or covers.

    c. Install system and maintain H-20 loading requirements while in use.

D. Valves and Fittings: Determined according to flow calculations, pump sizes previously determined, and system operating pressures.

E. Plugs: Selected and installed according to size of line to be plugged, pipe and manhole configurations, and based on specific site.

1. Additional plugs: Available in the event a plug fails. Plugs will be inspected before use for defects which may lead to failure.

F. Aluminum "irrigation type" piping or glued PVC piping will not be permitted.

G. Discharge hose will only be allowed in short sections when approved by Engineer. Hoses shall have no leaks, and all couplings shall be quick connecting with gaskets.

2.2 Equipment

A. All equipment used for bypass pumping shall be specifically designed for intended purpose. All piping, pumps, etc. in contact with sanitary sewage shall be manufactured with materials designed for use in a sewage environment.

B. All pumps used shall be fully automatic self-priming units which do not require foot valves or vacuum pumps in the priming system.

C. The pumps shall be electric, hydraulic, or diesel powered. Gasoline powered pumps may be used for bypass pumping of short segments for a limited duration (10 hours or less).

D. All pumps used shall be constructed to allow dry running for long time periods to accommodate cyclical nature of wastewater flows.

E. Above-ground pumps and/or power units shall be located inside a temporary portable berm to contain any fuel or sewage that may spill during the normal course of operation.

F. The multiple pump header system shall have check valves to facilitate pump removal, service, and/or replacement while the system remains operational.

G. All above ground pumps and/or power units shall be equipped with sound attenuation measures which reduce noise levels to 75-decibels maximum at a 30-foot distance from the equipment during all operation periods. If equipment is operated between 8:00 PM and 6:00 AM, this equipment shall also be provided with a sound attenuation 3-sided enclosure including a roof constructed of 2 x 4 lumber frame with 1/2-inch plywood sheathing and 2inch extruded polystyrene foam panels attached to the inside of the entire enclosure. The enclosure shall be portable to allow the enclosure to be moved when bypass pumping equipment is moved.

H. The discharge location (the point where the bypass main reenters the gravity sewer system) shall be constructed with adequate sealant materials to minimize sewer gas and odor release to the maximum extent possible.

2.3 Design Requirements

A. Provide bypass sewage pumping, as required, around the section in which work is to be performed. Bypass pumping shall be the Contractor's full responsibility. The bypass system shall be a sufficient capacity to handle 2.0 times the peak flow, as provided by Owner for trunk lines, of the pipeline section being bypassed. Bypass pumping systems shall be designed to operate 24 hours per day.

B. Provide pipeline plugs and pumps of adequate size to handle peak flow, and temporary discharge piping to ensure total flow of main can be safely diverted around section to be repaired.

Part 3 Execution

3.1 General Requirements

A. At least 4 weeks prior to the desired start date of construction requiring bypass pumping, submit a detailed description of the method proposed for bypass pumping to the Engineer for review and approval. The description shall include all materials and equipment to be used, personnel, spare equipment, and sketches showing proposed pump-around setups. No work shall commence until the Engineer approves.

B. Bypass pumping equipment shall include pumps, conduits, engines, and related equipment necessary to divert sewage flow around the section in which work is to be performed. Backup pumps shall be online and isolated from the primary system by valves. Include 100% mechanical redundancy installed online with a float or ultrasonic type system to switch to the standby system automatically if the primary system fails.

C. Piping redundancy may be required for relatively long bypass piping lengths or large diameter bypass pipes as deemed necessary by the Engineer. Special design considerations shall be made for pump suction lifts greater than 23 feet.

D. Make all arrangements for bypass pumping when the main is shut down for any reason. The system shall overcome any existing force main pressure on discharge.

E. Suction and discharge points shall only be located at manholes.

F. If at any time the Contractor is unable to properly bypass pump the sewage, construction will be stopped until the Contractor can continue work in an acceptable manner. Additional contract time for delays caused by improper equipment, labor, or breakdowns will not be considered.

G. Service shall be maintained at all times. Surcharges due to plugging the sewer line for bypass pumping shall be maintained to prevent service backups and overflows at any point in the system.

H. For rehabilitation projects, hose may be used for short runs with the Engineer's approval. If the anticipated bypass time exceeds 48-hours, use hard piping only. If using hose and the bypass time reaches 48-hours, the Contractor may either install hard piping to accomplish the bypass or restore flow until an approved bypass method can be employed. No modifications to the bypass system shall be made without Owner's approval.

I. The bypass or diversion pumping system shall be able to pump all the sewage in the existing line under all weather and seasonal conditions. All pumping equipment to be used shall be submitted to the Engineer for review and approval.

J. Bypass pumping systems are required to be operated and continuously monitored 24-hours per day for flow diversion.

K. For mains being lined, the bypass pumping must be done one manhole upstream and continue for one manhole downstream of the line being rehabilitated in order to use flow through plugs at the insertion and end points. The liner bag may not be used as part of the bypass pumping system or as a plug in the line.

L. For bypass or diversion pumping in overnight operations greater than 2 days, provide and maintain portable lighting systems as needed for monitoring and operation activities at the bypass pumping site(s).

M. The temporary diversion pumping system shall be placed in operation prior to the commencement of work in the areas being bypassed. Minimum times of operation prior to the commencement of work are 1 hour for small diameter CIPP lining and 4 hours for any other major system work such as trunk sewer diversion, large diameter sewer lining, or pumping station work.

N. Protect the bypass lines from damage in the areas of backhoe and excavation operations.

O. Provide the necessary stop/start controls and a visual alarm indicating a pump malfunction for each pump. Each pump shall have a 0-30 inch Hg vacuum gauge on the inlet and a 0-60 psi pressure gauge on the outlet.

3.2 Preparation

A. Determining location of bypass pipelines.

1. Minimal disturbance to existing utilities.
2. Field locate existing utilities in proposed bypass area.

B. Obtain approvals for placement within public or private property.

C. Obtain Engineer's approval of location.

3.3 Performance Requirements

A. It is essential for operating the existing system being bypassed that no interruptions in the flow occur throughout the project's duration. Provide, maintain, and operate all temporary facilities such as dams, plugs, pumping equipment (primary and backup units as required), conduits, all necessary power, and all other labor and equipment necessary to intercept the incoming flow before it reaches the point where it would interfere with the work, carry it past the work area, and return it to the existing system downstream of the work.

B. The temporary pumping system's design, installation, and operation shall be the Contractor's responsibility. The bypass system shall meet all codes and requirements for regulatory agencies having jurisdiction.

C. Provide all necessary means to safely convey the sewage past the work area. The Contractor will not be permitted to stop or impede the sewer main flows under any circumstances.

D. No flow diversion around the work area shall be performed in a manner that will cause damage to or surcharging of the existing system. The diversion shall protect public and private property from damage and flooding.

E. Protect water resources, wetlands, and other natural resources.

3.4 Installation and Removal

A. Remove manhole sections or make connections to existing sewer and construct temporary bypass pumping structures at access location indicated on Drawings and as required to provide adequate suction conduit.

B. Plugging or blocking of sewage flows shall incorporate a primary and secondary plugging device. When plugging or blocking is no longer needed for performance and acceptance of work, remove in a manner that permits the sewage flow to slowly return to normal without surge, to prevent surcharging or causing other major disturbances downstream.

C. When working inside manhole or force main, exercise caution. Follow OSHA, Local, State and Federal requirements. Take required measures to protect workforce against sewer gases and/or combustible or oxygen-deficient atmosphere.

D. Installation of Bypass Pipelines:

1. Bypass pipeline installation is prohibited in all wetland areas.
2. Pipeline may be placed along shoulder of roads. If in easements, the bypass pipeline shall be within the easement area acquired for the project.

    a. Do not place in streets or sidewalks.

3. When bypass pipeline crosses local streets and private driveways, place in roadway ramps.

    a. When roadway ramps cannot be used, place bypass in trenches and cover with temporary pavement as approved by Engineer.

E. During bypass pumping operation, protect sewer lines from damage inflicted by equipment.

F. Upon completion of bypass pumping operations, and after the receipt of written permission from Engineer, remove piping, restore property to pre-construction condition and restore pavement.

3.5 Field Quality Control and Maintenance

A. Testing: Prior to actual operation, test the bypass pumping discharge hard piping system for leaks and pressure using clean water. Bypass hard piping shall be hydrostatically tested following each setup and prior to flow diversion or bypass to a minimum pressure 2.5 times the pump(s) total dynamic head. The Engineer shall be given a 24-hour notice prior to testing.

B. Inspection: Inspect the bypass pumping system on a continuous basis to ensure the system is working properly. A daily checklist for physically inspecting the piping shall be required. The checklist shall contain all bypass pumping system components and shall be specifically developed to address aspects for the individual project. The daily checklist shall be submitted to and approved by the Engineer. The completed daily checklists will be maintained, available for review, and on-site for the project's duration.

C. Maintenance Service: Ensure the temporary bypass pumping system is properly maintained and that a responsible operator shall be readily available at all times when pumps are operating.

D. Monitoring

1. During bypass pumping, continuously monitor all bypass pumping system components.

2. A telemetry system or designated personnel to maintain 24-hour onsite monitoring shall be required to alert the Contractor to system malfunctions or high liquid levels in manholes.

3. If bypass pumping activities are conducted near state waters or in other situations where a potential exists for a sewage release to potentially enter state waters by other than direct means, an in-line stream monitoring system shall be used to measure real-time conductivity and dissolved oxygen (DO) concentrations in 30-minute intervals at a minimum. The system shall be mounted in the receiving stream in the immediate downstream area(s) adjacent to the location(s) of the bypass piping system discharge to the gravity conveyance system. The system shall have web-portal capabilities with alarm

functions for conductivity and DO. The alarm function shall be equipped with battery power and solar charging provisions and shall be able to send email and text messaging alarms to at least five devices.

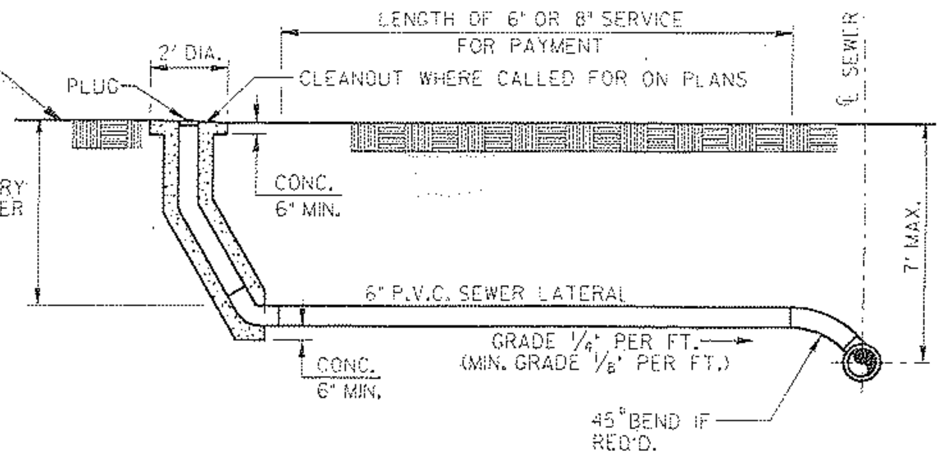
E. Additional Materials

1. Spare parts for pumps and piping shall be kept on site as required.

2. Adequate hoisting equipment for each pump and accessories shall be maintained on site.

3. Keep an HDPE fusion machine on site for the duration of bypass pumping to facilitate immediate repairs to hard piping.

END OF SECTION



END OF LINE CLEANOUT

Barge Waggoner Sumner and Cannon Inc

DETAIL NO.: C002

DATE ISSUED:

DATE REVISED:

BWSC$PLOT$TIME$$$

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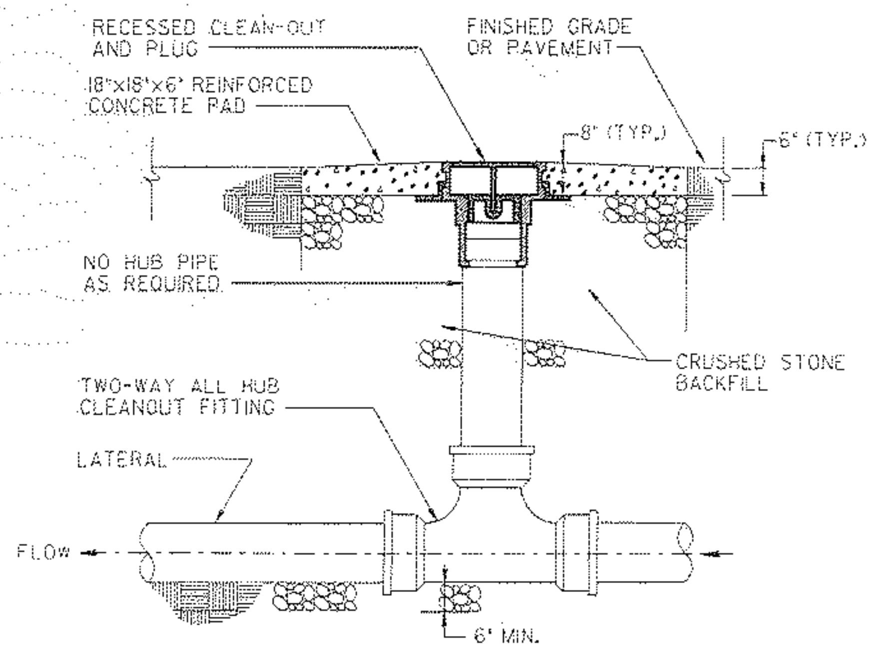


EXTERIOR TWO-WAY CLEANOUT DETAIL

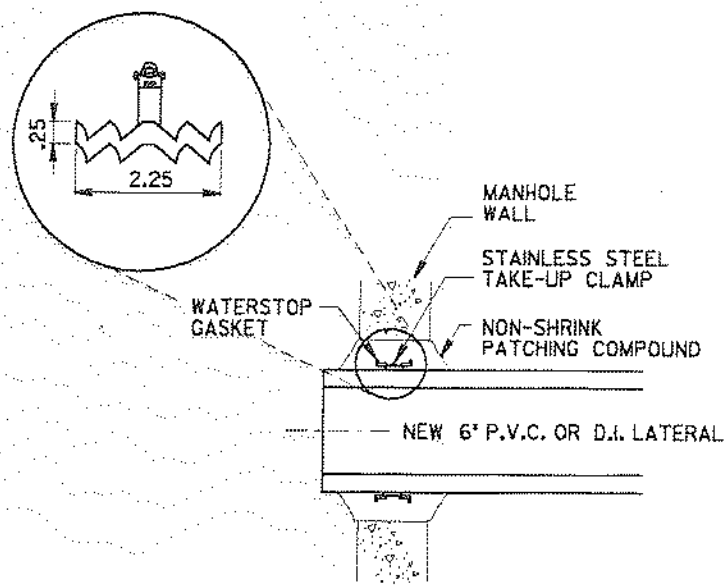
BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

Barge Waggoner Sumner and Cannon Inc

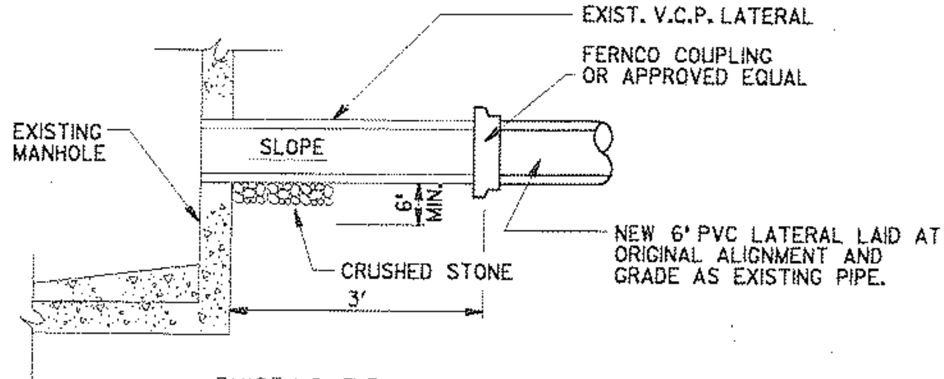
DETAIL NO.: C006A

DATE ISSUED:

DATE REVISED:



EXISTING TIE-IN IN REPLACEMENT



EXISTING TIE-IN IN GOOD CONDITION

MANHOLE TIE-IN DETAILS

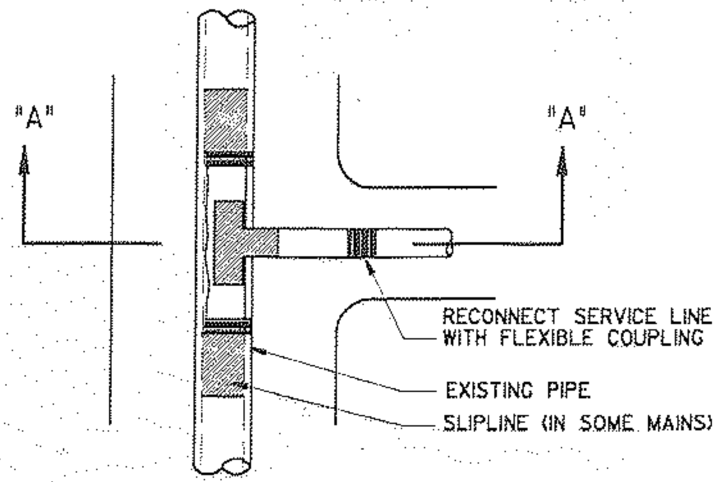
BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

Barge Waggoner Sumner and Cannon Inc

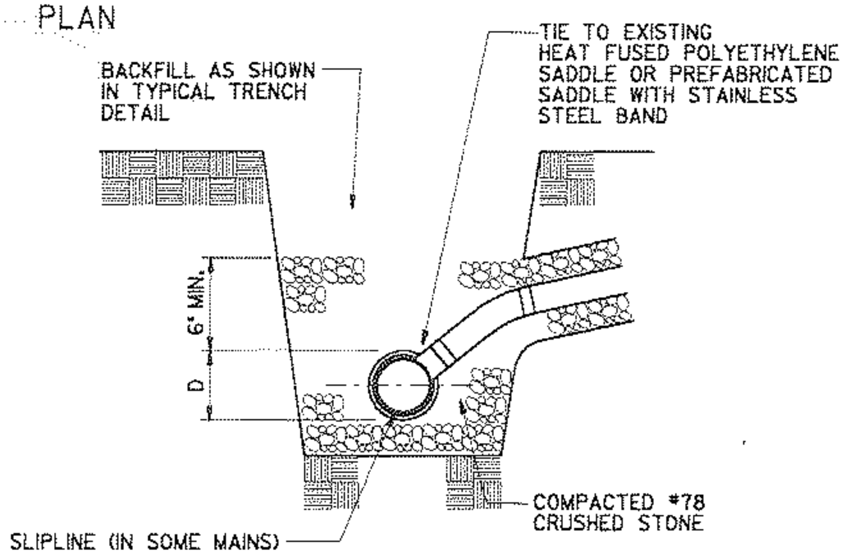
DETAIL NO.: C020

DATE ISSUED:

DATE REVISED:



PLAN



SECTION "A-A"

SERVICE CONNECTION DETAIL

Barge Waggoner Sumner and Cannon Inc

DETAIL NO.: C02I

DATE ISSUED:

DATE REVISED:

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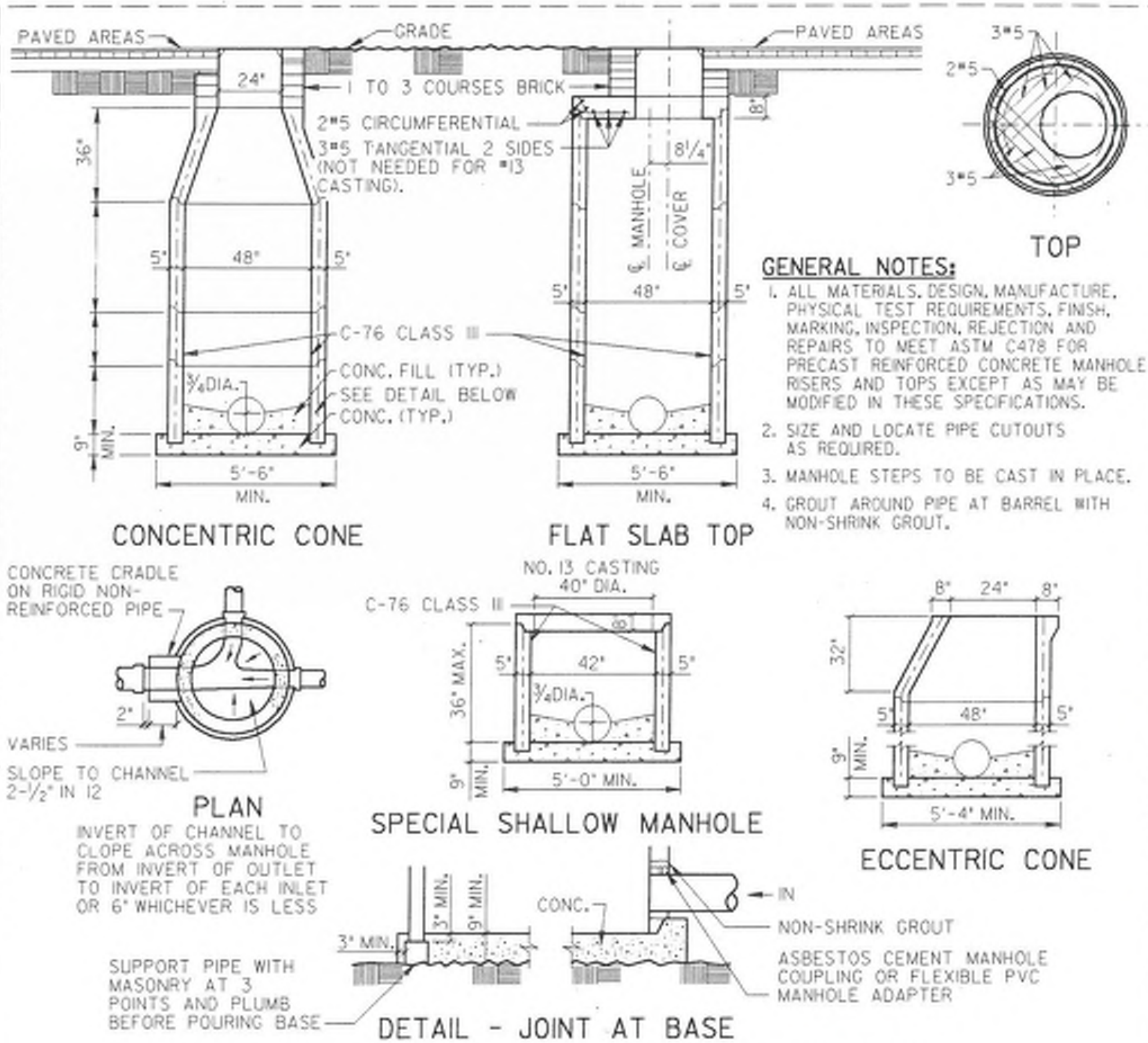


GENERAL NOTES:

1. ALL MATERIALS, DESIGN, MANUFACTURE, PHYSICAL TEST REQUIREMENTS, FINISH, MARKING, INSPECTION, REJECTION AND REPAIRS TO MEET ASTM C478 FOR PRECAST REINFORCED CONCRETE MANHOLE RISERS AND TOPS EXCEPT AS MAY BE MODIFIED IN THESE SPECIFICATIONS.
2. SIZE AND LOCATE PIPE CUTOUTS AS REQUIRED.
3. MANHOLE STEPS TO BE CAST IN PLACE.
4. GROUT AROUND PIPE AT BARREL WITH NON-SHRINK GROUT.

STANDARD PRECAST CONCRETE MANHOLES

BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$

Barge Waggoner Sumner and Cannon Inc

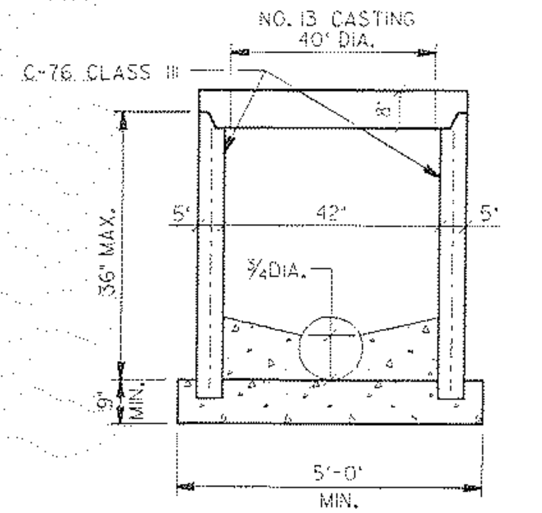
DETAIL NO.: C101

DATE ISSUED:

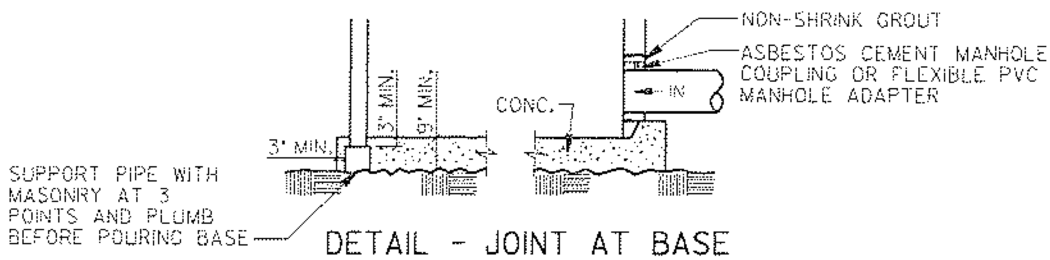
DATE REVISED:

GENERAL NOTES:

1. ALL MATERIALS, DESIGN, MANUFACTURE, PHYSICAL TEST REQUIREMENTS, FINISH, MARKING, INSPECTION, REJECTION AND REPAIRS TO MEET ASTM C478 FOR PRECAST REINFORCED CONCRETE MANHOLE RISERS AND TOPS EXCEPT AS MAY BE MODIFIED IN THESE SPECIFICATIONS.
2. SIZE AND LOCATE PIPE CUTOUTS AS REQUIRED.
3. MANHOLE STEPS TO BE CAST IN PLACE.
4. GROUT AROUND PIPE AT BARREL WITH NON-SHRINK GROUT.



SPECIAL SHALLOW MANHOLE



DETAIL - JOINT AT BASE

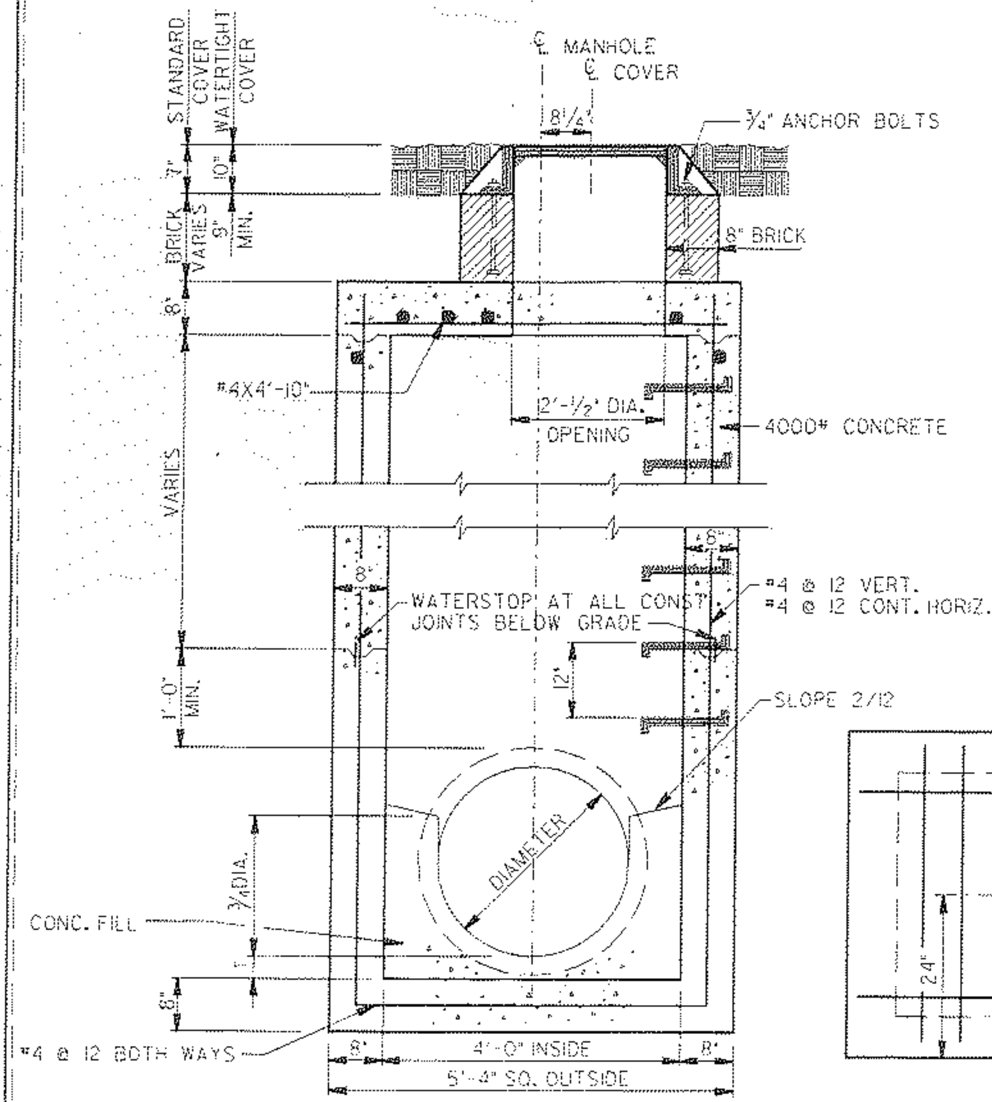
STANDARD PRECAST CONCRETE MANHOLES

(N.T.S.)

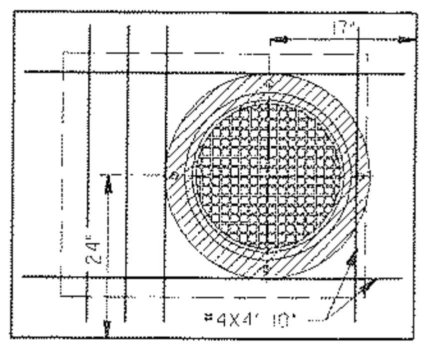
BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$

Barge Waggoner Sumner and Cannon Inc	DETAIL NO.: CIOIC
	DATE ISSUED:
	DATE REVISED:

PLACE BASE AND WALL
IN SINGLE POUR OR
PROVIDE 6" WATERSTOP
AT CONSTRUCTION JOINTS



SECTION



PLAN

(24" SEWER & SMALLER.: OF 30° OR LESS)

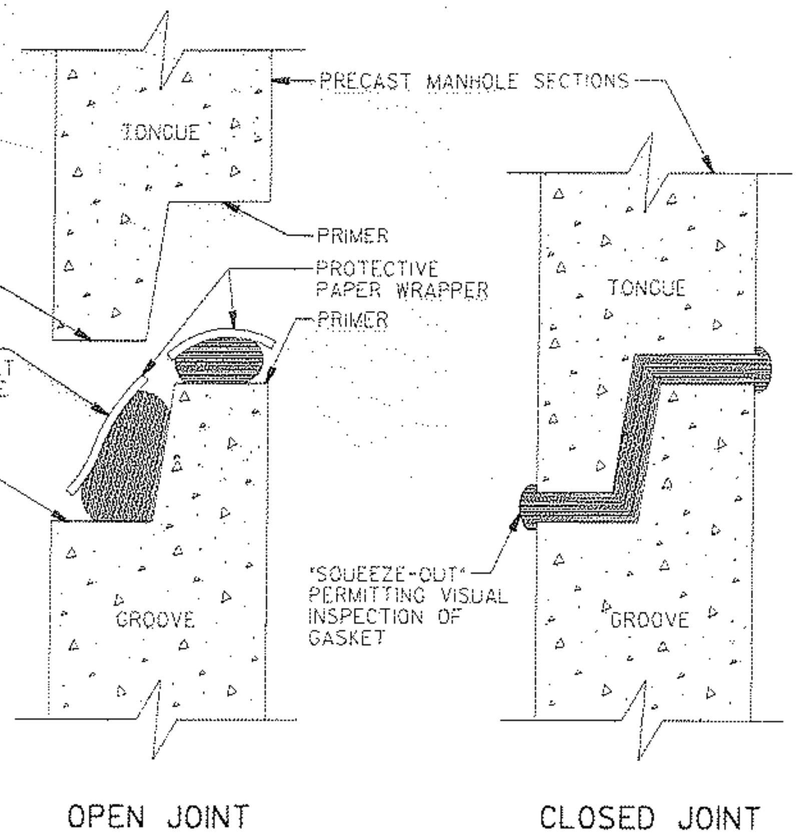
CAST-IN-PLACE STANDARD CONCRETE MANHOLE

(N.T.S.)

BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$

Barge Waggoner Sumner and Cannon Inc		DETAIL NO.: C105
		DATE ISSUED:
		DATE REVISED:

NOTE:
WHERE MASTIC DOES NOT PROTRUDE, EITHER INSIDE OR OUTSIDE, POINT UP JOINT WITH GROUT.

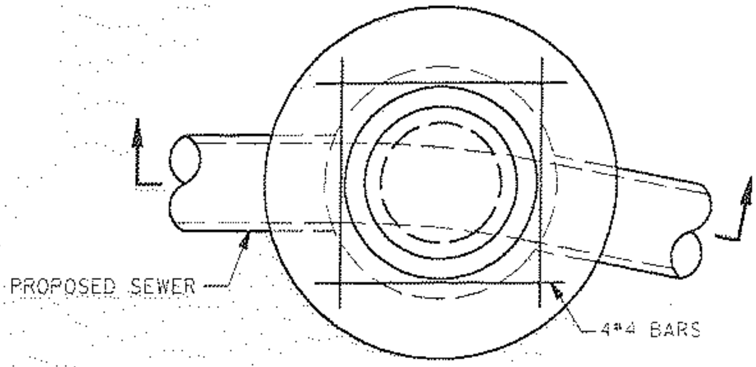


DETAIL OF PLASTIC GASKET FOR PRECAST MANHOLE SECTIONS

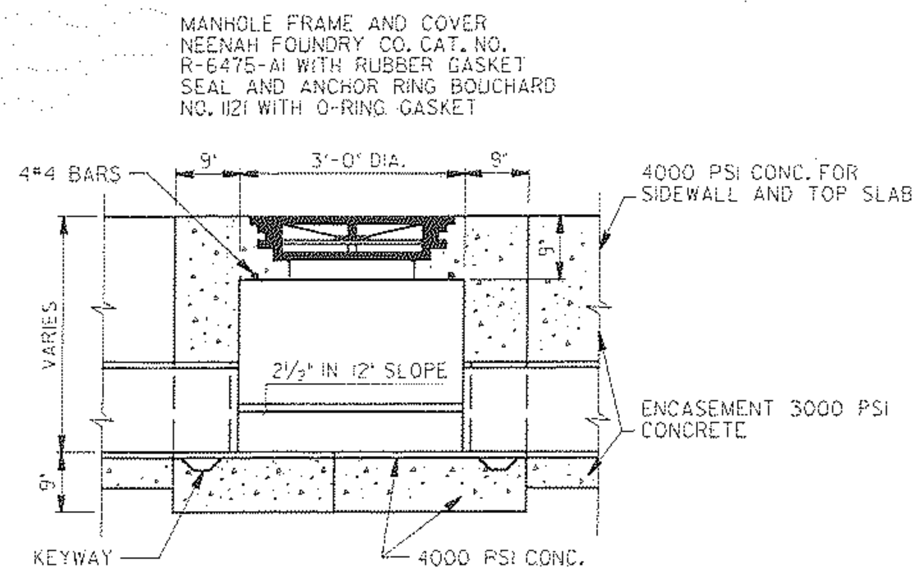
(N.T.S.)

BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

Barge Waggoner Sumner and Cannon Inc		DETAIL NO.: C106
		DATE ISSUED:
		DATE REVISED:



PLAN



SECTION

NOTE:
SIDEWALL AND TOP SLAB SHALL BE MONOLITHIC.

SPECIAL SHALLOW WATERTIGHT MANHOLE OR CREEK BOTTOM MANHOLE

(N.T.S.)

Barge Waggoner Sumner and Cannon Inc

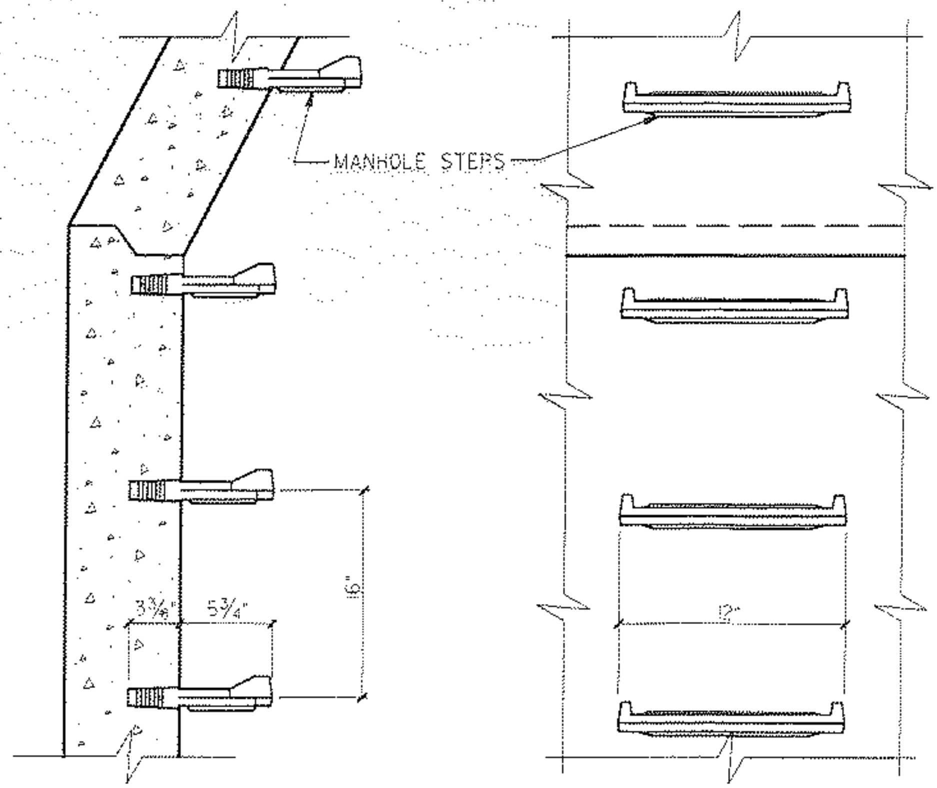
DETAIL NO.: C107

DATE ISSUED:

DATE REVISED:

BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

NOTE:
3/8" STEEL REINFORCED ROD ENCAPSULATED
IN POLYPROPYLENE PLASTIC OR EQUAL



SECTION

ELEVATION

DETAIL OF STANDARD LADDER BARS

N.T.S.

Barge
Waggoner
Sumner and
Cannon Inc

DETAIL NO.: C108

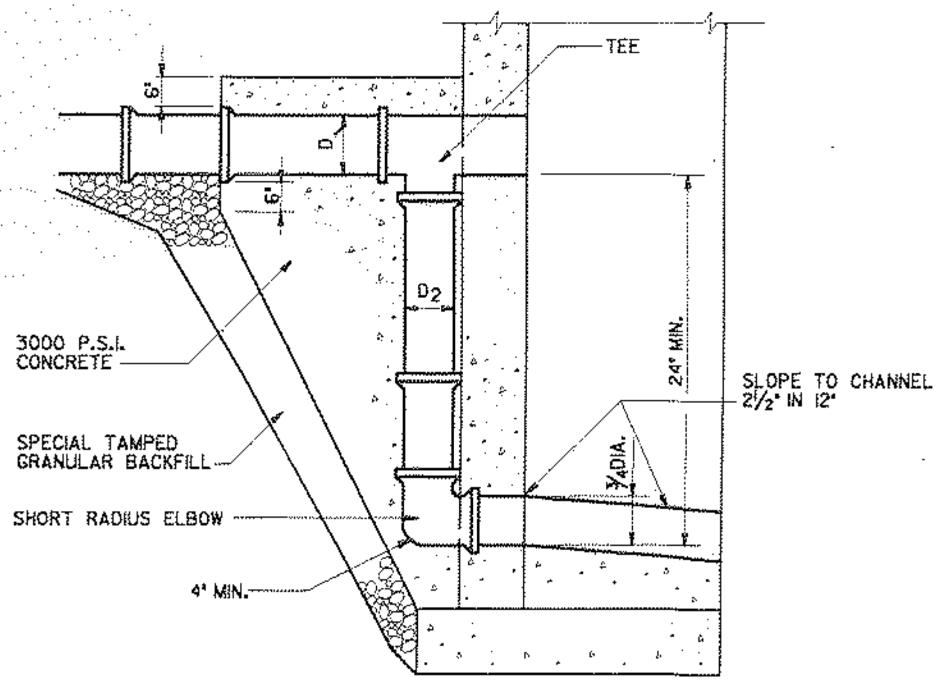
DATE ISSUED:

DATE REVISED:

BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

NOTES:

1. SET INLET FROM DROP TO MATCH CROWNS WITH OUTLET EXCEPT THAT MINIMUM FALL ACROSS M.H. INVERT MUST BE 3".
2. WHERE CALLED FOR UNIT PRICE EXTRA FOR DROP MANHOLE CONNECTIONS, THIS SHALL INCLUDE ALL ITEMS NOT NORMALLY INCLUDED IN STANDARD MANHOLE ITEMS, SUCH AS CONCRETE ENCASEMENT, ETC. NECESSARY AND APPURTENANT TO COMPLETION OF DROP MANHOLE CONNECTIONS.
3. FOR DETAILS NOT SHOWN SEE STANDARD MANHOLE DETAIL 101.



D_1	D_2
8"	8"
10"	10"
12"	12"
15"	15"
18"	18"

STANDARD DROP MANHOLE

N.T.S.

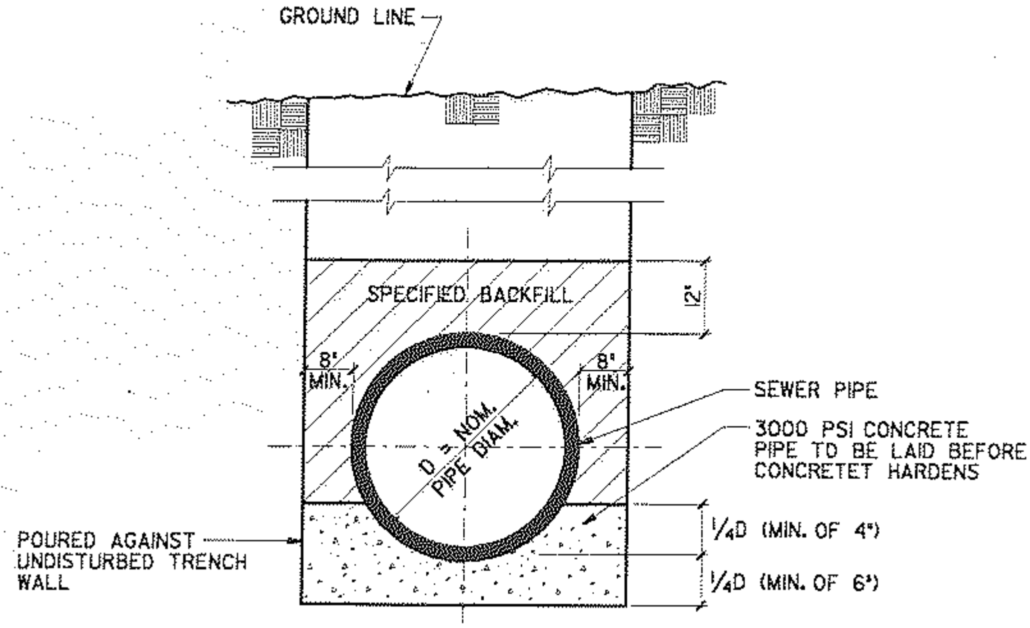
BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$

Barge Waggoner Sumner and Cannon Inc

DETAIL NO.: C110

DATE ISSUED:

DATE REVISED:



TYPICAL SECTION

NOTE:
CONCRETE TO BE POURED 16 HOURS BEFORE BACKFILL IS PLACED AND IN SUCH A MANNER AS TO PREVENT THE PIPE FROM FLOATING

CONCRETE CRADLE

N.T.S.

BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

Barge Waggoner Sumner and Cannon Inc		DETAIL NO.: CIII
		DATE ISSUED:
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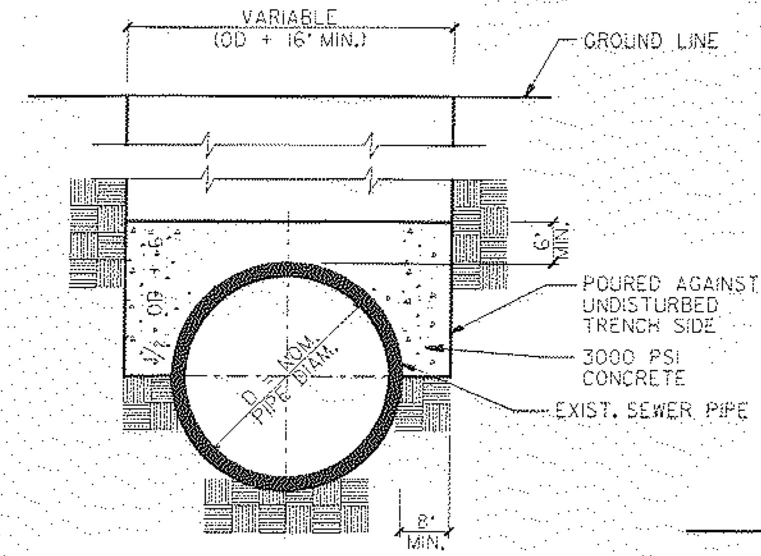
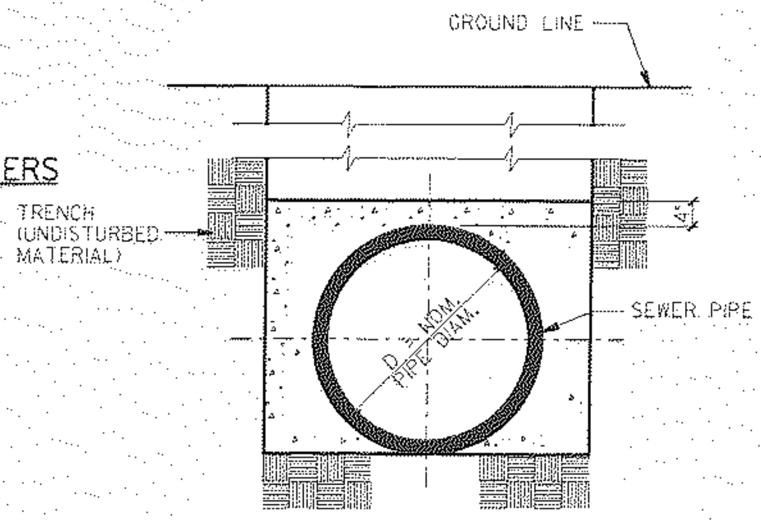


TYPICAL CONCRETE
PROTECTION FOR EXISTING SEWERS

NOTE:
3000 PSI CONCRETE TO BE POURED 16 HOURS BEFORE BACKFILL IS PLACED AND IN SUCH A MANNER AS TO PREVENT PIPE FROM FLOATING



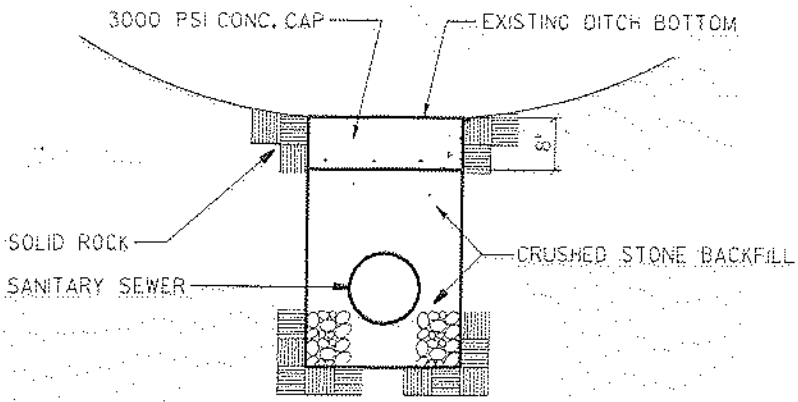
TYPICAL CONCRETE
PROTECTION FOR NEW SEWERS

CONCRETE PROTECTION

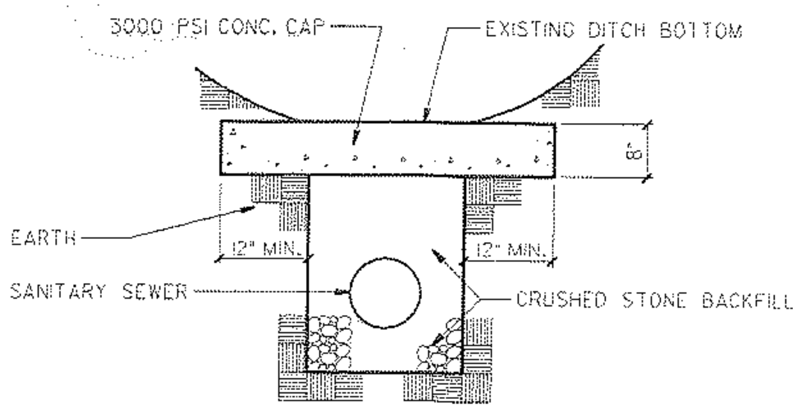
N.T.S.

Barge Waggoner Sumner and Cannon Inc		DETAIL NO.: C112
		DATE ISSUED:
		DATE REVISED:

BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$



ROCK EXCAVATION



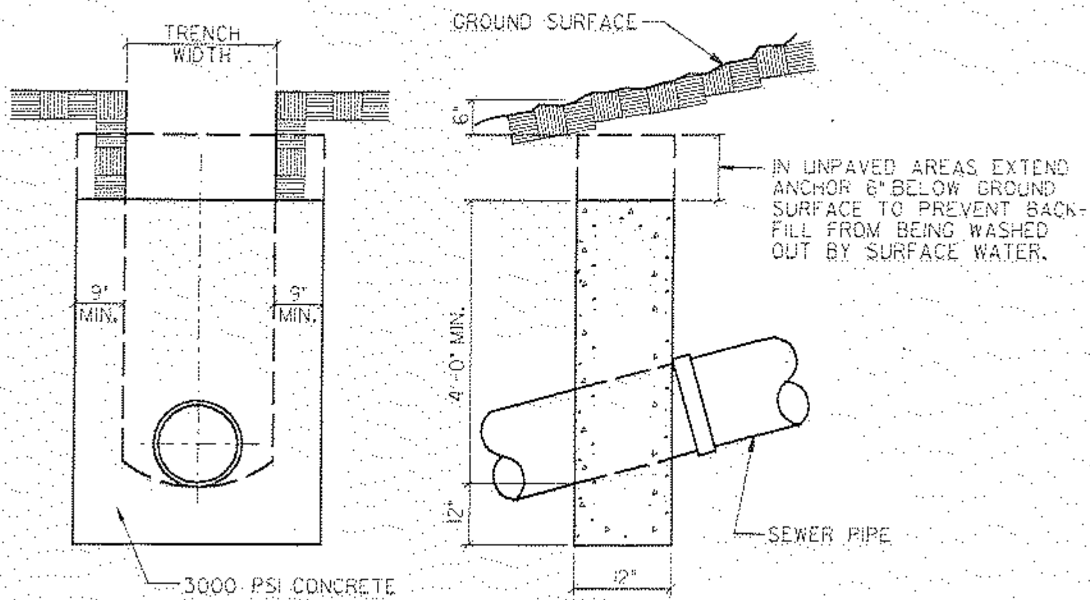
EARTH EXCAVATION

CONCRETE CAP

N.T.S.

BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$

Barge Waggoner Sumner and Cannon Inc		DETAIL NO.: C120
		DATE ISSUED:
		DATE REVISED:



CONCRETE ANCHORS FOR SEWERS ON STEEP GRADES

N.T.S.

PROVIDE NO ANCHORS ON GRADES LESS THAN 20% UNLESS NOTED.

PROVIDE ANCHOR 36' CENTER TO CENTER ON GRADES BETWEEN 20% & 34%.

PROVIDE ANCHOR 24' CENTER TO CENTER ON GRADES BETWEEN 34% & 50%.

PROVIDE ANCHOR 16' CENTER TO CENTER ON GRADES BETWEEN 50% & 70%.

CONTRACTOR MAY SUBMIT ALTERNATE DESIGN UTILIZING ROCK BOLTS TO KEY ANCHOR TO ROCK TRENCH.

FOR CONDITIONS OTHER THAN SHOWN HEREON ANCHORS SHALL BE PROVIDED AS REQUIRED BY THE CONTRACT PLANS OR ORDERED BY THE ENGINEER.

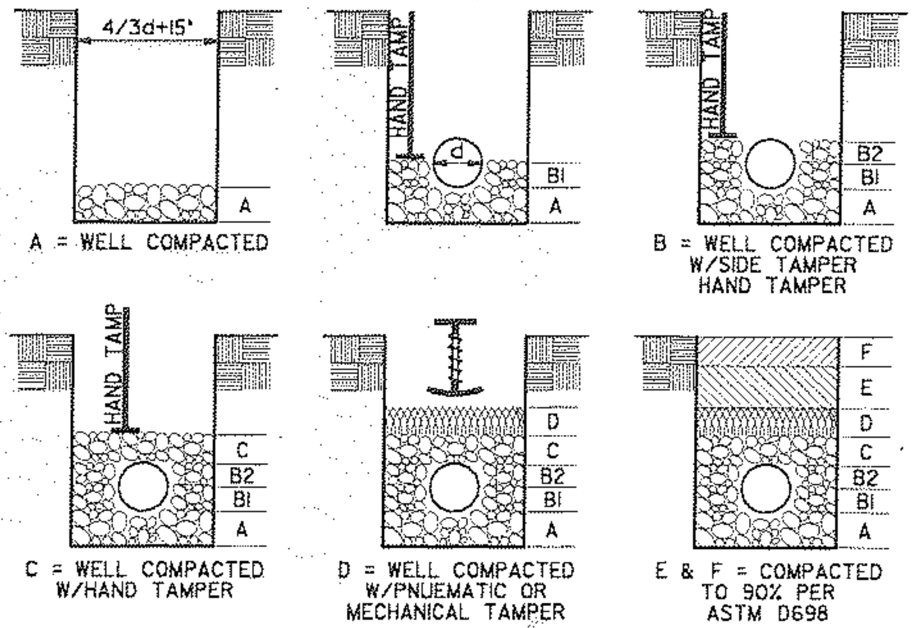
BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

Barge Waggoner Sumner and Cannon Inc

DETAIL NO.: C122

DATE ISSUED:

DATE REVISED:



LAYER	DEPTH	MATERIAL
A	6"	CLASS I FOR PLASTIC PIPE, CLASS I-IV FOR ALL OTHER PIPE *
B	VARIES	CLASS I FOR PLASTIC PIPE, CLASS I-IV FOR ALL OTHER PIPE, TAMPED IN 6" MAXIMUM LAYERS.
C	6"	CLASS I FOR PLASTIC PIPE, CLASS I-IV FOR ALL OTHER PIPE
D	6"	SELECTED BACKFILL MATERIAL-CLASS I-IV FOR ALL PIPE, UNLESS OTHERWISE NOTED
E	VARIES	CLASS I-IV FOR ALL PIPE UNLESS OTHERWISE NOTED, 75% OF BACKFILL MATERIAL MAY CONTAIN BROKEN STONES NOT EXCEEDING 6" IN DIAMETER-TAMPED IN 6" MAXIMUM LAYERS
F	12"	CLASS I-IV FOR ALL PIPE-EXCEPT USE CLASS A, GRADE D ** CRUSHED STONE ACROSS OR ALONG EXISTING PAVEMENT UNLESS OTHERWISE NOTED

* SEE SECTION 02221 FOR SPECIAL FOUNDATION PREPARATION

** SEE SECTION 02575

BACKFILLING AND COMPACTION OF GRAVITY SEWER TRENCHES IN IMPROVED AREAS

N.T.S.

BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$

Barge Waggoner Sumner and Cannon Inc

DETAIL NO.: C124A

DATE ISSUED:

DATE REVISED:

LAYER	DEPTH	MATERIAL
A	6" MIN.	CLASS I FOR PLASTIC PIPE, CLASS I-IV FOR ALL OTHER PIPE *
B	VARIES	CLASS I FOR PLASTIC PIPE, CLASS I-IV FOR ALL OTHER PIPE, TAMPED IN 6" MAXIMUM LAYERS.
C	6"	CLASS I FOR PLASTIC PIPE, CLASS I-IV FOR ALL OTHER PIPE
D	6"	SELECTED BACKFILL MATERIAL-CLASS I-IV FOR ALL PIPE
E	VARIES	CLASS I-IV FOR ALL PIPE, 75% OF BACKFILL MATERIAL MAY CONTAIN BROKEN STONES NOT EXCEEDING 6" IN DIAMETER-TAMPED IN 12" MAXIMUM LAYERS
F	12"	CLASS III OR IV FOR ALL PIPE, FREE OF LARGE CLODS, VEGETABLE MATTER, DEBRIS STONE AND/OR ANY OTHER OBJECTIONABLE MATTER

* SEE SECTION 02221 FOR SPECIAL FOUNDATION PREPARATION

BACKFILLING AND COMPACTION OF GRAVITY SEWER TRENCHES IN UNIMPROVED AREAS

N.T.S.

BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

Barge Waggoner Sumner and Cannon Inc

DETAIL NO.: CI24B

DATE ISSUED:

DATE REVISED:

LAYER	DEPTH	MATERIAL
A	6" MIN.	CLASS I-IV FOR ALL RIDID PIPE ✻
B	VARIES	CLASS I-IV FOR ALL RIDID PIPE TAMPED IN 6" MAXIMUM LAYERS.
C	6"	CLASS I-IV FOR ALL RIGID PIPE
D	6"	SELECTED BACKFILL MATERIAL-CLASS I-IV FOR ALL PIPE, UNLESS OTHERWISE NOTED
E	VARIES	CLASS I-IV FOR ALL PIPE UNLESS OTHERWISE NOTED, 75% OF BACKFILL MATERIAL MAY CONTAIN BROKEN STONES NOT EXCEEDING 6" IN DIAMETER-TAMPED IN 6" MAXIMUM LAYERS
F	12"	CLASS I-IV FOR ALL PIPE-EXCEPT USE CLASS A, GRADE D ✻✻ CRUSHED STONE ACROSS OR ALONG EXISTING PAVEMENT UNLESS OTHERWISE NOTED

✻ SEE SECTION 02221 FOR SPECIAL FOUNDATION PREPARATION

✻✻ SEE SECTION 02575

BACKFILLING AND COMPACTION OF WATER LINE AND FORCE MAIN TRENCHES IN IMPROVED AREAS

N.T.S.

BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

Barge Waggoner Sumner and Cannon Inc

DETAIL NO.: CI24C

DATE ISSUED:

DATE REVISED:

LAYER	DEPTH	MATERIAL
A	6" MIN.	CLASS I-IV FOR ALL RIDID PIPE ✱
B	VARIES	CLASS I-IV FOR ALL RIDID PIPE TAMPED IN 6" MAXIMUM LAYERS.
C	6"	CLASS I-IV FOR ALL RIGID PIPE
D	6"	SELECTED BACKFILL MATERIAL-CLASS I-IV FOR ALL PIPE
E	VARIES	CLASS I-IV FOR ALL PIPE, 75% OF BACKFILL MATERIAL MAY CONTAIN BROKEN STONES NOT EXCEEDING 6" IN DIAMETER-TAMPED IN 12" MAXIMUM LAYERS
F	12"	CLASS III OR IV FOR ALL PIPE, FREE OF LARGE CLODS, VEGETABLE MATTER, DEBRIS STONE AND/OR ANY OTHER OBJECTIONABLE MATTER

✱ SEE SECTION 02221 FOR SPECIAL FOUNDATION PREPARATION

BACKFILLING AND COMPACTION OF WATER LINE AND FORCE MAIN TRENCHES IN UNIMPROVED AREAS

N.T.S.

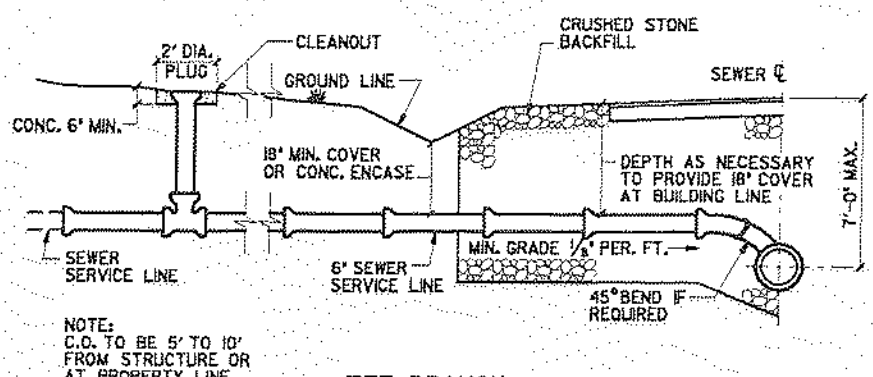
Barge Waggoner Sumner and Cannon Inc

DETAIL NO.: C124D

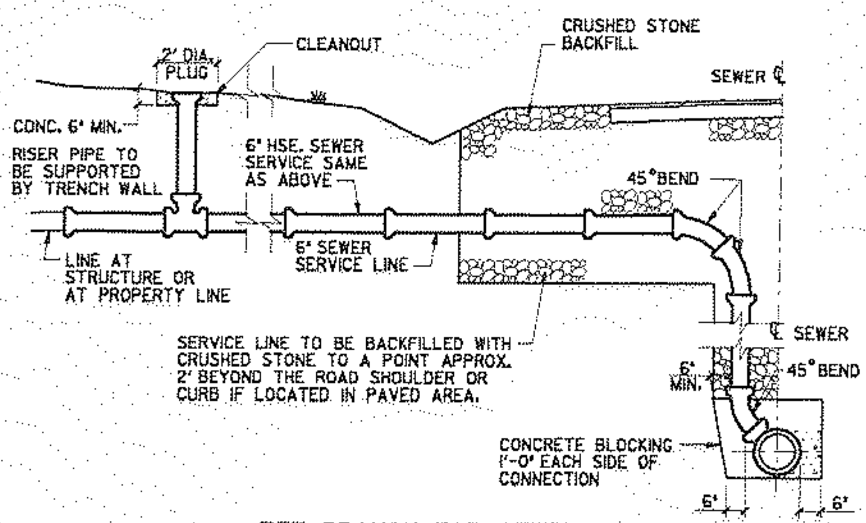
DATE ISSUED:

DATE REVISED:

BWSC $PLOT$TIME$$$
BWSC $FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$



TEE BRANCH



TEE BRANCH FOR SEWER DEPTHS OF 7'-0" OR MORE
(10" DIAMETER OR SMALLER)

SANITARY SEWER SERVICE LINES

N.T.S.

Barge Waggoner Sumner and Cannon Inc

DETAIL NO.: C128

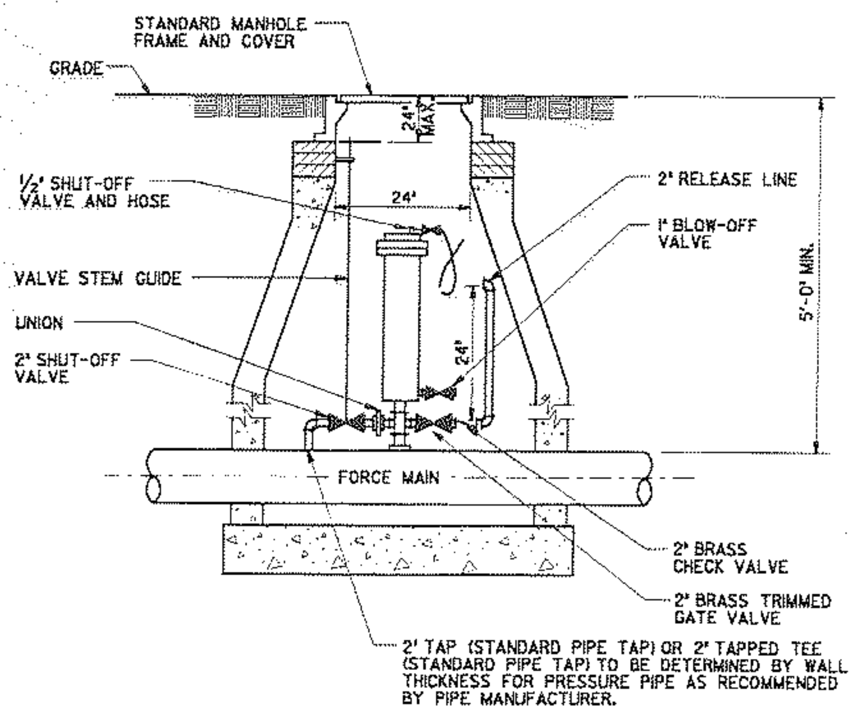
DATE ISSUED:

DATE REVISED:

BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

NOTES:

1. AIR RELEASE VALVE TO BE "CRISPIN SEWER VALVE", APCO 400 SEWAGE VALVE, OR EQUAL.
2. AIR VACUUM VALVE INSTALLATION TO BE SIMILAR EXCEPT VALVE TO BE APCO 402 SEWAGE VALVE OR EQUAL.
3. 2" RELEASE LINE, GATE AND CHECK VALVE ON AIR-VACUUM VALVE ONLY.



AIR RELEASE VALVE SANITARY FORCE MAIN

N.T.S.

BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

Barge Waggoner Sumner and Cannon Inc

DETAIL NO.: CI29

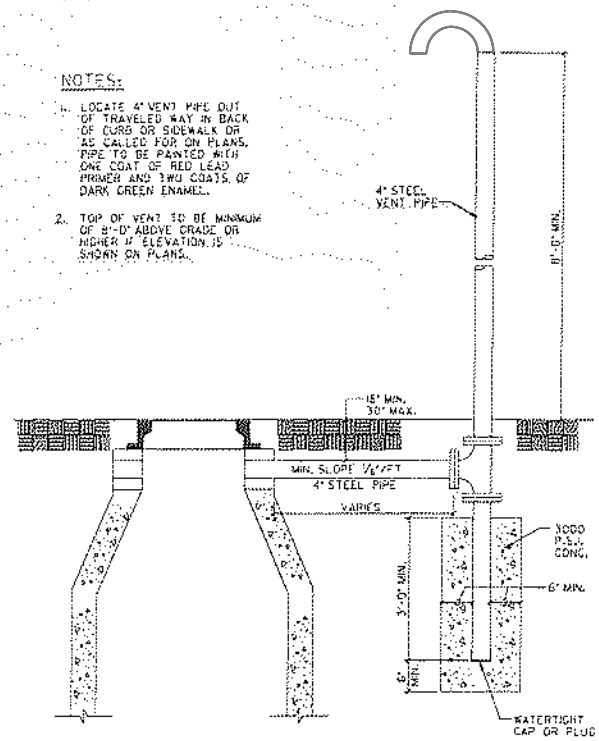
DATE ISSUED:

DATE REVISED:

NOTES:

1. LOCATE 4" VENT PIPE OUT OF TRAVELED WAY IN BACK OF CURB OR SIDEWALK OR AS CALLED FOR ON PLANS. PIPE TO BE PAINTED WITH ONE COAT OF RED LEAD PRIMER AND TWO COATS OF DARK GREEN ENAMEL.

2. TOP OF VENT TO BE MINIMUM OF 8'-0" ABOVE GRADE OR HIGHER IF ELEVATION IS SHOWN ON PLANS.



STANDARD MANHOLE VENT

N.T.S.

BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

Barge Waggoner Sumner and Cannon Inc		DETAIL NO.: C132
		DATE ISSUED:
		DATE REVISED: 03-96

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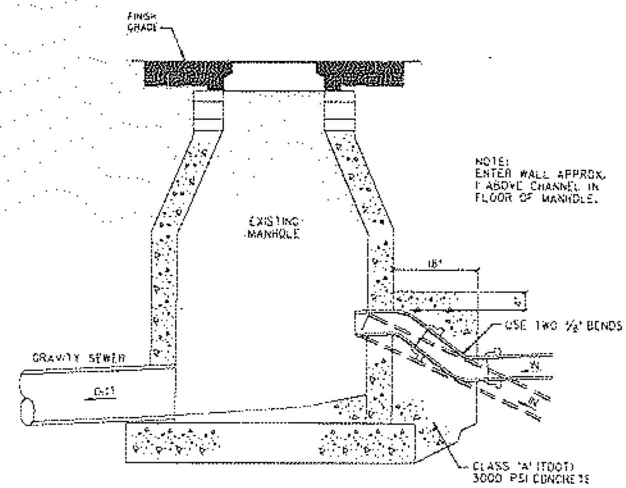

STANDARD CONNECTION OF FORCE MAIN TO MANHOLE

N.T.S.

BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

Barge Waggoner Sumner and Cannon Inc	DETAIL NO.: C135
	DATE ISSUED:
	DATE REVISED: 03-96

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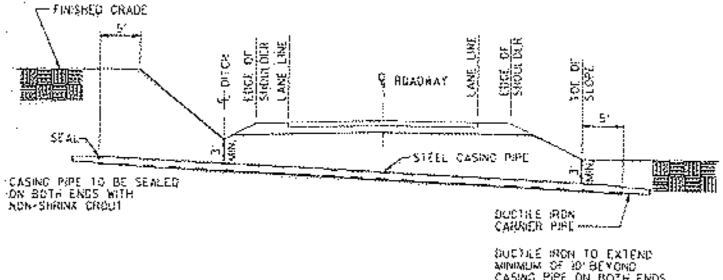

NOTES:

1. CASING SHALL EXTEND TO THE FOLLOWING DISTANCES:
   A. 5' BEYOND TOE OF SLOPE.
   B. 5' BEYOND BACK OF DITCH.

2. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH "TENNESSEE DEPARTMENT OF TRANSPORTATION RULES AND REGULATIONS FOR ACCOMMODATING UTILITIES WITHIN HIGHWAY RIGHTS OF WAY" LATEST REVISION.

PIPE LINE CROSSING UNDER HIGHWAYS

(FOR NONFLAMABLE SUBSTANCES)

BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

Barge Waggoner Sumner and Cannon Inc

DETAIL NO.: C165A

DATE ISSUED:

DATE REVISED: 03-96

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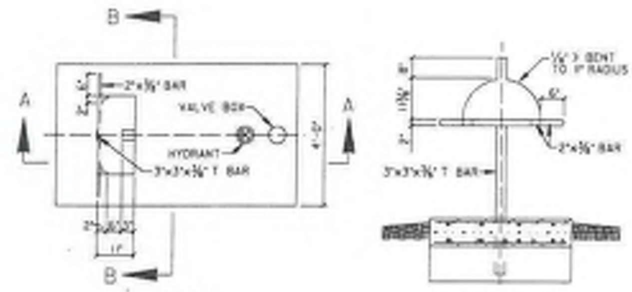
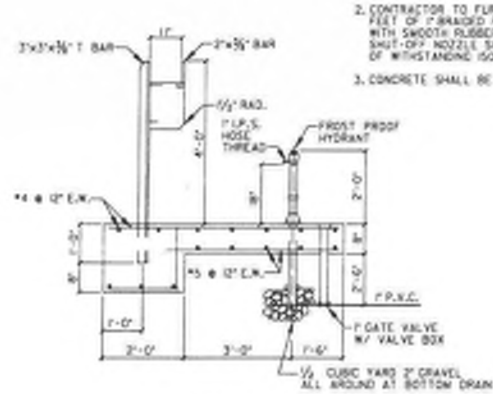


PLAN

SECTION B-B

NOTES:
1. FABRICATE HOSE RACK OF ALUMINUM, SHOP WELD.
2. CONTRACTOR TO FURNISH 100 LINEAR FEET OF 1" BRAIDED RAYON CORD HOSE WITH SMOOTH RUBBER COVER & BRASS SHUT-OFF NOZZLE SHALL BE CAPABLE OF WITHSTANDING 150 P.S.I. OF PRESSURE.
3. CONCRETE SHALL BE 3,500 P.S.I.



SECTION A-A

TYPICAL 1" FROST PROOF YARD HYDRANT
FOR POTABLE WATER

N.T.S.

BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

Barge Waggoner Sumner and Cannon Inc

DETAIL NO.:	C167
DATE ISSUED:	
DATE REVISED:	03-96

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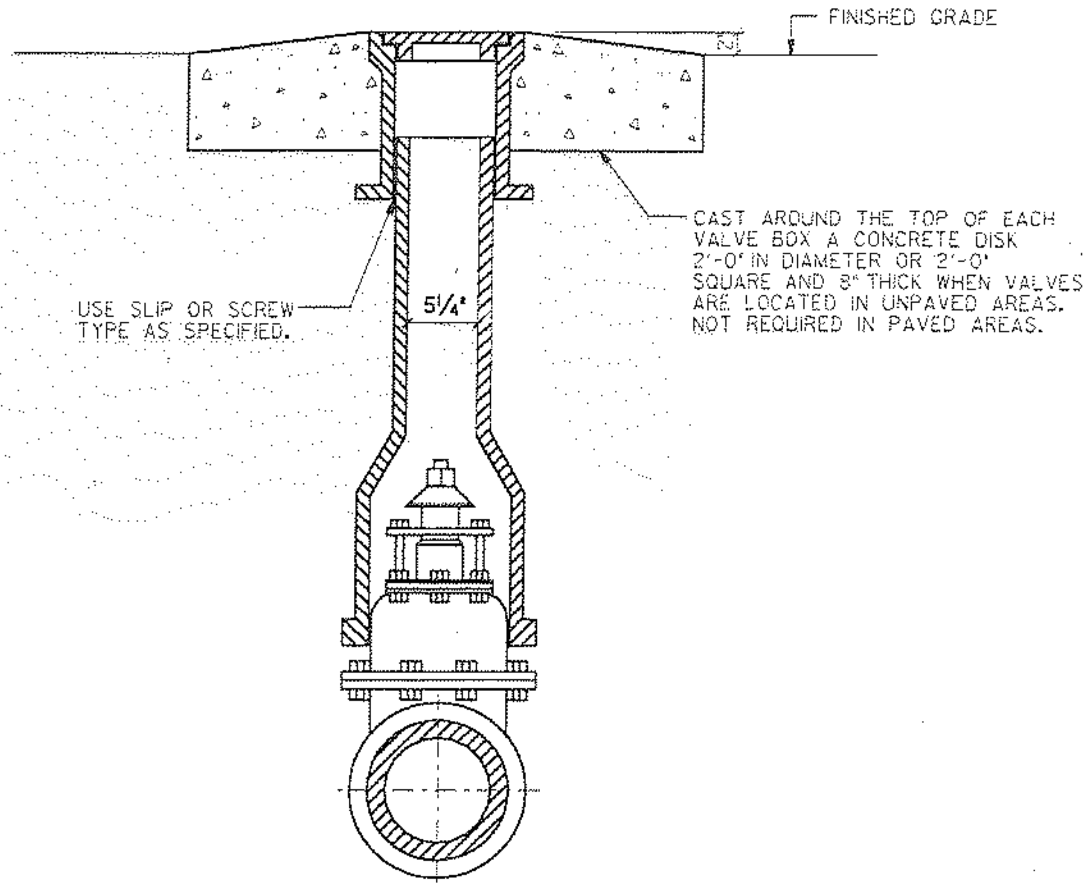


TYPICAL VALVE BOX SETTING

N.T.S.

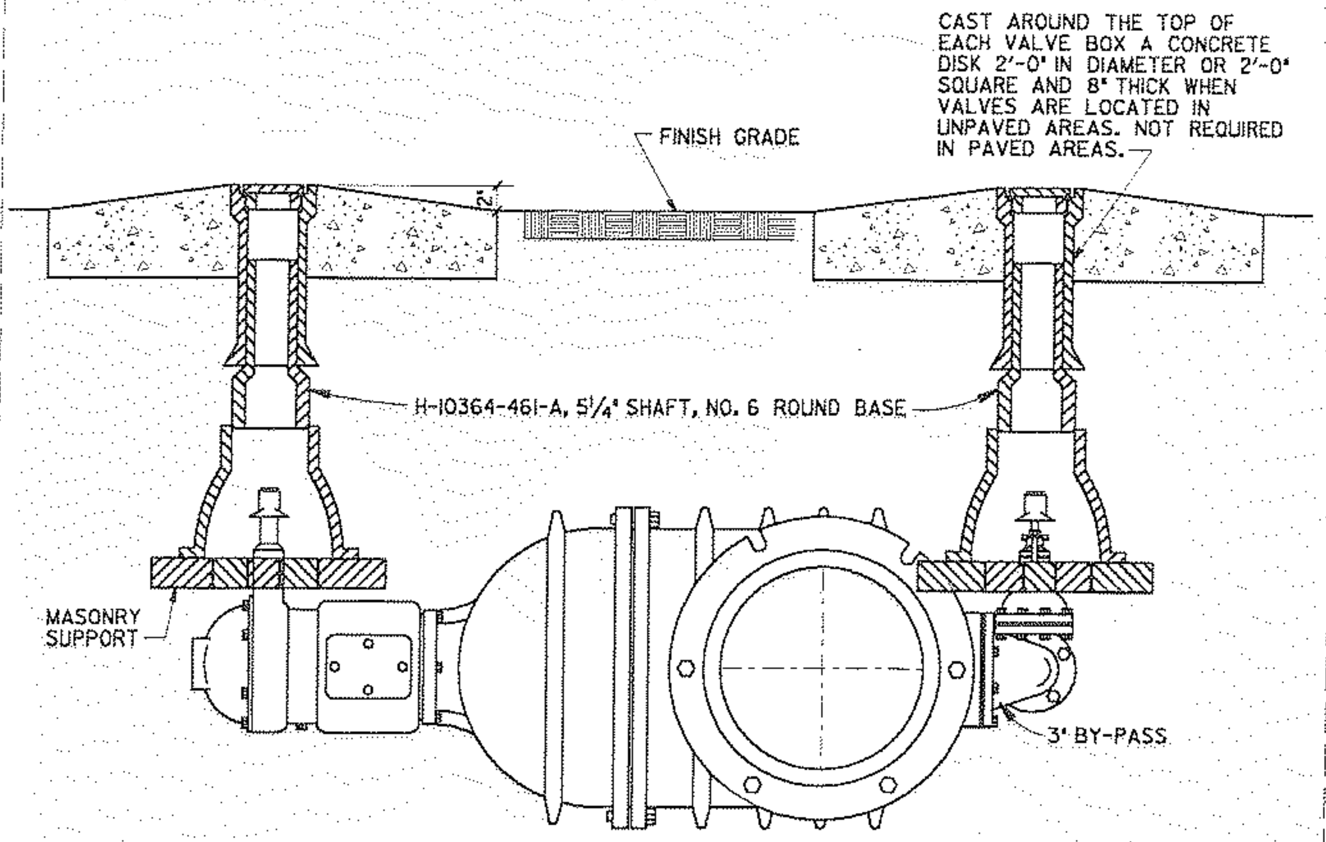
Barge Waggoner Sumner and Cannon Inc

DETAIL NO.: C201

DATE ISSUED:

DATE REVISED:

BWSC$PLOT$TIME$$$
BWSC$FILESNAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$



TYPICAL VALVE & BOX SETTING

14" & LARGER

NOTE:
MUELLER A-2480-20-06 AWWA MECHANICAL JOINT GATE VALVE, IBBM, DOUBLE DISC, PARALLEL SEAT, NRS, FOR FORIZONTAL SETTING, WITH BEVEL GEARING, GREASE CASE, 3" BY-PASS VALVE, WITH ROLLERS TRACKS AND SCRAPERS. VALVE IS TO BE COMPLETELY LUBRICATED INSTALLTION.

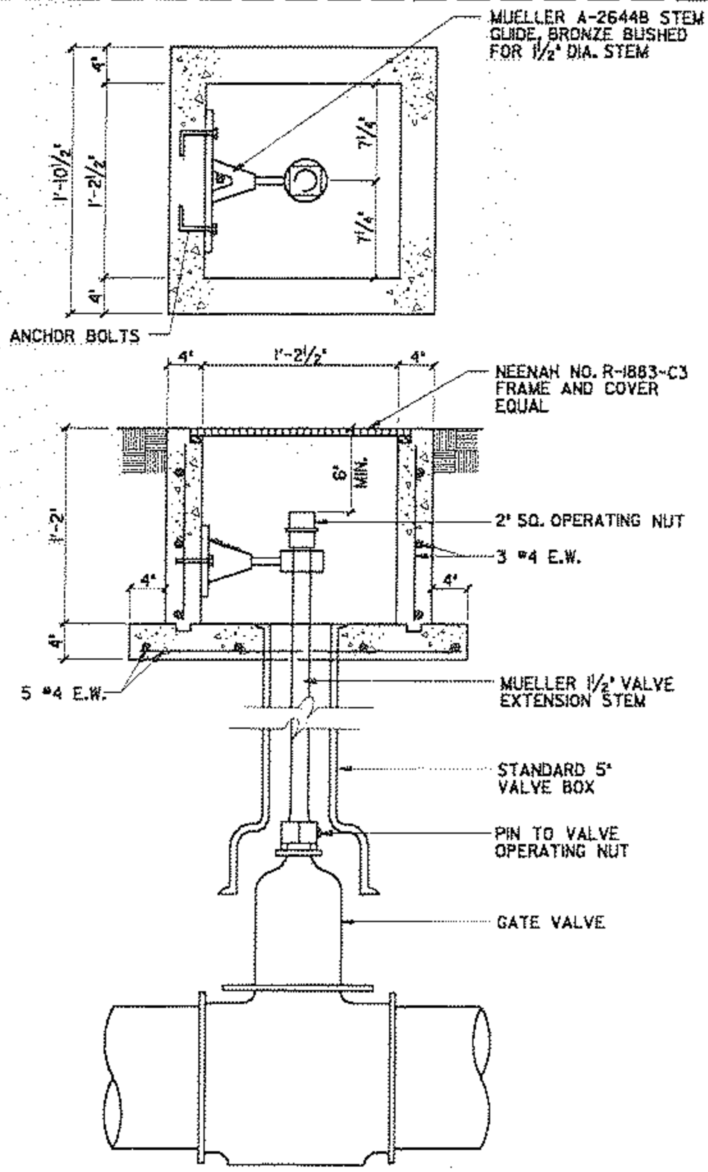
BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

Barge Waggoner Sumner and Cannon Inc

DETAIL NO.: C205

DATE ISSUED:

DATE REVISED:



VALVE STEM EXTENSION

N.T.S.

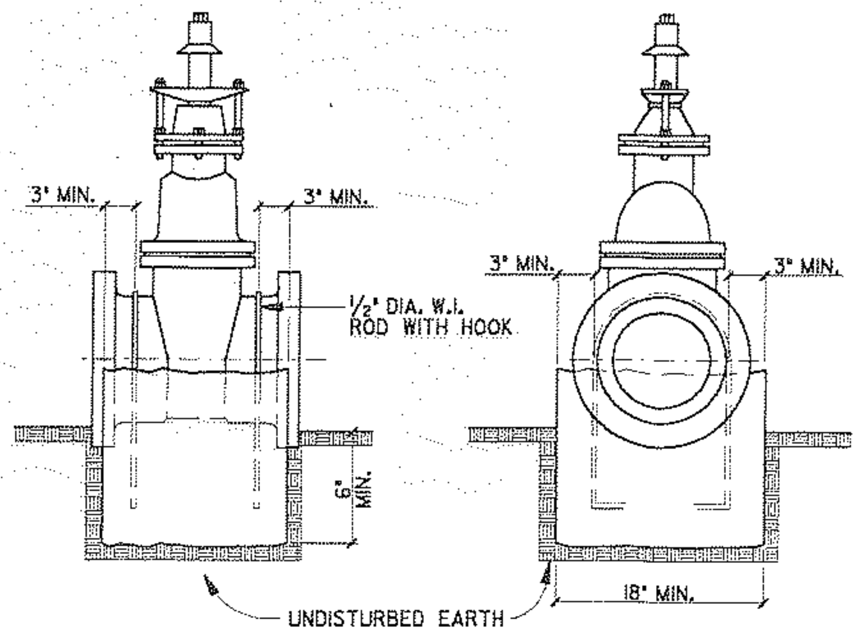
BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

Barge Waggoner Sumner and Cannon Inc

DETAIL NO.: C206

DATE ISSUED:

DATE REVISED:



SIZE OF VALVE	CONC. CU.FT.
2" & 2 1/4"	1.0
3" & 4"	1.0
6"	1.3
8"	1.5
10"	1.8
12"	2.5
14"	3.2
16"	3.4
18"	4.0

ASBESTOS CEMENT AND/OR PVC ONLY (applies to 2" & 2 1/4" through 10")

CONCRETE BLOCKING FOR VALVES

N.T.S.

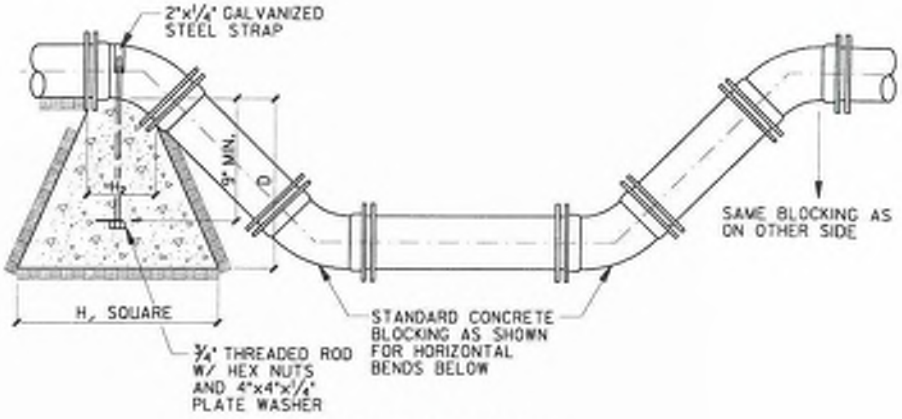
BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$

Barge Waggoner Sumner and Cannon Inc

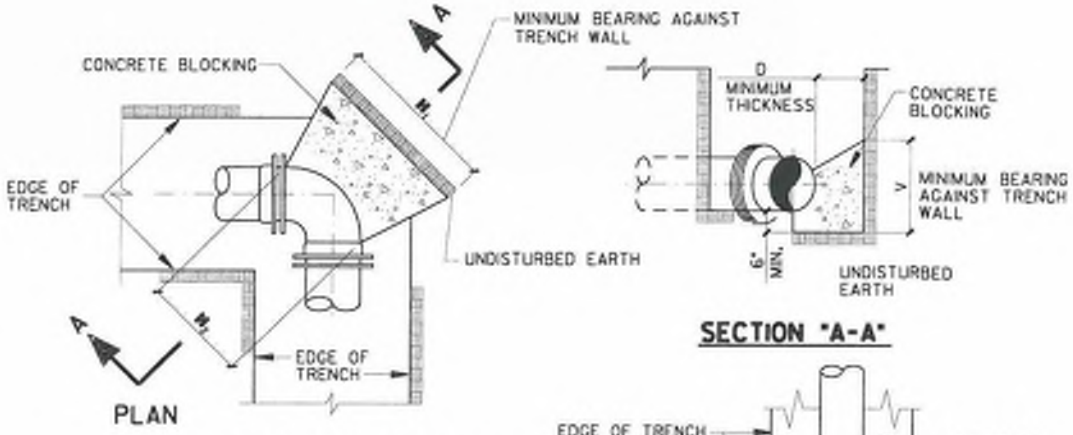
DETAIL NO.: C208

DATE ISSUED:

DATE REVISED:

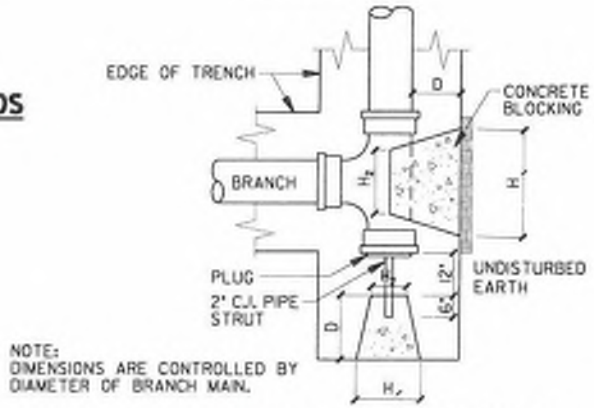


VERTICAL BENDS



HORIZONTAL BENDS

SECTION "A-A"



NOTE:
DIMENSIONS ARE CONTROLLED BY DIAMETER OF BRANCH MAIN.

TEES, CROSSES & PLUGS

Barge Waggoner Sumner and Cannon Inc

DETAIL NO.: C22IA

DATE ISSUED:

DATE REVISED:

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TABLE OF DIMENSIONS FOR CONCRETE BLOCKING

SIZE	TEES, PLUGS & CROSSES					90^ BENDS					45^ BENDS					22½^ BENDS					11¼^ BENDS					SIZE
PIPE	H_1	H_2	V	D	CU. FT.	H_1	H_2	V	D	CU. FT.	H_1	H_2	V	D	CU. FT.	H_1	H_2	V	D	CU. FT.	H_1	H_2	V	D	CU. FT.	PIPE
2"&2¼"	18"	10"	12"	18"	1.9	18"	10"	12"	18"	1.9	18"	6"	12"	18"	1.5	18"	6"	12"	18"	1.5	18"	6"	12"	18"	1.5	2"&2¼"
3"&4"	24"	12"	12"	18"	2.3	24"	12"	12"	18"	2.3	18"	8"	12"	18"	1.6	18"	8"	12"	18"	1.6	18"	8"	12"	18"	1.6	3"&4"
6"	24"	16"	18"	18"	3.5	30"	16"	18"	18"	4.1	24"	10"	16"	18"	3.2	24"	10"	16"	18"	3.2	24"	10"	16"	18"	3.2	6"
8"	36"	18"	18"	18"	5.1	39"	18"	24"	18"	7.3	30"	11"	18"	18"	4.0	24"	11"	18"	18"	3.5	24"	11"	16"	18"	3.4	8"
10"	48"	24"	18"	24"	7.2	54"	32"	24"	18"	10.3	24"	18"	21"	18"	4.6	24"	18"	21"	18"	4.6	24"	18"	21"	18"	4.6	10"
12"	54"	30"	24"	24"	13.4	54"	32"	36"	24"	18.2	42"	18"	24"	24"	9.6	24"	18"	24"	24"	6.6	24"	18"	21"	24"	6.1	12"
14"	60"	32"	30"	24"	17.9	60"	40"	42"	24"	25.0	44"	24"	30"	24"	13.2	30"	24"	24"	24"	9.2	27"	21"	24"	24"	7.9	14"
16"	66"	34"	36"	24"	22.5	69"	48"	48"	24"	29.0	48"	30"	36"	24"	17.0	36"	30"	27"	24"	11.8	27"	24"	27"	24"	9.1	16"
18"	72"	36"	40"	24"	30.0	72"	48"	60"	24"	38.0	48"	30"	42"	24"	21.0	42"	30"	30"	24"	15.0	30"	30"	36"	24"	13.0	18"
20"	84"	38"	42"	24"	36.0	84"	48"	66"	24"	48.0	54"	40"	46"	24"	27.0	48"	36"	36"	24"	19.0	42"	40"	36"	24"	18.0	20"
24"	108"	42"	48"	24"	45.0	108"	60"	72"	24"	68.0	60"	48"	56"	24"	41.0	54"	42"	42"	24"	25.0	48"	42"	42"	24"	23.0	24"
30"	132"	52"	60"	24"	70.0	132"	72"	92"	24"	104.0	72"	48"	76"	24"	58.0	60"	48"	48"	24"	32.0	54"	48"	54"	24"	32.0	30"
36"	162"	58"	72"	24"	100.0	162"	96"	108"	24"	150.0	84"	72"	84"	24"	85.0	66"	72"	60"	24"	50.0	60"	48"	60"	24"	40.0	36"

CONCRETE THRUST BLOCKING

N.T.S.

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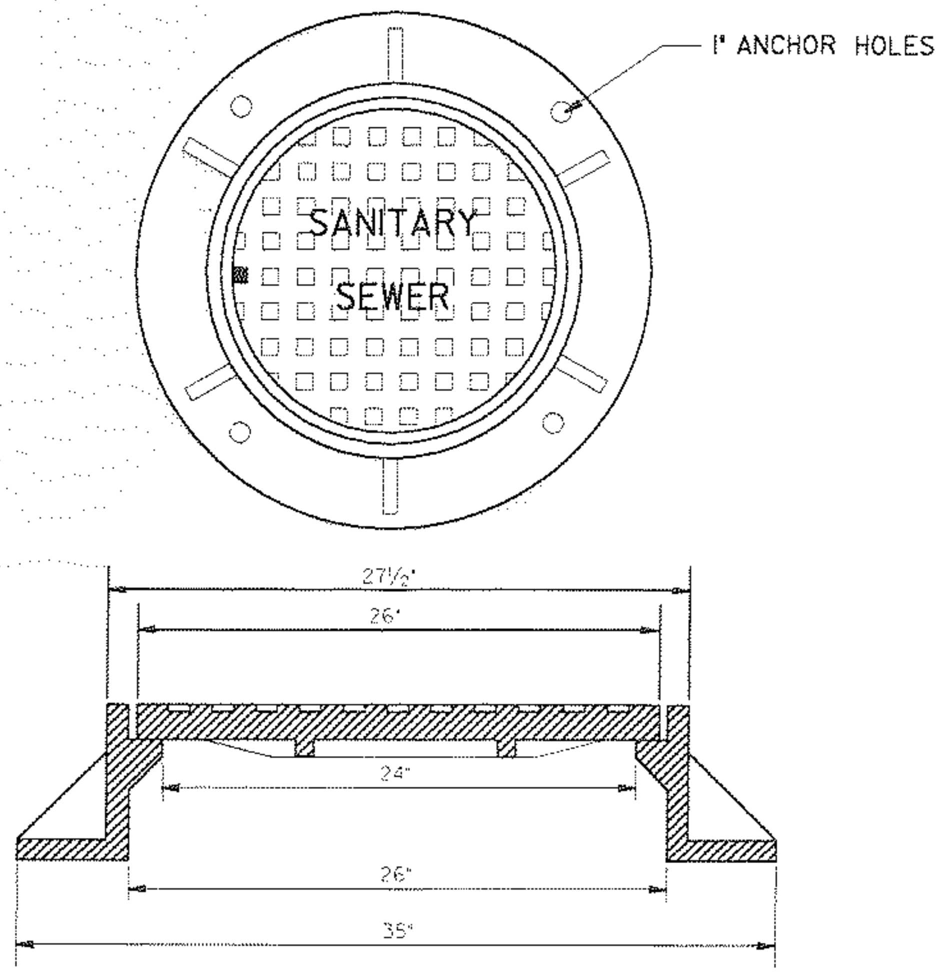
Barge Waggoner Sumner and Cannon Inc

DETAIL NO.: C221B

DATE ISSUED:

DATE REVISED:



BEARING SURFACES MACHINED

FRAME	235 LBS.
COVER	180 LBS.
TOTAL	415 LBS.

STANDARD MANHOLE FRAME AND COVER

(N.T.S.)

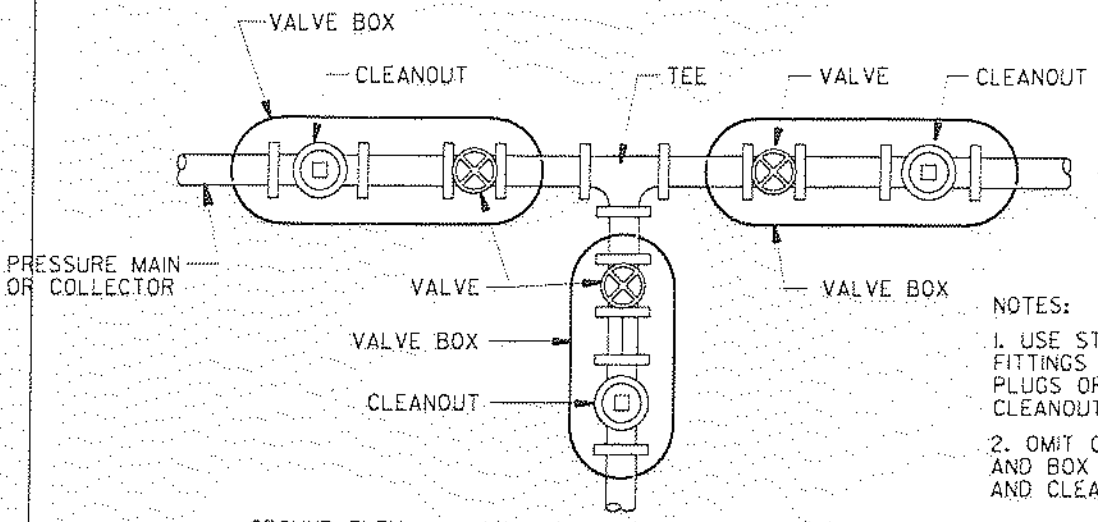
BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

Barge Waggoner Sumner and Cannon Inc

DETAIL NO.: C440A

DATE ISSUED: 4-1-95

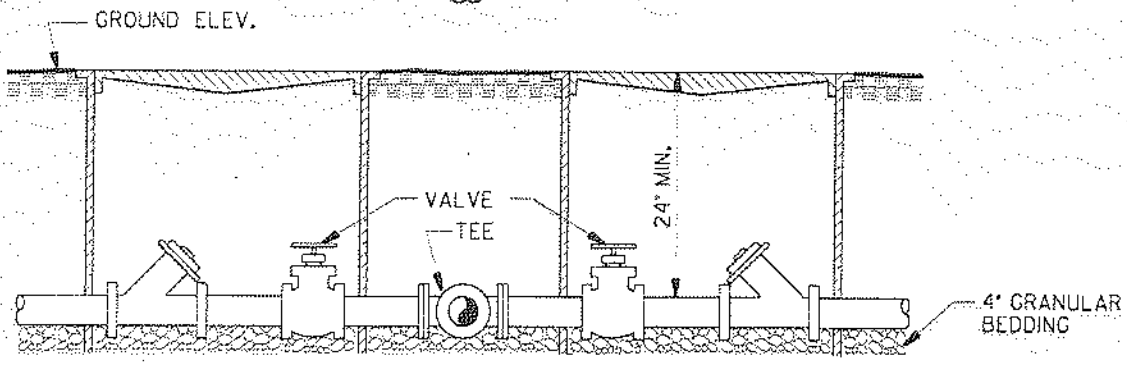
DATE REVISED:



NOTES:

1. USE STANDARD WYE FITTINGS WITH THREADED PLUGS OR CAPS FOR CLEANOUTS.

2. OMIT ONE VLAVE, CLEANOUT AND BOX FOR TWO VALVES AND CLEANOUT JUNCTION.



VALVE BOX AND CLEANOUT ARRANGEMENTS AT JUNCTION OF PRESSURE MAINS

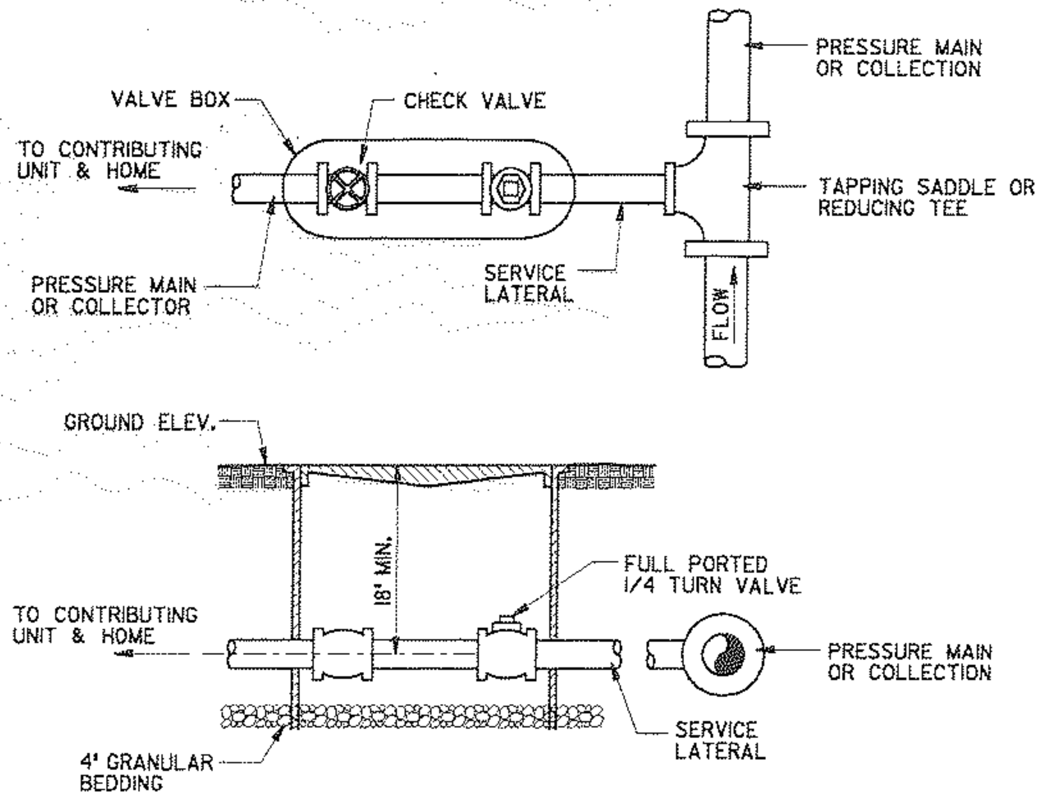
N.T.S.

Barge Waggoner Sumner and Cannon Inc

DETAIL NO. C701

DATE ISSUED

DATE REVISED

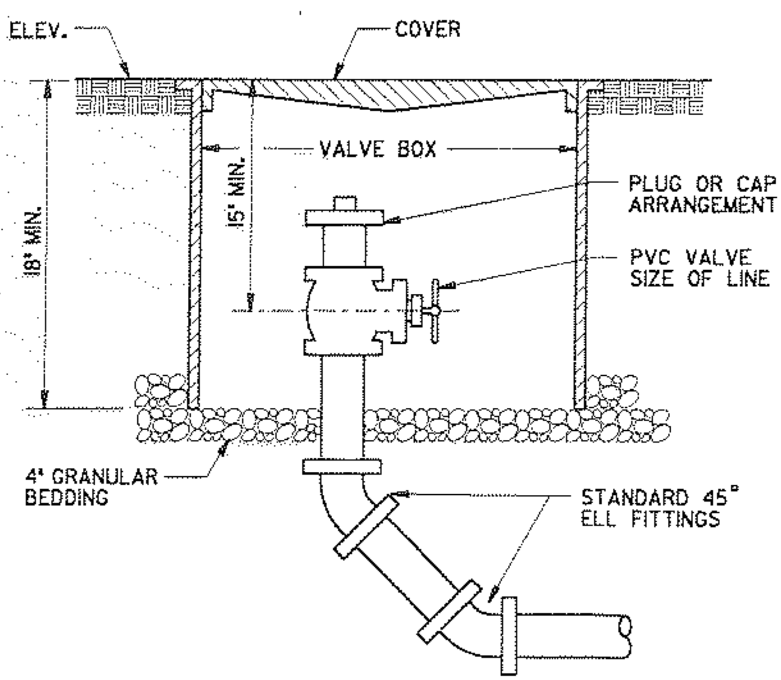


TYPICAL SERVICE LINE CONNECTION

N.T.S.

Barge Waggoner Sumner and Cannon Inc		DETAIL NO.: C702
		DATE ISSUED:
		DATE REVISED:

BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$



VALVE BOX AND CLEANOUT ARRANGEMENTS AT END OF PRESSURE MAIN

N.T.S.

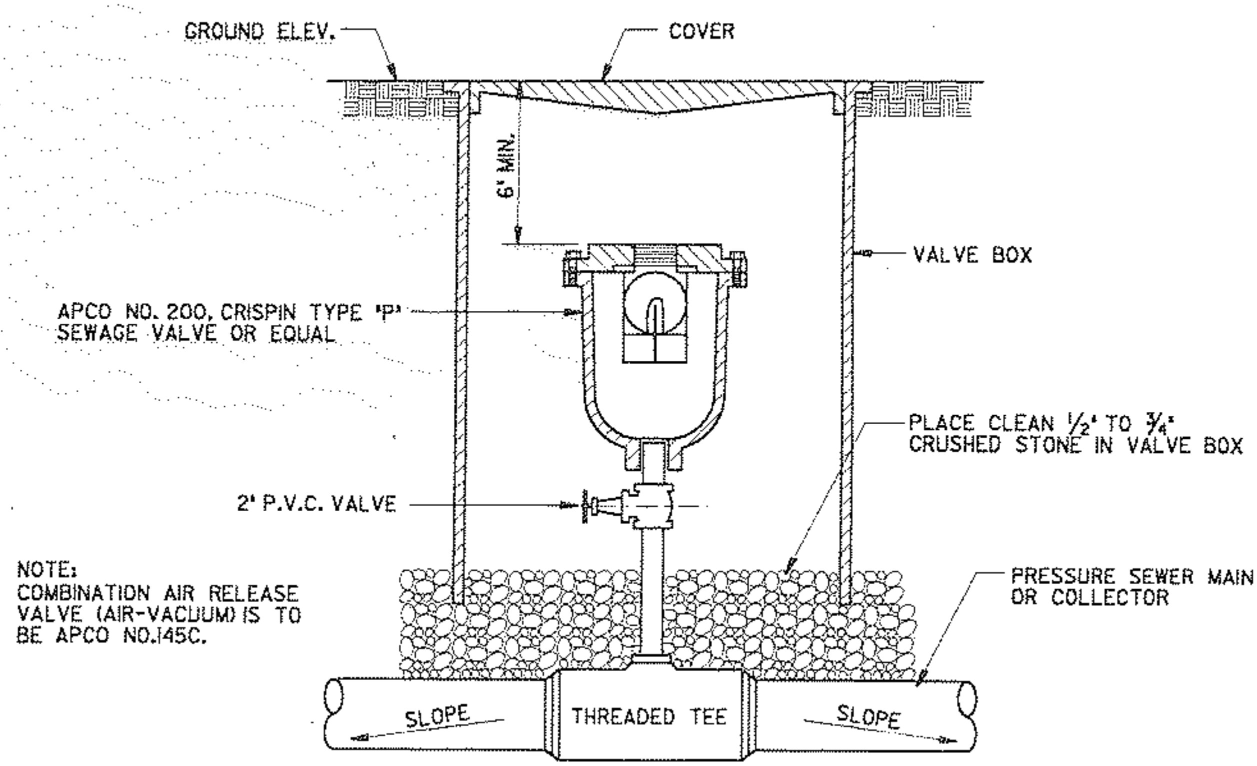
BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

Barge Waggoner Sumner and Cannon Inc

DETAIL NO.: C703

DATE ISSUED:

DATE REVISED:

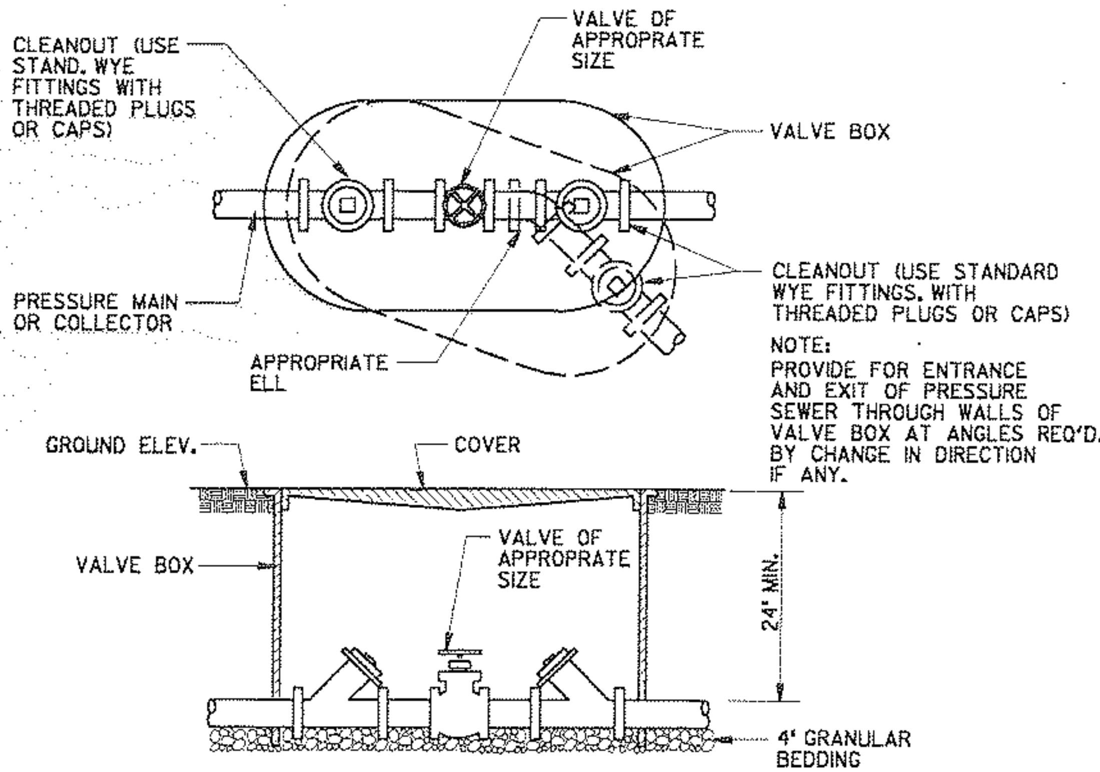


AUTOMATIC AIR RELEASE ARRANGEMENT

N.T.S.

BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

Barge Waggoner Sumner and Cannon Inc		DETAIL NO.: C704 DATE ISSUED: DATE REVISED:



VALVE BOX AND CLEANOUT ARRANGEMENTS ALONG STRAIGHT RUNS AND AT CHANGES IN DIRECTION

N.T.S.

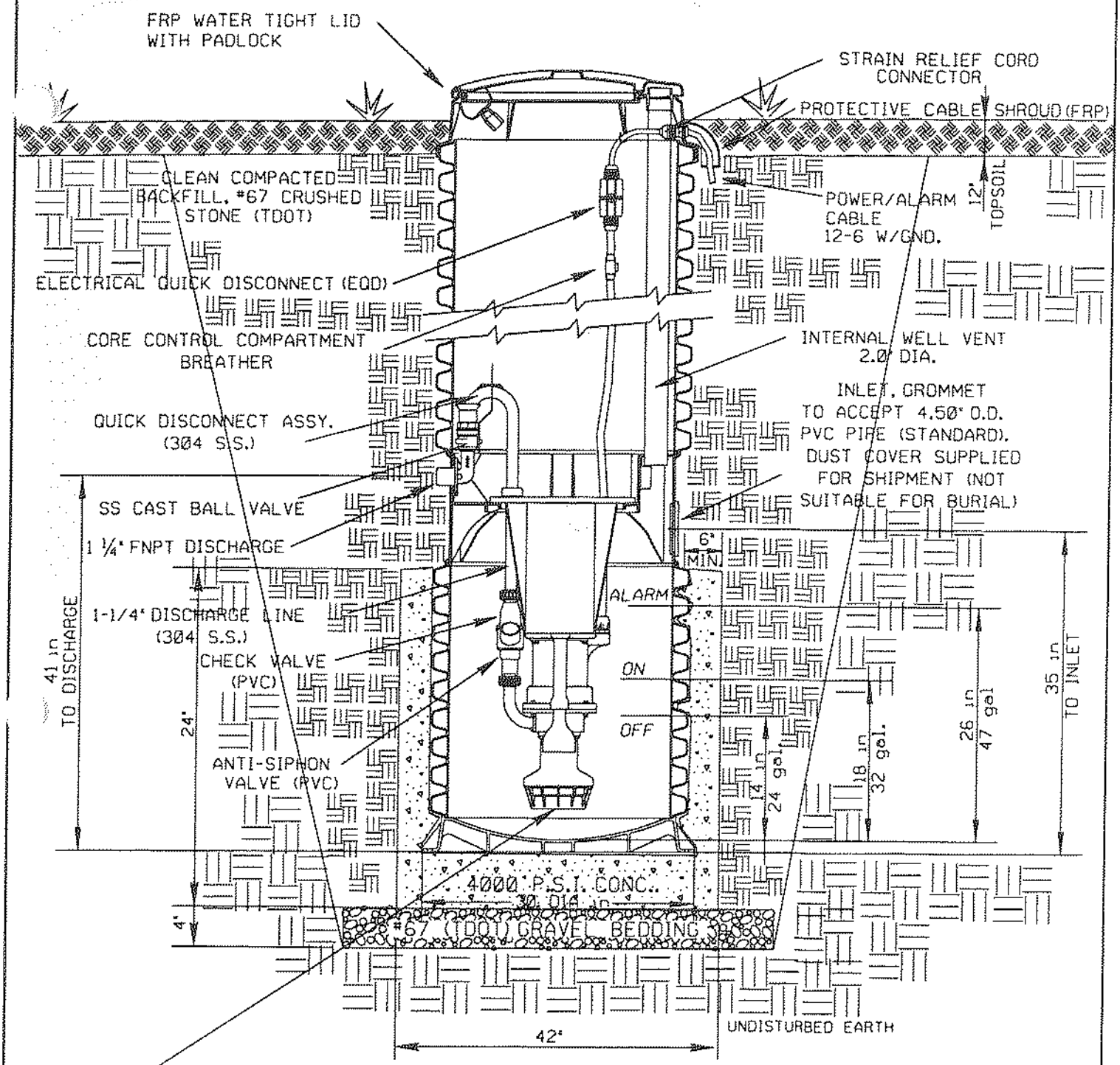
BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

Barge Waggoner Sumner and Cannon Inc

DETAIL NO.: C705

DATE ISSUED:

DATE REVISED:



ENVIRONMENT ONE GRINDER PUMP
MODEL 2010-58 w/ 1 HP MOTOR
CAPABLE OF DELIVERING 9 gpm AT 138' T.D.H.
PUMP SHALL ALSO CONFORM TO UL, NSF, AND CSA STANDARDS.

NOTE: A CONCRETE ANCHOR IS REQUIRED TO PREVENT TANK FROM FLOATING.

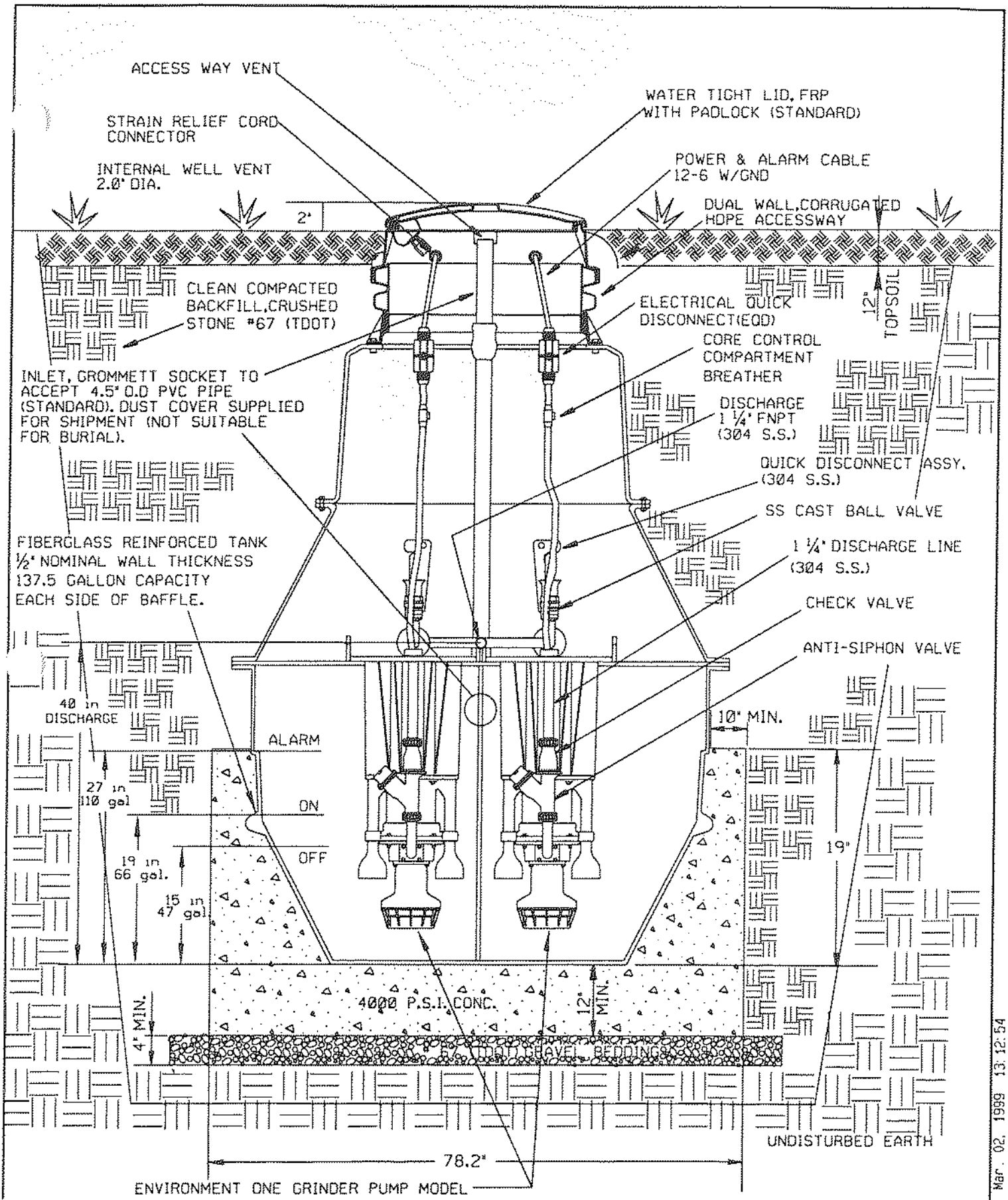
TYPICAL SIMPLEX GRINDER PUMP

N.T.S.

JULY 1998

713

k:\dgn\25534\c713.dgn Mar. 02, 1999 13:15:16



TYPICAL DUPLEX GRINDER PUMP

JULY 1998 | N.T.S. | 714

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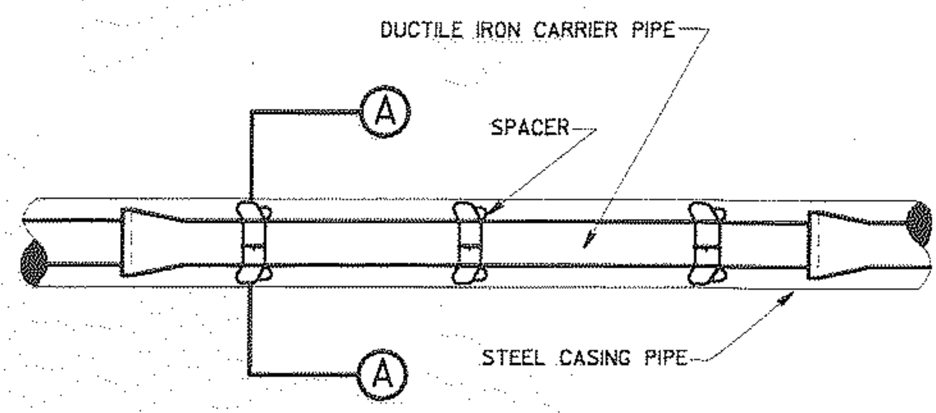
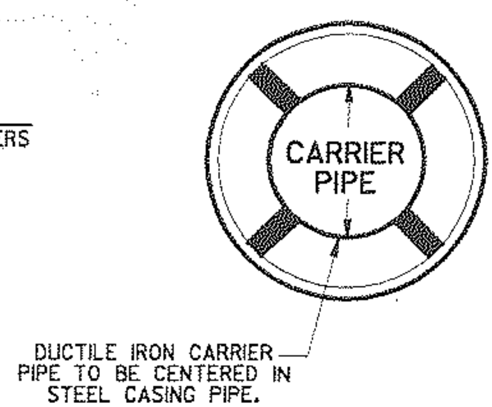


NOTE:
SPACERS TO BE PLACED ON 6.0' CENTERS OR THREE (3) TO A PIPE SEGMENT. SEE SPECIFICATIONS FOR SPACER MATERIAL REQUIREMENTS.



SECTION A-A

CASING SPACER INSTALLATION DETAIL

(N.T.S.)

BWSC$PLOT$TIME$$$
BWSC$FILE$NAME$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

Barge Waggoner Sumner and Cannon Inc

DETAIL NO.: CI024

DATE ISSUED: 10/23/95

DATE REVISED: