INFRASTRUCTURE DESIGN STANDARDS

THE CITY OF NEW YORK DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATER AND SEWER OPERATIONS

STANDARD SEWER AND WATER MAIN SPECIFICATIONS

August 8, 2022

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NYC DDC Department of Design and Construction

NYC Environmental Protection

INTRODUCTION

This publication has been prepared by the New York City Department of Design and Construction ("NYCDDC" or "the Department") to provide a compilation of standard requirements, called specifications, used by the New York City Department of Environmental Protection ("NYC DEP") for sewer and water main construction contracts. These specifications define the Contractor's responsibility in meeting the contract requirements, enumerate the Department's expectations, define how the Department will measure and pay for the work, and explain what the Contractor is expected to provide. When this publication, entitled Standard Sewer and Water Main Specifications and dated August 8, 2022, is incorporated by reference into the Department's construction contracts, it is made a part of that document.

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SECTION 10 – DEFINITIONS AND GENERAL PROVISIONS

10.01 DEFINITION OF TERMS

Whenever in the specifications and contract the following terms, words, expressions or pronouns in place of them are used, the meaning and intent must be interpreted as follows:

Whenever it is provided that anything is "to be" or "to be done", "if" or "as" or "when" or "where approved", "required", "directed", "prescribed", "satisfactory", "permitted", "ordered", "designated", "deemed necessary", or words of like import, it will be taken to mean and intend approved, required, prescribed, permitted, ordered, designated, deemed necessary, or satisfactory, as the case may be, by the Engineer.

Whenever "specified" is used herein, it must mean, "specified in the contract".

Whenever the word "Addenda" is used, it must mean written notice or notices furnished to prospective bidders prior to opening of bids and annexed to the contract.

Whenever the word "desirable", "suitable", "sufficient", "satisfactory", or others of a similar purport are used, it is hereby agreed that the desirability, suitability, sufficiency, satisfactoriness, or other denominated condition must be as determined by the Engineer.

Whenever the term "railroad area" is used, it refers to and means that portion of the street included between the tracks, the rails of the tracks and two (2) feet in width outside, and any other portion of the street that the railway company is required by its franchise to maintain.

Whenever reference is made herein to any other specification, plan or section of these specifications, it must mean the latest revision thereof in effect at the time of invitation to bid, unless otherwise specifically provided.

Whenever or wherever an article or any class of materials is specified by the name of any particular patentee, manufacturer or dealer, or by reference to the catalogue of any such manufacturer or dealer, it must be taken as intending to mean and specify the article or materials described, or any other equal thereto in quality, finish and durability, and equally as serviceable for the purposes for which it is or they are intended. Nothing in these specifications must be interpreted or taken to violate the provisions of **Chapter 13** of the New York City Charter including, without limitation, **Sections 312 and 321** thereof.

Whenever the word “shall” is used herein, the term is intended to convey a contractual mandate, such as the terms “must”, “will”, or “be obliged to” (and not “may”).

10.02 SEWERS, WATER MAINS, ETC., TO BE BUILT AS SHOWN ON THE CONTRACT PLANS

(1) The sewers, water mains and appurtenances will be built on the lines, at the depths, at the grades and in the manner shown on the contract plans and on any working drawings that are issued by the Engineer. Deviations to avoid boulders, rock outcrops or utilities are expressly prohibited, unless otherwise approved by the Commissioner or the Commissioner’s designee.

(2) LINE MAY BE CHANGED - If the line of the sewer and/or water main is changed from the location shown on the plan(s), so that the Contractor avoids disturbing existing or additional pavements which the Contractor otherwise would have had to disturb and replace, a sum of money representing the cost of such avoided replacement will be deducted from the amount which would have been payable to the Contractor upon the completion of this contract, had the line of the sewer and/or water main not been changed. Where there are no applicable unit bid prices for temporary or final restoration of pavement and the costs are included in the unit bid prices, this cost will be computed in accordance with and at the prices specified in **Subsection 11.06**.

The Commissioner or the Commissioner’s designee may change the line of the sewer and/or water main or the location of the receiving basins, or other sewer and/or water main appurtenances, provided such changes do not materially affect either the character or the amount of the work to be done, or the conditions under which it is to be performed, and provided that the sewer and/or water main must be built within the limits of the streets shown on the plan(s), and the Contractor hereby agrees to make no claim for damages or extra compensation on account thereof.

10.03 MEANS AND METHODS OF CONSTRUCTION

Unless otherwise expressly provided in the contract drawings, specifications and addenda, the Contractor must begin work at the outlet of the sewers to be connected thereto and proceed continuously upstream therefrom and complete it in a manner that will permit the expeditious use of the sewer to be built under the contract. For water main installations the sequence of work and shut down periods must be determined by the Engineer and approved by the NYC DEP agency borough distribution engineer. The means and methods of construction must be such as the Contractor may choose; subject, however, to the Engineer's right to reject means and methods proposed by the Contractor that in the opinion of the Engineer will:

(1) Constitute or create a hazard to the work, or to persons or property; or

(2) Not produce finished work in accordance with the terms of the contract; or

(3) Cause excessive damage to existing conditions (i.e. Trees, Curbs, Sidewalks, etc.).

The Engineer's approval of the Contractor's means and methods of construction, or the Engineer's failure to exercise the Engineer's right to reject such means and methods, does not relieve the Contractor of the Contractor's obligation to complete the work of the contract; nor will the exercise of such right to reject create a cause of action for damages.

10.04 HOURS OF WORK

Working hours will be as stipulated by the New York City Department of Transportation's ("NYCDOT") Office of Construction Mitigation and Coordination ("OCMC"). Generally, no work will be done on the job before 7:00 A.M. nor after 6:00 P.M., excepting that water mains cannot not be shut down before 8:30 A.M. nor after 4:30 P.M., nor will any work be done on Saturdays, Sundays, or the following holidays, as celebrated in New York City, unless the Contractor provides the Engineer at least seven (7) calendar days' advance notice in writing, and the Engineer will, in turn, have given written permission for such work:

(1)	New Year's Day	(3)	Independence Day	(5)	Thanksgiving Day
(2)	Memorial Day	(4)	Labor Day	(6)	Christmas Day

The above hours of work will apply except when, because of failure to shut down any water main due to any difficulty encountered, or because of any act or omission by the City, the work of connecting to existing water mains is delayed, and such delay mandates that work be performed beyond 4:30 P.M. in order to restore water service.

If the day preceding any of these holidays falls on a normal work day, then no water shutoffs will be allowed on that day preceding the holiday and the Contractor must cease construction operations and must restore the streets to public use by midday of that day. The Contractor may be granted permission to continue working beyond midday on the day preceding a holiday if the Contractor requests written permission at least seven (7) calendar days in advance from the Engineer and receives written approval from the Engineer prior to the holiday.

Pursuant to the provisions of §24-222 of the Noise Control Code: the permissible hours of work will be on weekdays from 7:00 A.M. to 6:00 P.M., unless a variance therefrom is provided in the contract.

(A) HOLIDAY CONSTRUCTION EMBARGO - A special Holiday Construction Embargo will be in effect on the Friday of the week preceding Thanksgiving Day week from 6:00 AM to 11:59 PM and again from the Monday of Thanksgiving Day week from 6:00 AM through January 2, at 11:59 PM. Roadway and sidewalk construction activities will be restricted during the embargo period on the streets listed below*.

Any permits issued prior to the date of this notice, for work during this embargo period on the streets listed below which do not already have the permit stipulation "410" are hereby suspended for the period noted above. All permittees must comply with this embargo unless a special waiver is granted by OCMC. Waiver requests must be filed at least thirteen (13) days before Thanksgiving Day, in the Permit Office by filing a "Request for Roadway/Sidewalk Permits During Embargo Periods" and submitting supporting documentation. Waiver requests should only be submitted for critical reasons for a specific project. If a waiver is granted, the applicant will be notified so they can apply for the approved permits. Waivers **are**

not required for ongoing Building Construction Activity Permits which already include the "410" permit stipulation. Waiver request forms may be obtained at any Permit Office or on the Department of Transportation's website at:

http://www.nyc.gov/html/dot/downloads/pdf/holidayembapp.pdf

Prior to this embargo period all necessary measures must be taken so that all roadways and sidewalks are in proper condition to allow for the expeditious and safe movement of vehicular, bicycle and pedestrian traffic. Tool carts, cable reels, containers, and material stored on roadways must be removed during the embargo period.

The opening of utility access covers is prohibited on any of the streets noted below between the hours of 6:00 AM and midnight unless the utility or contractor files for an Emergency Authorization Number as required by section 2-07 of the Department of Transportation's Highway Rules. The planned opening of utility access covers may occur during the hours of 12:01 AM and 5:59 AM where no authorization number is required.

Temporary restoration of the streets and sidewalks and removal thereof, if required for the Holiday Embargo period, will be paid for under the appropriate scheduled items.

No extension of time due to the shutdown period will be granted to the Contractor for completion of the work.

*** Please note that this embargo only applies to NYCDOT construction permits. List of street and maps of the affected locations are available by borough on the Department of Transportation's website at: http://www.nyc.gov/html/dot/html/motorist/trafalrt.shtml**

10.05 ADJUSTING EXISTING PAVEMENTS, SIDEWALKS, ETC.

Existing pavements, sidewalks, curbs, gutters, flags, and crosswalks must be properly adjusted to the work done under this contract, as directed.

10.06 TREE PRESERVATION, PROTECTION, REMOVAL, AND REPLACEMENT

(A) Tree Preservation, Protection, Removal and Replacement must be done in accordance with the following **New York City Department of Transportation (NYCDOT) Standard Highway Specifications: Subsection 1.06.48(l) - Tree Preservation, Removal, Relocation And Planting; Section 4.16 - Trees (Removal, Transplanting, Planting); Section 4.18 - Tree Pruning; Section 4.21 - Tree Consultant; and, Section 4.22 - Protective Tree Barrier**.

(B) When performing curb and sidewalk work around existing trees, the Contractor must be required to modify work methods of installing new curbs and sidewalks. This special modification of work must be done in accordance with **NYCDOT Standard Highway Specifications Section 8.02 - Special Modification Of Work For Installation Of New Curb And Sidewalks**. Payment for this special modification work will be made under following NYCDOT Highway item numbers:

Item No. 8.02 A - SPECIAL CARE EXCAVATION AND RESTORATION FOR SIDEWALK WORK

Item No. 8.02 B - SPECIAL CARE EXCAVATION AND RESTORATION FOR CURB WORK.

(C) The Contractor's attention is directed to the following additional requirement

(1) The Contractor must employ all means and methods necessary to avoid removal of existing trees. If the Engineer determines that it is necessary to remove existing healthy trees within the contract area due to the installation of new sewers, water mains or pavements, replacement trees must be planted within the project limits wherever possible, but the number planted must not exceed that required by the equal caliper replacement rule. Replacement trees must be planted where directed by the Engineer and in accordance with the standards of the Department of Parks and Recreation. Should the planting of trees require saw cutting and removal of existing sidewalks, the cost of such work must be deemed included in the prices bid for the respective Tree Planting items of the contract. Tree(s) cannot be planted less than five (5) feet from a utility pole or in front of bus stops.

(2) The Contractor must supply the office of the Director of Forestry of the Borough in which the work of this project is being performed with the name and certificate of insurance of the landscape contractor should one be needed for this project.

(3) The Department of Parks and Recreation must be notified by the Contractor twenty-four (24) hours in advance as to which trees are to be removed should this become necessary.

(4) In the event of tree trunk damage, the tree must be bark traced within three (3) days.

(5) New house connections must be constructed so as to provide safeguards to prevent existing tree damage.

(6) No storage of material and/or equipment on Parks Department's property will be allowed during construction.

(7) A recent survey of all existing trees within the scope of this project may be available from the Director of Forestry for the Borough.

(8) No additional or separate payment must be made for the hereinabove work described in this **Subsection 10.06(C)**. The costs thereof must be included in the prices bid for all items of the contract.

10.07 ENCUMBRANCES

The Contractor must follow New York City Administrative Code, Title 19, Chapter 1, Subchapter 1, Section 19-133 "Removal of unauthorized projections and encroachments" and New York City Administrative Code, Title 25, Chapter 3 "Landmarks Preservation and Historic Districts".

In addition, all fences, gates, shrubbery, lawn areas, pipes, retaining walls, paved entrances and exits, and all other encroachments, encumbrances, or obstructions above or below ground surface, and the related foundations and appurtenances which are upon the line of work when it is begun, or thereafter placed thereon, and which are affected by the construction operation, must be removed by the Contractor to the extent directed by the Engineer, and must be replaced and/or rebuilt to the satisfaction of the Engineer and the property owner.

The Contractor must take preconstruction photographs of all affected encumbrances as specified in **Subsection 10.32**. The Contractor must remove and restore all affected encumbrances and/or encroachments to at least the same condition in which they were prior to the start of construction. No salvageable material will be permitted to be re-used for the restoration of encumbrances without the approval of the Engineer. The Contractor must furnish all new materials required or necessary to perform the above work to the satisfaction of the Engineer. The cost of all labor, materials, plant, insurance and equipment necessary and required to remove, replace and/or rebuild such encumbrances must be deemed included in the prices bid for all items of work.

10.08 DISPOSAL OF EXCESS EXCAVATED MATERIAL

All excess excavated material, with the exception of contaminated material, will become the property of the Contractor and must be properly disposed of away from the site, at the Contractor's expense. Contaminated material must be disposed of separately in accordance with contract requirements.

10.09 LINES AND GRADES (CONTRACTOR'S SURVEY PARTY)

(1) A benchmark and the control lines for the alignment and levels necessary for the prosecution of the sewer and water main work, where required, will be established by a Licensed Professional Land Surveyor retained by the Contractor. When necessary, the Land Surveyor must obtain the required data from the Topographical Bureau, Office of the Borough President, in the respective borough in which the work is to be performed.

The Contractor must also provide the alignment, elevation and position for all construction work between the controls. Professional surveyor(s) employed by the Contractor, for establishing alignment and levels between control lines, must hold a license issued by the State of New York as a Land Surveyor.

The aforementioned work will be subject to check and correction by the Engineer. The Contractor must keep the Engineer informed at a reasonable time in advance of the time and place the Contractor intends to do work. The Contractor, at the Contractor's own expense, must, when required, supply all stakes, range

piles, range sites, scaffolding, platforms, and staging necessary to place and maintain the controls for lines and levels. The Contractor is responsible for the accuracy of all controls, lines and grades established by the Contractor.

When ordered by the Engineer, the Contractor's survey party must take all measurements and prepare cut sheets and sketches, indicating elevations, locations and other field data pertaining to this contract. Signed copies of such surveys and sketches with P.E. or L.S. seal affixed must be delivered to the Engineer as required.

During the progress of sewer work, the Contractor's Survey Party will be required to check the As-Builts of the completed work. The following survey data must be collected by the Contractor's survey party and furnished to the Engineer:

a. Centerline coordinates and invert elevations every five hundred (500) linear feet of sewer and at every manhole.

b. Elevations, coordinates, and positions for all sewer chambers, outfalls, and structures.

c. Notes whether all box sewers, manholes, chambers, outfalls, and structures are poured in place or precast.

(2) CONTRACTOR TO PROVIDE ASSISTANCE - The Contractor must provide all necessary assistance for the Engineer for inspection, measuring, investigation, etc., when required, without charge or expense to the City.

(3) Unless otherwise noted, the elevations indicated on the plans must refer to and be clearly identified as the North American Vertical Datum of 1988 (NAVD 88), in adherence to "[Docket No. 930650-3150] Notice: Affirmation of Vertical Datum for Surveying and Mapping Activities", Federal Register Doc. 93-14922, 58 FR 34245, 24-June-1993 and New York City Administrative Code, Title 28, Chapter 1, Article 104.7.6 "City Datum". All elevations referring to National Geodetic Vertical Datum of 1929 (NGVD 29) or a vertical/sewer datum for a New York City Borough must not be included in the submitted plans, except for demonstrating a conversion to NAVD. Conversions to NAVD 88 is summarized in Table 10.09.

Table 10.09 – Conversion to NAVD 88 from other Vertical Datums. The respective Borough Sewer Datum specified below in feet above mean sea level was established by the U.S.C.G.S. at Sandy Hook, New Jersey.

Vertical Datum:	**To Convert to NAVD 88:**
NGVD 29	Subtract 1.100 feet
The Bronx	Add 1.508 feet
Brooklyn (Highway)	Add 1.447 feet
Brooklyn (Sewer)	Add 0.610 feet
Manhattan	Add 1.652 feet
Queens	Add 1.625 feet
Richmond (Staten Island)	Add 2.092 feet

10.10 PRESERVATION OF POINTS, STAKES, ETC.

The Contractor must safeguard all points, stakes, grade marks, monuments and bench marks, made or established on or near the line of the work, and the Contractor agrees to accept the responsibility for and to remedy at the Contractor's expense any mistakes that may be caused by the unauthorized disturbance or removal of such points, stakes, grade marks, monuments and bench marks.

10.11 CONTRACTOR NOT TO DISTURB CITY MONUMENTS

Prior to starting any excavation work the Contractor will be required to contact the respective President of the Borough where the work is being performed to ascertain the exact locations of any City monuments within the limits of the work. A copy of the locations of these monuments must be given to the Engineer.

Based upon these locations the Contractor must not disturb or excavate within five (5) feet of any City monument until such time that said monument has been referenced or reset by a New York State Licensed Professional Land Surveyor. Notification must be given to the respective Borough President's Office prior to any resetting.

Upon permission from the Borough President's Office, the Contractor must remove and preserve such monument.

Upon completion of the work the Contractor will be required to reset the monument at its original location or set it at a new location as directed by the respective Borough President's Office.

A New York State Licensed Professional Land Surveyor at no cost to the City of New York must perform all work regarding the resetting of monuments. The costs thereof must be included in the prices bid for all items of work.

10.12 RIGHT TO CONSTRUCT SEWERS, WATER MAINS, HOUSE CONNECTIONS, ETC.

(1) Prior to the commencement of and during the progress of the work under this contract, the Commissioner will have the right to undertake, and to grant permits for any construction, reconstruction and repairing of any pipes, water mains, sewers, basins, subway ducts and railway tracks, and any appurtenances thereof located on and adjoining the line of the work, and for any connections with and additions to such pipes, etc.; and for such purposes, the Commissioner is hereby authorized to suspend work on any part of this contract. The Contractor agrees that the Contractor will not interfere with nor place any obstruction in the way of any person or persons who may be engaged upon such work.

(2) PERMITS FOR CONNECTIONS - The Commissioner is hereby authorized, by the contract or otherwise, to connect any water mains, sewers or drains to the work built under this contract and to grant permits to any person or persons to make connection therewith at any time before it is completed. The Contractor agrees that the Contractor will not interfere with nor place obstructions in the way of such persons as may be employed in building such water mains, sewers and drains, or in making such connections, and the flow from such sewers, drains and connections will be permitted by the Contractor to discharge into the work built under this contract and the Contractor agrees to make no claim for compensation, damages or delay on account thereof. The issuance of such permits must not be considered as an acceptance by the City of the part of the sewer into which such connections empty or flow, nor will the Contractor on account thereof be relieved from the cleaning of the sewer prior to the final examination of the work. No new connections or drains will be allowed made or joined to the work built under this contract unless the Commissioner has duly issued a permit. This permit must be shown in all cases to the Engineer.

10.13 FLOW OF SEWERS AND DRAINS, ETC. INTERRUPTED; SEWERS TO BE KEPT CLEAN; REMOVING AND ABANDONING SEWERS, WATER MAINS, ETC.

(1) The Contractor must provide at the Contractor’s own cost for the flow of the sewers, drains and watercourses interrupted during the progress of the work, and must immediately remove and dispose of all offensive matter. The flow throughout the entire length of such sewers and appurtenances are to be replaced by the work to be done under this contract, and must be maintained by the Contractor. The Contractor, as may be directed, must, at the Contractor’s own cost and expense, remove all bulkheads from the sewers with which the work under this contract will be connected.

Wherever the work to be built under this contract, or the trench in which it is to be constructed, follows the line and occupies the place of or intercepts any existing sewer, drain, culvert, basin connection or house connection, the Contractor must connect the same with the sewer built under this contract.

Where the Contractor's construction operation requires the cutting of house connection drains, or where house connection drains are inadvertently cut or broken, the Contractor must immediately restore service by installation of temporary pipe, pumping or fluming, or by permanent reconstruction as directed by the

Engineer. Temporary house connection services provided in accordance with the above must be replaced by permanent construction before the backfilling of the new sewer to which the house connection drains are to be reconnected.

The costs of providing temporary services must be included in the prices bid for all items of work.

At no time will the Contractor be permitted to use open troughs or use the trench as a flume.

Before bidding, the Contractor must examine the route of the existing sewer seeking all necessary information (including the examining of the existing sewers for evidence of surcharging) and the Contractor must make own determinations of any and all conditions, particularly the method of the Contractor's fluming operations, which may affect the performance of the Contractor's work and the Contractor's bid prices under this contract.

Prior to starting construction, the Contractor must submit the Contractor's method of fluming to the Engineer. The Contractor must provide and construct flumes, temporary sewers, dams and other facilities necessary to divert or otherwise take care of and maintain the flow in the existing sewer, including all incidental work without separate payment. The cost thereof must be included in the prices bid for all items of this contract.

(2) SEWERS TO BE KEPT CLEAN - During the progress of the work, and until the completion and acceptance thereof, the sewers, drains, basins, culverts and connections built under this contract must be kept thoroughly clean throughout, and must be left clean. They must be free from all defects due to poor materials or workmanship.

All existing catch basins located in the streets in which sewers are to be constructed within the limits of the contract, must be cleaned and connections flushed. Cleaning must be performed after final restoration is completed and prior to the final inspection.

Unless otherwise specified, the cost of cleaning the existing catch basins and connections must be deemed included in the prices bid for all items of work.

(3) EXISTING FLOW

(A) (1) Prior to the start of any sewer work, the Contractor must submit to the Borough Engineer a typical fluming and/or bypass-pumping diagram. This diagram must include detailed information pertaining to the maintenance of existing sewer flow, house connection pickup, sizes of flume piping, upstream and downstream damming, pump size, hours of operation, power driven air circulating system and overflow weirs. No sewer work must be performed before the Contractor receives written confirmation of the Engineer's approval of the detailed fluming and/or bypass-pumping diagram. The cost of all diagrams must be included in the prices bid for all items of this contract.

(2) The above referenced fluming diagram details the Contractor's method to prevent debris, silt, and grease from migrating downstream during any cleaning or construction operations. The Contractor must clean the downstream sewer if debris, silt and/or grease from any cleaning and/or construction operation are not captured and removed.

(B) In accordance with the approved fluming diagram, the Contractor must provide and construct flumes, temporary sewers, dams and other facilities necessary and required to maintain flow in existing sewers and house connections. The costs thereof must be included in the prices bid for the various contract items. No separate or additional payment will be made for this work.

(C) The Contractor must maintain fluming, and/or bypass pumping until such time that the Engineer inspects and approves, in writing, that portion of sewer that has been completed.

(4) REMOVING AND ABANDONING SEWERS, WATER MAINS, ETC. - All sewers, water mains, drains, culverts, basins, basin connections, structures and all portions of any watercourse in, through or across any street or easement rendered unnecessary by the construction of the work herein contemplated must be removed or abandoned as indicated on the plans or as specified or directed.

In general, sewers, drains, culverts, basins, basin connections, manholes, etc., physically interfering with the construction must be removed and all others must be abandoned, except as otherwise noted on the plans or as specified or directed.

The cost of removing and abandoning existing sewers, water mains, drains, etc., including the breaking down and filling in of inlets, basins, manholes, valve chambers and other appurtenant structures must be at the expense of the Contractor and must be included in the prices bid for all items of work. No separate or additional payment will be made for the removal and abandoning of existing sewers, water mains, drains, etc., including the breaking down and filling in of inlets, basins, manholes, valve chambers and other appurtenant structures unless there are specific items provided for in the Bid Schedule.

Unless otherwise specified, where inlets, basins, manholes and other appurtenant structures are to be abandoned on existing sewers, drains, etc., the Contractor at the Contractor's own expense, must bulkhead all pipe connection openings to existing structures, must remove all castings off existing structures, must break down existing structures to a depth four (4) feet below final grade, must break up the existing structures' bottom slab in such a manner as to prevent water from being trapped, and must fill in and compact the existing structures' entire openings in accordance with **Subsection 40.06.3** and as directed by the Engineer. Unless specific items are provided for in the Bid Schedule, the cost of this work must be deemed included in the prices bid for all items of work.

Unless otherwise specified, where water mains are to be abandoned, the Contractor at the Contractor's own expense, must remove all valves, hydrants, valve boxes and covers off mains, and must seal all ends of mains. In addition, valve chambers must have their heads and covers removed, must be broken down to a depth four (4) feet below final grade, must have bottom slab broken up in such a manner as to prevent water from being trapped, and must have the entire opening filled in and compacted in accordance with **Subsection 40.06.3** and as directed by the Engineer. Unless specific items are provided for in the Bid Schedule, the cost of this work must be deemed included in the prices bid for all items of work.

Wherever sewers, drains, basin connections, etc., twelve (12) inches or larger in their least dimension and water mains twenty-four (24) inches or larger in nominal diameter are to be abandoned they must be completely filled hydraulically with an excavatable flowable fill in accordance with **Section 72.11 - Hydraulic Fill For Abandoned Sewers And Water Mains** or other methods submitted by the Contractor and approved by the Engineer in writing. Payment for this work must be made under Item No. 72.11HF - HYDRAULIC FILL FOR ABANDONED SEWERS AND WATER MAINS.

10.14 CITY NOT RESPONSIBLE FOR ACCURACY OF SUBSURFACE RECORDS OR INFORMATION

The Contractor admits that the Contractor has carefully examined the location of the work, has made special inquiries at the offices of the companies or individuals owning, controlling or operating pipes, conduits, tunnels, tracks and other structures, and the Contractor has determined to the Contractor's satisfaction the character, size, location and length of such pipes, conduits, tunnels, tracks and other structures, and the obligations, if any, of said companies or individuals to protect and remove the same; that the Contractor has inspected the public records of the various City Departments having cognizance and control of the City's water pipes, conduits and sewers, and the Contractor has made such further personal inspection and investigation as the Contractor deemed proper to determine the correctness of the information so obtained; and the Contractor clearly understands that the City does not insure the accuracy of such records, reports or information, and agrees that the Contractor will not make any claim against the City for damages or extra work caused or occasioned by the Contractor's relying upon such records, reports or information furnished by any City Department or any companies, either as a whole or in part.

The existing elevations and existing locations shown on the plans may vary from actual field conditions. The proposed sewers must be constructed so as to meet existing sewers at outlet and inlet conditions and as directed by the Engineer.

The proposed water mains must be constructed so as to meet existing water mains as shown on the contract plans and as directed by the Engineer.

House connections and existing catch basin connections may not be shown on the contract plans.

The elevations and locations of underground facilities have been plotted on the plans by means of the most reliable information available, however, their accuracy is not guaranteed.

Prior to the start of construction, the Contractor must investigate all elevations and locations of all existing inlet and outlet sewers and manholes, water mains, utility facilities, etc. If the actual field locations and

elevations vary from those shown on the plans the Contractor must immediately notify the Engineer in writing.

All of the aforementioned investigations must be performed prior to the start of construction and the cost thereof must be deemed included in the prices bid for all items of work.

The Contractor's attention is directed to the fact that from time to time revisions and additions are made in the Sewer and Water Main Standard Drawings. A copy of the latest Standards may be obtained at the following location:

Department of Design and Construction

Division of Infrastructure

30-30 Thomson Avenue, 3rd Floor

Long Island City, New York 11101

All the work shown on the contract drawings must be done in accordance with the Specifications and Sewer and Water Main Standards.

10.15 NOTICE TO UTILITY COMPANIES, ETC., TO REMOVE STRUCTURES OCCUPYING PLACE OF SEWERS, WATER MAINS, OR APPURTENANCES

The Contractor must, except as otherwise provided for in **Subsections 10.19 and 10.25**, hereof, give notice in writing to all utility and other companies or individuals owning or controlling any pipes, conduits, tunnels, tracks or other structures which may be found, upon excavating, to occupy the place of the sewers, water mains and appurtenances thereof to be laid or built as required herein so that said companies or individuals may remove their structures at their expense and the Contractor must not cause any hindrance to or interference with such companies or individuals in removing their structures. However, if said utility, railroad, or other companies or individuals, within five (5) days after receipt of such notice will fail to remove their structures, the Contractor must, upon the written approval of the Commissioner, remove the same, it being expressly understood that the cost thereof will not be a charge against the City, but will be a matter for adjustment between the Contractor and the company or companies or individuals concerned.

10.16 NOTICE TO UTILITY COMPANIES, ETC., TO SUPPORT, PROTECT, TEMPORARILY REMOVE AND REPLACE STRUCTURES WITHIN LIMITS OF ORDERED EXCAVATION

The Contractor must, except as otherwise provided for in **Subsections 10.19 and 10.25**, hereof, give notice in writing to all utility and other companies or individuals owning or controlling any pipes, conduits, tunnels, tracks or other structures which may be found within one (1) foot of the limits of ordered excavation or otherwise be in interference so that said companies or individuals may protect, support, maintain or temporarily remove and replace their structures, and the Contractor must not cause any hindrance to or interference with any such utility company or companies or individuals in protecting, supporting, maintaining or temporarily removing and replacing main and service pipes, conduits, tunnels, lampposts, lamps, tracks or other structures. The Contractor agrees that the Contractor will suffer the said company or companies or individuals to take all such measures as are requisite for the purpose aforesaid.

Contractors must comply with the provisions of 16 NYCRR Part 753 (also cited as Industrial Code 53 or Code Rule 53), including, but not limited to, the provisions of Subparts 753-3.1(a) and (b), which states that excavators must notify the New York City One Call Center at 1-800-272-4480 at least two (2) but not more than ten (10) working days, not including the date of the call, before the commencement of excavation. Copies of which may be obtained at the following location:

Department of Labor

One Main Street

Brooklyn, New York 11201

The City will not be liable for any costs incurred by the Contractor as a result of the compliance, noncompliance, or improper compliance by the franchised operators of underground facilities, with 16 NYCRR Part 753.

The City will not be liable for any costs incurred by the Contractor for the support, protection, temporary removal, replacement and maintenance of underground facilities owned by franchised operators of such facilities.

The Contractor is advised that the provisions of 16 NYCRR Part 753 do not apply to City owned utilities. It is the Contractor's responsibility to determine the location of the City owned underground distribution systems. The Contractor must make own field observations and research the City's records to determine the location of such facilities before the commencement of excavation.

10.17 CONTRACTOR TO MAKE OR ENTERTAIN OFFER TO PROTECT, SUPPORT, TEMPORARILY REMOVE AND REPLACE, PIPES AND OTHER STRUCTURES OF PRIVATE COMPANIES OR INDIVIDUALS

The Contractor agrees, except as otherwise provided in **Subsections 10.19 and 10.25**, hereof, to confer with and to make an offer to or entertain an offer from such private companies or individuals as own the said pipes, conduits, tunnels, tracks or other structures, and the Contractor further agrees to enter into an agreement with said utility or other companies or individuals by what terms and at what prices the support, protection, maintenance, temporary removal and replacement of the pipes, conduits, tunnels, tracks and other structures will be undertaken and accomplished and in the event of the failure to make such agreement with said companies or individuals the Contractor will not complain nor make any demand for additional compensation or pay for supporting, protecting, maintaining, temporarily removing and replacing the said pipes, conduits, tunnels, tracks or other structures.

It is expressly understood that the cost of supporting, protecting, maintaining, temporarily removing and replacing the said pipes, conduits, tunnels, tracks or other structures will not be a charge against the City, but will be a matter of adjustment between the Contractor and the company or companies or individuals concerned.

10.18 CONTRACTOR TO PROTECT GAS MAINS, CONDUITS, SUBWAYS, STEAM PIPES, ETC., OWNED BY PRIVATE COMPANIES ALONG AND OUTSIDE OF THE LINE OF ORDERED EXCAVATION

The Contractor agrees to sustain in their places and protect from injury all railroad tracks, gas mains, conduits, subways, steam pipes and pneumatic pipes and all service connections therefrom and all other property belonging to public service companies along the line of the work and outside of the line of ordered excavation from direct or indirect injury by blasting, caving, or otherwise, and the Contractor hereby assumes all expenses for direct or indirect damage which may be occasioned by injury to any of them, and the Contractor agrees to have a sufficient quantity of timber and other necessary materials and appliances on hand at all times and use the same as required for the sheeting and bracing of sides and ends of excavation and for sustaining and supporting any structures that may be undermined, weakened and endangered or threatened; and in case any damage or injury results to said structure through or by reason of any negligence, willfulness, carelessness or want of skill on the part of the Contractor, the Contractor's agents or servants, the Contractor hereby agrees to pay such amount as must be sufficient to cover the expenses and damages occasioned thereby, and that such amount will be charged against the Contractor; and the Commissioner is hereby authorized to deduct and retain from any moneys which may be due, or which will become due under this contract, a sum sufficient in the Commissioner's judgment to cover the cost of making good any such damages, expenses or loss, and to apply said sum so deducted and retained to the requisite repairs or renewals, or to reimburse the parties damaged or injured.

10.19 GAS COST SHARING WORK (EP-7)

All prospective bidders are hereby advised that, pursuant to the "Gas Facility Cost Allocation Act", ("the Act"), the City of New York has entered into an agreement ("the Agreement") with the gas companies (Con Edison and National Grid (formerly Keyspan Energy Delivery)) operating in their respective areas of the City to "share" the cost of facility relocation and/or support and protection of facilities disturbed by proposed water and/or sewer and related City work specified in this contract. Therefore, bid items, specifications and estimated quantities for the incremental costs of support and protection of certain gas facilities have been included in this contract. The low bid for this contract will be determined by examining each bid for all work to be performed under this contract including any work of support and protection of gas facilities to be

performed. The Contractor must not seek additional compensation from gas companies except as specifically set forth in its contract. **(See for EP7-PAGES in the contract if Gas Cost Sharing Work is applicable)**

10.20 CONTRACTOR APPROVES DRAWINGS AND SPECIFICATIONS AS INVOLVING NO DAMAGE TO CITY PROPERTY OR TO PRIVATE BUILDINGS

The Contractor expressly admits and covenants that the drawings, specifications and other provisions of this contract, if the work be done without fault or negligence on the part of the Contractor, do not involve any danger to the fire alarm telegraph system of the City, sewers, water mains, hydrants, hydrant connections, duct lines owned, leased or operated by the City, lamps, lampposts, monuments, sewer and water service pipes, sidewalks, curbs, trees or any other city-owned properties or to the foundation walls or vault walls, stoops or other parts of abutting or adjacent private buildings. The Contractor will at the Contractor's own expense make good any direct or indirect damage that will be done in the course of construction to any such structures or property through or by reason of the prosecution of the work.

10.21 CONTRACTOR TO NOTIFY CITY DEPARTMENTS

Unless otherwise specified, at least forty-eight (48) hours before breaking ground for the purpose of constructing the work on this contract, the Contractor agrees to give notice hereof in writing to each and every City Department owning structures within the limits of the work and obtain their written permission before the Contractor disturbs any property or structure under the jurisdiction of these Departments.

(A) NEW YORK CITY FIRE DEPARTMENT

The Contractor must notify the Fire Department's Bureau of Fire Communications at Tel. No. (718) 624-4194 or (718) 624-3752 at least thirty (30) days in advance of starting construction and to make an appointment to pick up FDNY base maps at 87 Union Street, Brooklyn, N.Y. 11231. However, said drawings are made available to the Contractor only as information in the possession of the City, without any warranty, expressed or implied, as to their accuracy or sufficiency. The Contractor must make own field check of all information obtained from these drawings before putting it to use.

All existing Fire Department Communication facilities must be supported, protected and maintained, and have provisions made for their continuous operation during construction. All alarm boxes and posts must remain accessible. If, due to the Contractor's operation, Fire Alarm Service is inadvertently interrupted, or Fire Communication System equipment or facilities are damaged, the Contractor will be held responsible and must replace them immediately at the Contractor's own expense and in accordance with Fire Department standards, specifications and requirements.

To request street mark outs of Fire Communications underground facilities, the Contractor must contact Plant Operations Engineering at Tel. No. (718) 624-4194 or (718) 624-3752 at least thirty (30) days prior to commencement of work.

All Fire Department work must be done in accordance with the regulations, specifications and standards of the New York City Fire Department and under the direction of the Fire Department Engineer.

(B) NEW YORK CITY DEPARTMENT OF PARKS AND RECREATION

The Contractor must notify the Department of Parks and Recreation, not less than seventy-two (72) hours prior to the start of construction to permit a survey and examination of the site by the Department of Parks and Recreation Inspection Unit.

10.22 COST OF PERMANENT REMOVAL OF CITY STRUCTURES

Existing water pipes or appurtenances owned, controlled or operated by the City, or any part of the fire alarm telegraph system of the City, or any duct line or conduit owned, leased or operated by the City, occupying the place of the sewers, water mains and appurtenances to be laid or built as required herein, will be removed and relaid or rebuilt as required by the work of the contract. The cost thereof must be included in the prices bid for all the items for which there are contract prices, unless otherwise specified.

10.23 CONTRACTOR AGREES TO PROTECT CITY STRUCTURES WITHIN THE LIMITS OF, ALONG, AND OUTSIDE THE LIMITS OF ORDERED EXCAVATION

The Contractor agrees to support and to properly protect from injury the City fire alarm communication system, all water mains and service water pipes, sewers and appurtenances and conduits or duct lines owned, controlled or operated by the City which may be affected in any manner by the work done under this contract, except as hereinbefore provided, and to protect all such water and service pipes from freezing. If the Contractor fails to do so, the Commissioner is hereby authorized, after two (2) days written notice to the Contractor, to relay and recaulk and repair the same immediately, in each block, as the work progresses, and the cost thereof will be charged to the Contractor, and the City hereby is authorized to retain and deduct said cost out of the monies which may be due or become due to the Contractor. In general, existing traffic signal and streetlighting conduits are not shown on the contract drawings. It is the Contractor's responsibility to determine the location of the traffic signal and streetlighting underground distribution system. The Contractor must make own field observations and research the City's records to determine the location of such facilities. The cost of all support, protection and investigation performed by the Contractor as specified above must be included in the prices bid for all the items for which there are contract prices, unless otherwise specified. Should it prove necessary to disturb existing traffic signals or streetlighting equipment that is the property of the City of New York, the Contractor must provide temporary signals and streetlighting. Upon completion of the work, traffic signals, lamps, lampposts, and accessory equipment must be restored and temporary facilities must be removed. Such work must be accomplished in coordination with the Department of Transportation, Division of Traffic Operations and the appropriate utility companies. All costs for connections, disconnections, supply, erection, dismantlement, storage, and restoration of existing facilities must be included in the prices bid for all contract items, unless otherwise specified. Should the Contractor disturb, damage, or relocate any conduits, junction boxes, traffic and/or lampposts, lamps or traffic signals in the streets affected by this work, such damage or relocation must be immediately repaired with the knowledge of and to the satisfaction of the City. The cost of such work must be at the sole expense of the Contractor, unless otherwise specified.

10.24 DAMAGED WATER SERVICE PIPES TO BE REPAIRED BY A LICENSED PLUMBER

All temporary house connection materials, including hoses or tubing, must be certified per NSF/ANSI 61: "Drinking Water System Components – Health Effects." The Contractor must submit to the Engineer certificates of compliance with NSF/ANSI 61 for all temporary house connection materials prior to their use. Garden hoses, hoses specified for industrial use, or other materials not intended for potable water supply must not be used.

All water service pipes damaged, cut or otherwise interrupted in the performance of the work under this contract must be repaired by a licensed plumber at the expense of the Contractor under the rules and regulations of the City of New York. The Contractor must obtain all no-fee permits for water service repair.

All water service pipes damaged during construction and requiring repair must be replaced with one (1) continuous piece from the water main to the farthest point of the damage utilizing a single coupling as directed by the Engineer. If the damaged or cut water service pipe is lead, galvanized steel, or galvanized iron, the service pipe must not be partially replaced, but fully replaced from the main to the house control valve. If the service pipe was damaged, cut, or otherwise interrupted due to the Contractor's actions or means & methods (including selection of shoring systems), the water service pipe will be replaced at the Contractor's own cost.

10.25 CONTRACTOR TO CARRY OUT AGREEMENT BETWEEN CITY AND RAILROAD COMPANY OR PROPERTY OWNER(S)

If, for the purpose of performing the work or any part thereof required by the contract, the City has entered into an agreement with any railroad company, or the owner(s) of any property through or across which the work, or any part thereof, is to be constructed, the Contractor agrees to carry on such work or such part thereof, as directed, in accordance with the terms of such agreement, a copy of which is annexed and is hereby agreed upon as forming part of this contract.

10.26 MATERIALS ON PRIVATE PROPERTY

The Contractor hereby agrees that no excavated material or materials of construction will be placed by the Contractor or for the Contractor upon private property, unless by written permission of the owners or lessees thereof. Any such material placed without written permission will be removed by the Contractor, and all damages to said property remedied by the Contractor at the Contractor's own cost and expense. Unless such materials are removed and such damage remedied by the Contractor within forty-eight (48) hours after service upon the Contractor of a written notice to do so, the Contractor agrees that the Commissioner will be and is hereby authorized to dispose of such materials, and to remedy such damage and deduct the expense thereof from the moneys due or to become due under this contract. Copies of all written permissions will be given to the Engineer prior to the placement of any material on private property.

10.27 SAFE AND HEALTHFUL WORKING CONDITIONS

The Contractor must provide working conditions that are as safe and healthful as the nature of the construction operation permits. All such safe and healthful working conditions must be in accordance with OSHA requirements and regulations. Sewer and water main construction that require proper lighting in order to comply with OSHA must be lighted with electric lights in sufficient number to insure proper work and inspection.

The Contractor must keep the air in all sewers and water mains in which work is being performed in a condition suitable for the health of the workers. A sufficient supply of fresh air must be provided at all times in all places underground. Provisions must be made for the testing and monitoring of gases and for the quick removal of gases and dust created by operations in the sewers and water mains.

Should natural ventilation prove inadequate, ventilation plants of ample capacity must be installed and operated while the work is going on and at such other times as is required to produce conditions hereinbefore specified.

No separate payment will be made for the providing of safe and healthful working conditions. The cost for the above work must be included in the prices bid for all items of the contract.

10.28 SALVAGEABLE MATERIALS

Except as specified below, no salvageable material will be returned to the New York City Department of Environmental Protection regardless of condition. It will become the property of the Contractor for removal and disposal, by the Contractor, away from the site. No salvage of materials is required on contracts with federal funding.

The Contractor must salvage the following water system components removed during construction of the contract:

- All unbroken Metropolitan gate valves (6" thru 20")
- All unbroken 20" resilient seated gate valves

The Contractor must salvage the following sewer system components:

- All unbroken 24" sewer manhole covers
- All unbroken 27" sewer manhole covers
- All unbroken catch basin grates
- All unbroken catch basin hoods
- All unbroken catch basin curb pieces

The salvaged water and sewer system components must be delivered to the nearest NYC DEP Repair Yard as listed below between the hours of 9:00AM and 2:00PM. The delivered materials shall be free of all debris and have no attached piping.

NYC DEP REPAIR YARDS

FACILITY	TYPE	LOCATION / PHONE NUMBER
Pike Street	Manhattan Repairs	30 Pike Street, New York, NY 10002, 212-788-0105
Joline Avenue	Staten Island Repairs	182 Joline Avenue, Staten Island, NY 10307, 718-668-6307
Zerega Avenue	Bronx Repairs / Bronx Water Maintenance (E-BX)	930 Zerega Avenue, Bronx, NY 10473, 718-829-5349
Queens Repairs	Queens Repairs	106-36 180 Street, Jamaica, NY 11433, 718-820-4501
Brooklyn Repairs	Brooklyn Repairs	9023 Avenue D, Brooklyn, NY 11236, 718-240-4311

The Contractor must obtain from the repair yard a Return Requisition Slip as proof of delivery and shall submit it to the Engineer. Failure to provide a Return Requisition Slip to the Engineer shall incur a deduction to the Contactor, for each failure, in an amount as determined by the Engineer.

The cost of all labor, material and equipment required and necessary for the removal, cleaning, dismantling, loading, transporting, unloading, etc. of the salvaged materials to the NYC DEP yard shall be deemed included in the unit prices bid for all items of the contract. No separate or additional payment will be made for this work.

10.29 MATERIAL ON PUBLIC PROPERTY

No excavated or other material necessary to be disposed of, excepting as herein otherwise specified, will be dumped or placed within the limits of any existing or projected public street or road, nor will any material be excavated and removed from such locations, without the written permission of the Commissioner. In addition, no construction material or equipment will be stored on public property without all appropriate permits and the written permission of the Engineer.

10.30 CONTRACTOR TO PROVIDE FOR TRAFFIC

The Contractor must maintain and protect all pedestrian and vehicular traffic within the limits of the contract in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 6.70 - Maintenance And Protection Of Traffic**.

10.31 CONTRACTOR TO GIVE NOTICE TO AND COOPERATE WITH CITY DEPARTMENTS AND UTILITY COMPANIES

The Contractor must give notice in writing, at least forty-eight (48) hours before breaking ground for the purpose of constructing the work mentioned herein, to the Department of Transportation, Fire Department, Police Department, Department of Sanitation, Transit Authority and to any bus company operating on the street(s) affected by the work. The Contractor must cooperate with the City Departments and Agencies and utility companies affected by the work of this contract.

10.32 PHOTOGRAPHS

The Contractor will be required to provide “PHOTOGRAPHS” in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 6.43 – Photographs**.

10.33 BORING RECORDS

For the purpose of design, borings have been taken for projects that include sewer work. If not included as part of the contract documents, the boring samples, field and office records, and the reports on subsurface conditions are available for inspection by bidders. The Contractor may obtain copies of the boring records, reports, etc. at the following location:

Department of Design and Construction
Technical Support Division, Site Engineering Unit

30-30 Thomson Avenue
Long Island City, New York 11101

All the above-mentioned material is furnished for informative purpose only.

Projects that only involve water main work may not have boring information available.

10.34 USE OF WATER MAINS AND APPURTENANCES

The City will have the right to use and place in service any of the mains and appurtenances installed as soon as the same are laid and connected. If these mains and appurtenances require testing and there is a delay of over seven (7) calendar days in conducting such tests, regardless of the reason for delay in such testing, the mains and appurtenances may be used before being tested. Such use will not be considered as an acceptance of the work or any part thereof, nor will it affect the maintenance period as described.

10.35 FIRST CLASS MATERIAL AND WORKMANSHIP

(A) The specifications are intended to assure sewer and water supply facilities of great permanence and of maximum degree of reliability of service.

(B) All materials, fixtures, fittings, supplies and equipment furnished under this contract must be new, of standard, first grade quality, and of the best workmanship and design. No inferior or low grade, or obsolete articles will be approved or accepted, and all work of assembly, installation and construction must be done neat, first class and workmanlike in manner. The apparent silence of the specifications as to any detail, or the apparent omission from them of a detailed description concerning any work to be done and materials to be furnished, will be regarded as meaning that only the best practice is to prevail and that only the best material and workmanship is to be used; and interpretation of these specifications will be made upon that basis. Should any conflict occur in or between the drawings and specifications, the Contractor will be deemed to have estimated on the most expensive way of doing the work unless the Contractor has asked for and obtained a decision in writing from the Commissioner before the submission of the Contractor's bid, as to what will govern. In asking for prices on, or placing orders for, materials, fixtures, fittings, supplies and equipment intended for use or installation under this contract, the Contractor must provide the manufacturer or dealer with such complete information from these specifications as may in any case be necessary, and in every case the Contractor must quote in full to each such manufacturer or dealer the text of this paragraph, as well as the text of such other portions of the specifications as are appropriate. The chemical and physical tests, including the optional tests, called for in the ASTM, Federal and other specifications cited in this contract must be made as specified, unless otherwise approved. The following statement must appear on the face of every purchase order issued by the Contractor for work to be incorporated in this contract and the Contractor must instruct approved manufacturers or dealers to place this statement on purchase orders issued by them for such work:

"This order is subject to inspection by The City of New York; and must not be processed until inspection instructions have been issued by the Engineer."

(C) Whenever the characteristics of any required material are not particularly specified, such approved material must be used as is customary in first class work of the nature for which the material is employed.

The Contractor must install any proprietary articles in full compliance with all recommendations of the manufacturers of such articles.

Materials or equipment furnished for identical service or use must be the product of one manufacturer, except as otherwise approved by the Engineer.

10.36 URGENT REPAIRS

The Contractor must make all repairs to sewers, water mains, appurtenances and street surfaces labeled "URGENT REPAIRS" within eight (8) hours of notification of such by the Engineer. If the Contractor fails to make the required urgent repairs within the time specified, and because of the urgency of repairs it precludes the issuance of a notice as provided in **Article 48.2** of the Contract, the Commissioner will have the right to have the work done by others in the same manner as provided for under **Article 51** of the Contract.

10.37 CORROSIVE SOILS

The Contractor is notified that wherever ductile iron pipe is installed within the project scope, especially in soil environments that are considered potentially corrosive to ductile iron pipe, that the Engineer will direct the Contractor to test the soil and other conditions that affect the corrosion rate of ductile iron pipe in accordance with “AWWA C105/A21.5, Appendix A” to determine the necessity of polyethylene encasement of pipe. The rate of testing shall not exceed two tests per block. The Engineer reserves the right to witness all sampling and testing of the soil.

The cost for testing the soil, including all labor, materials, and equipment, will be included in the prices bid for laying ductile iron pipe and fittings per Section 60.12 of the Standard Sewer and Water Main Specifications.

If the soil is found corrosive for the ductile iron pipe, the Contractor must encase the new ductile iron pipe and appurtenances in an approved loose 8-mil thick polyethylene sleeve in accordance with item 65.21 PS – “FURNISHING AND PLACING POLYETHYLENE SLEEVE”, or as ordered by the Engineer. The payment for all labor, materials, and equipment, etc., complete, required for encasing the ductile iron pipe will be deemed included in the price bid for the item 65.21 PS – “FURNISHING AND PLACING POLYETHYLENE SLEEVE” and no separate payment will be made.

SECTION 11 – SURFACE RESTORATION UNDER MAINTENANCE GUARANTEE

11.01 CONTRACTOR TO KEEP INFORMED OF CONDITION OF PAVEMENT

The Contractor must keep informed of the condition of the curbs, sidewalks, roadway pavement, gutters and headers, etc., under the maintenance guarantee period specified in **Article 24** of the Contract and will be required to keep the same in repair without notice from the Commissioner. In case of failure or neglect on the Contractor's part to do so, then the Commissioner will have the right to purchase such materials as deemed necessary, and to employ such person or persons as deemed proper, and to undertake and complete said repairs by contract or otherwise and to charge the expense thereof against any sum of money retained by the City, as specified in **Article 24** of the Contract. When the expense to the City is greater than the sum retained, the Contractor must pay all such expense to which the City may have been put by reason of the Contractor's neglect to make such repairs as aforesaid.

11.02 CONTRACTOR TO MAKE REPAIRS

The Contractor must immediately repair and make good to the satisfaction of the Engineer all disintegration, cracks, bunches, waves, deteriorations and defects of every nature or settlements or depressions in the pavement, pavement base, subgrade material, gutters, headers, curbs, sidewalks, etc., which will occur at any time during the maintenance guarantee period. Prior to proceeding with repairs, the Contractor must notify and obtain the approval of the Department of Design and Construction as to the Contractor's method of repairs. The City will repair all defects for which, in the opinion of the Engineer, the Contractor is not responsible.

Where a settlement, depression or defect in the pavement, pavement base, subgrade material, gutters, headers, curbs, sidewalks, etc., is a result of backfilling not placed under this contract, as certified by the Engineer; or is caused by settlement of the backfill which is not due to the failure of the Contractor to comply with the requirements of the specifications, but is due to the unstable condition of the soil underneath the backfill, (as certified by the Engineer); the Contractor will not be responsible for the restoration of such settled pavement, pavement base, subgrade material, gutters, headers, curbs, sidewalks, etc., over such settled area to the original grade. The Contractor must, however, immediately repair all other defects to the satisfaction of the Engineer.

On unpaved streets, if the earth has not settled level with the adjoining roadway within thirty (30) days after the backfilling of the trench, the Contractor must bring the fill to the grade of the adjoining roadway.

11.03 AMOUNT DEPOSITED AS GUARANTEE TO BE USED FOR RESTORATION IF NECESSARY

The moneys deposited as specified in **Article 24** of the Contract may be used on behalf of the City by the Commissioner in replacing the curbs, sidewalks, headers, gutters, roadway pavement, pavement base or surface of unpaved streets, subgrade material, etc., and in replacing, recaulking or repairing water mains, water service pipes and appurtenances, should any settlement occur or other defect develop within the time specified in **Article 24** of the Contract, which in the opinion of the Engineer was due to improper workmanship or materials supplied by the Contractor.

11.04 REMEDY OF DEFECTS

Should the Contractor fail to remedy defects promptly within two (2) days after the service of notice upon the Contractor to do so, then the Commissioner will have the right to have the work done by other parties and deduct the cost thereof from any moneys due the Contractor under this contract. Within this period no certificates given, nor payment made, will be construed as accepting defective work or material or condoning any negligence or omission.

11.05 PAYMENT OF AMOUNT DEPOSITED

The payment of the moneys deposited in accordance with **Article 24** of the Contract will be contingent on the Contractor's compliance with all stipulations and requirements for surface restoration under the maintenance guarantee as certified by the Engineer. The City will pay to the Contractor the sum deposited or such parts thereof as may remain at the end of the specified period after the expense of making repairs has been paid therefrom. The City will not pay any interest on any moneys deposited.

11.06 DEDUCTIONS FROM PARTIAL PAYMENTS

Where there are no applicable unit bid prices for temporary or final restoration of pavement and the costs are included in the unit bid prices, deductions from partial payments for pavements, curbs, sidewalks, etc., that have been disturbed but not permanently restored will be made at the unit prices listed below for the restoration required under the contract.

Asphaltic Concrete Mixture	161.00 per Ton
Binder Mixture	146.00 per Ton
2" Asphaltic Concrete Wearing Course	31.00 per Sq. Yd.
3" Asphaltic Concrete Wearing Course	40.00 per Sq. Yd.
Asphalt Macadam Pavement 4” Thick	52.00 per Sq. Yd.
Asphalt Macadam Pavement 5” Thick	56.00 per Sq. Yd.
Asphalt Macadam Pavement 6” Thick	61.00 per Sq. Yd.
Asphalt Macadam Pavement 7” Thick	66.00 per Sq. Yd.
Asphalt Macadam Pavement 8” Thick	77.00 per Sq. Yd.
Asphalt Macadam Pavement 9” Thick	84.00 per Sq. Yd.
Concrete Base For Pavement	333.00 per Cu. Yd.
Subbase Course, Select Granular Material (Material D)	97.00 per Cu. Yd.
Dense Graded Stone Base	52.00 per Cu. Yd.
Reinforced Concrete Pavement	500.00 per Cu. Yd.
Granite Block Pavement	233.00 per Sq. Yd.
Granite Block Sidewalk	155.00 per Sq. Yd.
4” Concrete Sidewalk.	16.00 per Sq. Ft.
7” Concrete Sidewalk in Driveways	17.00 per Sq. Ft.
2” Asphaltic Concrete Sidewalk on 3” Screenings	29.00 per Sq. Ft.
Seeding	10.00 per Sq. Yd.
Concrete Curb (18” Deep)	81.00 per Lin. Ft.
Concrete Header	44.00 per Lin. Ft.
Granite Curb Straight on Concrete Cradle	199.00 per Lin. Ft.
Granite Curb at Corner on Concrete Cradle	301.00 per Lin. Ft.
Granite Curb in Driveway on Concrete Cradle	211.00 per Lin. Ft.
Sodding	26.00 per Sq. Yd.
Straight Steel Faced Concrete Curb (18” Deep)	145.00 per Lin. Ft.
Corner Steel Faced Concrete Curb (18” Deep)	160.00 per Lin. Ft.
Chain Link Fence 4’-0” High	73.00 per Lin. Ft.
Chain Link Gate for 4’-0” High Fence	112.00 per Lin. Ft.

11.07 UNDERGROUND FACILITIES

The Contractor must exercise care and caution while performing the restoration work so as to insure the maintenance of continuing service to all underground facilities.

11.08 DATE FOR COMPLETION OF SURFACE RESTORATION FOR PROJECT

The Contractor must complete the surface restoration work within the time fixed therefor in **Article 14** of the Contract**,** or within the time to which such completion may be extended. If the date for completion should fall within the months of December through March (inclusive), and the Contractor has not finished

the surface restoration work, then in that case the Contractor may be eligible for an extension of time for said months, or such part thereof as the Commissioner may determine the Contractor was precluded from performing surface restoration work due to weather.

SECTION 12 – MISCELLANEOUS PROVISIONS

12.01 LABOR

(1) The Contractor must comply with the requirements of Labor Law 220. The Contractor's attention is directed to the following five (5) requirements for full contract compliance with Labor Law 220; proper payment, posting, sign-in sheets, information cards and identification badges.

(2) Payroll records will be provided to the Engineer together with payment requests.

(3) A copy of the Letter of Transmittal is to be sent to the Department of Design and Construction. At the time of completion, of all contract work, the Contractor must obtain a letter from the Division of Labor Services, evaluating the Contractor's compliance with Executive Order No. 50 (E.O. 50). The Department of Design and Construction cannot process a distribution of final payment until the above is complied with.

12.02 VENDORS

Prior to starting work, the Contractor must submit in writing to the Engineer the names of all vendors and manufacturers the Contractor intends to use. Unless otherwise specified in the contract documents or a written exception is granted by NYCDDC, the Contractor may submit only one (1) vendor or manufacturer for each product that is to be incorporated in the contract. The use of multiple vendors or manufacturers to supply the same product will be prohibited, unless otherwise specified in the contract documents or a written exception is granted by NYCDDC. If the vendor or manufacturer is not approved, the Contractor will be notified to either submit another vendor or manufacturer, or have their proposed vendor or manufacturer submit a request for approval from NYCDDC. The Contractor will be prohibited from using the vendor or manufacturer until approval of the vendor or manufacturer has been acquired from NYCDDC.

12.03 PERMITS

The Contractor must, at the Contractor's own cost and expense except as otherwise may be provided, make the necessary arrangements for, and obtain all permits required for the Contractor's work.

The Contractor must furnish to the Engineer, copies of all permits and all correspondence between the Contractor and the permit-issuing agency, including copies of all routine forms that must be submitted as a condition of such permits.

12.04 TEMPORARY USE OF CITY WATER ON CONSTRUCTION PROJECTS

(1) It will be the Contractor's responsibility to obtain all necessary permits from the Department of Environmental Protection.

(2) Such permits and all City water necessary to perform the work of the contract, including but not restricted to filling and testing water mains, will be furnished by the Department of Environmental Protection from the nearest City hydrant without cost to the Contractor. An approved and certified RPZ (Reduced Pressure Zone Backflow Preventer) must be connected to the hydrant while the hydrant is being used. All water must be used as directed by the Engineer so that unnecessary waste may be avoided.

12.05 ROADWAY OPENINGS, USE, STORAGE, ETC.

The Contractor will receive upon request, all necessary no fee permits required by the New York City Department of Transportation, to open, use, store equipment and conduct operations in the roadway.

12.06 PROCESSING OF SUBSTANTIAL OR FINAL PAYMENT

At the time of completion of all contract work, the Contractor must obtain a letter from the Director of Contract Compliance Programs evaluating the Contractor's Compliance with all applicable LBE/MBE/WBE requirements. The Department of Design and Construction cannot process a final payment until the above is complied with.

12.07 SUBMITTAL OF SCHEDULE LOG

The Contractor's attention is directed to **Article 9 - Progress Schedule** of the Contract. The Contractor must submit along with the proposed progress schedule the following: A schedule log in Excel Format (tied to the proposed progress schedule) indicating a description of and the schedule submission dates for all required submittals, shop drawings, approval requests, design mixes, reports, samples, etc., as required by the specifications and the terms of the contract.

(NO TEXT ON THIS PAGE)

THE CITY OF NEW YORK

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF WATER AND SEWER OPERATIONS

DIVISION II – MATERIALS OF CONSTRUCTION

SECTIONS 20.01 TO 26.02

(NO TEXT ON THIS PAGE)

SECTION 20.01 – DUCTILE IRON PIPE AND ACCESSORIES

20.01.1 INTENT

This specification describes the requirements of materials, coating, shop testing and delivery of Ductile Iron Pipe for the potable Water Supply System in The City of New York, New York.

20.01.2 GENERAL

The latest revision on the bidding date (contract date for DDC contracts) shall apply for all industry standard specifications. In case of a discrepancy in the standard specifications and this specification, the requirements of this specification shall prevail. In any dispute regarding the interpretation, the decision of the Chief-Distribution Engineering, NYC DEP Bureau of Water and Sewer Operations (NYC DEP-BWSO) is final.

20.01.3 KIND

(A) PIPE

(1) The pipe must be: Push-on joint with restrained rubber gaskets; Mechanical Joint with rubber gasket; or Flanged Joints -as per purchase order.

(2) The pipe and accessories shall comply with ANSI/AWWA listed below; and the additional requirements in this specification.

(a) Pipe shall comply to C151/A 21.51- Ductile Iron Pipe Centrifugally Cast for Water.

(b) Cement Mortar Lining shall comply to C104/A21.4 – Cement Mortar Lining for Ductile Iron Pipe & Fittings for Water, except that the cement mortar lining shall be double the minimum thickness specified in the ANSI/AWWA Standard.

(c) Flanged Pipe shall comply to C115/A21.15 – Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges shall comply to ASME B16.1 Class 125. (Cast Iron pipe or flanges are NOT ACCEPTABLE)

(B) JOINTS

(1) Joint connecting hardware shall comply to C 111/A21.11 – Rubber Gasket Joints for Ductile Iron Pressure Pipe & Fittings,

(2) Push-on gasket joint shall be to the following industry standards:

(a) Fastite
(b) Tyton
(c) Super-Lok
(d) TR Flex with gripper rings
(e) Snap-Lock
(f) Flex-ring
(g) Field Lok 350 - 4-inch thru 24-inch
(h) Field Lok 30-inch to 36-inch
(i) Fast Grip 4-inch thru 20-inch
(j) As approved by DEP-BWSO-ME&QA

(3) Mechanical Joints shall use the following Mechanical Wedge Restraints:

(a) Megalug Series 1100, up to 48-inch diameter, from EBBA Iron Works;
(b) One-Lok Model SLD, up to 36-inch pipe diameter, from Sigma Company;
(c) Ford Meter Box Model 1400, up to 24-inch diameter;
(d) Romac Industries RomaGrip Pipe Restraint, 3-inch thru 12-inch diameters;

(4) Flanged Joints:

The flange gasket, bolts, nuts and washers as specified in **Subsection 20.01.4** shall be provided by others unless specifically ordered.

20.01.4 MATERIAL

(A) PIPE

(1) The pipe with Push-on Joint or Mechanical Joint (MJ) shall be ductile iron to ASTM A536 Grade 60-42-10 or as approved by the engineer and shall comply with the following Class requirements of AWWA/ANSI C151/A21.51:

(a) 3, 4, 6, 8, 10 and 12-inch nominal pipe diameters to Class 56

(b) 14, 16, 20, 24, 30, 36, 42 and 48-inch nominal pipe diameters to Class 55.

(2) Flanged Pipe shall be to ANSI/AWWA C115/A21.15 with Solid Ductile Iron threaded flanges, except the bolt hole diameter shall be larger as indicated elsewhere in this specification, if insulating joint is specified. The pipe thickness shall be as specified for the Push-on or MJ joints as listed in this specification.

(B) PIPE CONNECTING HARDWARE

(1) Push-on Joints

(a) Gasket material shall meet the requirements of ANSI/AWWA C111/A21.11. Rubbers other than SBR may be submitted for DEP approval. Gasket suitable for the type of pipe joint and lubricant shall be supplied with the pipe unless specified otherwise.

(b) Short length pipes or if the pipe to be cut in the field must be a full-length gaged pipe and shall be properly identified. The spigot end shall be according to AWWA/ANSI C151/A21.51.

(2) Mechanical Joints

(a) Connecting hardware shall meet the requirements of ANSI/AWWA C111/A21.11. Rubber other than SBR may be submitted for DEP approval. Gaskets suitable for the type of pipe joint along with the DEP-BWSO Mechanical Engineering and Quality Assurance (ME&QA) approved Wedge Type Restraint Glands and T-bolts and nuts shall be supplied by others unless required by the purchase order.

(b) MJ Field Lok Gaskets and glands (package) as manufactured by U.S. Pipe are acceptable up to and including 24-inch nominal pipe size.

(c) Plain Glands or Glands with setscrews are NOT acceptable.

(d) T-Bolts and nuts shall meet the requirements of ANSI/AWWA C111/A21.11. T-bolts and nuts shall be coated with Fluoropolymer or other DEP-BWSO-ME&QA approved coatings. The bolts, nuts and washers coating shall meet the 1000 hours salt spray requirements of ASTM B117. At present, bolts and nuts manufactured by Tripac Fasteners, 475 Klug Circle, Corona, CA 92880 are approved.

(3) Flanged Joints

(a) Un-insulated Joint shall be made with Full-face gasket approximately 1/8th - inch thick cotton reinforced SBR/EPDM gasket. Allstate Gasket Style 1175 – C.I. Rubber is acceptable. Other gaskets may be submitted for NYC DEP-BWSO ME&QA approval.

(b) Insulating Flanges

(1) Gaskets for insulated flanges shall be 1/8-inch thick, full-face type, with bolt holes and bolt circle diameter to match ASME B16.1 Class 125 flanges.

(2) Flange insulating gasket shall be Allstate Gasket, Inc. Style 1175 (Cloth inserted SBR, Shore 65) Type “E” (Full face), or DEP-BWSO-ME&QA approved equal.

(3) Every bolt/stud for the insulated flanged joint shall be provided with:

(i) One full length Mylar insulating sleeve with a wall thickness of at least 1/32-inch

(ii) Two (2) 1/8th -inch thick Phenolic insulating washers. The outside diameter of the insulating washers shall be 1/32nd -inch larger than that of the steel washers.

(c) Hex. Head bolts, nuts and washers shall be coated with Fluoropolymer or other DEP-BWSO-ME&QA approved coatings. The bolts, nuts and washers coating shall meet the 1000 hours salt spray requirements of ASTM B117. At present, bolts, nuts and washers manufactured by Tripac Fasteners, 475 Klug Circle, Corona, CA 92880 are approved.

(d) Bolts shall be carbon steel to meet the requirements of the "Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi tensile strength", ASTM A307 Grade B (Heavy Hex)

(e) Nuts shall be to ASTM A563 Grade A (Heavy Hex).

(f) Steel washers shall be to ASTM F844 (Wide).

(g) Bolt head shall be Heavy Hex series in accordance with ASME B18.2.1 and Heavy Hex nuts to ANSI B18.2.2. Washers shall be in accordance with ASME B18.22.1, Type A, Table 1B (wide). All bolts and nuts shall be threaded in accordance with ASME B1.1 - Unified Inch Screw Threads, Coarse Thread Series (UNC), Class 2A and 2B fit respectively. Metric standard Bolts, Nuts and Washers are NOT ACCEPTABLE.

20.01.5 COATING AND WRAPPING

(A) Outside coating shall be to ANSI/AWWA C151/A21.51 or as specified in the purchase order.

(B) Outside shall be tape wrapped if ordered. The tape wrapping shall be submitted to DEP-BWSO-ME&QA for approval.

20.01.6 LINING

(A) Inside shall be lined with cement-mortar in accordance with ANSI/AWWA C104/A21.4 except that the cement-mortar thickness shall be double the minimum thickness specified in the ANSI/AWWA Standard and a seal coat shall be applied.

(B) Inside of pipes without the cement mortar lining shall be coated with DEP-BWSO-ME&QA approved coating material when ordered.

20.01.7 MARKING

(A) In addition to the markings required by ANSI/AWWA C151/A21.51, each length shall have cast letters "WSNY" not less than ½-inch in height. Each pipe shall have a serial number to identify the pipe so as to correlate pipe material tests and Material Release and Shipping Authorization.

(B) Each pipe length shall be marked with a serial number.

20.01.8 INSPECTION

(A) At least five working days before the start of casting, the manufacturer shall inform DEP-BWSO-ME&QA for purchase orders from NYCDEP / NYC Department of Citywide Administrative Services (NYCDCAS) or to NYCDDC Quality Assurance (NYCDDC-QA) for purchase orders from a supply house or a contractor.

(B) Order for less than 1000 feet of pipe shall be completed in one workweek.

20.01.9 CERTIFICATION

(A) An Affidavit of Compliance and a set of all material certifications duly notarized shall be provided to the NYC-QA inspector on premises and request Material Release and Shipping Authorization. The serial numbers of the pipes to be shipped shall be listed on the Affidavit of Compliance.

(B) If onsite inspection was waived, then an Affidavit of Compliance and a set of all material certifications duly notarized shall be sent to DEP-BWSO-ME&QA for DEP / DCAS purchase orders; and to DDC-QA for the purchase orders from a supply house or a contractor, for the issuing of Material Release & Shipping Authorization. The serial numbers of the pipes to be shipped shall be listed on the Affidavit of Compliance.

(C) The above documents may be submitted on a CD.

20.01.10 PACKING, HANDLING, AND SHIPPING

(A) Pipes shall be properly constrained and protected from any damage during shipping.

(B) Each shipment shall have a Material Release and Shipping Authorization issued by DEP-BWSO-ME&QA for purchase orders by DEP/DCAS and by DDC-QA for purchase orders by a supply house or a contractor.

(C) Pipes shall be shipped on a flatbed/open truck unless the truck has provision to off- load the pipes at delivery site.

SECTION 20.02 – DUCTILE IRON PIPE FITTINGS & ACCESSORIES

20.02.1 INTENT

This specification describes the requirements of materials, coating, shop testing and delivery of Ductile Iron Fittings for the potable Water Supply System in The City of New York, New York.

20.02.2 GENERAL

The latest revision on the bidding date (contract date for DDC contracts) shall apply for all industry standard specifications. In case of discrepancy in the standard specifications and this specification, the requirements of this specification shall prevail. In any dispute regarding the interpretation, the decision of the Chief-Distribution Engineering, DEP-BWSO shall be final.

20.02.3 KIND

The fittings and accessories shall comply with ANSI/AWWA listed below; and the additional requirements of this specification.

(A) ANSI/AWWA C110/A21.10 Standard for Ductile-Iron & Gray-Iron Fittings, 3- inch through 48-inch for Water. Gray-Iron Fittings are NOT ACCEPTABLE.

(B) Joint connecting hardware to C 111/A21.11- Rubber Gasket Joints for Ductile- Iron Pressure Pipe & Fittings.

(C) AWWA C116/A21.16-15 Protective Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service. Fusion Bonded Epoxy Coatings are also acceptable.

(D) Cement Mortar Lining to ANSI/AWWA C104/A21.4 - Cement Mortar Lining for Ductile Iron Pipe & Fittings for Water, except that the cement mortar lining shall be double the minimum thickness as specified in the ANSI/AWWA Standard.

20.02.4 MATERIAL

(A) The fitting shall be Push-on Joint with restrained type rubber gasket, Mechanical Joint with rubber gasket, or flanged, as per purchase order.

(B) The material shall be ductile iron to ASTM A536 Grade 65-45-12 or Grade 70-50-05.

(C) Fittings with threaded flanges shall be to ANSI/AWWA C115/A21.15, Solid Ductile Iron flanges, except the bolt hole diameter shall be larger as indicated elsewhere in this specification, if insulating joint is specified.

20.02.5 JOINTS

(A) PUSH-ON JOINTS

Fittings with push-on joints to ANSI/AWWA C110/A21.10 shall be supplied with proper gasket and lubricant. Only restraint gaskets shall be supplied unless un- restraint gaskets are specially ordered.

(B) MECHANICAL JOINTS

(1) Connecting hardware shall meet the requirements of ANSI/AWWA C111/A21.11. Rubber other than SBR may be submitted for DEP approval. Gasket suitable for the type of joint along with the DEP approved Wedge Type Restraint Gland, T-Bolts and nuts shall be provided by others unless specifically ordered.

(2) Mechanical Joints shall use the following Mechanical Wedge Type Restraints:

(a) EBBA Iron Works Megalug Series 1100, up to 48-inch diameter.

(b) Sigma Company One-Lok Model SLD/SLDE, up to 48-inch pipe diameter.

(c) Ford Meter Box Model 1400, up to 24-inch diameter.

(d) Romac Industries RomaGrip Pipe Restraint, up to 24-inch diameter.

(e) MJ Field Lok Gasket and gland as manufactured by U.S. Pipe is acceptable up to 24-inch nominal pipe size.

(f) Tyler Union TUF Grip Restraint Glands 3-inch to 24-inch diameter.

(g) Star Pipe Products STAR Grip Restraint Gland 3-inch to 24-inch diameter.

(3) Plain Glands or Glands with setscrews are NOT ACCEPTABLE .

T-Bolts and nuts shall meet the requirements of ANSI/AWWA C111/A21.11. T-bolts and nuts shall be coated with Fluoropolymer or other DEP-BWSO-ME&QA approved coatings. The bolts, nuts, and washers coating shall meet the 1000 hours salt spray requirements of ASTM B117. At present, bolts and nuts manufactured by Tripac Fasteners, 475 Klug Circle, Corona, CA 92880 are approved.

(C) FLANGED JOINTS

Flange gasket, bolts, nuts and washers are specified in **Subsection 20.01.4(B)(3).**

20.02.6 COATING AND WRAPPING

(A) All fittings except glands shall be cement mortar lined in accordance with ANSI/AWWA C104/A21.4, except the cement mortar lining thickness shall be double the minimum thickness specified in the ANSI/AWWA Standard. Interior and exterior surfaces shall be coated according to ANSI/AWWA C110/A21.10.

(B) Outside shall be tape wrapped if ordered. The tape wrapping shall be submitted to DEP-BWSO-ME&QA for approval.

20.02.7 MARKING

All markings shall be according to ANSI/AWWA C110/A21.10.

20.02.8 INSPECTION

(A) The manufacturer shall inform at least five working days (fifteen working days for foreign manufacture) before the start of casting to DEP-BWSO-ME&QA for purchase orders from DEP/DCAS; and DDC-QA for purchase orders from supply houses or contractors.

(B) For fittings from a foreign source where DEP-BWSO-ME&QA or DDC-QA waive off inspection of these fittings at the foundry, all fittings shall have a lug approximately 0.75- square inch area integrally cast in a location on the casting from where the removal will not damage the casting or hinder the installation, and material microstructure can be obtained. This requirement is waived for castings 8-inch or less nominal pipe diameter.

20.02.9 CERTIFICATION

(A) An Affidavit of Compliance and a set of all material certifications duly notarized shall be provided to the NYC-QA inspector on premises before requesting the Material Release and Shipping Authorization.

(B) If onsite inspection was waived, then an Affidavit of Compliance and a set of all material certifications duly notarized shall be sent to DEP-BWSO-ME&QA for DEP/DCAS purchase orders; and to DDC-QA for the purchase orders from a supply house or a contractor, for the issuing of Material Release & Shipping Authorization.

(C) The above documents on a CD are preferred.

(D) All documents shall be in English.

20.02.10 PACKING, HANDLING, AND SHIPPING

(A) Fittings shall be properly constrained and protected from any damage during shipping.

(B) Each shipment shall have a Material Release and Shipping Authorization issued by DEP-BWSO-ME&QA for purchase order by DEP/DCAS and by DDC-QA for the purchase order by a supply house or a contractor.

(C) These fittings shall be shipped on a flatbed or open truck unless the truck has provisions to off-load the fittings at delivery site.

SECTION 20.03 – BUTTERFLY VALVES 20-INCH THRU 72-INCH WITH MANUAL ACTUATORS

20.03.1 INTENT

This specification describes the requirements of Butterfly Valves for the City of New York Water Supply System (excludes the valves purchased by NYCDEP Bureau of Engineering, Design and Construction (BEDC)). These valves shall be manually operated. All butterfly valves (BFV) shall meet the requirements of this specification.

20.03.2 GENERAL

(A) Since the contractor for the City of New York Water Supply System may purchase these valves, the contractor shall buy these valves from DEP-BWSO approved vendors and to DEP-BWSO- Mechanical Engineering & Quality Assurance Division (ME&QA) approved drawings only.

(B) The latest issue of AWWA C504 at the time of bid shall be consulted and any change in the latest issue affecting AWWA C504 requirements shall be brought to the attention of DEP- BWSO-ME&QA for resolution before the bid opening, if possible.

20.03.3 MANUFACTURER'S QUALIFICATIONS

(A) Butterfly Valves shall be manufactured by reputable establishments who have been manufacturing similar valves with compatible materials and size for a minimum of three years. These Butterfly Valves should have been performing satisfactorily under actual operating conditions at verifiable locations. Manufacturers new to New York City DEP-BWSO shall provide the names, addresses and telephone numbers of the managing Engineer or Superintendent of three (3) municipalities or organizations who can certify the performance, quality and operational experience of these valves.

(B) The manufacturer shall be required to establish:

(1) that they currently have within their own organization a competent and adequately staffed operating Quality Control Department responsible for maintaining the high standards regarding materials, manufacturing and testing of the work done in their plant. Quality Control and Quality Assurance procedures manuals shall be made available to DEP-BWSO engineer / inspector on demand and a copy of each shall be submitted on request.

(2) that they have a production force and plant facilities of a type and size suitable to perform the work required under this contract. All facilities proposed to be used for this work are subject to inspection and approval by DEP-BWSO-ME&QA.

(C) Use of any facility without the prior written approval of the DEP-BWSO-ME&QA shall not be permitted. Sub-contractors will have to be approved by DEP-BWSO-ME&QA before any part of this contract is assigned to them.

(D) Testing shall be conducted in accordance with DEP-BWSO-ME&QA approved procedures in the United States of America. The manufacturer shall submit the test procedures before starting the valve manufacture.

20.03.4 DESIGN CRITERIA

(A) GENERAL DESIGN REQUIREMENTS

(1) The BFV shall be in compliance with the AWWA C504, latest edition, except as modified in this specification. In case of a discrepancy, the requirements of these specifications shall prevail and the decision of DEP-BWSO-ME&QA shall be final and binding.

(2) These valves shall meet the requirements of AWWA C504, latest edition, Class 150B or Class 250B with Ductile Iron body.

(3) The BFV and the manual actuator shall be suitable for buried service and water submersion to a pressure of at least 10 psig.

(4) The valve and the actuator orientation shall be as specified on the purchase order and approved drawing.

(5) The manual actuator shall be provided with a torque-limiting device called Aunspach, suitable for the valve duty, with a 2-inch AWWA wrench nut. The AWWA wrench nut clockwise movement i.e. right-hand movement shall OPEN the valves. Aunspach torque shall be limited to the maximum torque permissible for the actuator.

(6) Materials for the valve shall comply with the requirements of the Safe Drinking Water Act and other federal, state and local requirements and ANSI/NSF Standard 61.

(7) The manufacturer shall submit design calculations as per AWWA C504-00 Sec. 4.5.3.3 when requested.

(8) The valve manufacturer shall be responsible for the proper working and testing of the BFV and the actuator as a unit after installation.

(9) The maximum shut-off design pressure shall be 150 psig or 250 psig as ordered. The maximum flow shall be 40 MGD (Million Gallons per Day) for the 24-inch; 75 MGD for the 30-inch; 90 MGD for the 36-inch; 130 MGD for the 48-inch; 200 MGD for 60-inch and 290 MGD for 72-inch nominal size valves. These values shall be used for the valve and the valve actuator design.

(10) The manufacturer shall submit fully dimensioned drawings, bill of materials, flow characteristics, actuator torque calculations, actuator manufacturer and model number, shop test procedures, quality control and quality assurance procedures in accordance with this specification for approval to DEP-BWSO-ME&QA. The drawings shall list calculated / estimated weight of the valve without the actuator and the weight of the actuator.

(B) VALVE ENDS

(1) 24-inch BFV shall be with mechanical joint-ends or flanged ends as specified in the purchase order; 30-inch, 36-inch, 48-inch, 60-inch & 72-inch BFV shall be Short-body flat flanged type.

(2) Valve waterway flanges shall be flat faced finished with serrated-spiral or concentric grooves in accordance with MSS Standard Practice SP-6. The face dimensions and drilling shall be in accordance with Cast Iron Pipe Flanges and Flange Fittings, ASME B16.1 Class 125 or to ANSI/AWWA C207 Class "D" or Class "E" as ordered, except that the bolt-holes shall have 1/8-inch larger diameter than the standard to accept Mylar insulating sleeves, this dimension shall be verified with the insulating bolt sleeves to be used. Back face of flange bolt-holes shall be spot faced in accordance with MSS Standard Practice SP-9. The spot face diameter shall be at least 1/2-inch larger than the insulating washer diameter. If tapped holes are required in the waterway flanges, they shall be Unified Inch Screw Threads, ASME B1.1, with Class 28 fit; the contractor shall coordinate the threads form with the BFV manufacturers and the Stud / Bolts & Nut manufacturer.

(3) Mechanical joint-end dimensions shall conform to ANSI/AWWA C111/A21.11. Slotted bolt openings of the same width as the diameter of the bolt-holes shall be provided instead of holes only where absolutely necessary for the insertion of bolts.

(C) VALVE ACTUATORS

(1) See **Subsection 20.03.4(A)(5)** of this specification.

(2) All components of the actuators shall meet or exceed the requirements of ANSI/AWWA.

(3) C-504 for the manual actuators.

(4) The actuator suitability tests for the subject BFV, duly certified by the testing authority to meet the requirements of ANSI/AWWA C504, shall be submitted to DEP-BWSO-ME&QA for approval.

In addition to the above, the actuator shall meet the following. AWWA wrench nut turns for 90 degrees rotation of the valve disc from fully open to fully closed position.

TABLE 20.03.4.1

Valve Size (Inches)	Approved Actuator Models	Shaft Orientation	Number of Turns from fully open to fully closed
24	Limitorque- HBC-3 GS 160.3 / GZ 160.3-4	Horizontal	50 to 54.5
30 and 36	Limitorque- HBC-4 Auma GS-250.3 / GZ 250.3-16	Horizontal	180 to 212
48	Limitorque- HBC-5 Auma GS-250.3 / GZ 250.3-16	Horizontal	195 to 212
60	Limitorque-HBC-6 Auma GS 315 / GZ 30-16	Horizontal	212 to 224.5
72	Limitorque- HBC-7 Auma GS400 / GZ35.- 8 / GST 14.5-2.8	Horizontal	302.4 to 331.25

(5) Actuators other than those listed above may be submitted to DEP BWSO ME&QA for approval. Only worm gear actuators are acceptable.

(6) The valve manufacturer shall be responsible for the adequate actuator design for each.

(7) valve. The manufacturer shall submit all calculations required to substantiate the selection of the proposed actuator to DEP-BWSO-ME&QA Engineer. These calculations shall be readily checkable and detailed. A computer printout of only the critical torque value will not be accepted. If the calculations show that an actuator of higher capacity is required, it shall be provided by the manufacturer at no additional cost to the City of New York.

(8) A duly notarized Affidavit of Compliance shall be provided by the BFV Manufacturer that the Actuator meets the requirements of ANSI/AWWA C504 Manual Actuator design and test requirements as well as these specification requirements.

20.03.5 MATERIAL

(A) The valve body and disc shall be ductile iron conforming to Specification for Ductile Iron Castings ASTM A-536 Grade 65-45-12 or Grade 70-50-05.

(B) The horizontal shaft shall meet or exceed the requirements of ANSI/AWWA C-504. The bearings shall be to ANSI/AWWA C-504. BFV shaft material shall be stainless steel to ASTM A240 Type 316, ASTM A276 Type 316 or ASTM A564 grade 630 H-1150 for BFV 24-inch to 30-inch. The shaft material for 36-inch, 48-inch, 60-inch & 72-inch BFV shall be to ASTM A564 grade 630 H-1150 or as approved by DEP-BWSO-ME&QA.

(C) The surface mating the valve resilient seat shall be stainless steel to ASTM A240 Type 316 stainless steel.

(D) Valve seats shall be natural or synthetic rubber as approved by DEP.

(E) Shaft keys / Pins connecting the disc and the shaft shall be same specification as the shafts.

(F) The manufacturer shall also submit to the DEP-BWSO-ME&QA or DDC-QA as applicable, CMTR for all major pressure retaining components of the valves.

(G) The list of components requiring CMTRS shall preferably be listed on the drawings or listed separately with the drawings submitted for approval.

(H) All wetted bolts, nuts studs, screws and washers for the BFV, Actuator, and AWWA Stop shall be stainless steel unless approved otherwise. Stainless steel screws, bolts, studs, and washers shall comply with the requirements of the Standard Specification for Alloy Steel and Stainless-Steel Bolting Materials for High-Temperature Service, ASTM A193 Grade B8 Class 1. Stainless steel nuts shall comply with the requirements of the Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and

High- Temperature Service ASTM A194, Grade SF Class 2B fit. CMTRS, if required, shall be listed on the approved drawing. CMTRS are required for bolts, studs & nuts larger than 1/2 inch diameter only.

(I) Nuts for non-wetted stainless-steel fasteners shall be made up with a thread lubricant during shop and field assembly. The thread lubricant shall have properties that will prevent galling and seizing between the male and female threads, reduce the torque required to tighten the fastener, permit ready disassembly after many years of service in damp locations, and prevent contamination at the bearing surface of heads, nuts, and flanges. The thread lubricant shall have no detrimental effect on the gaskets used. The thread lubricant shall be approved by DEP-BWSO-ME&QA. Thread lubricant is not be required for Fluoropolymer coated bolts and nuts.

(J) All wetted screws and studs shall be coated with ''Permatex Locktite Red High Strength Thread locker'' or other DEP-BWSO approved screw-locking material.

20.03.6 MARKING

(A) The outer surface of the butterfly valve body castings shall have cast identifying marks in raised letters indicating the year of manufacture, foundry identification, cast material D.I. and the letters "W S N Y". Letters for the year of manufacture and ·" W S N Y'' shall be (2) inches in height and be raised one-eighth (I /8) inch. The foundry identifying marks shall be at least one (1) inch high and raised one-eighth (1/8) inch or as approved by the DEP- BWSO-ME&QA. "WSNY" is required on all bodies for NYC Water Supply System Butterfly Valves.

(B) The markings shall be located in an area that is easily visible after installation.

(C) If a casting is rejected, the letters " W S N Y'' shall be ground off or casting destroyed by the manufacturer in the presence of DEP-BWSO-ME&QA / DDC-QA inspector.

(D) At least one identifying plate according to AWWA C504 Sec. 6.1 shall be permanently attached (Glued plate is NOT ACCEPTABLE) so that it is visible from above after installation. The plate shall have a serial number for the valve.

(E) A stainless steel or copper / brass plate, with no sharp corners, listing the number of turns and the open direction shall be installed with small screws or rivets on the valve at a place easily visible after installation

20.03.7 TESTING

(A) PROOF-OF-DESIGN TESTS:

The manufacturer shall furnish certified documents for proof-of-design tests for the Butterfly valve and the Actuator as described in AWWA C-504 to DEP-BWSO-ME&QA Division, 12th Floor High Rise, 59-17 Junction Boulevard, Flushing, NY 11373. If the tests were conducted on a valve or actuator of a design different than the one proposed, then DEP-BWSO may require the Proof-of-Design tests performed in the presence of DEP- BWSO-ME&QA Engineer before the design approval of the valve and the actuator of the manufacturer(s).

(B) SHOP TESTING

(1) Valve body shall be hydrostatically tested at 300 psig or 500 psig for Class 250 BFV before assembly and coating application. A rust preventive coating may be applied before this testing. The test pressure shall be maintained for a period of fifteen (15) minutes or as required by the Engineer / Inspector. There shall be no leakage /seepage through the valve body casting and there shall not be any permanent deformation.

(2) All valves shall be tested in accordance with Section 5.2 of the Rubber-Seated Butterfly Valves ANSI/AWWA Standard C-504 in the presence of DEP-BWSO-ME&QA or DDC-QA inspector / engineer unless advised otherwise.

(3) Unless approved otherwise by the DEP Engineer, all shop testing shall be performed in the Continental United States of America. All test procedures shall be submitted to the DEP-BWSO-ME&QA Engineer for approval a minimum of 15 days prior to any proposed tests.

(4) The Contractor / BFV manufacturer shall notify the DDC-QA and DEP-BWSO-ME&QA Engineer at least five (5) business days in advance of any shop testing activity.

(5) The settings (adjustments) of the internal stops of the gearbox and the AWWA stop of the valve shall be verified after testing.

(6) The settings for Limitorque Actuators shall be as follows:

Gearbox stops -	Open:	worm sector gear in contact and stop shall be tight.
	Close:	worm sector gear not in contact and the stop 1/4 turn backed off from contact position.
AWWA stop -	Open:	the open stop trips and the input shaft cannot rotate.
	Close:	the close stop trips and the input shaft cannot rotate.

(7) Valve performance and leakage tests shall be conducted according to AWWA C504-00 Sec. 5.2 as applicable. The leakage test shall be in both directions.

20.03.8 COATING

(A) Outside surfaces of actuator, AWWA Stop, Gear Box etc. shall be coated with DEP-BWSO-ME&QA approved epoxy to a dry film thickness of 8 mils to 12 mils. Mating machined surfaces, bolt hole spot faces and bolt holes shall be coated with DEP-BWSO- ME&QA approved epoxy to a dry film thickness of 3 mils to 5 mils.

(B) Pota-Pox Plus Series Nl40, beige, as manufactured by the TNEMEC Company, Inc., Kansas City, Missouri is approved. Fusion bonded epoxy for any of the components may be submitted for DEP-BWSO-ME&QA approval.

(C) All inside and outside coatings for BFV shall meet the requirements of ANSI/ AWWA C550.

(D) BFV body, disc, Actuator and Gear Box coatings shall pass the holiday tests of NACE Standard RPO I88, latest revision.

20.03.9 FASTENERS

(A) Flange connecting hardware shall be supplied by the installation contractor, unless ordered otherwise.

(B) Bolts for the flanges shall be to ASTM A193 Grade B7 or ASTM A307 Grade B Heavy Hex head, Fluoropolymer coated (Tripac coated preferred) SAE J429 equivalent bolts / studs Fluoropolymer coated may also be submitted for approval. The nuts for the flanges shall be to ASTM A563 Class C3 or DH3, fluoropolymer coated (Tripac coated preferred). The fluoropolymer coating shall meet 1 ,000 hours salt spray testing of ASTM B 117. Material Test Reports are required for all bolts and nuts for the flanges. Washers shall be to ASTM F436, fluoropolymer coated. Certified MTRS are required for the bolts and nuts, certification for the washers.

20.03.10 INSULATING FLANGE JOINT HARDWARE

(A) Insulating gaskets, sleeves and washers shall be supplied by installation contractor, unless ordered otherwise.

(B) Gaskets for insulated flanges shall be 1/8-inch thick, full-face type, with bolt holes and bolt circle diameter to match ASME B16.I Class I25 flanges or AWWA C200 Class D or E as required

(C) Insulating gaskets for 24 in. thru 48 in. flat face flanges shall be Style 1175 (cloth inserted SBR Shore 65), Type E (full face) made by “Allstate Gasket Inc.” and for 24 in. thru 72 in. flanges shall be Type G10 made by “Advanced Products & Systems”. Insulating gaskets for ring-grooved flanges (as ordered) shall have one “O” ring for up to 48 in. and two “O” rings for 60 in. and larger diameter.

(D) Every bolt / stud for the insulated flanged joint shall be provided with:

(1) One full length Mylar insulating sleeve with a wall thickness of at least l/32-inch.

(2) Two (2) 1/8th -inch thick Phenolic insulating washers. The outside diameter of the insulating. washers shall be 1/32 -inch larger than that of the steel washers
(3) Two steel washers Fluoropolymer coated for each bolt and nut.

(E) Where spot facing is more than 1/16th -inch deep, additional insulating washers shall be used to provide at least I/4-inch clearance between the steel washer and the valve casting.

20.03.11 INSPECTION

(A) Inspection shall be according to AWWA C504-00 Sec.5.1.

(B) After the completion of the final acceptance tests, the DEP-BWSO-ME&QA or DDC-QA inspector shall issue a Material Release and Shipping Authorization. This Material Release and Shipping Authorization shall accompany the shipment.

20.03.12 OPERATION AND MAINTENANCE MANUALS

(A) For NYCDDC contracts, the Butterfly Valve manufacturer shall furnish six (6) bound copies (for each size BFV ordered) of operation and maintenance manuals with shop test results, installation instructions, a copy of as built drawings and Affidavit of Compliance and warranty: five (5) sets delivered to the NYCDDC Resident Engineer (or as called for in the contract) at the time the valve is shipped and one (1) set enclosed in the crate. These manuals shall be delivered to DEP-BWSO Operation when the valve installation is completed / placed in service.

(B) For DEP contracts, six (6) bound copies (for each size ordered) of operation and maintenance manuals with shop test results, installation instructions, a copy of as built drawings and Affidavit of Compliance and warranty: five (5) sets delivered to the DEP-BWSO-ME&QA Engineer at the time the valve is shipped, and one (1) set enclosed in the crate.

20.03.13 WARRANTY PERIOD

The BFV and Actuator shall be warranted for ten years after delivery for any material or manufacturing defect.

20.03.14 PACKING, HANDLING, AND SHIPPING

(A) The valve and the actuator shall be delivered an assembled unit ready for installation unless it is not possible to ship as a unit.

(B) The Contractor shall submit to the DEP-BWSO-ME&QA Engineer the crating, shipping and handling procedures so as to protect the equipment during shipping and storing for approval. All crate contents shall be fully enclosed and hermetically sealed in approved plastic wrap. Proper desiccants shall be used to protect the box contents from excessive humidity. Each crate shall have two removable inspection panels located on opposite sides of the crate. The crates shall be marked with paint with the following information on two opposite faces of the crate:

PROPERTY OF CITY OF NEW YORK
(DEPARTMENT OF DESIGN AND CONSTRUCTION OR DEPARTMENT OF ENVIRONMENTAL PROTECTION)
CONTRACT NUMBER / PURCHASE ORDER NUMBER
BUTTERFLY VALVE SERIAL#_____
SIZE:____ INCHES
MONTH & YEAR OF MANUFACTURE: ____/_____
DESTINATION ADDRESS: _____
MANUFACTURER: _____
GROSS WEIGHT: _____ NET WEIGHT: _____
SHIPPING DOCUMENT_____
DDC/DEP CONTACT NAME:_____ TEL:_____

(C) A copy of the shipping documents shall be plastic wrapped and securely attached to the outside of the crate and an additional copy included inside.

(D) The BFV manufacturer / Contractor shall make all arrangements for the transportation, handling, and delivery of all equipment furnished under this contract from the manufacturer's plant to the storage / construction site. All deliveries shall be done during normal business hours.

(E) The equipment shall be delivered to the construction site in the valve manufacturer's original, unopened, and labeled crates. Upon delivery, the Contractor shall inspect the shipment in the presence of the Resident Engineer or his representative to assure that:

(1) The shipment complies with the required contract documents and approved submittals.
(2) Quantities are correct according to the shipment documents.
(3) Containers or packages are intact, and the labels or markings are legible.
(4) Equipment is properly protected and undamaged.
(5) All MTRS and material certifications are enclosed.
(6) Material Release and Shipping Authorization from DDC-QA or DEP-BWSO-ME&QA inspector is enclosed.

SECTION 20.04 – PRESSURE REDUCING VALVES 8-INCH THROUGH 30-INCH

20.04.1 INTENT

This specification describes the requirements of design, materials; coating; shop testing and delivery of Pressure Reducing Valves (PRV) 8-inch through 30-inch for the potable water supply system in The City of New York, New York.

20.04.2 QUALIFICATIONS

(A) MANUFACTURER'S QUALIFICATIONS

(1) These valves shall be manufactured by an established and reputable manufacturer, who is experienced in the production of Pressure Reducing (Pressure Regulating) Valves of a similar design and size and in compliance with similar specifications for a minimum of two (2) years. The manufacturer shall provide the names, addresses and telephone numbers of at least three (3) municipalities or utilities, which can be contacted to verify the quality and performance of their valves.

(2) Any manufacturer, not approved by DEP, intending to bid for these valves for the NYC Water Supply System shall submit their Quality Control and Quality Assurance manuals to DEP-BWSO-ME&QA at least 15 working days before the bid submission date.

(3) Any manufacturer intending to supply these valves to NYC Water Supply System shall submit detailed valve drawings and complete bill of materials with industry standards to DEP-BWSO-ME&QA / DCAS (Department of Citywide Administrative Services) for approval. This should preferably be accomplished before bidding for the valves. These valves shall be supplied ONLY to the approved drawings and approved test procedures to this specification.

(4) The manufacturer shall machine, assemble and test these valves with their own production force. Subcontracting or subletting any of the aforementioned portions of the work must be approved in writing by DEP-BWSO-ME&QA in advance.

(5) Regardless of the country of origin of casting and machining, assembly and testing shall be in the continental United States of America or Canada. DEP-BWSO-ME&QA personnel may witness any or all the assembly and testing during manufacture and /or QA inspection.

(B) FOUNDRY REQUIREMENTS

(1) All ferrous material casting foundries shall have a minimum of three (3) years experience in casting Ductile Iron valve bodies, seal plates and bonnets for similar valve sizes and design in ductile iron grades as specified herein.

(2) All brass / bronze foundries shall have a minimum of three (3) years experience in casting brass / bronze valve components for the materials specified herein.

(3) All foundries and testing facilities are subject to inspection and approval by DEP-BWSO-ME&QA / DCAS.

20.04.3 DESIGN CRITERIA AND MATERIALS

(A) Since there is no industry standard for the design of Pressure Reducing (Regulating) valves, DEP will follow ANSI / AWWA C500 for the minimum thickness for the valve body & bonnet.

(B) The Pressure reducing valve shall be flanged globe-type. The pressure Reducing Valve may be supplied with resilient seated isolation valves and piping in a pre-stressed concrete chamber if purchase order calls for that. The complete assembly drawing shall have been approved by DEP / DDC engineering division.

(C) Diaphragm operated Pressure Reducing Valves (PRV) shall have rolling diaphragms only. Valves must have two independently housed rolling diaphragm chambers. Only one diaphragm shall be controlling at any time. In case of a failure of one diaphragm, the redundant diaphragm shall take over with downstream pressure rise of less than 10 pisg.

(D) Pressure Reducing Valves shall have dual parallel pilot valves to control the downstream water pressure. The valve shall maintain downstream water set pressure between 20 psig to 85 psig with upstream pressure varying up to 175 psig. The downstream pressure shall be field adjustable.

(E) The downstream pressure shall be field adjustable from twenty (20) psig to 10% above the factory set pressure. The valve shall maintain downstream pressure within five (5) psig of the set pressure, regardless of variations in the upstream water pressure, within the limits specified, or the quantity of water flowing through the valve. A momentary surge of maximum eight (8) psig above the set downstream water pressure is acceptable.

(F) Eight inch and twelve-inch PRV shall be FULL PORT only; 16-inch thru 30-inch Pressure Reducing Valves may have their port size one pipe size smaller if they meet the water flow requirements of this specification.

(G) All ferrous components for this valve shall be Ductile Iron ASTM A536 Grade 65-45-12 or 70-50-05.

(H) Valve end flanges shall conform to ASME B16.1 Class 125 (flat face). Bolt-holes shall straddle the valve centerline.

(1) Flange back facing, if required, shall be in accordance with MSS SP-9. The flange thickness at any point shall not be less than ASME B16.1 Class 125 Table 4.

(I) Pilot valves, strainers, restrictor valves or any other replaceable part shall have isolating brass / stainless steel ball valves to facilitate replacement in the field. The ball valve handles shall be brass or stainless steel.

(J) Pilot valves and restrictor wetted internal parts shall be stainless steel. Stems shall be stainless steel Type 304 / 316. Pilot and restrictor valve seat shall be field replaceable.

(K) The PRV shall be provided with two strainers in parallel so that any strainer can be isolated.

(L) Strainer element shall be stainless steel only.

(M) Control piping for Piston operated valves shall be at least one (1) inch nominal pipe size of rigid brass, copper or stainless steel. Any section of this piping shall be replaceable in the field without disturbing other sections of the piping or valves /strainer etc. All piping shall be properly supported.

(N) Singer valves shall have stainless steel reinforced rubber flexible hose at least 3/8th-inch nominal internal diameter and pressure rated not less than ten thousand (10,000) psig. Any section of this hose / piping shall be replaceable without disturbing other piping. All fittings shall be high strength bronze. All control valves and strainers shall be properly supported.

(O) All piping shall be on one side of the main valve or near the centerline of the valve; and shall not obstruct the maintenance of the main valve. The piping side shall be specified in the purchase order. The PRV shall have provision to change the piping side in the field.

(P) A corrosion-resistant material graduated scale assembly shall visually indicate the valve position. The scale shall be marked “0” for fully closed position and it shall also indicate partial open positions. The scale shall be readable in low light condition.

(Q) Stainless steel half couplings with shut-off valves for pressure gages shall be provided for the upstream and downstream water pressures.

(R) The valve shall be provided with 2 ½ -inch minimum diameter pressure gages to indicate the upstream and downstream water pressures. The pressure range for the up-stream pressure gage shall not be more than 300 psig and for the downstream not more than 100 psig. These gages shall be protected from damage during transportation.

(S) As a measure of performance, while automatically maintaining any regulated downstream pressure within the specified limits (pressure drop not exceeding 20 psig), a fully open pressure reducing valve shall have the following flow capacities without chattering or water hammer:

(1) 8- inch -- three and a half (3 ½) million gallons per day (MGD)
(2) 12- inch -- eight (8) MGD

(3) 16- inch -- fifteen (15) MGD
(4) 20- inch -- twenty (20) MGD
(5) 24- inch -- thirty-four (34) MGD
(6) 30- inch -- fifty-three (53) MGD

(T) Composition material/impregnated paper gaskets are NOT ACCEPTABLE; O- ring design for the flange connections will be preferred.

(U) The bolts, studs, washers and nut materials shall be stainless steel or high strength carbon steel with Fluoropolymer coating (meeting the requirements of ASTM B-117). The hardware specifications shall be submitted to DEP-BWSO-ME&QA for approval. Metric sized bolts, studs and nuts are NOT ACCEPTABLE.

(V) All screws, bolts and nuts in wetted areas shall be stainless steel or as approved by DEP-BWSO-ME&QA .

(W) Since the various designs vary considerably, it is not possible to list the material for all the parts, but in general, all internal wetted parts shall be stainless steel to ASTM Type 304 / 316. Other suitable materials may be submitted for approval to DEP-BWSO-ME&QA

(X) All non-metallic material specifications shall be submitted for DEP-BWSO-ME&QA for approval.

20.04.4 SUBMITTALS

(A) The manufacturer shall submit four (4) sets of fully dimensioned drawings, complete bill of materials with industry standard specifications to DEP-BWSO-ME&QA for approval. All valves shall be furnished to DEP-BWSO / DCAS OR DDC contractors in accordance with these DEP-BWSO-ME&QA approved drawings only. These drawings shall be black lines on white paper. Drawings shall preferably on paper not larger than 17-inch x 11-inch.

(B) All dimensions shall be in inches. Metric equivalents are NOT ACCEPTABLE.

(C) The manufacturer shall assign a separate set of drawing numbers for NYC valves.

(D) Pressure Reducing Valve design proven to meet the requirements of this specification and which has performed satisfactorily for at least two years in other Water Supply Systems will be considered for the NYC Water Supply System.

(E) A new design Pressure Reducing Valve meeting the requirements of this specification may be submitted for approval to DEP-BWSO-ME&QA.

(F) PRV flow characteristic flow charts shall be submitted for approval

20.04.5 MARKING

(A) Each valve shall have cast in raised letters at least 3/4-inch high and 1/8-inch relief in the bonnet / body or both, the letters “WSNY”, the manufacturer’s mark (Logo), valve size, port size, the year of manufacture, D.I.(Ductile Iron), country of manufacture and the rated working pressure. The casting shall also bear markings identifying the foundry as well as the heat number. A stainless steel or copper alloy tag indicating the valve serial number shall be permanently attached (riveted or screwed with corrosion resistant material) to each valve body / bonnet, as approved. The serial number shall be at least 1/8th-inch high raised or punched letters. No two valves shall have the same serial number. Serial number unique to the valve should include manufacturer’s mark, year and month of manufacture. The numbering system shall be explained on the respective drawing. The tag shall not have sharp or raised edges or corners.

20.04.6 TESTING

(A) Each fully assembled valve with the flanges blanked off shall be subjected to a hydrostatic pressure of 400 psig for 8-inch & 12-inch valves, and 300 psig for 16-inch and larger valves. There shall be no leakage through any joint or metal for the duration of the leakage test but no less than 15 minutes.

(B) Each valve shall be fully cycled (full open and close positions) for at least five (5) times through the manipulation of each control valve to verify the operation at the set pressures. Singer PRV shall be tested five (5) times with each diaphragm for both control valves.

20.04.7 COATING

(A) Inside and outside of ferrous castings shall meet surface preparation requirements of ANSI/AWWA C550.

(B) Any casting showing any defect, however minor, shall be set aside for the City of New York DEP-BWSO-ME&QA or DDC-QA engineer / inspector for evaluation and acceptance. Welding repairs, even for cosmetic purposes, are NOT permitted unless approved by the DEP-BWSO-ME&QA or DDC-QA engineer.

(C) Outside & inside surfaces of PRV shall be coated with DEP-BWSO-ME&QA approved epoxy to a dry film thickness of 12 to16 mils. Machined surfaces, spot faces, bolt holes shall be coated with DEP-BWSO approved epoxy to a maximum dry film thickness of 4 mils. All coatings shall meet the requirements of Food and Drug Administration Document, Title 21 of the Code of Federal Regulations on Food Additives, Sec. 175.300, Resinous and Polymeric Coatings or ANSI/NSF 61, Drinking Water Systems Components – Health Effects.

(D) Pota-Pox Plus Series N140 and N140F, beige, as manufactured by the TNEMEC Company, Inc., Kansas City, Missouri are approved. Fusion bonded powder epoxy, meeting the requirements of ANSI/AWWA C116/A21.16 OR fusion bonded liquid epoxy to ANSI/AWWA C550 is also acceptable. Fusion bonded epoxy shall be approved by DEP-BWSO-ME&QA before application.

(E) PRV coatings shall pass the holiday tests of NACE Standard RP0188, latest revision.

20.04.8 INSPECTION

(A) The contracted manufacturer shall submit a tentative production schedule to DEP-BWSO-ME&QA AND DDC-QA within 30 days of receiving the order but not less than fifteen business days before starting production. In general, the purchase orders by DEP / DCAS shall be inspected by DEP-BWSO-ME&QA, and purchase orders by DDC contractors by DDC-QA.

(B) DEP-BWSO-ME&QA OR DDC-QA inspectors have the right to witness retest of production tests of all valves. Failed valve(s) may be repaired under the supervision of the inspector with the approval from DEP-BWSO-ME&QA OR DDC-QA engineer as applicable.

20.04.9 SPARE PARTS

At present DEP-BWSO uses Pressure Reducing Valves of three different designs from three manufacturers, therefore, it is not possible to make only one list of the spare parts required with the PRV order. The following list of spare parts required is based upon the presently approved drawings of these manufacturers. This list of spares may be changed for any purchase order. The purchase order list for spare parts shall prevail.

Following spare parts shall be supplied with each Pressure Reducing Valve. The part numbers may be different on the final approved drawings for the valves and appurtenances, in case of discrepancy, the part description shall prevail:

(A) Ross Valve Mfg. Co. Inc. – Pressure Regulating Valve with Dual Pilots, Model: 40WR-PR-NYC, Globe Body: 8-inch thru 30-inch, Drawing: 40WR-PR-NYC_REV E

(1) Part # 5 – Piston Cup Packing – five (5) sets.
(2) Part # 9 – Seat Packing – five (5).
(3) Part # 10 – Seat Packing Support – one (1).
(4) Part # 13 – Main Cup Packing – five (5) sets.
(5) Part # 15 – Top Stem Nut – one (1).
(6) Part # 17 – Needle Valve – one (1) complete valve; with five (5) refurbishing kits.
(7) Part # 18 – Isolation Valves (Ball Valve) – four (4) complete valves.
(8) Part # 19 – Pilot Valve (Low Control) – one (1) complete valve; with five (5) refurbishing kits.
(9) Part # 22 – Bolts & Nuts (ST PCKG SPT) – two packages.
(10) Part # 25 – Strainer – five elements.
(11) Part # 30 – Pilot Valve (High Control) – one (1) complete valve; with five (5) refurbishing kits.
(12) No Part # – Bolts and Nuts (for Part # 12 – Main Cup Plates) – two (2) sets.
(13) No Part # – Cover & Main Bushing Gaskets – five (5) sets.

(14) No Part # – Stem Gaskets – five (5) sets.

(B) GA Industries, Inc. – 20-inch Globe Dual Pilot Pressure Reducing Valve for NYC DEP, Drawing No. D-1459, Fig. No. X4600-D; For 12-inch and 20-inch PRV:

(1) Body Assembly Part # 3 – Liner – one (1).
(2) Body Assembly Part # 4 – Piston Cup – five (5).
(3) Body Assembly Part # 5 - Piston Cup Follower – one (1).
(4) Body Assembly Part # 6 – Piston Follower Screws – one (1) set.
(5) Body Assembly Part # 7 – Liner Cup – five (5).
(6) Body Assembly Part # 8 – Liner Cup Follower – one (1).
(7) Body Assembly Part # 9 – Liner Follower Screws – one (1) set.
(8) Body Assembly Part # 10 – Seat Ring - five (5).
(9) Body Assembly Part # 11 – Seat Ring Follower – one (1).
(10) Body Assembly Part # 12 – Seat Ring Screws – one (1) set.
(11) Body Assembly Part # 15 – Cover Gasket – five (5).
(12) Body Assembly Part # 21 – Seat Crown – one (1).
(13) One (1) inch NPT Reducing Pilot Valve – one (1) complete valve; with five (5) sets of refurbishing kits.
(14) High Pressure Control Reducing Pilot "H" Valve – one (1) complete valve; with five (5) refurbishing kits.
(15) Low Pressure Control Reducing Pilot "C" Valve – one (1) complete valve; with five (5) refurbishing kits.
(16) Closing Speed Control Needle Valve – one (1) complete valve; with five (5) refurbishing kits.
(17) Isolation Valves (Ball Valves) – four (4) valves.
(18) Strainer – five (5) strainer elements.

(C) Singer Valve Inc. – Singer Model S106-PGM-NY, Size: 12-inch, Drawing: A0892A-280105; and Singer Model S206-PGM-NY, Size: 20-inch, Drawing: A0892A-280105

(1) Part # 12 – Resilient Disc – five (5).
(2) Part # 25 – Seat Ring Seal – five (5).
(3) Part # 26 - Top Cover Seal – five (5).
(4) Part # 27 – Stem Seal – five (5).
(5) Part # 32 – Seat Ring Screws – one (1) set.
(6) Part # 33 – Clamp Plate Plugs (for upper Clamp Plate) – one (1) set.
(7) Part # 33 – Clamp Plate Plugs (for lower Clamp Plate) – one (1) set.
(8) Part # 53 – Bleed Valve (Ball Valve) – four (4).
(9) Part # 76 – Bleed Valve (Ball Valve) – four (4).
(10) No Part # – Opening Speed Control Valve – one (1) complete valve; with five (5) refurbishing kits.
(11) No Part # – Pressure Reducing Pilot (Low) Valve – one (1) complete valve; with five (5) refurbishing kits.
(12) No Part # – Pressure Reducing Pilot (High) Valve – one (1) piece; with five (5) refurbishing kits.
(13) No Part # – Rebuild Kits – five (5).
(14) No Part # - Spring Casing to Bonnet Gasket – five (5) pieces.

20.04.10 CERTIFICATION

(A) The following notarized Material Test Reports (MTRs) (Mechanical & Chemical properties) and /or material certification (as applicable), are required for issuing the Material Release and Shipping Authorization:

(1) Valve body, bonnet etc.
(2) Body, bonnet bolts / studs and nuts
(3) Material certifications for all gaskets and non-metal parts of the main valve.

(B) A duly notarized Affidavit of Compliance stating that the valve with the serial number stamped on the valve body meets all the requirements of DEP-BWSO specification for the Pressure Reducing Valves dated. (latest specification to which the valve is made). All required tests were conducted and were satisfactory.

20.04.11 INSTRUCTION MANUALS

For each order of same size and identical Pressure Reducing Valves, five (5) copies of maintenance manuals shall be shipped to Chief-Distribution Engineering, DEP-BWSO, 12th Floor High Rise, 59-17 Junction Boulevard, Flushing, NY 11373 at the time the valves are shipped or earlier, or as advised in the purchase order. Each manual shall contain at least the following:

(A) A set of all drawings for the Pressure Reducing Valve and the appurtenances with each part identified by a number or alphanumeric character.
(B) Affidavit of Compliance with the valve serial number(s).
(C) Installation procedures.
(D) Downstream pressure setting and adjustments.
(E) Maintenance schedule.
(F) List of spare parts shipped,
(G) Warranty for each valve with serial number.
(H) Copy of the Material Release and Shipping Authorization.

20.04.12 WARRANTY PERIOD

Each valve shall be warranted to be free of any manufacturing defect for ten (10) years from the time of delivery.

20.04.13 PACKING, HANDLING, AND SHIPPING

(A) REQUIRED DOCUMENTATION

(1) The manufacturer shall submit two copies of all MTRS and certifications to DEP- BWSO-ME&QA Division and the same to DDC-QA (for DDC contractor orders only) with the Affidavit of Compliance (Notarized) when requesting a Material Release & Shipping Authorization.

(2) The manufacturer shall obtain Material Release & Shipping Authorization from DEP- BWSO-ME&QA OR DDC-QA, as applicable, after the inspection at the manufacturing plant or waived inspection before the valves are shipped.

(B) PACKAGING

(1) The Pressure Reducing Valve shall be fully assembled and ready for installation (the pressure gages may be packed separately in the crate), completely drained of all fluids, covered with vinyl or other material, packed with desiccant, and placed in a suitable fully enclosed sturdy box on a skid. The proposed method of packing shall be approval by the DEP-BWSO-ME&QA Engineer.

(2) The PRV shall be protected against possible damage from atmospheric conditions, vibrations and shock during shipping from the manufacturer's plant to the Bureau's designated storage area or the site designated by the contractor.

(3) Unless directed otherwise, each delivery shall have the following documents in triplicate (3 copies) with each shipment:

(a) Shipping document shall contain manufacturer's name, address, telephone number, valve size, number of valves and their serial numbers etc. Each report shall be numbered with # 1 for the first shipping report addressed to DCAS / DEP-BWSO OR DDC – as applicable.
(b) Affidavit of Compliance and Warranty.
(c) Material Release & Shipping Authorization issued by DEP- BWSO-ME&QA OR DDC-QA, as applicable.
(d) A copy of the installation manual.

(4) The manufacturer/Contractor shall make all arrangements for the transportation, handling, and delivery of all equipment furnished under this purchase order from the manufacturer's plant to the construction site or DEP storage facility. All deliveries shall be done during normal business hours.
(5) All spare parts shall be packed individually or in sets as listed in the spare parts list.
(6) These spares properly identified, packed and marked with the DEP / DCAS order # OR DDC

contract number shall be delivered to DEP warehouse at 1201 Metropolitan Avenue, Brooklyn, New York 11237, telephone # 718-326-6903/6906, at the same time the Pressure Reducing Valve is shipped. The PRV manufacturer shall notify DDC Contractor of these spare parts delivery.

(7) The exterior of each crate shall be marked on at least two opposite sides, as follows: The markings shall be at least one (1) inch in height, unless it is not possible to print that large.

PROPERTY OF THE CITY OF NEW YORK
BUREAU OF WATER AND SEWER OPERATIONS OR CONTRACTOR'S NAME
DEP-BWSO /DCAS PURCHASE ORDER # OR CONTRACTOR PURCHASE ORDER #
DESTINATION ADDRESS
CONTENTS AND SIZE
MANUFACTURER AND ADDRESS
MONTH AND YEAR OF MANUFACTURE
GROSS WEIGHT

SECTION 20.05 –RESILIENT-SEATED GATE VALVES 3-INCH THROUGH 20-INCH AND TAPPING VALVES 3-INCH THROUGH 12-INCH

20.05.1 INTENT

This specification describes the requirements for the design, materials, coating, shop testing and delivery of Non-Rising Stem Resilient-Seated Gate Valves from 3-inch thru 20-inch and 3-inch thru 12-inch Tapping Valves for the City of New York's potable water system.

20.05.2 GENERAL

The latest revision on the bidding date (contract date for DDC contracts) shall apply for all industry standard specifications. In case of discrepancy in the standard specifications and DEP's specification, the requirements of DEP's specification shall prevail. In any dispute regarding the interpretation of both specifications, the decision of the Mechanical Engineering and QA Division (DEP-BWSO ME&QA) shall be final.

20.05.3 KIND

(A) Valves purchased under this Contract shall comply with ANSI/AWWA C509 "Standard for Resilient Seated Gate Valves for Water Supply Services" or the latest version of this standard, in addition to complying with the DEP specification.

(B) AWWA C515 Thin Valves. must meet the requirements of:

(1) NSF/ANSI/CAN 61: Drinking Water System Components - Health Effects,

(2) Title XIV of the Public Health Service Act: Safety of Public Water Systems (Safe Drinking Water Act), and

(3) 40 CFR 141 - National Primary Drinking Water Regulations.

(C) Suppliers must provide valves that meet the requirements described under this Contract from manufacturers approved by DEP.

20.05.4 QUALIFICATIONS

(A) MANUFACTURER QUALIFICATIONS

(1) The Supplier/Manufacturer shall have at least five (5) years' work experience in the production of Resilient-Seated Gate Valves of a similar design and size as described herein; and must be compliant with all applicable industry standard specifications.

(2) The Supplier/Manufacturer shall provide the necessary documentation to establish its financial capabilities to ensure that it has sufficient financial resources to perform the Work.

(3) The Supplier/Manufacturer shall provide the contact names, addresses, email and telephone numbers of at least three (3) municipalities or utilities in the United States of America, where bidder has existing contracts or contracts completed within the past year, with scopes and magnitudes similar to the Work described herein. DEP shall contact all references to verify the quality, delivery and performance of their valves for all sizes. Names, telephone numbers and addresses of consultants, middlemen, warehouse personnel and persons not involved in the operation of the valves are NOT ACCEPTABLE .

(4) The Supplier/Manufacturer shall submit their valve drawings, as described in **Subsection 20.05.10** along with all other requested materials herein for approval to DEP-BWSO ME&QA at least three (3) weeks before the bid date. Bids received with drawings not approved by DEP-BWSO shall be voided. Valve drawings shall be legible with a font size at least 10 points PostScript. Additionally, drawings shall be printed on only paper sized 11-inch x 17-inch.

(5) The Supplier/Manufacturer shall submit, at least three (3) weeks before the bid date, its manufacturer's Quality Control and Quality Assurance manuals for approval to DEP-BWSO ME&QA.

(6) DDC contractors shall use valves produced by DEP-BWSO-ME&QA / DCAS approved manufacturers in compliance with DEP-BWSO approved drawings only.

(7) The Supplier/Manufacturer must assemble and test their valves with their own production force.

(8) DEP-BWSO-ME&QA must approve any proposed Subcontractors prior to the Subcontractor starting work under this Contract.

(9) The Supplier/Manufacturer shall maintain an adequate labor force, facilities and staffing resources in the United States of America (USA) for the assembly, disassembly, hydro testing and Proof-of-Design testing of the valves. The facility shall be approved by DEP-BWSO-ME&QA, at least three (3) weeks before the bid date.

(B) FOUNDRY REQUIREMENTS

(1) All ferrous material casting foundries used in production for this Contract, shall have a minimum of five (5) years' experience in casting ductile iron valve bodies, seal plates and bonnets for similar valve sizes and design in ductile iron grades as specified herein.

(2) All brass/bronze foundries used in production for this contract shall have a minimum of five (5) years' experience in casting brass/bronze valve components.

(3) If the Supplier/Manufacturer changes the foundry after the bid approval or after the contract award, the new foundry would have to be approved by DEP-BWSO-ME&QA before any production can commence.

(4) DEP will conduct periodic site inspections of all manufacturing and testing facilities both before the Contract award date and during the term of this Contract.

(5) Foundries located outside the USA & Canada must be ISO 9000 certified and have a valid certification at the time of bidding. Certifications shall be valid for at least one more year from bid date.

(6) The manufacturer shall prove to the satisfaction of DEP-BWSO that they have complete control over the production and inspection of the valve castings.

(7) All ductile iron valve castings shall have a lug approximately 0.75- square inch area. The lug shall be cast in a location on the casting where its removal will not damage the casting or hinder the assembly, testing and installation of the valve. The lug may be used for material verification in accordance with ASTM A247 procedures by DEP-BWSO or DDC-QA. The material shall meet, at a minimum, 85% Nodularity of Type I, II, IV & VI combined, but with at least 60% of Type I and Type II; 50 to 100 counts per square millimeter.

20.05.5 DESIGN CRITERIA AND MATERIALS

(A) The valves shall be manually operated with Non-Rising Stem (N.R.S.). A clockwise torque shall be required to open the valve. Word "OPEN" in 1/2-inch or larger raised letters and an arrow shall be cast on the operating nut to clearly indicate the direction to turn to open the valve. The number of turns to open/close the valve shall be in accordance with AWWA C509, but the number of turns for 20-inch valve shall be 63 plus or minus one turn which is not specified in the AWWA Standard C509.

(B) All materials used under this Contract shall comply with NSF 61-Drinking Water System Components-Health Effects; NSF / ANSI 372- Drinking Water Systems Lead Contents, and U.S. Safe Drinking Water Act (SDWA).

(C) The valve body, bonnet and seal plate shall be ductile iron ASTM A536, Grade 70-50-05 or 65-45-12.

(D) The operating nut to 2-inch AWWA standard shall either be gray Cast Iron to ASTM A126 Class B or Ductile Iron ASTM A536 Grade 65-45-12/70-50-05.

(E) Unobstructed waterways in fully open position for valves (MJ to MJ and MJ to Tapping Flange) 3-inch through 8-inch shall be at least 3/16-inch larger than the nominal pipe size, and 1/4.-inch larger for the 12-inch. A 20-inch valve may have the waterways in fully open position equal to the nominal pipe size.

(F) Valve ends shall be as ordered- mechanical joint, flanged, insulated flange, plain or any combination thereof, to ASME/ANSI B16.1, class 125. Bolt holes shall straddle the valve centerline.

(a) Insulated flange bolt-hole diameter shall be 1/8-inch larger than the table values for valves 16-inch nominal size or less; 3/16-inch larger than the table values for valves 20-inch nominal size.

(G) The valve gate movement shall be smooth and fully guided throughout its travel. The gate encapsulation shall not rub against the valve / body guides. The gate encapsulation, guide or the valve body shall not wear out to expose metal after 1000 cycle test under Proof-of-Design testing.

(H) GATE:

Gate materials and encapsulation shall be according to AWWA C509-01. If the encapsulation material, the encapsulating process / method, or the encapsulating company is changed after DEP approves the valves, then Proof- of-Design testing for 1000 cycles shall be required before production.

(I) VALVE STEM:

Valve Stem shall meet the requirements of AWWA C 509-01 except that the following materials shall be used:

(1) ASTM B 98 -UNS - C65500 (H02);
(2) ASTM B 584 - UNS - C86200; C86300; C86400; C86500; C86700; C87500; 87600.
(3) ASTM B 763 - UNS C 99500
(4) Or as approved by DEP-BWSO-ME&QA. Please note the lead content shall not be more than 0.25%.
(5) Stainless steel stem may be submitted for DEP-approval.

(J) STEM NUT:

Stem Nut materials shall be according to AWWA C 509-01 or as approved by DEP-BWSO-ME&QA.

20.05.6 MARKING

(A) Each valve shall have cast in raised letters at least 3/4-inch high and 1/8-inch relief in the bonnet / body or both, the letters "WSNY", the manufacturer's name mark, the valve size, the year of manufacture, the country of manufacture and the rated working pressure. The casting shall also bear markings identifying the foundry as well as the heat number.

(B) Stainless steel or copper alloy tag indicating the valve serial number shall be permanently attached (riveted or screwed with corrosion resistant material) to each valve bonnet flange, as approved. The serial number shall be at least 1/4-inch-high; at least 1/16th -inch raised or punched letters. No two valves shall have the same serial number. Serial number unique to the valve should include the manufacturer's mark, two-digit year, two-digit month, and three-digit unique number for the valve. The numbering system shall be explained on the respective drawing. The tag shall be at the same location on each valve where it shall not be damaged during assembly or testing. Preferred location for the tag is the valve body, bonnet, or mating flange wide side. Illegible tags or tags damaged during assembly or testing shall be replaced.

20.05.7 TESTING

(A) PROOF OF DESIGN TESTS:

Proof of design testing shall be in accordance with AWWA C509 Section 5.1 plus the following requirement:

(1) Torque Test - After the torque test according to AWWA C509 Section 5.1.2, the valve shall be disassembled and inspected for any damage to the valve components. It shall show NO bending in the stem or any damage to thrust bearings, valve body, bonnet bolts or the gate. Re-assembled valve shall pass the Production Test of this specification.

(2) Leakage Test - The leakage test according to AWWA C509-01 Section 5.1.3 shall comprise 1000 complete cycles. For 20-inch valve the stem travel can be 60% of the full stem travel.

(3) All tests shall be conducted in the presence of DEP-BWSO-QA or DDC-QA engineer / inspector and will be repeated if the valve / stem design or material is changed.

(4) Valve design failing any Proof-of-Design test shall be rejected.

(5) All Proof-of-Design testing and production testing shall be in the Continental United States of America.

(B) PRODUCTION TEST:

The valves shall meet the requirements of AWWA C509-01 Section 5.2 except that the hold time at the test pressure shall not be less than 30 seconds for manual testing, and not less than 15 seconds for an automatic computer aided testing.

20.05.8 CLEANING

Inside and outside of castings must be thoroughly cleaned of sand, oxidation, rust, dust or any other foreign matter before coating. All cleaning shall be by shot blasting only; acids, other liquids and/or brushes are not permitted. The coating surface must meet or exceed the surface requirements of the coating manufacturer. A casting showing any defect, however minor, shall be set aside for inspection by the City of New York, DEP-BWSO/DDC-QA engineer/inspector before coating.

20.05.9 COATING

(A) All ferrous components (inside and outside) shall be coated with DEP-BWSO approved color Fusion Bonded Epoxy (FBE), meeting the requirements of AWWA C550 for epoxy coatings. The dry film thickness shall not be less than 8 mils and not over 20 mils. The bolt holes may be coated to 3 mils only.

(B) The valve operating nut must be coated red with FBE or liquid epoxy.

20.05.10 SUBMITTALS

(A) The Supplier/Manufacturer shall submit four (4) sets of fully dimensioned and manufacturer approved shop drawings to the Chief, Mechanical Engineering & QA division, DEP-BWSO for approval before going into production. The drawings shall indicate part name / number; ASTM materials designation, etc. All valves shall be furnished to DEP BWSO in accordance with these DEP approved drawings only.

(B) All dimensions shall be in inches. Metric equivalents are NOT ACCEPTABLE.

(C) The manufacturer shall assign a separate set of drawing numbers for NYC valves.

20.05.11 BOLTS, STUDS, AND NUTS

(A) Bolts and studs used for the body, bonnet, seal plate, etc. shall conform to ASTM A307 "Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength", Grade B or to ASTM A193 "Standard Specification for Alloy-Steel and Stainless-Steel Bolting Materials for High-Temperature Service" Grade B8, Class 1, or SAE J429 Table 1 Grade 2 or Grade 5.

(B) Nuts shall conform to ASTM A563, "Standard Specification for Carbon and Alloy Steel Nuts", Grade C or to ASTM A194 "Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service" Grade 8 / 8F or SAE J995 Grade 2 or Grade 5.

(C) Carbon steel bolts, studs, nuts and washers shall be made corrosion resistant by DEP-BWSO-QA approved Fluoropolymer coatings. A notarized statement from the Fluoropolymer coater is required verifying compliance with the ASTM B117 requirements. Zinc coating is NOT ACCEPTABLE . Stainless steel bolts / nuts/studs/washers shall be passivated.

(D) The external threads of bolts or studs and the internal threads of nuts, and of any tapped holes in other parts, shall conform to the requirements of the Unified Inch Screw Threads, ASME B1.1; Class 2A for external and class 2B for internal threads.

(E) Bolt heads shall conform to the requirements of Square and Hex Bolts (Inch Series), ASME B18.2.1 and shall be semi-finished Hexagonal Head type.

(F) All nuts shall be semi-finished hexagonal in shape and in accordance with the requirements of Square

and Hex Nuts (Inch Series), ASME B18.2.2.

(G) Metric sized bolts and nuts for any of the above standards are NOT ACCEPTABLE.

20.05.12 INSPECTION

(A) A minimum of five (5) business day notice shall be given to the Engineer (DEP-BWSO-ME&QA / DDC-QA) prior to production and any scheduled inspection.

(B) If any of the selected valves fail the inspection test, the inspector shall retest 5% more valves (minimum of two), while increasing the test time to at least one minute. Failure of another valve shall require retest of all the valves or rejection of the whole lot at the discretion of the DEP-BWSO-ME&QA / DDC-QA engineer, as applicable.

(C) All Quality Assurance testing shall be in the Continental United States of America.

20.05.13 CERTIFICATION AND REQUIRED REPORTING

(A) A duly notarized Affidavit of Compliance as per AWWA C509-01 Section 6.3 required MTRS and certifications shall be sent to DEP-BWSO-ME&QA or DDC - QA Engineer with a request for Material Release and Shipping Authorization. This certification shall include name of purchasing party, purchase order (PO) number, date of purchase order (PO), total as number of valves and their serial numbers. The affidavit shall be sealed and signed by the Notary Public.

(B) The following Material Test Reports (MTRs) (chemical and mechanical) or material certification, are required:

(1) Stem and Stem Nut (MTR).
(2) Gate encapsulation (Certification).
(3) Valve body, bonnet, seal plate (MTR).
(4) Body, bonnet bolts, studs, and nuts (MTR).
(5) Wedge Restraint Glands body and wedges (MTR); when ordered.
(6) Wedge Restraint Gland gaskets (Certifications)-if ordered.
(7) MTRs for bolts, nuts and screws (Chemical and mechanical).
(8) Notarized certification for Fluoropolymer coated bolts, nuts and washers.

(C) A "Y" block test bar as per ASTM A536 for each ductile iron part heat shall be saved for DEP-BWSO and delivered upon DEP's request.

(D) Microstructures at 100X for each heat shall be included with the MTR package.

(E) All MTRs submitted to DEP shall be in English. MTRs in a foreign language shall be translated into English where both versions shall be submitted to DEP.

20.05.14 PACKING, HANDLING, AND SHIPPING

(A) REQUIRED DOCUMENTATION:

The Supplier/Manufacturer shall obtain shipping authorization from DEP-BWSO-ME&QA or DDC Quality Assurance Division, as applicable, before the valves are shipped. This authorization shall be issued by DEP-BWSO-ME&QA for DEP / DCAS purchase orders and by DDC-QA for the Suppliers/Manufacturers purchase orders. The request for this release shall have a certification duly notarized by a Notary Public sealed and signed including the valve specification to which manufactured, name of the material ordering party, their purchase order number, valve serial numbers and total quantity. The request shall include all the MTRs required in duplicate if printed material; or a data CD, and must include all information such as photographs of the valves as stacked ready for shipment as well as close-ups showing valve tag number, bolts & nuts.

(B) PACKAGING

(1) All valves shall be completely drained of all fluids and shipped in the almost closed position. Full flange protectors of waterproof plywood, plastic or weather resistant material, at least equal to the outside diameter of the flange, shall be secured to each end. Individual flange protection

requirement may be waived if the valves shall be protected by other means from any damage during shipping or storage. The proposed method of packaging shall be approved by the DEP-BWSO-ME&QA Engineer.

(2) The valves shall be protected against possible damage from atmospheric conditions, vibrations and shock during handling and shipment from the manufacturer's plant to the Bureau's designated storage area or the site designated by the Supplier.

(3) The skid / crates shall be strong enough to hold the valves safe during shipping and stackable up to two (2) skids / crates without crushing. 20-inch valves shall be individually placed on a skid or crated and up to two (2) stackable.

(4) Unless directed otherwise, each delivery shall have the following documents in duplicate (2 copies) or a Data CD with each shipment:

(a) Manufacturer's name, report number assigned by the manufacturer, starting with #1 for each DEP-BWSO-DCAS / DDC Supplier purchase order, for example “Order # -ABC - 001".
(b) Valve list with size and the unique serial numbers.
(c) Notarized Affidavit of Compliance and Warranty.
(d) Material Release and Shipping Authorization issued by DEP-BWSO- ME&QA / DDC-QA, as applicable.

(5) Valves shall be shipped on a flatbed truck / open truck only.

(6) The exterior of each crate shall be marked on at least two opposite sides, as follows

PROPERTY OF THE CITY OF NEW YORK
BUREAU OF WATER AND SEWER OPERATIONS OR SUPPLIER/MANUFACTURER’S NAME
DEP-BWSO/DCAS PO NUMBER# OR SUPPLIER/MANUFACTURER ORDER#
DESTINATION ADDRESS
CONTENTS AND SIZE
MANUFACTURER AND ADDRESS
MONTH AND YEAR OF MANUFACTURE
GROSS WEIGHT

(7) The markings shall be at least one (1) inch in height, unless it is not possible to print that large.

(8) The valves may be shipped on a skid provided the skid is properly protected from damage during shipping and during its storage in a DEP storage facility which is open to the natural elements

(9) The valves shall be manufactured and delivered to the location(s) identified by the Department of Environmental Protection, Bureau of Water & Sewer Operation, Distribution Engineering Division, ME&QA, and as described below:

DEP DELIVERY LOCATION:

49-14 Fresh Meadow Lane
Fresh Meadow, Queens, NY 11365
Tel. # 718 359 0976/ 5187

(10) The valves shall be shipped only after getting a shipping release from DEP-BWSO or other purchasing entity.

(11) Under this Contract, the Supplier/Manufacturer shall supply and deliver Non-Rising Stem Resilient-Seated Gate Valves, also known as Resilient Wedge valves (RW), to the location(s) identified in **Subsection 20.05.14(B)(12)**

(12) Identified Valves purchased under this Contract shall be delivered to the following DEP address:

49-14 FRESH MEADOW LANE
FRESH MEADOW, QUEENS, NY 11365
TEL.# 718 359 0976 / 5187

(13) DEP may add or delete delivery locations where valves can be delivered to over the course of the actual performance of this Contract.

SECTION 20.06 – DOUBLE DISC GATE VALVES

20.06.1 INTENT

(A) This specification meets or exceeds the requirements of ANSI/AWWA Metal Seated Gate Valves for Water Supply Service. These valves have thicker bodies and bonnets, larger diameter stems, and a double disc seat wedging mechanism. Therefore, in those areas of these specifications and related drawings where the specific quality, dimensions or characteristics of a valve component or principal requirements of construction differs from the ANSI /AWWA standard, this specification shall prevail. However, the items not specifically mentioned in this specification shall be to ANSI /AWWA and good engineering practice.

(B) This specification enables the City of New York to obtain its Metropolitan gate valves from various manufacturers so that all valve parts are interchangeable irrespective of the manufacturer of the valve. This is to minimize maintenance and operation costs and consequently reduce the inconvenience to the public in the event repairs are necessary.

20.06.2 GENERAL

Before proceeding with the work, and during the progress thereof, the contractor shall check all applicable DEP drawings and specifications and shall notify the DEP-BWSO-ME&QA / DDC-QA Engineer of any and all errors and omissions discovered therein. The drawings and specifications are intended to be explanatory of each other but should any error or discrepancy or any misunderstanding arise, the decision of the DEP-BWSO-ME&QA Engineer shall be final and binding upon the contractor. The contractor shall not be compensated for any expense that may result from any error, discrepancy or misunderstanding.

20.06.3 QUALIFICATIONS

(A) MANUFACTURERS QUALIFICATIONS:

These valves shall be manufactured and delivered to the designated site according to this specification from DEP-BWSO-ME&QA Division approved manufacturers only. The following manufacturers or DEP-BWSO-ME&QA approved vendor shall manufacture these valves

TABLE 20.06.3.1

Manufacturer	Address
M & H Valve	PO Box 2088, Anniston, AL 36202
Sigma Corp	100 Goldman Drive, PO Box 300 Cream Ridge, NJ 08514

(B) BIDDER REQUIREMENTS

(1) An established, reputable and experienced manufacturer shall produce these valves. They shall certify that they have been producing Metropolitan type gate valves or valves of a similar design, materials and size and in compliance with similar specifications for a minimum of three (3) years, and that their performance and service are excellent under actual operating conditions at verifiable locations. The bidder shall provide the names and addresses of the managing Engineer or Superintendent of three (3) municipalities / facilities (end users) who will verify the quality and operation of their gate valves.

(2) Bidders new to NYC shall provide within fourteen (14) days of the notification from the BWSO or DCAS sufficiently detailed information to establish that the manufacturer of these valves has the necessary personnel, facilities, experience, ability, capacity and financial resources to perform the work in a manner satisfactory to the DEP-BWSO / DCAS.

(3) The manufacturer shall be required to establish that they currently have within their own organization a competent and adequately staffed quality control department responsible for maintaining high standards regarding materials, manufacturing, and testing of work done in their plant; and that they have a production force, plant and facilities of a type and size suitable to

perform the work required under this contract. All facilities to be used for this work are subject to inspection and approval by DEP-BWSO & DCAS. If an overseas facility is to be used for any part, it must be indicated at the time of bidding. The overseas facility will have to be approved by DEP-BWSO / DCAS before the order is placed.

(4) The contractor is required to machine, assemble and test the valves with his own production force. Subcontracting or subletting any of the aforementioned portions of the work will not be permitted without the written permission of the DEP-BWSO Engineer. This approval shall not be unreasonably denied. Regardless of the country in which the valves or their parts are manufactured and assembled, all testing shall be conducted in accordance with DEP-BWSO approved procedures and in the United States of America. DEP-BWSO-QA personnel may witness the valve assembly and testing at any time during the normal working hours of the manufacturer.

(C) FOUNDRY REQUIREMENTS

(1) The foundries shall have a minimum of two (2) years' experience in casting ductile iron valve bodies, seal plates and bonnets for double disc gate valves of a similar size, design, and grade of ductile iron ASTM A536, Grade 70-50-05 or 65-45-12.

(2) All brass/bronze foundries shall have a minimum of two (2) years' experience in casting brass / bronze valve components.

20.06.4 PHYSICAL AND CHEMICAL REQUIREMENTS

All materials specified herein for use in the valves produced under these specifications shall conform to the standards designated for each material listed. When reference is made to the American National Standards Institute (ANSI), American Society for Testing Materials (ASTM) or American Water Works Association (AWWA) or other standards, it is understood that the latest revision thereof at the time of the bid, unless otherwise indicated, shall apply. The requirements of ANSI, ASTM, AWWA or other standards, to which reference is made anywhere in these specifications, shall govern the physical and chemical characteristics of the valve components unless specific exceptions are stated.

20.06.5 DESIGN CRITERIA

(A) These valves shall be manually operated, inside non-rising stem, ductile iron body / bonnet / seal plate, non-packing, bronze seated, double disc, seat wedging mechanism type, built in accordance with the DEP drawings lists specified in **Subsection 20.06.5(C)**

(B) TABLE – 20.06.5.1. indicates the rated and hydrostatic test pressures for the valves.

TABLE - 20.06.5.1

Valve Size	Rated Pressure	Hydrostatic Test Pressure (for body)
3", 4", 6", 8" & 12"	200 psig	400 psig
20"	150 psig	300 psig

(C) Valve ends can be mechanical joint, insulated flange, tapping flange or any combination thereof as required for use with cast iron or ductile iron pipe. Valves shall open clockwise on rotation of an AWWA operating nut. Valves shall be made for vertical stem installation. The disc seats shall be provided with a wedging device. The seating surfaces shall be bronze, created by using bronze seat rings, except for 3" and 4" valves where the discs shall be fully bronze.

The following are the DEP standard drawings lists for these standard valves:

DRAWINGS LIST FOR 3" VALVE

DRAWING TITLE	DRAWING /SHEET NO.
3"-20" Standard Valves with Various End Connections Shown	48359 Sh. 1/1 Rev. A
3" MJ X MJ, Metropolitan Gate Valve Body	48385 Sh. 1/11 Rev. B
3" Flange X Flange, Met. Gate Valve Body, Insulated Flanges	48386 Sh. 2/11 Rev. B
3" Mechanical Joint X Flange, Tapping Valve Body	47443-X Sh. 3/11 Rev. D
Standard 3" Valve-Detail of Body Ring	48387 Sh. 4/11 Rev. C
Standard 3" Valve-Detail of Bonnet	48388 Sh. 5/I1 Rev. C
Standard 3" Valve-Detail of Disc	48389 Sh. 6/11 Rev. A
Standard 3" Valve-Detail of Stem Yoke, Stem Nut & Operating Nut	48390 Sh. 7/11 Rev. B
Standard 3" Valve-"O" Rings and Yoke Pin	48391 Sh. 8/11
Standard 3" Valve-Detail of Wedge Standard 3"	48392 Sh. 9/11 Rev. A
Valve-"O" Ring Seal Plate	48393 Sh. 10/I1 Rev. B
Standard 3" Valve-Detail of Washer, Stem Collar Bushing & Body-Alt. Bonnet	48394 Sh. 11/11 Rev. A
Gasket Material: Nitrile 60+/- 5 Durometer, 1/16-inch thick, 1000 psi tensile strength, elongation not less than 350% and compression 70% maximum	West American Rubber Company Nitrile gasket material Style 37 meets this requirement
Addendum #2 dated March 6, 2003 incorporated	

DRAWINGS LIST FOR 4" VALVE

DRAWING TITLE	DRAWING. /SHEET NO.
3"-20" Standard Valves with Various End Connections Shown	48359 Sh. 1/1 Rev. A
4" MJ X MJ, Metropolitan Gate Valve Body	48395 Sh. 1/11 Rev. B
4" Flange X Flange, Met. Gate Valve Body, Insulated Flanges	48396 Sh. 2/11 Rev. B
4" Mechanical Joint X Flange, Tapping Valve Body	47437-X Sh. 3/11 Rev. C
Standard 4" Valve-Detail of Body Ring	48397 Sh. 4/11 Rev. A
Standard 4" Valve-Detail of Bonnet	48398 Sh. 5/I1 Rev. B
Standard 4" Valve-Detail of Disc	48399 Sh. 6/11
Standard 4" Valve-Detail of Stem, Yoke Stem Nut & Operating Nut	48400 Sh. 7/11 Rev. A
Standard 4" Valve-"O" Rings and Yoke Pin	48401 Sh. 8/11
Standard 4" Valve-Detail of Wedge Standard 4"	48402 Sh. 9/11
Valve-"O" Ring Seal Plate	48403 Sh. 10/I1 Rev. B
Standard 4" Valve-Detail of Washer, Stem Collar Bushing & Body- Alt.	48404 Sh. 11/11 Rev. A
Bonnet Gasket Material: Nitrile 60+/- 5 Durometer, 1/16-inch thick, 1000 psi tensile strength, elongation not less than 350% and compression 70% maximum	West American Rubber Company Nitrile gasket material Style 37 meets this requirement
Addendum #2 dated March 6, 2003 incorporated	

DRAWINGS LIST FOR 6" VALVE

DRAWING TITLE	DRAWING. /SHEET NO.
3"-20" Standard Valves with Various End Connections Shown	48359 Sh. 1/1 Rev. A
6" MJ X MJ, Metropolitan Gate Valve Body	48328 Sh. 1/12 Rev. C
6" Flange X Flange, Metropolitan Gate Valve Body, Insulated Flanges	48329 Sh. 2/12 Rev. C
6" Mechanical Joint X Flange, Tapping Valve Body	47440-X Sh. 3/12 Rev. D
6" Mechanical Joint X Flange Non-Tap Valve Body, Insulated Flange	48998 Sh. 4/12 Rev. B
Standard 6" Valve-Detail of Body Ring	47198-Z Sh. 5/l2 Rev. B
Standard 6" Valve-Detail of Bonnet	48330 Sh. 6/12 Rev. B
Standard 6" Valve-Detail of Disc	10356-Z Sh. 7/12 Rev. C
Standard 6" Valve-Detail of Stem, Yoke Stem Nut & Operating Nut	48331 Sh. 8/12 Rev. A
Standard 6" Valve-"O" Rings and Yoke Pin	48332 Sh. 9/12
Standard 6" Valve-Detail of Wedge Standard 6"	10358-Z Sh. 10/12 Rev. A
Valve-"O" Ring Seal Plate	48333 Sh. 11/l2 Rev. B
Standard 6" Valve-Detail of Washer, Stem Collar Bushing & Body- Alt.	48334 Sh. 12/12 Rev. A
Bonnet Gasket Material: Nitrile 60+/- 5 Durometer, 1/16-inch thick, 1000 psi tensile strength, elongation not less than 350% and compression 70% maximum	West American Rubber Company Nitrile gasket material Style 37 meets this requirement
Addendum #2 dated March 6, 2003 incorporated	

DRAWINGS LIST FOR 8" VALVE

DRAWING TITLE	DRAWING /SHEET NO.
3"-20" Standard Valves with Various End Connections Shown	48359 Sh. 1/1 Rev. A
8" MJ X MJ, Metropolitan Gate Valve Body	48335 Sh. 1/12 Rev. B
8" Flange X Flange, Met. Gate Valve Body, Insulated Flanges	48336 Sh. 2/12 Rev. B
8" Mechanical Joint X Flange, Tapping Valve Body	47447-X Sh. 3/12 Rev. D
8" Mechanical Joint X Flange Non-Tap Valve Body, Insulated Flange	48999 Sh. 4/12 Rev. B
Standard 8" Valve-Detail of Body Ring	48337 Sh. 5/l2 Rev. A
Standard 8" Valve-Detail of Bonnet	48338 Sh. 6/12 Rev. B
Standard 8" Valve-Detail of Disc	10364-Z Sh. 7/12 Rev. C
Standard 8" Valve-Detail of Stem, Yoke Stem Nut & Operating Nut	48339 Sh. 8/12 Rev. A
Standard 8" Valve-"O" Rings and Yoke Pin	48340 Sh. 9/12
Standard 8" Valve-Detail of Wedge Standard 8"	10367-Z Sh. 10/12 Rev. A
Valve-"O" Ring Seal Plate	48341 Sh. 11/l2 Rev. B
Standard 8" Valve-Detail of Washer, Stem Collar Bushing & Body- Alt.	48342 Sh. 12/12 Rev. A West American Rubber Company Nitrile gasket material Style 37 meets this requirement
Bonnet Gasket Material: Nitrile 60+/- 5 Durometer, 1/16-inch thick, 1000 psi tensile strength, elongation not less than 350% and compression 70% maximum	
Addendum #2 dated March 6, 2003 incorporated	

DRAWINGS LIST FOR I2" VALVE

DRAWING TITLE	DRAWING /SHEET NO.
3"-20" Standard Valves with Various End Connections Shown	48359 Sh. 1/1 Rev. A
12" MJ X MJ, Metropolitan Gate Valve Body	48343 Sh. 1/12 Rev. B
12" Flange X Flange, Met. Gate Valve Body, Insulated Flanges	48344 Sh. 2/12 Rev. C
12" Mechanical Joint X Flange, Tapping Valve Body	47450-X Sh. 3/12 Rev. C
12" Mechanical Joint X Flange Non-Tap Valve Body, Insulated Flange	49000 Sh. 4/12 Rev. B
Standard 12" Valve-Detail of Body Ring	47200-Z Sh. 5/I2 Rev. B
Standard 12" Valve-Detail of Bonnet	48345 Sh. 6/12 Rev. B
Standard 12" Valve-Detail of Disc	10374-Z Sh. 7/12 Rev. C
Standard 12" Valve-Detail of Stem, Yoke Stem Nut & Operating Nut	48346 Sh. 8/12 Rev. B
Standard 12" Valve-"O" Rings and Yoke Pin	48347 Sh. 9/12
Standard 12" Valve-Detail of Wedge Standard	10376-A-Z Sh.10/12 Rev. C
12" Valve-"O" Ring Seal Plate	48348 Sh. 11/I2 Rev. B
Standard 12" Valve-Detail of Washer, Stem Collar Bushing & Alt. Bonnet	48349 Sh. 12/12 Rev. A West American Rubber Company Nitrile gasket material Style 37 meets this requirement
Gasket Material: Nitrile 60+/- 5 Durometer, 1/16-inch thick, 1000 psi tensile strength, elongation not less than 350% and compression 70% maximum	
Addendum #2 dated March 6, 2003 incorporated	

DRAWINGS LIST FOR 20" VALVE

DRAWING TITLE	DRAWING /SHEET NO.
3"-20" Standard Valves with Various End Connections Shown	48359 Sh. 1/1 Rev. A
20" MJ X MJ, Metropolitan Gate Valve Body	48350 Sh. 1/11 Rev. B
20" Flange X Flange, Met. Gate Valve Body, Insulated Flanges	48351 Sh. 2/11 Rev. C
20" Mechanical Joint X Flange Non-Tap Valve Body, Insulated Flange	49001 Sh. 3/11 Rev. B
Standard 20" Valve-Detail of Body Ring	48352 Sh. 4/11 Rev. A
Standard 20" Valve-Detail of Bonnet	48353 Sh. 5/I1 Rev. B
Standard 20" Valve-Detail of Disc	48354 Sh. 6/11 Rev. B
Standard 20" Valve-Detail of Stem, Yoke Stem Nut & Operating Nut	48355 Sh. 7/11 Rev. B
Standard 20" Valve-"O" Rings and Yoke Pin	48356 Sh. 8/11
Standard 20" Valve-Detail of Wedge Standard	48357 Sh. 9/11 Rev. B
20" Valve-"O" Ring Seal Plate	48358 Sh. 10/11 Rev. B
Standard 20" Valve-Detail of Washer, Stem Collar Bushing & Body- Alt. Bonnet	47215-Z Sh. 11/I1 Rev. A West American Rubber Company Nitrile gasket material Style 37 meets this requirement
Gasket Material: Nitrile 60+/- 5 Durometer, 1/16-inch thick, 1000 psi tensile strength, elongation not less than 350% and compression 70% maximum	
Addendum #2 dated March 6, 2003 incorporated	

20.06.6 MATERIAL

(A) CASTING IRON GRADES

(1) Unless otherwise specified on the detail drawings, ductile iron parts shall conform to the requirements of the Standard Specifications for Ductile Iron Castings, ASTM Designation: A536, Grade 70-50-05 or 65-45-12.

(2) In addition to the Material Test Reports (MTRs) / Material Certifications for the valve body and bonnet, at least one (1) integrally cast bar /coupon of at least one (1) cubic inch shall be provided on each casting. The bar / coupon should be removable without damaging the casting in any way and shall not obstruct the assembly or installation.

(3) This bar/coupon may be removed for material microstructure verification. The testing shall be in accordance with ASTM A247 procedures in the presence of the NYC inspector, if required. The material microstructure shall meet a minimum of 85% Nodularity of Type I, II, IV & VI combined, but with at least 60% of Type I and II combined; and 50 to 100 counts per square millimeter. The cost of this additional testing of up to 10% of the total number of castings shall be borne by the vendor. If any of the casting fails these microstructure requirements, the matter shall be referred to The Engineer for disposition.

(4) All castings shall be smooth, sound and true to pattern and free from injurious cold shuts, porosity, dimples, cracks, flows, swells, lumps, scales, sand holes, excessive shrinkage or other defects and imperfections. Plugging, welding, or repairing of any defect, whether structural or cosmetic, is not permitted, and if so repaired, that casting shall be rejected.

(B) BRONZE COMPOSITIONS

(1) All bronze components shall be made of material specified on the drawings. In case of a discrepancy of material on the drawing and the specification, the material specified in these specifications will prevail. General material specifications and physical properties of the required bronzes are listed below:

TABLE - 20.06.5.2

Part Name	Bronze Ingot Material Specifications	Physical Properties (Minimums)
Disc Rings 6” and Larger (Part No. 5)	ASTM B584 UNS C83600	Tensile Strength: > 30,000 psi Yield: > 14,000 psi Elongation: >20% Compressive Strength > 4,000 psi without deformation
Yoke Pins (Part No. 8)	ASTM B21 UNS C46400 Temper HO2	Tensile Strength: > 60,000 psi Yield:> 20,000 psi Elongation:>22%
Valve Stems (Part No. 6)	ASTM B584 UNS C87600	Tensile strength: > 60,000 psi Yield: > 30,000 psi Elongation: >16%
All other Bronze Components not specified above	ASTM B584 UNS C83600	Tensile strength: > 30,000 psi Yield: > 14,000 psi Elongation: > 20%

20.06.7 MARKING

(A) Each valve will have the letters "WSNY", the manufacturer's name / mark, foundry mark, Metropolitan

gate valve size, year of manufacture, country of manufacture and rated pressure cast integral with either the bonnet or the body at least one (1) inch high and 1/8-inch relief. The letter height can be 3/4-inch for valves 6-inch and smaller.

(B) A stainless steel / brass tag with engraved or raised stamped letters at least 1/8-inch high indicating the unique serial number of the valve shall be permanently attached (riveted or screwed) to the valve body or bonnet flange. The tag shall be on the same place for all valves. The tag shall not have any sharp corners and shall be flat with the flange.

(C) The "heat" number for the discs, body and bonnet shall be cast in at least 1/4-inch high raised letters/numbers.

20.06.8 DISC AND SEAT RINGS

Ductile iron discs in valve sizes 6" and larger shall be accurately machined as specified on the drawings. The surfaces of the disc ring, including the V-locking dovetail projection, shall be in full contact and supported by the ductile iron disc when attached and shall be fully pre-machined, and thereafter, the ring shall be rolled, penned or pressed into the machined grooves of the disc. No gaps between the disc and the seating ring shall be permitted and no filler or grouting materials other than the approved valve waterway coating shall be permitted. When secured in place, a rough cut and a finish cut shall be taken over the ring seating faces. Discs with brazed-on rings or rings with molten copper alloy deposited on the discs shall not be permitted.

20.06.9 BODY SEAT RINGS

The bronze body seat rings shall be carefully and accurately machined as specified on the drawings. The threaded portion of the body seat rings shall be coated with an approved sealing compound suitable for use with potable water and threaded into the valve body. This shall provide the threaded joint with a seal under test pressure. A finished machined cut shall be made on the face of the body seat ring after assembly into the body.

20.06.10 BOLTS, NUTS, AND TAPPED HOLES

(A) All bolts and studs used for the body, bonnet, "O" ring seal plate, etc. shall conform to the requirements of the Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength, ASTM Designation: A307, Grade B, heavy hex. The corresponding nuts shall conform to the requirements of the Standard Specification for Carbon and Alloy Steel Nuts, ASTM Designation: A563, Grade B. All bolts, studs and nuts shall be made corrosion resistant by fluoropolymer coating meeting the requirements of the 1000 hours salt spray test of ASTM B117. The external threads of bolts or studs and the internal threads of nuts and of any tapped holes in other parts shall conform to the requirements of Unified Inch Screw Threads, ASME B1.1, Class 2A for external threads and Class 2B for internal threads. Bolt heads shall be heavy hex and conform to the requirements of Square and Hex Head Bolts and Screws (Inch Series), ASME B18.2.1. Nuts shall conform to Square and Hex Nuts (Inch Series) ASME B18.2.2 and shall be semi-finished, heavy hex head type. Metric equivalents of any of the above standards will not be accepted.

(B) Fluoropolymer coating by Tripac is approved. Other coatings meeting the requirements of the 1000 hours salt spray of ASTM B117 may be submitted to DEP-BWSO-ME&QA Engineer for approval.

20.06.11 SEAT WEDGING DEVICE

(A) Valves shall be so assembled that the wedging device shall operate freely. In closing the valve, the internal wedging device shall not operate until after the disc seat rings are in proper alignment with the port opening in the body seat rings. Continued rotation of the valve stem shall actuate the engagement of the wedging device, spreading the discs against and in firm contact with the body seat rings. In opening the valve, the wedging device shall be released before any disc travel takes place.

(B) In the fully open position, the waterway shall be entirely unobstructed. For valve sizes 12-inch & 20-inch, the material of the wedge may be bronze or ductile iron, however, the wedge contact surfaces with the disc must be bronze.

(C) 20-inch valves shall have bronze wedging surfaces on the disc. Pins and bolts in the wedging mechanism of all valves shall be made of an approved bronze material.

20.06.12 COATING

(A) Both inside and outside of castings shall be thoroughly cleaned of sand, oxidation, rust and other foreign matter. All cleaning shall be by abrasive blasting only, acids or other liquids and/or brushes shall not be permitted.

(B) All coating shall be applied in a neat, professional and workman like manner. Valve components shall not have runs or sags. Coatings shall be uniformly distributed and shall be applied in accordance with the coating manufacturer's recommendations and as approved. All coating materials shall be delivered to the shop in original, unbroken, and unopened containers plainly marked with name, brand and analysis of the product, and the name of the manufacturer. Maximum storage time of the coating material to be used on the work is one (1) year. Should any coating be damaged or found unsatisfactory, such coating shall be removed to the extent directed by the engineer and the affected surface again prepared, re-coated, and retested. Whether shop or field repair, the coating material shall be the same as originally applied.

(C) All internal and external ferrous surfaces shall be coated with a non-toxic coating and be N.S.F.-61 approved. The valves shall be coated with a minimum two coats of Tnemec 140 Pota-Pox Plus epoxy coating system with primer Hydro Zinc 2000 91-H20 OR approved equal, meeting the requirements of ANSI/AWWA C550- Protective Interior Coatings for Valves and Hydrants, having a total dry film thickness of ten (10) mils minimum. Touching up of paint to repair handling damage is permitted without the requirement of grinding to the bare metal. Operating nuts shall be painted red with an approved epoxy coating.

(D) Bolt holes and machined ferrous surfaces shall be coated with one coat of approved primer for a maximum dry film thickness of three (3) mils.

20.06.13 JOINT ACCESSORIES

(A) Joint accessories shall be supplied if ordered.

(B) MECHANICAL JOINT ENDS:

All mechanical joint end (s) valves shall be furnished with DEP-BWSO / DDC-QA approved wedge type restraint glands, bolts, nuts, washers and gaskets conforming to the "Rubber-Gasket Joints For Ductile-Iron Pressure Pipe and Fittings", ANSI/AWWA C111/A21.11. The wedge type restraint glands shall be as specified in "Specifications for Ductile Iron Pipe with Push-On Joints and Ductile Iron Fittings with Mechanical Joints, 6 inches through 48 inches in Diameter". The Wedge Type restraint Glands must be of an approved model of an approved manufacturer. At present the approved manufacturers and their models are as follows:

(1) E.B.B.A. Iron, Eastland, Texas, Series 1100;

(2) Ford Uni-Flange Series 1400;

(3) Sigma One-Lok

(C) FLANGED ENDS:

End flanges shall conform to dimensions and drillings requirements of Cast Iron Pipe Flanges and Flange Fittings, ANSI B16.1, Class 125. Bolt holes shall straddle the vertical centerline of the valve. Bolts, nuts, washers and gaskets for the flange connection shall be furnished with the valve and shall be in accordance with "Specifications for Ductile Iron Pipe with Push-On Joints and Ductile Iron Fittings with Mechanical Joints, 6 inches through 48 inches in Diameter".

(D) TAPPING FLANGE

(1) The gasket between the tapping valve flange and the tapping sleeve flange shall not be furnished (the tapping sleeve comes with the gasket), but the bolts, nuts and washers for connecting to the tapping sleeve shall be furnished as stated in this specification.

(2) Bolt length calculation: contractor shall use the dimensions and drilling as per ANSI B16.5 -Pipe Flanges and Flanged Fittings Class 150. At least three threads shall protrude beyond the nuts when these bolts are fully torqued.

(E) INSULATING FLANGES

(1) Gaskets for insulated flanges shall be 1/8-inch thick, full-face type, with bolt holes and bolt circle diameter to match ASME B16.1 Class 125 flanges.

(2) Flange insulating gasket shall be Allstate Gasket, Inc. Style 1175 (Cloth inserted SBR, Shore 65) Type 'E' (Full Face), or DEP-BWSO-ME&QA approved equal. Every bolt / stud for the insulated flanged joint shall be provided with:

(a) One full length Mylar insulating sleeve with a wall thickness of at least 1/32- inch.

(b) Two (2) 1/8th -inch thick Phenolic insulating washers. The outside diameter of the insulating washers shall be 1/32nd -inch larger than that of the steel washers.

(F) FLANGE SPOT FACING

Where spot facing is more than 1/16th -inch deep, additional insulating washers shall be used to provide at least 1/4-inch clearance between the steel washer and the valve body casting.

20.06.14 TESTING

(A) OPERATIONAL TEST

Each valve shall be tested at the manufacturer's plant for operation, water tightness and resistance to distortion under internal pressure. Each valve shall be operated in the upright vertical stem position for the full length of gate travel in both directions to demonstrate the free and proper functioning of all parts. Any defects in workmanship shall be corrected and the test repeated until satisfactory performance is demonstrated. All testing shall be conducted with approved procedure and in the United States. Submerging valves in a tank in order to fill the valve with water shall not be permitted.

(B) HYDROSTATIC BODY TEST

Each valve shall be subjected to a hydrostatic body test as per Table - 20.06.5.1. The valve shall be in the open position and the ends blanked off. This test pressure shall be held for a minimum of five (5) minutes or as approved by the Engineer. The test pressure shall be increased and decreased gradually to prevent shock loading of the valve components. During this hydrostatic test, no leakage is allowed through metal, flanged joints, or stem seals. In case of any leakage through the metal, the letters WSNY shall be ground-off from the casting or an "X" two (2) inches in height shall be ground if there are no letters on the casting, in the presence of the inspector.

(C) SEAT LEAKAGE TEST

Each valve shall be tested for the seat leakage at the rated pressure as per Table - 20.06.5.1. This pressure shall be applied between the discs, with the valve in the closed position for a minimum of five (5) minutes, or as approved by the Engineer. The total leakage past valve seats shall be limited to one fluid ounce per hour per inch of nominal valve size.

20.06.15 INSPECTION

(A) The entire manufacturing/assembly process of the valves shall be open to the Engineer or his authorized representative for inspection during working hours. All defects shall be corrected to the satisfaction of the Engineer or his representative, or the valves shall be rejected. Approval by the Engineer or his representative shall not prevent rejection for defects subsequently discovered.

(B) Casting, machining, assembling and shop testing of the valves may be inspected by the DEP-BWSOP-ME&QA / DDC Quality-Assurance personnel, as applicable. A minimum of ten (10)-business days advance notice of intent to schedule the work shall be given to the Quality Assurance Division of concerned party.

(C) If an inspector is present at the manufacturing facility, the manufacturer shall request a Material Release and Shipping Authorization for the valves inspected and approved

(D) If the inspection is waived, the manufacturer shall send all required MTRs and an Affidavit of Compliance stating that these valves meet or exceed the requirements of this specification and are warranted against any defect in material and workmanship for ten (10) years from the receipt of these valves by the purchaser to, Chief, Mechanical Engineering & Quality Assurance Division, DEP-BWSO-

ME&QA, 3rd Floor – Low Rise, 59-17 Junction Boulevard, Flushing, NY 11373 for DEP-BWSO / DCAS purchase order and to DDC-QA for supply house and contractor purchase orders and request Material Release and Shipping Authorization.

20.06.16 PACKING, HANDLING, AND SHIPPING

(A) Each shipment shall include the following:

(1) Nominal weight of each size valve,

(2) Total weight of shipment,

(3) Total quantity of each size and type of valve,

(4) Delivery point,

(5) NYC purchase order / project number,

(6) Report number (this number is assigned by the contractor starting from (1) for each unique NYC order/project number),

(7) Affidavit of Compliance (Notarized),and

(8) Material Release and Shipping Authorization duly signed by DEP-BWSO-ME&QA or DDC-QA

(B) All valves shall be completely drained of all fluids and be in the closed position. Full flange protectors of waterproof plywood, plastic or weather-resistant pressboard, of at least the outside diameter of the flange, shall be fastened to each end. The packaging method shall be submitted to the DEP-BWSO-ME&QA Engineer for approval.

(C) The valves shall be securely placed on stackable wooden skids or crate for shipment. The strapping should not damage the valve during shipment. Each skid / crate shall protect the valves against possible damage from atmospheric conditions, vibrations and shock during handling and transportation from the manufacturer's plant to the Bureau's / Contractors designated storage area.

(D) Only one-size valves shall be packed on one skid.

(E) The exterior of the crate shall be clearly marked on at least two (2) sides as follows:

PROPERTY OF THE CITY OF NEW YORK
BUREAU OF WATER & SEWER OPERATIONS OR CONTRACTORS NAME
PURCHASE ORDER NUMBER / CONTRACT NUMBER
DESTINATION ADDRESS
COUPLING(S) PIPE SIZE(S).
MONTH AND YEAR OF MANUFACTURE
VENDOR AND MANUFACTURER'S NAME AND ADDRESS
GROSS WEIGHT

SECTION 20.07 – IRON CASTINGS

20.07.1 INTENT

These specifications meet or exceed the requirements of ASTM A48 - Standard Specification for Gray Iron Castings; and ASTM A834 - Standard Specification for Common Requirements for Iron Castings for General Industrial Use. In case of a discrepancy, this specification shall prevail and the decision of the DEP-ME&QA Engineer shall be final.

20.07.2 GENERAL

Before proceeding with the work, and during the progress thereof, the contractor shall check all applicable drawings and specifications, and notify the Project Engineer DDC; and Chief, Mechanical Engineering & QA Division (ME&QA), 3rd floor Low Rise, 59-17 Junction Boulevard, Flushing, NY 11373 of any and all errors and omissions discovered therein. The drawings and specifications are intended to be explanatory of each other but should any error or discrepancy or any misunderstanding arise, the decision of the DEP-ME&QA Engineer shall be final and binding upon the contractor. The contractor shall not be compensated for any expense that may result from any error, discrepancy or misunderstanding.

20.07.3 QUALIFICATIONS

(A) DDC contractors and supply house shall use only DEP-BWSO-ME&QA Division approved foundries / manufacturers.

(B) An established, reputable and experienced foundry shall produce these castings. They shall certify that their foundry has been producing similar castings with similar specifications for a minimum of three (3) years, and that their performance and service are excellent under actual operating conditions at verifiable locations. The bidder shall provide the names and addresses of the managing Engineer or Superintendent of three (3) municipalities / facilities (end users) who will verify the quality of these castings and references. The Bidder shall list the name of the foundry in the bid document.

(C) A bidder new to DCAS for these castings shall within fourteen (14) days of the notification from the DEP / DCAS will submit for approval of his bid a sufficiently detailed information (a copy of Quality Control and Quality Assurance manuals) to establish that they have the necessary personnel, facilities, experience, ability, capacity and financial resources to perform the work in a manner satisfactory to DEP. The bidder shall have storage and testing facilities in United States of America where the product can be inspected and tested.

(D) The foundry shall be required to substantiate that they currently have within their own organization a competent and adequately staffed Quality Control Department responsible for maintaining high standards regarding materials, manufacturing, and testing of work done in their plant; and that they have a production force, plant and facilities of a type and size suitable to perform the work required under this contract. All facilities to be used for this contract are subject to inspection and approval by DEP-BWSO-ME&QA and/or DCAS. If an overseas facility is to be used for any product, it must be indicated at the time of bidding. The overseas foundry must be approved by DEP-BWSO-ME&QA / DCAS before the order is placed. A foundry change during the contract period is not permitted unless approved by DEP-BWSO-ME&QA / DCAS in advance.

(E) Subcontracting or subletting any of the aforementioned portions of the work will not be permitted without the written permission of the DEP-BWSO-ME&QA Engineer. This approval shall not be unreasonably denied.

20.07.4 MATERIALS

(A) CHEMICAL AND PHYSICAL REQUIREMENTS

(1) The requirements of American Society for Testing Materials (ASTM) or American Water Works Association (AWWA) or other standards as called for in this specification, latest revision at the time of the bidding, unless indicated otherwise, shall govern the physical and chemical characteristics of the cast components unless specific exceptions are stated.

(2) All castings shall conform to the requirements of the ASTM A48 Class 35B or higher- class

material (Standard Specification for Gray Cast Iron Castings) and ASTM A834 (Standard Specification for Common Requirements for Iron Castings for General Industrial Use) in addition to the specific requirements of this specification. Castings to ASTM A536 (Standard Specification for Ductile Iron Castings), any Grade is acceptable.

(B) TESTING

(1) Chemical analysis shall be provided for each heat as per ASTM E351.

(2) Tension test results shall be provided for each heat as per ASTM A48 / A536. One un-broken test bar for each heat shall be made available to the Engineer for material verification. The foundry might have to cast more test bars than called for in ASTM A48 / A536.

20.07.5 MARKING

Castings shall have the markings as shown on the casting drawing.

20.07.6 CLEANING

Both inside and outside of the castings shall be thoroughly cleaned of sand, oxidation, rust and other foreign matter. All cleaning must be by abrasive blasting only; acids or other liquids and/or brushes shall not be permitted.

20.07.7 COATING

If called for in the purchase order, specified coating shall be applied in a neat, professional and workman like manner. There shall be no runs or sags. Coatings shall be uniformly distributed and shall be applied in accordance with the coating manufacturer's recommendations and as approved. All coating materials shall be delivered to the shop in original, unbroken, and unopened containers plainly marked with name, brand and analysis of the product, and the name of the manufacturer. Maximum storage time of the coating material shall one (1) year or as recommended by the coating manufacturer. Should any coating be damaged or found unsatisfactory, such coating shall be removed to the extent directed by the engineer and the affected surface again prepared, re-coated, and retested. Whether shop or field repair, the coating material shall be the same as originally applied.

20.07.8 GENERAL REQUIREMENTS

(A) The castings shall conform to DEP-BWSO drawings included or listed in the purchase order.

(B) Manhole Cover or Grate and Frame

(1) Manhole cover or grate of the same size and pattern shall be interchangeable. The cover or grate shall not rock when rotated / placed in any position.

(2) The cover or grate top surface shall be flush with the top surface of the frame. The cover / grate when placed into the frame in any position shall not be lower than 1/8th of an inch and not higher than 1/16th of an inch.

(C) Valve Box Castings

Upper part of the hydrant valve box shall revolve freely around the lower part and the covers shall fit the upper part.

20.07.9 INSPECTION

(A) A minimum of five (5) business days advance notice of intent to schedule the work shall be given to the DDC-QA and Chief, Mechanical Engineering & QA Division, DEP-BWSO, 3rd Floor Low Rise, 59-17 Junction Boulevard, Flushing, NY 11373.

(B) The entire casting / manufacturing shall be open to the Engineer or his authorized representative for inspection during working hours.

(C) All materials may be inspected at the point of casting / manufacture and /or on delivery. If the inspection is not performed at the foundry / manufacturing plant, an inspection for Quality Assurance purposes may be required at the point of delivery. The inspection at the point of delivery will require the

contractor to engage, at his expense, a laboratory approved by DEP-BWSO to conduct the metal analysis and proof load tests. The laboratory shall be located within 100 miles (via automobile) from the DEP Queens office.

(D) Foundry Records

(1) NYC inspector shall have free access to the foundry daily testing and analysis records.

(E) Visual inspection:

Casting showing porosity, sand inclusion, shrinkage, weft, overlap, chipped or cracks, shall be rejected. If more than 5% castings per shipment have such indications, the complete shipment shall be rejected.

(F) Casting Weight

(1) Casting shall weigh within the weight limits specified for the casting.

(2) NYC inspector may select up to 10% of each item for dimensions and weight verification. If any casting does not meet the dimensions and /or weighs less than the minimum weight listed for the casting, the entire shipment of that item is subject to rejection.

(3) In case the minimum weight for the casting is not listed, up to 5% less than the nominal weight listed shall be acceptable.

(G) Load Test:

One set of manhole frame and cover and one set of catch basin frame and grate, weighing close to the minimum weight of the manhole / grate out of every lot of 200 castings (if the order is for less than 200 pieces, then one set out of the lot) may be subjected to a load of 40,000 Lb on a concentrated area of 9-inch x 9-inch at the center of the cover/grate. The load shall be held for a period of at least one minute in a suitable testing machine. The casting shall not show any crack or permanent deformation after the load is removed. If the casting fails the test, the complete lot shall be rejected. The proof tested cover/grate and frame shall be destroyed.

(H) Rejected Castings:

All markings pertaining to NYC shall be ground off from all rejected castings or the casting destroyed in the presence of the NYC inspector.

20.07.10 PACKING, HANDLING, AND SHIPPING

(A) REQUIRED CERTIFICATIONS

(1) A set of all required MTRs and certifications shall be sent to DDC-QA and Chief, Mechanical Engineering & Quality Assurance Division, DEP-BWSO, 3rd Floor – Low Rise, 59-17 Junction Boulevard, Flushing, NY 11373, for Material Release & Shipping Authorization. These MTRs and other information may be submitted on a Compact Disc (CD). The Quality Assurance Division of DDC or DEP (depending upon the ordering entity) shall issue a Material Release and Shipping authorization either after physical inspection at the manufacturing plant or at the designated storage facility.

(2) No shipment shall be made without the Material Release and Shipping authorization. Whether or not the required castings are inspected at the place of manufacture, the manufacturer shall furnish a notarized certification employing forms acceptable to the purchasing and use agencies, that the product was designed, manufactured and tested in full compliance with these specifications and all applicable standards. Each delivery shall include Material Release and Shipping Authorization issued by DDC–QA or DEP-BWSO-ME& QA Division.

(a) The shipping documents shall include the following information:

(1) Name & nominal weight of each product

(2) Total quantity of each product

(3) Total weight of shipment

(4) Delivery point

(5) Report number (this number is assigned by the contractor starting from one for each unique DDC / DCAS order / project number)

(6) An un-machined test bar for each heat properly identified

(B) PACKAGING

(1) The crating method shall be submitted to the ME&QA Engineer for approval.

(2) The castings shall be securely placed on stackable wooden / metal skid or box for shipment. The strapping should not damage the castings during shipment. Each crate shall protect the castings against possible damage from vibrations and shock during handling and transportation from the manufacturer to the purchaser's designated storage area.

(3) The exterior of the crate shall be clearly marked on at least two (2) opposite sides or tagged with two stainless steel tags with the following information:

PROPERTY OF THE CITY OF NEW YORK
DEP BUREAU OF WATER AND SEWER OPERATIONS
DDC / CONTRACTOR DEP PURCHASE ORDER NUMBER OR
DDC / CONTRACTOR ORDER NUMBER
DESTINATION ADDRESS
CONTENTS AND SIZE
MONTH AND YEAR OF MANUFACTURE
MANUFACTURER'S NAME AND ADDRESS
GROSS WEIGHT

SECTION 20.08 – DRY BARREL FIRE HYDRANTS & EXTENSION KITS

20.08.1 INTENT

These specifications describe the requirements of Dry Barrel Fire Hydrants for New York City.

20.08.2 GENERAL

All fully assembled fire hydrants; fire hydrant "Top Section" and fire hydrant parts furnished under these specifications must meet or exceed all the requirements of the AWWA Standard for Dry-Barrel Fire Hydrants, ANSI / AWWA C502 (latest revision), except as modified herein. Should any discrepancy be found between AWWA standards and The City of New York specifications, the City of NY specifications shall prevail.

20.08.3 MANUFACTURER'S QUALIFICATIONS

(A) The manufacturer shall certify that they have been producing dry barrel fire hydrants of a similar design, materials and size in compliance with similar specifications for a minimum of three (3) years and that they are satisfactorily performing in service at verifiable and documented locations. The manufacturer shall provide the names and addresses of the managing Engineer or Superintendent of at least three (3) municipalities or organizations who will verify the quality of the performance of the fire hydrants used by them.

(B) Manufacturers new to NYC DEP-BWSO shall be required to establish that they currently have within their own organization an experienced, competent and adequately staffed operating Quality Control Department responsible for maintaining high standards regarding materials, manufacturing and testing of the work performed in their plant; and they have a production force and plant facilities of a type and size suitable to perform the work required under this contract.

(C) All facilities / foundries proposed to be used for this work are subject to inspection and approval by DEP-BWSO. The use of any facility / foundry without the prior approval of the DEP-BWSO- (ME&QA) is not permitted. If an overseas facility is to be used for any part, its name and location must be indicated at the time of bidding. The foreign castings foundry must be approved by DEP-BWSO-ME&QA Division before production of any casting. The criteria for the approval process will be provided on request.

(D) The manufacturer will be required to machine, assemble and test the completed fire hydrants, fire hydrant "Top Section," and fire hydrant parts with their own production force. Subcontracting or subletting any of the aforementioned portions of the work will not be permitted unless approved by the DEP-BWSO-ME&QA. This approval shall not be unreasonably denied. Regardless of the country in which the fire hydrants, fire hydrant "Top Section" and fire hydrant parts are manufactured and assembled, all testing shall be conducted in accordance with approved procedures and in the United States of America in the presence of DEP-BWSO-ME&QA or DDC- QA inspectors, as applicable.

(E) These fire hydrants / fire hydrant "Top Section" shall be supplied by approved manufacturers / contractors only. Any manufacturer desiring to manufacture these fire hydrants shall contact DEP-BWSO-ME&QA division for approval.

(F) The following manufacturers have been approved:

Manufacturer	Address	Phone Number
United States Pipe & Foundry Company	956 Industrial Blvd., Albertville, AL 35950-9803	256-878-7930
M&H Valve (for D-2-LP)	P.O. Box 2088; Anniston, AL 36202	256-741-6225
Mueller Company	956 Industrial Blvd., Albertville, AL 35950-9803	256-878-7930

20.08.4 KIND

(A) These specifications cover the following two (2) types of Dry Barrel Fire Hydrants & Extension Kits:

(1) D-2-LP- Dresser Type Fire Hydrant: Assembly drawing# 43142-Z and Extension Kit assembly drawing# 44045-Z. Drawings set issued April 2014.

(2) S-2-LP - Smith Type Fire Hydrant: Assembly drawing# 50346-Z and Extension Kit assembly drawing# 44027-Z. Drawings set issued April 2014.

(3) Fire Hydrant "Top Section" shall include the following items:

(4) D-2-LP -Nozzle Section complete with all the internal parts, nozzle caps, Ground Flange Joint connecting hardware, Stem Breakaway coupling and hardware, Joint Flange Joint Ring Gasket.

(5) S-2-LP -Nozzle Section complete with all the internal parts, nozzle caps, Standpipe Coupling and screws, Main Rod Coupling complete with pins and springs, Standpipe Middle 'oh' Ring.

(B) If a specific type of fire hydrant is required, it will be called for in the purchase order or contract.

20.08.5 SUBMITTALS

(A) Complete set of drawings for each type fire hydrant is available from DEP-BWSO Procurement as well as NYC-DCAS. Before proceeding with the work, and during the progress thereof, the manufacturer shall check all applicable drawings, material specifications and notify the DEP-BWSO-ME&QA Engineer of any and all errors and omissions discovered therein. The drawings and specifications are intended to be explanatory of each other, but should any error or discrepancy appear, or any misunderstanding arise, the decision of the DEP-BWSO-ME&QA Engineer shall be final and binding upon the manufacturer and/or his authorized representative or contractor. The manufacturer / authorized representative or contractor shall not be compensated for any damage that may result from any error, discrepancy or misunderstanding.

(B) Complete fire hydrant / fire hydrant "Top Section" / fire hydrant extension kit and fire hydrant parts shall be manufactured to the detail drawings listed in these specifications for the Hydrant Type. The assembly drawings refer to the detailed drawing for the specific fire hydrant part.

20.08.6 MATERIAL

(A) All materials specified shall conform to the standard designated for each material as listed on the drawings. When reference is made to the ANSI, ASTM, AWWA or other industry standards, it is understood that the latest revision at the time of the bid opening or designated otherwise shall apply.

(B) A material equal or better may be submitted to DEP-BWSO-ME&QA for evaluation and approval.

(C) All Ductile Iron castings shall meet the requirements of ASTM A536 Grade 60-42-10 or 65-45-12 or 70-50-05.

20.08.7 REJECTION

Plugging, welding or repairing of any defective part without the written permission of the DEP-BWSO-ME&QA Engineer is not permitted; any such act will subject the casting to rejection.

20.08.8 IDENTIFICATION AND MARKING

(A) Fire Hydrant Nozzle Section and Standpipe shall have cast markings to meet the requirements of ANSI/AWWA C502 Section 6.1 PLUS WSNY and heat number.

(B) The Fire Hydrant Barrel shall have a corrosion resistant metal tag with a unique serial number punched in and permanently attached by rivets or screws at a position (preferably on a flat surface) agreed upon by DEP-BWSO-ME&QA. This tag shall not have any sharp corners. This identification number shall be legible and at least inch high letters and numbers. The tag may include the year, month and a unique number. This tag shall also be attached when fire hydrant "Top Section" is ordered

TABLE 20.08.8.1 – For S-2-LP Fire Hydrant:

S-2-LP	Components
Part # 2	Seal Plate
Part # *5*	Bonnet
Part# 59	Standpipe - Upper (Nozzle) Section
Part # 52	Standpipe - Lower Section
Part # *55*	Elbow

TABLE 20.08.8.2 – For D-2-LP Fire Hydrant:

D-2-LP	Components
Part 2B	Weather Shield
Part # 3	Bonnet
Part # 10	Nozzle Section
Part # 34	Standpipe
Part # 52	Shoe

(C) MTRs-Chemical & Physical data for the following parts are also required

TABLE 20.08.8.3 – For S-2-LP Fire Hydrant:

S-2-LP	Components
Part# 9	Valve Seat Ring
Part # 10	Operating Nut (Yoke Stem Nut)
Part # 28	Key Pin for Valve Rod
Part# 32	Elbow Bolt and Nut
Part# 33	Yoke Bolt & Nut Part
Part # 34	Bonnet Bolt & Nut
Part# 57	Valve Top Plate

TABLE 20.08.8.4 – For D-2-LP Fire Hydrant:

D-2-LP	Components
Part# 4	Stem Nut Lock Nut
Part# 6/6A	Stem Nut
Part # 37	Main Valve Top Plate
Part # 41	Shoe Bolt & Nut
Part# 43	Seat Ring
Part# 45	Seat Ring Retainer

20.08.9 WORKMANSHIP

(A) These fire hydrants must meet the requirements of ANSI / AWWA C502 Section 4.1 for workmanship, except that all repairs shall be approved by the DEP-BWSO-ME&QA inspector / engineer.

(B) All moving parts threads must be lubricated with NSF 61 approved lubricant and all non-moving threaded connections shall be sprayed with Dupont Molykote G-n Metal or DEP approved anti-seize compound. D-2-LP (Dresser Type) Stem Nut Lock Nut part# 4 (drawing# 43146-Z) threads must be coated with anti-seize compound and shall not be tightened too hard.

20.08.10 COATING

(A) All ferrous parts shall meet the requirements of ANSI / AWWA C502 Section 4.2.1. Manufacturer shall submit coating material specifications to DEP-BWSO-ME&QA for approval.

(B) All stainless steel, brass, bronze, and rubber parts shall not be coated.

(C) Gasket sealing surfaces shall have limited coating to avoid corrosion or joint leak.

(D) Exterior surface of Nozzle Section, nozzle caps and Standpipe coupling shall be coated with black colored polyurethane or DEP-BWSO-ME&QA approved coating to a minimum dry film thickness of 8 Mils.

(E) The chain assembly for the caps shall be zinc / chrome / nickel-plated / polyurethane coated. It should be freely movable in the cap groove.

(F) The Bonnet, Weather Shield and Operating Nut for D-2-LP shall be coated with Silver / Aluminum colored polyurethane or a coating approved by DEP-BWSO-ME&QA to a minimum dry film thickness of 8 mils.

(G) Bonnet for S-2-LP shall be coated with Silver / Aluminum colored polyurethane a coating approved by DEP-BWSO-ME&QA to a minimum dry film thickness of 8 mils. Operating Nut for S-2-LP shall NOT BE COATED

(H) Standpipe (D-2-LP) / Standpipe Lower section (S-2-LP) exterior surface shall be coated in black colored polyurethane or other DEP-BWSO-ME&QA approved coating material with a minimum dry film thickness of 8 mils. Sherwin Williams Polane SP is approved Polyurethane.

(I) Inside and outside surface of the Shoe / Elbow can be coated Black / Orange with polyurethane or fusion bonded epoxy applied by fluid or powder coating method approved by DEP-BWSO-ME&QA. The oversize / modified (see drawing for dimensions) Shoe / Elbow outside surface shall be coated green or a 1 ½ to 2 -inch green colored band must be applied to the mechanical joint flange. Dry film thickness shall not be less than 8 mils.

(J) Fire hydrant ferrous parts not listed above shall be coated with black colored polyurethane approved by DEP-BWSO-ME&QA.

(K) Fire hydrant "Top Section" when ordered separately shall be coated according to the coating requirements of complete fire hydrant.

(L) Fire hydrant extension kit shall be coated according to the coating requirements of complete fire hydrant parts.

(M) All other fire hydrant internal or external parts for which the coating requirements are not listed herein shall meet the requirements of ANSI / AWWA C502 Section 4.13 and coated to a minimum dry film thickness of 5 mils with DEP-BWSO-ME&QA approved enamel or polyurethane. Electrophoretic coating of 0.8 to 1.5 mils prior to coating shall be acceptable. ASPHALTIC COATING IS NOT ACCEPTABLE .

20.08.11 TESTING

(A) Production testing shall be as per ANSI / AWWA C502 Sections 5.1. & 5.3. DEP-BWSO-ME&QA OR DDC-QA (for supply house / contractor orders) may witness the testing and assembly at the manufacturing and assembly location. Test results shall be recorded even when a DEP-BWSO-ME&QA / DDC-QA inspector is present.

(B) When fire hydrant "Top Section" only is ordered, it shall be attached to a seal plate / flange of same dimensions as the Standpipe on which it will be fitted and pressurized to three hundred (300) psig as per ANSI / AWWA C502 section 5.1.3 or as desired by the inspector. Any leakage through the body will subject the "Top Section" to scrap; leakage through the joints or gasket can be repaired and the "Top Section" retested. After the successful hydro testing of the "Top Section", it shall not be disassembled except to replace the test "OH" ring with a new "OH" ring. The "OH" ring should be secured inside the coupling or attached in a waterproof pouch for shipping or attached securely to the hydrant or skid holding the hydrant "Top Sections".

(C) Extension kit barrel shall be hydrostatically tested to 300 psig as per ANSI / AWWA C502 Section 5.1.3 or as desired by the inspector. No leakage is permitted through the barrel.

(D) The hydrant main valve shall open when the Operating Nut is rotated clockwise.

(E) The hydrant must drain through the drain outlet when the Operating Nut is rotated anti-clockwise to close the hydrant main valve after the hydro-tests.

20.08.12 BOLTS, NUTS AND ACCESSORIES

(A) Fully assembled Dry Barrel Fire Hydrants shall be supplied with shoe / elbow connecting hardware as follows:

(1) Fire hydrants with modified (oversize) Shoe / Elbow (Dresser type fire hydrant Drawing No. 43152-Z part 53 “Shoe” and Smith type fire hydrant Drawing No. 44014-Z part 55 “Elbow – Mechanical Joint”) shall be supplied with modified plain glands to the dimensions given for the Shoe / Elbow. Gland, gasket, nuts, and T-bolts shall be packed separately in a carton for each hydrant. The glands shall preferably be fully coated GREEN, or the gland flange coated

green for 1 ½ to 2-inches. The carton shall be properly identified. If possible, make the carton green color.

(2) Fire hydrants with Standard size Shoe / Elbow shall be supplied with Wedge Type ductile iron Restraint Glands from EBBA Iron Sales (Megalug 1100 series); Sigma Corp. (One Lok); Romac (Roma Grip); Ford Meter Box Company (Uni-flange); Tyler (Tuf Grip) or Star Pipe (Star Grip) Gland, gasket, bolts and nuts shall be packed separately in a carton for each fire hydrant. The gland shall be coated with corrosion resistant material in black, epoxy coating is acceptable. The gland and hardware carton shall be properly identified.

(B) Fire hydrant "Top Section" shall be supplied with the necessary accessories and hardware to connect it to the Standpipe (D-2-LP) / Standpipe Lower Section (S-2-LP) or as specified in the purchase order.

(C) All Carbon Steel bolts shall be to ASTM A307 Grade B or SAE J429 Grade 2 or Grade 5 with dimensions conforming to ANSI / AWWA B18.2.1. All Carbon Steel and Alloy Steel nuts shall be to ASTM A563 Grade A or Grade B or nuts to SAE J995 Grade 2 or Grade 5 with threads conforming to ANSI / AWWA B18.2.2. All carbon steel bolts, nuts and screws (except for Ground Flange joint or Standpipe Lower Coupling) shall be made corrosion resistant with Fluoropolymer coating meeting the requirements of ASTM B117 of salt spray for 1000 hours. The coating company shall have been approved by DEP-BWSO-ME&QA. All other bolts and nuts (other than carbon steel) shall be according to the detailed drawing for that part.

(D) Bolts and nuts for Ground Flange joint (D-2-LP) and Standpipe Lower Section Coupling (S-2-LP) may be coated with the same material (black Polyurethane) as TOP / Nozzle Section. Fluoropolymer coated bolts and nuts may also be coated with Polyurethane. Zinc coated bolts and nuts are NOT ACCEPTABLE but stainless-steel bolts and nuts may be coated with the same material as the Top section.

(E) T-Bolts, nuts and gasket for the MJ connection for the gland shall meet the requirements of AWWA C111.

20.08.13 WARRANTY PERIOD

Fully assembled fire hydrants and fire hydrant "Top Section" shall be warranted by the manufacturer against defects in materials or workmanship for a period of ten (10) years from the date of manufacture.

20.08.14 PACKING, HANDLING, AND SHIPPING

(A) REQUIRED DOCUMENTATION

(1) At least five business days before the completion of the order, the manufacturer shall submit a request for inspection or "Material Release and Shipping Authorization, to DEP-BWSO- ME&QA as well as to DDC-QA (for supply house / contractor orders only). This authorization shall be issued by DEP-BWSO-ME&QA for DEP / DCAS purchase orders and by DDC-QA for the supply house / contractor purchase orders. The request shall include a list of serial numbers for the fire hydrants / fire hydrant "Top section"; legible copies of Material Test Reports (MTRs) for parts as required by this specification.

(2) An affidavit of Compliance duly Notarized by a Notary Public per ANSI / AWWA C502 Section 1.7 and warranty (per **Subsection 20.08.13**) shall be submitted with the request for "Material Release & Shipping Authorization".

(3) All MTRs, photos of the hydrants or Top Sections as bundled with a few close-up photos showing the serial numbers as visible in the shipping skid shall be submitted on a CD.

(4) The warranty (specified in **Subsection 20.08.13**) with the serial numbers for the fully assembled fire hydrants and fire hydrant "Top Section" shall be attached with the

request for "Material Release and Shipping Authorization".

(B) PACKAGING

(1) Each shipment shall have the following information in the shipping documents:

(a) Uniquely numbered lists of all the fire hydrants / tire hydrant "Top Section" serial numbers, weight of each item (each list shall contain same length hydrants) and total shipment weight. The list shall also include the purchase order number / bid number / contract number, delivery location and duly signed-off Material Release and Shipping Authorization from DEP-BWSO-ME&QA or DDC-QA (as applicable).

(2) All fully assembled fire hydrants / fire hydrant "Top Section" shall be laid in horizontal position with the nozzles facing in one direction, not touching each other and securely banded on wooden skids. The hydrants and Top Sections shall be protected from damage during shipping and storage. Each pallet shall have only three (3) complete fire hydrants and only three (3) such pallets banded together on a skid. The "Top Sections" shall also be packed in similar manner. Steel bands shall not damage the hydrant coating. Packing procedure with drawings of the pallets shall be submitted to DEP-BWSO-ME&QA Engineer for approval.

(3) Each extension kit shall be packed separately in a suitable carton and properly identified. These cartons shall be placed on a skid and saran wrapped. A pallet / skid shall contain same size extension kits.

(4) Each skid shall be wrapped in a translucent wrap and clearly marked in permanent ink on two opposite sides with the following in at least one (1)- inch high letters.

PROPERTY OF THE CITY OF NEW YORK DEP
PURCHASE ORDER# I CONTRACT# OR NYC PROJECT NUMBER (AS APPLICABLE)
DESTINATION ADDRESS
CONTENTS AND SIZE
MONTH AND YEAR OF MANUFACTURE
MANUFACTURER'S NAME AND ADDRESS
SKID GROSS WEIGHT

SECTION 20.09 – STAINLESS STEEL TAPPING SLEEVES WITH BRANCH CONNECTIONS FOR FLANGED TAPPING VALVE OR MECHANICAL JOINT TAPPING VALVE

20.09.1 INTENT

These specifications describe the requirements of Stainless-Steel Tapping Sleeves for the New York City Water Supply System.

20.09.2 GENERAL

(A) Stainless Steel Tapping Sleeves furnished under these specifications must meet or exceed all the requirements of the AWWA Standard for Fabricated Steel and Stainless-Steel Tapping Sleeves, ANSI / AWWA C223, except as modified herein.

(B) Should any discrepancy be found between AWWA standards and this specification, the City of NY specifications shall prevail. The decision of DEP- BWSO-ME&QA shall be final.

20.09.3 QUALIFICATIONS

(A) MANUFACTURER'S QUALIFICATIONS

(1) These tapping sleeves shall be produced by established reputable and experienced manufacturers who shall certify that they have been producing tapping sleeves of a similar design, materials and size and in compliance with specifications similar to these for a minimum of two years, and that the tapping sleeves are satisfactory in their performance and service under actual operating conditions at verifiable documented locations. Manufactures new to DEP-BWSO shall provide the names and addresses of the managing Engineer or Superintendent of three (3) municipalities or organizations who will verify the quality of these tapping sleeves.

(2) The manufacturer shall be required to establish:

(a) that they currently have within their own organization a competent operating Quality Control Department responsible for maintaining the high standards regarding materials inspection, welding, manufacturing and testing of the work done in their plant. The Quality Control department shall be adequately staffed and in operation during the course of this contract. A copy of the quality control and quality assurance manual (may be un- controlled) shall be submitted.

(b) that they have a production force and plant facilities of a type and size suitable to perform the work required in a timely manner under this contract. All facilities proposed to be used for this work are subject to inspection and approval by the DEP-BWSO ME&QA.

(c) FOR MANUFACTURER AND TAPPING SLEEVE DESIGN APPROVAL

(1) Four (4) sets of proposed tapping sleeve fully dimensioned drawings with bill of materials & materials specifications.

(2) Organization chart.

(3) Two sets of Quality Control and Quality Assurance manuals (may be un-controlled).

(4) Production facilities capacity, equipment list.

(5) Production force available and names of certified welders.

(6) Name and location of all the facilities to be used in the manufacture of these tapping sleeves.

(7) Name of three (3) municipalities where these sleeves are presently used with the contact name, telephone number and address.

(8) Cleaning and passivation procedures.

(9) Tapping Sleeve markings and location.

(10) Tapping Sleeve numbering system, tag size and location for the number tag.

(11) Hydro test equipment description and test procedure.

(12) After the welding procedures, weld qualifications and the welders are approved, all welds shall be tested to meet the ditch structure requirements of ASTM A262 Practice “A”.

(13) Tapping sleeve packing carton description.

(14) Packaging design.

(3) All welding procedures and qualifications shall be based upon the current applicable welding code, such as ASME Boiler & Pressure Vessel Code Section IX or AWS D1.6.

(4) Welders and welding operators shall be qualified (on manufacturer’s expense) as specified in this specification. List of certified welders and the name & address of the qualifying / certifying authority is required. DEP-BWSO-ME&QA may oversee the welding procedures and welder performance qualification test(s) when due. List of equipment needed for the contract shall be provided.

(5) Use of any facility for the manufacturing / fabrication / testing of these sleeves without the prior approval of the DEP-BWSO-ME&QA will not be permitted.

(6) All testing shall be conducted in the United States of America in accordance with DEP-BWSO-ME&QA approved procedures.

(7) The manufacturer shall be responsible for the verification / inspection to meet the requirements of the material specifications of all the materials used for these tapping sleeves. Notarized MTR (chemical composition, USA industry standard material name grade, tensile and yield strength reports from laboratories in USA) are required for all sheet metal, plate, flange and fasteners. Material certifications are required for all resilient materials. All reports shall be in English and in United States Customary System.

(8) All contractors shall use the Stainless-Steel Tapping Sleeves manufactured by DEP-BWSO-ME&QA approved manufacturers to the DEP approved drawings to the latest specifications only. A list of approved manufacturers is listed elsewhere in this specification.

(B) APPROVED MANUFACTURERS

(1) The following manufacturers are approved to fabricate the Stainless-Steel Tapping Sleeves for the NYC Water Supply System to the drawings approved to meet the requirements of this specification. This approval may be withdrawn any time the Tapping Sleeves manufactured by them are not to these specifications.

MANUFACTURER	LOCATION
PowerSeal Pipeline Products Division	Wichita Falls, Texas
Romac Industries	Seattle, Washington
Mueller Company	Cleveland, Tennessee

(2) DEP-BWSO Engineer may add other manufacturer meeting the requirements of this specification at any time without any notice to the other manufacturers.

20.09.4 MATERIAL

(A) The tapping sleeves shall be fabricated in accordance with these specifications to assure a 360-degree seal around the water pipe. All materials shall meet or exceed the requirements of respective industry standards and this specification. These tapping sleeves shall be fabricated to DEP-BWSO-ME&QA approved drawings of approved manufacturers only.

(B) All materials specified herein for use in the tapping sleeves produced under these specifications shall conform to the industry standards designated for each material. When reference is made to (ANSI), (ASTM) or (AWWA) or any other industry standards, it is understood that the latest revision at the time of the bid shall apply.

20.09.5 CHEMICAL AND PHYSICAL REQUIREMENTS

The requirements of ANSI, ASTM, AWWA or other standards, to which reference is made anywhere in these specifications, shall govern the physical and chemical characteristics of the tapping sleeve components unless specific exceptions are stated herein.

20.09.6 DESIGN CRITERIA

(A) SHELL DESIGN

(1) Tapping sleeves shell shall fit pipe outside diameters as listed below:

TABLE 20.09.6.1

Nominal Pipe Size	Pipe OD Range inches	Shell Thickness (Minimum)
6 inch	6.90 – 7.30	0.1196" / 11 gage
8 inch	9.05 – 9.45	0.1196" / 11 gage
12 inch	13.20 – 13.60	0.1196" / 11 gage
16 inch	17.40 – 17.80	0.1495" / 9 gage
20 inch	21.50 – 22.06	0.1495" / 9 gage
24 inch	25.80 – 26.32	0.1495" / 9 gage
30 inch	31.60 – 32.40 or as ordered	3 pieces; 0.1875" / 7 gage
36 inch	37.90-38.70 or as ordered	3 pieces; 0.1875" / 7 gage
48inch	50.40 – 51.40 or as ordered	3 pieces; 0.1875" / 7 gage

(2) The material shall be ASTM A240 Type 304L in solution annealed-condition.

(3) It shall be in two / three-sections with two / three sets of lugs (sidebars), bolts, nuts and washers.

(4) It shall not kink, bend, twist or damage during manufacturing, shipping or installation.

(5) Stainless steel lugs (or sidebars) to ASTM 240 Type 304L in solution-annealed condition shall be fillet welded to the Shell. The lugs shall be symmetrical on centerline and the faces parallel when installed on a pipe with OD equal to the mid-range of the pipe diameters listed.

(6) The lugs (side bars) thickness shall not be less than as listed below:

(a) Tapping Sleeves up to & including 12-inch – ¼ inch;

(b) Tapping Sleeves 16-inch to & including 24-inch – 5/16 inch

(c) Tapping Sleeves 30-inch thru 48-inch – 3/8 inch;

(7) The lugs shall not deform during proof-of-design tests or field installation.

(8) The weld undercut at the end of the lug shall not exceed 1/16-inch (0.06 inch).

(9) Shell lining shall meet the requirements of AWWA C223 Section 4.1.3.

(10) Securely attached shell lining shall not detach or slip during prolonged (up to 6 months) storage at 100ºF or during tapping operation.

(11) Shields to span the gap between the shell sections shall be austenitic stainless steel at least fourteen (14) gage thick. It shall be welded / bonded to the inner shell / gasket.

(12) Sleeve lengths shall be as follows unless specified otherwise:

(1) TABLE 20.09.6.2

Nominal Sleeve & Branch Size (Inches)	Minimum Sleeve Length (Inches)
6 x 3, 8 x 3, 12 x 3, 16 x 3, 20 x 3 and 24 x 3	12
6 x 4, 8 x 4, 12 x 4, 16 x 4, 20 x 4 and 24 x 4	15
8 x 6, 12 x 6, 16 x 6, 20 x 6, 24 x 6, 30x6 and 36x6	16
12 x 8, 16 x 8, 20 x 8, 24 x 8, 30x8, 36x8 and 48x8	24
20 x 12, 24x12, 30x12, 36x12, 48x12	36

(13) The bolt head shall be track head or Oval head and shall not rotate in the lug / side bar slot. The bolts shall be as follows:

(a) Sleeves up to and including 12-inch diameter – not less than 5/8-inch diameter;
(b) Sleeves 16-inch diameter – not less than ¾-inch diameter;
(c) Sleeves 20-inch thru 30-inch – not less than 1-inch diameter;
(d) Sleeves 36-inch thru 48-inch have to be approved before manufacture.

(14) Drop-in stainless-steel bolts shall comply with the requirements of ASTM – A193, Grade B8, Class 1 with Class 2A thread fit OR to ASTM F593 Alloy Group 1, Condition A UNC Class 2A thread fit. Bolt threads shall be protected from damage during shipping. The bolt length should allow for Tapping Sleeve assembly without excessive force. If need be, starter bolts should be provided.

(15) The nuts shall comply with ASTM A194, Grade 8F with Class 2B thread fit OR to ASTM F594, Alloy Group 1 Condition A UNC Class 2B thread fit. Nut shall not gall on bolt. Teflon or Fluoropolymer coated nuts shall not require passivation test and grease.

(16) Washers shall comply with ASTM A167 / A176 / A240 Type 304, meeting dimensional standards of ANSI B18.22.1. Teflon or Fluoropolymer coated washers shall not require passivation test.

(17) Stainless steel bolts, nuts and washers not coated with Teflon / fluoropolymer shall pass the Copper Sulfate test as per ASTM A380.

(18) Stainless steel nut (not coated with Teflon or Fluoropolymer) threads shall be shop lubricated during shop test as well as field assembly. The thread lubricant shall have the properties to prevent galling and seizing, reduce the torque required to tighten fasteners and prevent contamination at the bearing surfaces. The non-coated nuts

may be pre-lubricated, or lubricant supplied with the nuts.

(19) All sharp edges and corners shall be properly deburred.

(B) BRANCH DESIGN:

Common requirements for flanged tapping valve or mechanical joint tapping valve

(1) The Branch shall conform to the following dimensions:

(1) TABLE 20.09.6.3

Nominal Pipe Size	Minimum Wall Thickness	Inside Diameter Minimum
3-inch	0.1196" / 11 gage	3.37 inches
4-inch	0.1196" / 11 gage	4.37 inches
6-inch	0.1196" / 11 gage	6.37 inches
8-inch	0.1495" / 9 gage	8.37 inches
12-inch	0.1495" / 9 gage	12.50 inches

(2) The material shall be ASTM A240 Type 304L in solution annealed-condition

(3) The branch shall have a ¾-inch NPT Stainless Steel Type 304L half-coupling for pressure testing the branch prior to tapping. The half-coupling shall be furnished with an austenitic stainless-steel plug with threads properly lubricated or Teflon taped. The plug may be packed with the other hardware for the tapping sleeve.

(4) The half-coupling shall not obstruct the installation of the tapping valve.

(5) The half-coupling shall be pointing upwards when the branch axis is horizontal.

(6) The bolt-holes shall straddle the center line i.e. the tapping valve stem shall be vertical after installation when the branch axis is horizontal.

(C) BRANCH DESIGN FOR FLANGED TAPPING VALVE

(1) The flange material shall comply with ASTM A240 Type 304L in solution-annealed condition. The tolerances shall be according to AWWA C 207 – Tolerances Section.

(2) The flange dimensions and drilling shall be to AWWA C 207 flange Class D and recessed to Manufacturer's Standardization Society Standard MSS-SP 60 (Connecting Flange Joints Between Tapping Sleeves and Tapping Valves). 3-inch flange shall be to ASME 16.5 dimensions except that the thickness shall be to AWWA C207 Class D for 4-inch flange.

(3) The flange method of welding to the branch shall meet or exceed the requirements of AWWA C207 – Method of Attachment of Flanges.

(4) Full-face gasket shall be at least 1/8-inch-thick meeting or exceeding the requirements of AWWA C207 – Material section.

(5) The gasket shall not detach from the flange during storage at temperatures up to 100 degrees Fahrenheit or during installation.

(D) BRANCH DESIGN FOR MECHANICAL JOINT TAPPING VALVE

(1) The branch end shall have a welded gland to mate tapping valve with Mechanical Joint (MJ) to ANSI/AWWA C111/A21.11. The gland thickness shall not be less than the flange thickness specified in AWWA C207 Class D flange.

(2) The gland material shall comply with ASTM A240 Type 304L in solution-annealed

condition.

(3) The rubber-gasket shall meet the requirements of ANSI/AWWA C111/A21.11.

(4) A tag warning the installer to use only DEP-BWSO-ME&QA approved MJ X MJ valves for tapping shall be attached to the valve with stainless steel wire. The tap should preferably be reduced diameter. The MJ valves to be used for tapping have diameters larger than the nominal pipe size.

20.09.7 SUBMITTALS

(A) Four (4) sets of proposed Stainless-Steel Tapping Sleeve drawings showing all dimensions; material thickness; materials specifications; welding procedures; quality assurance test procedures and Proof-of-Design test conducted by the manufacturer shall be submitted for approval.

(B) Two copies of manufacturer's Quality Control and Quality Assurance shall be submitted with the drawings for approval.

(C) All dimensions shall be in English units – foot-pound-second system only. Metric equivalents are NOT ACCEPTABLE .

(D) Any item offered shall not infringe upon any patent. Contractor / manufacturer shall hold the City of New York safe and harmless and defend the City of New York from any claim arising out of the patent (s) infringement.

(E) Stainless Steel Tapping Sleeves for the City of New York Water Supply System shall be fabricated to the DEP-BWSO-ME&QA approved drawings meeting the requirements of this specification.

(F) The Manufacturer / Contractor shall verify the submittals requirements with these specifications and purchase order

20.09.8 TESTING

(A) Proof of design testis required only for Tapping Sleeve Design approval; this test shall be repeated only if the Tapping Sleeve design, material or fabrication process has changed.

(B) One Tapping Sleeve of each pipe and branch size or as required by the DEP-BWSO-ME&QA Engineer fabricated to the approved drawings of the manufacturer shall be installed on a Cast Iron / Ductile Iron test pipe according to the manufacturer's approved installation procedures. The branch connection shall be blanked off. A certified pressure gauge at least 4-inch diameter with maximum pressure range of 600 psig shall be attached to the branch. The branch shall be pressurized with water at room temperature to 300 psig. There shall be no leakage for one (1) hour.

(C) The pressure gauges used for the hydro test shall have been certified for not more than one year on the day of the test. Proper certifications shall be provided to the Engineer at the time of the test. There shall be at least two (2) pressure gauges in the system.

(D) There shall be no gasket protrusion during the hydro test.

(E) After the hydro test, the sleeve shall be disassembled and checked for any visible damage / deformation to the shell, lugs / sidebars, bolts, nuts, washers or branch; any leakage or damage to the tapping sleeve or its appurtenances will be a cause for rejection of that sleeve and branch size design or based upon the Engineer's determination all sleeves made to that design.

(F) Before the Tapping Sleeves are approved for production, all welds shall be tested for ditch structure as explained in ASTM A 262 Section 6.3.3. In other words, any weld of the Tapping Sleeve when cut, mounted, polished and examined after electrolytic oxalic acid etching shall not show a ditch structure completely surrounding a grain in the weld heat affected zone. These tests can be conducted on separate pieces of metal configuring the welds of a Tapping Sleeve. The production welds for the Tapping Sleeves shall be made only according to these approved weld procedures and with 304L stainless steel sheets.

(G) Any change in the welding procedure or weld rod material will require re-tests for the ditch structure of all Tapping Sleeve welds.

20.09.9 OUTER SURFACE

All metal (un-coated) surfaces excluding fasteners shall be chemically passivated. Descaling and removal of oxide films shall meet the requirements of ASTM A380 or ASTM A967. The passivated parts shall be checked for free iron contamination, using copper sulfate solution test or other DEP- BWSO approved method. Non-conforming parts shall be re-passivated and inspected.

20.09.10 MARKING

(A) Each Tapping Sleeve body shall be marked with the following information by stenciling in a non-washable ink or paint free of chlorides:

(1) Contractor (if other than manufacturer) and manufacturer's name;

(2) Pipe diameter range for sleeve and branch;

(3) Country of manufacture;

(4) Letters "WSNY";

(5) All letters / numbers shall be at least 3/8-inch high unless approved otherwise.

(6) The torque required for the bolts shall be listed on the sleeve.

(B) Each tapping sleeve shall have a stainless-steel sheet metal tag with the Tapping Sleeve unique serial number stamped on it and tack welded to the branch flange circumference. The tag shall be approximately ½ -inch wide & approximately 2 ½ - inch long. The serial number shall not be less than 1/8th inch high. No two (2) tapping sleeves shall have the same serial number.

(C) The serial number system shall be explained on the drawings. The numbering system shall preferably be as follows: Manufacturer two letter initials followed by unique sleeve sequence number. The tag shall not have any sharp corner or edge. Punched or etched serial number on the flange circumference may also be submitted for consideration and approval.

20.09.11 INSPECTION

(A) At least 10 working days prior to starting fabrication / manufacture, the manufacturer shall send a notice for inspection to DEP-BWSO-ME&QA for DEP / DCAS purchase orders and to DEP-BWSO-ME&QA as well to DDC-QA for contractor / supply house orders. Unless advised otherwise, the manufacturer can proceed with fabrication.

(B) One (1) set of all MTRs and material certifications duly signed-off along with the serial numbers for the Tapping Sleeves ready for inspection, shall be sent to DEP-BWSO-ME&QA for DEP / DCAS purchase orders; and to DDC-QA for Supply House purchase orders requesting a Material Release and Shipping Authorization. The inspecting agency will decide to do onsite inspection or waive it. This information on a CD is preferred.

(C) Request for shop inspection or Material Release and Shipping Authorization after partial or full completion of the purchase order shall be sent to (based upon the ordering party) DEP-BWSO-ME&QA OR to DDC- Quality Assurance Division, accompanied by an affidavit of compliance stating that the listed Tapping Sleeves meet the requirements of this specification (a CD with the same information is acceptable). All MTRs and Certifications shall be properly identified with the applicable Tapping Sleeve serial number.

(D) These Tapping sleeves shall be shipped only after receiving the Material Release and Shipping Authorization from the DEP-BWSO-ME&QA or DDC-QA Engineer / inspector as applicable.

(E) DEP-BWSO-ME&QA or DDC-QA inspector may test up to 5% of the Tapping Sleeve branch connections for leakage to the test procedure similar to the test under proof-of- design test, but the test shall be restricted to the branch only; and it is not necessary to mount the

complete sleeve on a pipe. The test pressure shall be held only for three (3) minutes or longer, if required, instead of one (1) hour. Any failure will require evaluation and determination by the DEP-BWSO- ME&QA or DDC - QA Engineer. 10% of the sleeves may be tested for passivation.

(F) During shop inspection the DEP-BWSO-ME&QA or DDC-QA inspectors shall be provided with all material test reports / certifications for their review and approval. The inspectors shall be provided with all instruments needed for the inspection. If the manufacturer does not want the DEP-BWSO-ME&QA or DDC-QA inspector to handle their instruments, the manufacturer's inspector shall perform the tests in the presence of DEP-BWSO-ME&QA or DDC-QA inspector.

(G) Re-welding i.e. welding over a failed weld is not permitted, unless the existing weld is fully ground. A burned or re-welded hole 1/8th inch or larger, will be a cause for rejection of the Tapping Sleeve.

(H) DEP-BWSO-ME&QA or DDC-QA Engineer / inspector may visit the manufacturing facility at any time during the contract.

20.09.12 WARRANTY PERIOD

The contractor shall warrant the Tapping Sleeves to be free of any manufacturing defect for five (5) years after the receiving date at the New York City facility.

20.09.13 PACKING, HANDLING, AND SHIPPING

(A) Each Tapping Sleeve and appurtenances shall be individually boxed in a suitable carton along with installation instructions. Tapping Sleeve manufacturer's name, Tapping Sleeve Pipe and Branch size and serial number shall be indicated on at least two (2) opposite sides on the outside of the carton. The Tapping Sleeves shall be so packed that it is not damaged during transit to the designated delivery site.

(B) Bolts, nuts, washers and plugs for each Tapping Sleeve shall be packed with the tapping sleeve in the same carton. The hardware shall not damage the tapping sleeve, nor be damaged, during transit.

(C) A skid shall contain one size Tapping Sleeves only. The cartons shall be saran wrapped (or protected by other means from water damage) for shipment.

(D) The skids shall be stackable up to three levels without toppling or damage to the Tapping Sleeves. The proposed method of packaging and shipping shall be submitted to the DEP - BWSO-ME&QA Engineer for approval.

(E) Material Release and Shipping Authorization with a list of serial numbers for the Tapping Sleeves (specified in **Subsection 20.09.11)** shall be included with the shipment.

(F) The exterior of the skid (visible through the protective wrappings) shall be marked as follows, or as directed by the contractor

PROPERTY OF THE CITY OF NEW YORK
BUREAU OF WATER & SEWER OPERATIONS OR CONTRACTORS NAME
PURCHASE ORDER NUMBER / CONTRACT NUMBER
DESTINATION ADDRESS
COUPLING (S) PIPE SIZE(S).
MONTH AND YEAR OF MANUFACTURE
VENDOR AND MANUFACTURER'S NAME AND ADDRESS
GROSS WEIGHT

(1) INCLUDED WITH THE SHIPMENT

(a) FOR DEP ORDERS: Duly signed-off Material Release and Shipping Authorization and the serial numbers for the Tapping Sleeves shipped. This information on a CD is preferred.

(b) FOR SUPPLY HOUSE / DDC CONTRACTOR PURCHASE ORDERS: Duly signed-off Material Release and Shipping Authorization and the serial numbers for the Tapping Sleeves shipped. This information may be submitted on a CD.

SECTION 20.10 – CORPORATION STOPS AND QUARTER BENDS

20.10.1 INTENT

This specification describes the requirements of ¾ -inch, 1-inch, 1 ½-inch and 2– inch Corporation Stops complete with Quarter Bend, Nut and Gasket.

20.10.2 GENERAL

The latest revision on the bidding date shall apply for all industry standard specifications. In case of a discrepancy in the industry standard specifications and this specification, the requirements of this specification shall prevail. In any dispute regarding the interpretation, the decision of the Chief-Mechanical Engineering and QA Division (DEP-BWSO-ME&QA) shall be final.

20.10.3 MANUFACTURER QUALIFICATIONS

(A) These corporation stops and bends shall be manufactured by an established and reputable manufacturer, who is experienced in the production of corporation stops of a similar design and size and in compliance with similar specifications for a minimum of two (2) years.

(B) The manufacturer shall provide names, addresses and telephone numbers for at least three (3) municipalities or utilities, which can be contacted for verification of the quality and performance of their Corporation Stops and Quarter Bends; and provide two copies of their Quality Control and Quality Assurance manuals (may be uncontrolled copies) to DEP-ME&QA/DCAS for approval.

(C) For DEP/DCAS purchase orders, within fourteen (14) days of the notification of the award from the DCAS, the successful bidder / manufacturer shall submit the manufacturing schedule to DEP-BWSO-ME&QA/DCAS.

(D) DEP-BWSO-ME&QA / DCAS approved manufacturer shall machine, assemble and test these Corporation Stops and Quarter Bends with their own production force. DEP-BWSO-ME&QA / DCAS must approve in advance any subcontracting of the aforementioned portion of the work

(E) All manufacturers qualified under **Subsection 20.10.3**, interested in supplying Corporation Stops and Quarter Bends to this specification shall submit their product model number and details to DEP-BWSO-ME&QA for approval. Only the models approved by DEP-BWSO-ME&QA shall be furnished to DEP, Supply Houses and contractors.

20.10.4 DESIGN CRITERIA AND MATERIAL

(A) These Corporation Stops shall comply with ANSI/AWWA C 800 “Underground Service Line Valves and Fittings”, and the requirements of this specification.

(B) Corporation Stop shall be to ANSI/AWWA C 800 – high-pressure Ball type suitable for installation on water pipes under pressure with standard tapping and drilling machine and insertion tools (example Mueller Type).

(C) Materials in contact with potable water shall be to ASTM B584 or ASTM B30 with lead content not exceeding 0.250%. Other CDA no / low lead materials may be submitted for approval. Materials not in contact with potable water may be ASTM B584 or B30 with lead content not exceeding 3.00%.

(D) The Ball shall have either an un-coated no lead (maximum 0.25% lead) brass ball sealed by two Teflon seats OR ball coated with Teflon (PTFE) supported and held in place by EPDM to ASTM D2000 rubber seals.

(E) The Corporation Stop inlet threads shall be to AWWA C 800 “Corporation Stop External Threads”.

(F) Corporation Stop shall have throughway dimension no smaller than the nominal size of the Corporation Stop.

(G) Corporation Stop outlet shall be Male National Pipe Thread to ASME B1.20.1 with AWWA standard Internal Driving Threads. These threads shall be mating Mueller Tapping Machine Model B101 for ¾-inch & 1-inch corporation stops, and Mueller Model A-3 for 1 ½-inch & 2-inch corporation stops. Corporation Stop shall have a blowout proof operating head. Operating head shall have at least one EPDM O-ring seal. Operating head shall rotate 360 degrees.

(H) Quarter Bends shall be to AWWA C 800 – high-pressure design.

(I) Quarter Bends material in contact with potable water shall be to ASTM B584 or ASTM B30 with lead content not exceeding 0.250%. Other CDA no / low lead materials may be submitted for approval. Materials not in contact with potable water may be ASTM B584 or B30 with lead content not exceeding 3.00%.

(J) Quarter Bends shall have throughway dimension no smaller than the nominal size of the Corporation Stop.

(K) Quarter Bend with swivel nut and gasket shall fit the outlet of Corporation Stop.

(L) Swivel nut threads shall be Female National Pipe Thread to ASME B1.20.1.

(M) Quarter Bend outlet thread shall be Male National Iron Pipe thread to ASME B 1.20.1.

(N) Sealing gasket between Corporation Stop and swivel nut shall be a suitable sealing material, with minimum torque on the swivel nut to achieve a watertight seal. The gasket must hold pressure equal to the Corporation Stop test pressure.

(O) All materials in contact with water shall comply with ANSI/NSF Standard 61, Drinking Water Components – Health Effects, Section 8. The manufacturer shall submit proof of this compliance on request.

(P) Corporation Stop and Quarter Bend shall be marked as specified in AWWA C 800 standard.

20.10.5 TESTING

(A) At least one Corporation Stop and one Quarter Bend of each size hydrostatically tested at 300 psig for fifteen (15) minutes shall show no leakage or deformation.

(B) All Corporation Stops hydrostatically tested at 300 psig or Pneumatically at 100 psig for at least ten (10) seconds in both open and closed position shall have no leakage.

(C) All Quarter Bends hydrostatically tested at 300 psig or pneumatically at 100 psig for at least ten (10) seconds shall have no leakage.

20.10.6 INSPECTION

(A) The manufacturer shall submit the manufacturing and testing schedule to DEP-BWSO-ME&QA for DEP / DCAS orders at least 15 business days before the start date.

(B) DEP-BWSO-ME&QA or assigned inspectors shall be provided free access to the plant(s) where the items ordered are being manufactured / cast / machined at all times. The manufacturer shall provide all the drawings, material test reports and other information for the inspector to ascertain that the requirements of this specification are met. The manufacturer shall provide all the tools for inspection to be used by the inspector or conduct the tests required in the inspector's presence.

(C) The inspector at the manufacturing/testing facility may test up to two (2) percent of each item ordered, but not less than two (2) percent. Any failure shall require testing of additional two percent of the item ordered; and if any one item fails, the matter shall be referred to DEP-BWSO-ME&QA division for resolution.

(D) If an inspection was not conducted at the manufacturing plant, then QA inspection to meet the requirements of **Subsection 20.10.6(C)** shall be conducted after delivery. Inspection after delivery will require the contractor to engage, at his own expense, a DEP-BWSO-ME&QA approved laboratory in the continental United States of America within one-thousand (1,000) miles radius of DEP headquarters in Queens, NY, to perform the metal analysis per **Subsection**

20.10.4 and hydrostatic tests per **Subsection 20.10.5** All material destroyed or damaged by the tests shall be replaced by the contractor at no cost to the City.

(E) A successful bidder new to New York City DEP for the Corporation Stops and Quarter Bends to this specification shall submit samples as requested by DEP-BWSO-ME&QA of each item before the order is placed.

20.10.7 AFFIDAVIT OF COMPLIANCE & WARRANTY

The manufacturer shall provide a notarized Affidavit of Compliance and warranty that all items ordered and delivered meet the requirements of this specification and warranted to be free of material and manufacturing defects for ten (10) years from the delivery date.

20.10.8 PACKING, HANDLING, AND SHIPPING

(A) REQUIRED DOCUMENTATION

(1) The manufacturer shall obtain Material Release and Shipping Authorization from DEP- BWSO-ME&QA for DEP / DCAS purchase orders; and from DDC - QA for Supply House or contractor purchase orders; before the items are shipped.

(2) A request for Material Release and Shipping Authorization shall contain the details of the items ready for inspection / shipping, number of items and notarized Affidavit of Compliance as well as copies of material tensile strength and chemical composition results for each heat. The name of the item shall be identified on the material certifications. All foreign source material shall have test results and certification from testing laboratory located in USA.

(3) The above information on a CD is preferred.

(4) A copy of the Material Release and Shipping Authorization shall be included in the shipping documents.

(B) PACKAGING

(1) Each size Corporation Stop, the Quarter Bend, Nut and Gasket shall be packed together in one small carton. This small carton may be packed in a larger carton for placing them on a Skid.

(2) All items shall be complete and ready for installation when shipped. One Corporation Stop, one Quarter Bend, nut, gasket (washer) of one size shall be packed in a carton duly identified with its contents and size. These individually packed cartons of one-size shall be packed in a larger carton, this larger carton shall have individually packed cartons as follows: ¾ inch – 20 pieces per carton, one- inch -15 pieces per carton, 1 ½ -inch - 4 pieces per carton, 2-inch - 2 pieces per carton, these cartons shall be identified with the contents. Up to a maximum of 12 such cartons can be placed in one tier of a skid. These cartons shall be strong enough to hold up to 4 tiers high on a standard 48-inch skid. The cartons per skid shall not exceed 48. Different size Corporation Stops, and Bends cartons shall not be mixed on one skid except when it cannot be avoided due to a small purchase order. These cartons on the skid shall be either fully enclosed in a wooden box or if domestic delivery, in a suitable plastic wrap completely protecting the cartons from physical or water damage.

(3) All items shall be packed so that they are not damaged during transit and handling.

(4) The exterior of each crate shall be marked on at least two opposite sides with letters / numbers at least one (1) inch high, unless it is not possible to print that large, as follows:

Property of the City of New York
Bureau of Water and Sewer Operations
DEP/DCAS/DDC Purchase Order Number #
Destination Address
Contents and Size
Manufacturer's Name & Address Month
and Year of Manufacture
Gross Weight

SECTION 20.11 – TRUNK MAIN WORK

20.11.1 DESCRIPTION

This section describes how to obtain the specifications for trunk main work.

20.11.2 GENERAL REQUIREMENTS

To perform trunk main work, the Contractor must acquire the trunk main work material, fabrication, inspection, sampling, testing, delivery, installation and construction procedures specifications (latest revisions) for this contract from the following address:

New York City Department of Design and Construction
Division of Infrastructure, Design Services, Specifications
30-30 Thomson Avenue, 3rd Floor, Long Island City, NY 11101

SECTION 20.12 – BI-DIRECTIONAL DUCTILE-IRON VENTURI FLOWMETERS AND APPURTENANCES 30-INCH THROUGH 48-INCH DIAMETER FOR NYC POTABLE WATER PIPES

20.12.1 INTENT

This specification describes the requirements for design, materials, coating, shop testing etc. and delivery of bi-directional ductile-iron Venturi flowmeters and appurtenances complete in all respects for the required flow measurement and recording for the potable water supply system in The City of New York**,** New York.

20.12.2 QUALIFICATIONS

(A) MANUFACTURER'S QUALIFICATIONS

(1) Flowmeter and appurtenances shall be manufactured by an established and reputable manufacturer, who is experienced in the production of bi-directional Venturi type flowmeters of similar design and size and in compliance with similar specifications for a minimum of ten (10) years. The manufacturer shall provide the names, addresses and telephone numbers of at least five (5) municipalities or utilities, which can be contacted to verify the quality and performance of their bi-directional Venturi flowmeters of the same size and comparable flow rates.

(2) Any manufacturer not pre-approved by DEP, intending to bid for these flowmeters for the NYC Water Supply System, shall submit their Quality Control and Quality Assurance manuals to DEP-BWSO-ME&QA at least 30 working days before the bid submission date. They shall also submit proof of their experience as listed in **Subsection 20.12.2(A)(1)**.

(3) The selected manufacturer shall submit detailed manufacturing drawings, flow calculations, complete bill of materials with industry standards, Quality Control & Quality Assurance procedures, and flow measurement accuracy tests to DEP-BWSO-ME&QA for approval. The flowmeters and appurtenances shall be supplied ONLY to the approved drawings and test procedures**.**

(4) The manufacturer shall machine, assemble and test these flowmeters with their own production force. Subcontracting or subletting any of the aforementioned portions of the work must be approved in writing by DEP-BWSO-ME&QA in advance.

(5) Regardless of the country of origin of casting and machining, assembly and flow accuracy testing, if required, shall be in the continental United States of America or Canada. DEP-BWSO-ME&QA / DDC-QA personnel may witness any or all assembly and testing during manufacturing and /or QA inspection.

(B) FOUNDRY REQUIREMENTS

(1) All ferrous material casting foundries shall have a minimum of ten (10) years' experience in casting Ductile Iron Venturi flowmeter tubes and appurtenances of comparable size and design in ductile iron grades as specified herein.

(2) All foundries and testing facilities are subject to inspection and approval by DEP-BWSO-ME&QA and / or DDC-QA.

20.12.3 DESIGN CRITERIA AND MATERIALS

(A) Since there is no industry standard for the design of Venturi Flowmeters, DEP would prefer the use of recommendations made in the report of ASME Research Committee on Fluid Meters 6th Edition. DEP will review the design and accordingly approve / disapprove it. The flowmeter shall be able to measure the flow in either direction with the same accuracy.

(B) Flowmeter shall be of pressure-differential type utilizing pure static pressure sensed at the inlet and the throat section and be capable of measuring the flow rate in either direction as listed in Table 20.12.3.1.

(C) The differential pressure shall indicate static pressure change only as a Herschel Standard Venturi tube. Any device that employs entire or partial pilot effects or amplifies differential pressure by changing flow direction at the point of sensing pressure, thus introducing unwanted hydraulic noise, will not be acceptable.

Table 20.12.3.1- Flow Rates

Pipe Size OD Inches	Minimum Flow MGD	Maximum Flow MGD
30	7.50	75
36	9.0	90
48	13	130

(D) The flowmeter maximum error over a 10 to 1 (Ten to One) range of differential pressure shall be within + / - 0.50% (one-half percent) of the actual flow rate within the specified maximum & minimum flow rate. If required under the contract, the accuracy of the flowmeter shall be demonstrated and certified by actual laboratory wet flow tests on the flowmeter supplied. The manufacturer shall provide prior independent lab wet test data on comparable size & type flowmeters made by the same manufacturer for at least 30 flowmeters even when the wet flow test is required by the contract.

(E) The flowmeter design shall comply with ANSI/AWWA C110/A21.10 latest edition Section 5, except for the additional requirements of this DEP / DDC specification. The design pressure shall be 200 psig. Flowmeter tubes wall thickness calculations shall be submitted. The design wall thickness must have additional allowance for casting dimensions variations and machining.

(F) The inlet and outlet approach section tubes shall be cylindrical and of the same diameters as the pipes connected to them.

(1) NYC ductile-iron pipes will be cement-mortar lined to double the thickness specified in ANSI/AWWA C104.

(2) NYC steel pipes will be to ANSI /AWWA C200 – cement mortar lined with inside diameter, i.e. steel barrel diameter represents the nominal pipe size. The manufacturer shall verify the pipe inside diameter to match the flowmeter inside diameter.

(3) A minor mismatch in the inside diameter is acceptable provided the manufacturer has developed the offset factor applicable to the field conditions and the offset does not exceed 6% of the actual inside diameter.

(G) The flowmeter tubes shall not have any debris-collecting cavities or annular chambers.

(H) Flowmeter inlet and outlet tube ends shall be flanged to meet the dimensional requirements of ASME B16.1 -1998 Class 125 flat face. If the flowmeter is made by joining two tubes, then the tubes' connection shall also be to ASME B16.1-1998 Class 125. Bolt-holes shall straddle the tubes centerline. The flowmeter inlet and outlet tube flange bolt-holes shall be drilled larger depending upon the flange size to accommodate insulating sleeves if the mating pipe material is other than ductile-iron or if insulating flange connections are ordered.

(I) Flange back facing or spot facing, if required, shall be in accordance with MSS SP-9. The

flange thickness at any point shall not be less than ASME B16.1-1998 Class 125 Table 4.

(J) The bolts for connecting the Venturi section tubes shall be to ASTM A370 grade B or SAE J429 grade 2 / grade 5. Nuts shall be to ASTM A563 Grade C3 or DH3. Washers shall be to ASTM F436. Bolts, nuts and washers shall be Fluoropolymer coated (Tripac Fasteners coating is acceptable). Bolts, nuts and washers Fluoropolymer coated by other methods may be submitted to DEP-BWSO-ME&QA Division for approval. Proof of meeting the 1,000 hours of salt spray testing to ASTM B117 for bolts and nuts shall be submitted.

(K) The Beta ratio shall be constant for the flows specified i.e. 0.5; 0.6 or 0.7. The uncovered head loss shall not exceed 40% of the differential head at all flows in either metering direction.

(L) The Reynolds number at the flow rate shall be at least 80,000.

(M) The laying length of the throat shall be at least half the throat diameter. The throat area shall be lined with ASTM A240 Type 316L or fabricated from a centrifugal casting conforming to ASTM A276 Type 316L stainless steel. The liner shall be securely attached to the flowmeter body and shall not loosen due to pressurization / de-pressurization or vibrations in service.

(N) The flowmeter shall have two (2) high pressure sensing taps on each end; and two (2) low pressure sensing taps at the throat. These taps shall be at 180 degrees to each other in a horizontal plane. All taps shall be fitted with ASTM A276 Type 304L / 316L stainless steel bushings. One set of high- and low-pressure taps shall be plugged with type 316 stainless steel threaded plugs.

(O) A vent port and a drain tap at least one-inch nominal pipe diameter on both ends shall be at a 90-degree plane to the high-pressure taps. The vent port and drain tap shall be lined with ASTM A276 304L / 316L stainless steel bushings. The vent and drain taps shall be plugged with Type 316 stainless steel threaded plugs.

(P) The flowmeter shall be installed in an underground chamber. The pipe layout shall be according to the approved installation drawings.

(Q) Flow measurement and recording devices, piping, valves etc. shall be according to **Subsection 20.12.7**

(R) All ferrous components for the flowmeters shall be Ductile Iron ASTM A536 Grade 65-45-12 or 70-50-05.

20.12.4 REPORTING REQUIREMENTS AND CERTIFICATION

Material Test Reports for bolts and nuts; and certification for washers is required.

20.12.5 SUBMITTALS

(A) The manufacturer shall submit four (4) sets of fully dimensioned envelope drawings and complete Bill of Materials with industry standard specifications to DEP-BWSO-ME&QA for approval. Flowmeter shall be furnished to DEP-BWSO / DCAS OR DDC contractors in accordance with these DEP-BWSO-ME&QA approved drawings only. These drawings shall have black lines on white paper. Drawings shall preferably be not larger than 11 x 17 inches. Drawings shall be signed-off with date and revision number.

(B) The manufacturer of the flowmeter shall submit fully dimensioned drawing(s) with the following information based upon their design of at least 30 (thirty) similar Venturi flowmeters actually wet tested in a certified laboratory:

(1) Flowmeter coefficient and tolerances.

(2) Proof that the coefficient is constant above a Reynolds number of 80,000 and independent of the beta ratio and line size.

(3) Effects of up-stream piping configuration on the coefficient.

(4) Permanent head loss as a percentage of the differential pressure produced.

(5) A flow-versus-differential curve for the potable water.

(6) If the flow metering accuracy required is better than 0.50% of the actual flow rate, then the flowmeter of each size ordered shall be wet tested for performance for parameter **in subsections 20.12.5(B)(1), 20.12.5(B)(2),** and **20.12.5(B)(4),** at a DEP approved laboratory. The flow test shall be an actual wet laboratory test including at least ten (10) points between the minimum and maximum flow rates specified. Laboratory tests shall be run in each metering direction in operation.

(C) All dimensions shall be in inches. Metric equivalents are NOT ACCEPTABLE.

(D) The manufacturer shall assign a separate set of drawing numbers for NYC Flowmeters, if possible.

20.12.6 MARKING

(A) Each flowmeter shall have cast in raised letters at least 2-inch high and 1/8-inch relief on each tube the letters "WSNY", the manufacturer's mark (Logo), flowmeter size, port size, the year of manufacture, D.I.(Ductile Iron), design pressure, country of casting (the letters shall be almost equal to the letter size of WSNY – approximately 2-inch high 1/8th-inch relief). The casting shall also bear markings identifying the foundry as well as the heat number.

(B) Two stainless steel or copper alloy tags at least 3" x 1" shall be permanently attached with corrosion resistant screws or rivets on opposite sides of each flange circumference in a horizontal plane indicating the flowmeter serial number for each flowmeter, as approved. The serial number shall be at least 3/8th-inch high raised or punched letters. Each flowmeter shall have a unique serial number. The serial number should include manufacturer's mark & year and month of manufacture. The numbering system shall be explained on the respective drawing. The tag shall not have sharp or raised edges or corners.

20.12.7 FLOW MEASURING AND RECORDING INSTRUMENTATION, VALVES PIPING

(A) The flowmeter shall be supplied complete in all respects with the specified flow measuring and recording instrumentation, valves piping etc. as stated in this specification and the contract.

(B) The Venturi flowmeter manufacturer shall supply the following instrumentation, recorders, piping, tubing etc. in order to measure and record the flow through the flowmeter as required by the specification listed above. The manufacturer shall submit a complete list of all materials required (including those not listed below) to accomplish the purpose of the flowmeter to the subject specification for DEP-ME&QA Division approval. All the instruments including but not limited to power supply, surge suppressor etc. shall be enclosed in water proof NEMA Type 4 enclosures factory assembled and tested.

(1) Differential Pressure Transmitters:

Dual pressure sensors system shall be used for these flowmeters. The differential pressure transmitters shall be ABB Inc. Model 264DS. The transmitter shall be complete with all the appurtenances required to operate the system.

(2) Receiver:

Each receiver shall be capable of indicating, recording and totalizing the flow or pressure, as specified in accordance with the signal transmitted by means of the telemetry signal circuit connected to each transmitter system. The receiver shall be solid state, full case instrument and shall include a programmable fluorescent display with rate indicator, totalizer and circular chart recorder. The receiver shall be provided with test points and shall have an internal calibrated signal to adjust the indicator, recorder and totalizer. The maximum error of the indicator and totalizer shall be within 0.5% of the actual flow.

(3) Recorder:

The chart recorder shall be Chessell Inc., Model 394, six-channel with one pen, one totalizer and math package. The Recorder shall operate on 115-volts, 60-hertz power. It shall be equipped with regulated power supplies to power the internal electronics and the flow or pressure transmitters system within the accuracy specified for each

range. Since DEP would like to record the flow data on a computer located away from the instrument room, any other suitable recorder may be submitted to the DEP-ME&QA Division.

(4) Piping:

The assemblies shall be made of one (1) inch nominal size stainless steel pipe. The stainless-steel valves shall be ball type rated for at least 300 psig. The piping system including the instruments shall be factory assembled and hydro-tested at 300 psig or air tested at 100 psig; there shall be no leakage. The vent and drainage system shall be submitted for approval by ME&QA Division. Drain cleaning system rods shall be made of non-corroding material suitable for the service.

20.12.8 INSPECTION

(A) The contracted manufacturer shall submit a tentative production schedule to DEP-BWSO-ME&QA or DDC-QA (if applicable) within 30 days of receiving the order but not less than fifteen business days before starting production. In general, the purchase orders by DEP / DCAS shall be inspected by DEP-BWSO-ME&QA, and purchase orders by DDC Contractors by DDC-QA.

(B) Each tube shall be given a primer thin coating to reduce corrosion after casting. The machined tube shall not have its thickness less than the calculated thickness as shown on the manufacturing drawing. The casting shall be inspected for any defect to MSS Standard Practice SP-112. The manufacturer shall inform DEP-BWSO-ME&QA Division as well as DDC-QA (if required by the contract) for this inspection. The tube shall not be coated until this inspection is approved by DEP-BWSO-ME&QA or DDC-QA (if required).

(C) Any casting showing a defect, however minor, shall be set aside for the City of New York DEP-BWSO-ME&QA or DDC-QA engineer / inspector for evaluation and acceptance. Welding repairs, even for cosmetic purposes, are NOT PERMITTED unless approved by the DEP-BWSO-ME&QA or DDC-QA engineer.

20.12.9 TESTING

(A) Each flowmeter tube shall be hydro-tested to 300 psig for at least 20 minutes or as required to verify the integrity of the tube. The pressure shall remain steady at 300 psig.

(B) Each fully assembled flowmeter with the flanges blanked off and taps plugged, shall be hydrostatically tested at 300 psig pressure. There shall be no leakage through any joint or metal for at least twenty (20) minutes or as required for completing the leakage test.

20.12.10 COATING

(A) The inside and outside of ferrous castings shall meet the surface preparation requirements of ANSI/AWWA C550.

(B) Outside & inside surfaces of flowmeters (excluding stainless steel) shall be coated with DEP-BWSO-ME&QA approved epoxy to a dry film thickness of 12 to16 mils. Machined surfaces, spot faces and bolt holes shall be coated with DEP-BWSO approved epoxy to a maximum dry film thickness of 4 mils. All coatings shall meet the requirements of Food and Drug Administration Document, Title 21 of the Code of Federal Regulations on Food Additives, Sec. 175.300, Resinous and Polymeric Coatings or ANSI/NSF 61, Drinking Water Systems Components – Health Effects.

(C) Pota-Pox Plus Series N140, beige, as manufactured by the TNEMEC Company, Inc., Kansas City, Missouri is approved. Fusion bonded powder epoxy meeting the requirements of ANSI/AWWA C116/A21.16; fusion bonded liquid epoxy to ANSI/AWWA C550 is acceptable**.** Also, other Fusion bonded epoxy may be approved by DEP-BWSO-ME&QA before application.

(D) The coatings shall pass the holiday tests of NACE Standard SP0188, or latest revision.

20.12.11 WARRANTY PERIOD

Each flowmeter shall be warranted to be free of any material or workmanship defect for twenty-five (25) years from the time of installation, successful testing and acceptance for operation. The appurtenances shall be warranted for five (5) years.

20.12.12 INSTRUCTION MANUALS

(A) For each order of the same size and design flowmeter, six (6) copies of maintenance manuals shall be shipped to the address below at the time the flowmeter is shipped, or earlier as advised in the purchase order.

Chief Mechanical Engineering & Quality Assurance
DEP-BWSO-3rd Floor, Low Rise
59-17 Junction Boulevard
Flushing, NY 11373

(B) Each manual shall contain, at a minimum, the following:

(1) A set of all drawings for the flowmeter and the appurtenances with each part identified by a number or alphanumeric character

(2) Affidavit of Compliance with the flowmeter serial number

(3) Installation procedures

(4) Flow versus pressure differential in inches of water

(5) Maintenance schedule

(6) List of spare parts shipped

(7) Warranty

(8) Copy of the Material Release and Shipping Authorization

20.12.13 PACKING, HANDLING, AND SHIPPING

(A) REQUIRED DOCUMENTATION

(1) The manufacturer shall obtain “Material Release & Shipping Authorization” from DEP-BWSO-ME&QA or DDC-QA, as applicable, after the inspection at the manufacturing plant or after the inspection is waived, but before the Flowmeter is shipped.

(2) To obtain “Material Release & Shipping Authorization” the manufacturer shall submit three (3) copies of all MTRs and certifications as listed below to DEP-BWSO-ME&QA Division and the same to DDC-QA (for DDC contractor orders only):

(a) Flowmeter tubes – MTRs and coatings test reports.

(b) Bolts and Nuts - MTRs and certification for Fluoropolymer coating

(c) Washers - certification for Fluoropolymer coating.

(d) Gaskets - Material certifications

(e) A duly notarized Affidavit of Compliance stating that the flowmeter with serial number ----- meets all the requirements of the DEP-BWSO / DDC specification for the flowmeter dated (Specifications to which the flowmeter is made). All required tests were conducted and were satisfactory.

(B) PACKAGING

(1) The flowmeter shall be fully assembled and ready for installation except for the appurtenances. All piping, valves, flow measuring, transmitting and recording devices shall be completely drained of all fluids. All appurtenances shall be covered with vinyl or other water-proof material packed with desiccant and placed in a suitable fully enclosed sturdy box. The proposed method of packing shall be approved by the DEP-BWSO-ME&QA Engineer**.**

(2) The flowmeter shall be protected against possible damage from atmospheric conditions, vibrations and shock during shipping from the manufacturer's plant to the Bureau's designated storage area **or** the site designated by the contractor.

(3) Unless directed otherwise, each delivery shall have the following documents in triplicate (3 copies) with each shipment:

(a) Shipping document shall contain manufacturer's name, address, telephone number, Flowmeter size and serial number, appurtenances etc. Each report shall be numbered, with # 1 for the first shipping report, addressed to DCAS, DEP-BWSO, or DDC – as applicable.

(b) Affidavit of Compliance and Warranty.

(c) Material Release & Shipping Authorization issued by DEP-BWSO-ME&QA OR DDC-QA, as applicable.

(d) Copy of the installation manual

(4) The manufacturer / contractor shall make all arrangements for the transportation, handling, and delivery of all equipment furnished under this purchase order from the manufacturer's plant to the construction site or DEP storage facility. All deliveries shall be done during normal business hours.

(5) All spare parts shall be packed individually or in sets so as to arrive safely to the delivery site. These spare parts properly identified, packed and marked with the DEP / DCAS order # or DDC contract number shall be delivered to the DEP warehouse at 1201 Metropolitan Avenue, Brooklyn, NY 11237, telephone # 718-326-6903/6906,as soon as the flowmeter is shipped. The flowmeter manufacturer shall notify DEP-BWSO-ME&QA / DDC-QA & Contractor of the spare parts delivery to the DEP storage facility at Metropolitan Ave., Brooklyn.

(6) The exterior of each crate shall be marked on at least two opposite sides, as follows: The markings shall be at least two (2) inches in height, unless it is not possible to print that large.

PROPERTY OF THE CITY OF NEW YORK
BUREAU OF WATER AND SEWER OPERATIONS OR CONTRACTOR'S NAME
DEP-BWSO /DCAS PURCHASE ORDER # OR CONTRACTOR PURCHASE ORDER #
DESTINATION ADDRESS
CONTENTS AND SIZE
MANUFACTURER'S ADDRESS
MONTH AND YEAR OF MANUFACTURE
GROSS WEIGHT

20.12.14 INSTALLATION

The flowmeter manufacturer shall provide the services of factory trained technicians to supervise the installation, initial operation and testing of the flowmeters.

SECTION 20.13 – UNI-DIRECTIONAL DUCTILE-IRON VENTURI FLOWMETERS AND APPURTENANCES 30-INCH THROUGH 48-INCH DIAMETER

20.13.1 INTENT

This specification describes the requirements for design, materials, coating, shop testing etc. and delivery of uni-directional ductile-iron Venturi flowmeters and appurtenances complete in all respects for the required flow measurement and recording for the potable water supply system in The City of New York, New York.

20.13.2 QUALIFICATIONS

(A) MANUFACTURER'S QUALIFICATIONS

(1) Flowmeter and appurtenances shall be manufactured by an established and reputable manufacturer, who is experienced in the production of Venturi type flowmeters of similar design and size in compliance with similar specifications for a minimum of ten (10) years. The manufacturer shall provide the names, addresses and telephone numbers of at least five (5) municipalities or utilities, which can be contacted to verify the quality and performance of their Venturi flowmeters of the same size and comparable flow rates.

(2) Any manufacturer not pre-approved by DEP, intending to bid for these flowmeters for the NYC Water Supply System, shall submit their Quality Control and Quality Assurance manuals to DEP-BWSO-ME&QA at least 30 working days before the bid submission date. They shall also submit proof of their experience as listed in **Subsection 20.13.2(A)(1)**.

(3) The selected manufacturer shall submit detailed manufacturing drawings, flow calculations, complete bill of materials with industry standards, Quality Control & Quality Assurance procedures, and flow measurement accuracy tests to DEP-BWSO-ME&QA for approval. The flowmeters and appurtenances shall be supplied ONLY to the approved drawings and test procedures.

(4) The manufacturer shall machine, assemble and test these flowmeters with their own production force. Subcontracting or subletting any of the aforementioned portions of the work must be approved in writing by DEP-BWSO-ME&QA in advance.

(5) Regardless of the country of origin of casting and machining, assembly and flow accuracy testing, if required, shall be in the continental United States of America or Canada. DEP-BWSO-ME&QA/BEDC- QA / DDC-QA personnel may witness any or all assembly and testing during manufacture and inspection**.**

(B) FOUNDRY REQUIREMENTS

(1) All ferrous material casting foundries shall have a minimum of ten (10) years' experience in casting Ductile Iron Venturi flowmeter tubes and appurtenances of comparable size and design in ductile iron grades as specified herein.

(2) All foundries and testing facilities are subject to inspection and approval by DEP-BWSO-ME&QA.

20.13.3 DESIGN CRITERIA AND MATERIALS

(A) Since there is no industry standard for the design of Venturi Flowmeters, DEP would prefer the use of recommendations made in the report of ASME Research Committee on Fluid Meters 6th Edition. DEP will review the design and accordingly approve / disapprove it.

(B) Flowmeter shall be of pressure-differential type utilizing pure static pressure sensed at the inlet and the throat section and be capable of measuring the flow rate as listed in Table 1.

(C) The differential pressure shall indicate static pressure change only as a Herschel Standard Venturi tube.

Any device that employs entire or partial pilot effects or amplifies differential pressure by changing flow direction at the point of sensing pressure, thus introducing unwanted hydraulic noise, will not be acceptable.

Table 20.13.3.1- Flow Rates

Pipe Size OD Inches	Minimum Flow MGD	Maximum Flow MGD
30	7.50	75
36	9.0	90
48	I3	130

(D) The flowmeter maximum error over a 10 to 1 (Ten to One) range of differential pressure shall be within +/- 0.50% (one-half percent) of the actual flow rate within the specified maximum & minimum flow rate. If required under the contract, the accuracy of the flowmeter shall be demonstrated and certified by actual laboratory wet flow tests on the flowmeter supplied. The manufacturer shall provide prior independent lab wet test data on comparable size & type flowmeters made by the same manufacturer for at least 30 flowmeters even when the wet flow test is required by the contract.

(E) The flowmeter design shall comply with ANSI/AWWA C 110/A21. 10 latest edition Section 5, except for the additional requirements of this DEP specification. The design pressure shall be 200 psig. Flowmeter tubes wall thickness calculations shall be submitted. The design thickness shall have ample allowance for casting dimensions variations and machining.

(F) The inlet and outlet approach section tubes shall be cylindrical and of the same diameters as the pipes connected to them.

(1) NYC ductile-iron pipes will be cement-mortar lined to double the thickness specified in ANSI/A WWA C I 04 "Cement Mortar Lining for DI pipe & fittings".

(2) NYC steel pipes will be to ANSI /A WWA C200- cement mortar lined with inside diameter, i.e. steel barrel diameter represents the nominal pipe size. The manufacturer shall verify the pipe inside diameter to match the flowmeter inside diameter.

(3) A minor mismatch in the inside diameter is acceptable provided the manufacturer has developed the offset factor applicable to the field conditions and the offset does not exceed 6% of the actual inside diameter.

(G) The flowmeter tubes shall not have any debris-collecting cavities or annular chambers.

(H) Flowmeter inlet and outlet tube ends shall be flanged to meet the dimensional requirements of ASME B16.1 -1998 Class 125 flat face. If the flowmeter is made by joining two tubes, then the tubes connection shall also be to ASME B16.1-1998 Class 125. Bolt-holes shall straddle the tubes centerline. The flowmeter inlet and outlet tube flange bolt-holes shall be drilled larger depending upon the flange size to accommodate insulating sleeves if the mating pipe material is other than ductile-iron or if insulating flange connections are ordered.

(I) Flange back facing or spot facing, if required, shall be in accordance with MSS SP-9.The flange thickness at any point shall not be less than ASME B16.1-1998 Class 125 Table 4.

(J) The bolts for connecting the Venturi section tubes shall be to ASTM A370 grade B or SAE *1429* grade 2 / grade 5. Nuts shall be to ASTM A563 Grade C3 or DH3. Washers shall be to ASTM F436. Bolts, nuts and washers shall be Fluoropolymer coated (Tripac Fasteners coating is acceptable). Bolts, nuts and washers Fluoropolymer coated by other methods may be submitted to DEP-BWSO-ME&QA Division for approval. Proof of meeting the 1,000 hours of salt spray testing to ASTM B117 for bolts and nuts shall be submitted.

(K) The Beta ratio shall be constant for the flows specified i.e. 0.5; 0.6 or 0.7. The uncovered head loss shall not exceed 40% of the differential head at all flows in either metering direction.

(L) The Reynolds number at the flow rate shall be at least 80,000.

(M) The laying length of the throat shall be at least half the throat diameter. The throat area shall be lined with ASTM A240 Type 316L or fabricated from a centrifugal casting conforming to ASTM A276 Type 316L stainless steel. The liner shall be securely attached to the flowmeter body and shall not loosen due to pressurization / depressurization or vibrations in service.

(N) The flowmeter shall have two (2) high pressure sensing taps on inlet end two (2) low pressure sensing taps at the throat. These taps shall be at 180 degrees to each other in a horizontal plane. All taps shall be fitted with ASTM A276 Type 304L / 316L stainless steel bushings. One set of high- and low-pressure taps shall be plugged with type 316 stainless steel threaded plugs.

(O) A vent port and a drain tap at least one-inch nominal pipe diameter on both ends shall be at the highest and lowest point of the tubes. The vent ports and drain taps shall be lined with ASTM A276 304L / 316L stainless steel bushings. The vent and drain taps shall be plugged with Type 316 stainless steel threaded plugs.

(P) The flowmeter shall be installed in an underground chamber. The pipe layout shall be according to the approved installation drawings.

(Q) Flow measurement and recording devices, piping, valves etc. shall be according to **Subsection 20.13.7**

(R) All ferrous components for the flowmeters shall be Ductile Iron ASTM A536 Grade 65-45-12 or 70-50-05.

20.13.4 REPORTING REQUIREMENTS AND CERTIFICATION

Material Test Reports (chemical and physical) for bolts and nuts certified by a USA material testing laboratory and certification for steel washers is required. DEP-QA for the respective purchase order must be informed before the tests on the bolts and nuts are conducted and permission granted to proceed with the tests

20.13.5 SUBMITTALS

(A) The manufacturer shall submit four (4) sets of fully dimensioned envelope drawings and complete Bill of Materials with industry standard specifications to DEP-BWSO-ME&QA for approval. Flowmeter shall be furnished to DEP-BWSO / BEDC / DCAS or DOC contractors in accordance with these DEP-BWSO-ME&QA approved drawings only. These drawings shall have black lines on white paper. Drawings shall preferably be not larger than 11 x 17 inches. Drawings shall be signed-off with date and revision number.

(B) The manufacturer of the flowmeter shall submit fully dimensioned drawing(s) with the following information based upon their design of at least 30 (thirty) similar Venturi flowmeters actually wet tested in a certified laboratory:

(1) Flowmeter coefficient and tolerances.

(2) Proof that the coefficient is constant above a Reynolds number of 80,000 and independent of the beta ratio and line size..

(3) Effects of up-stream piping configuration on the coefficient.

(4) Permanent head loss as a percentage of the differential pressure produced.

(5) A flow-versus-differential curve for the potable water.

(6) If the flow metering accuracy required is better than 0.50% of the actual flow rate, then the flowmeter of each size ordered shall be wet tested for performance for parameters in **subsections 20.13.5(B)(1), 20.13.5(B)(2),** and **20.13.5(B)(4),** at a DEP approved laboratory. The flow test shall be an actual wet laboratory test including at

least ten (10) points between the minimum and maximum flow rates specified. Laboratory tests shall be run in each metering direction in operation.

(C) All dimensions shall be in inches. Metric equivalents are NOT ACCEPTABLE.

(D) The manufacturer shall assign a separate set of drawing numbers for NYC Flowmeters, if possible.

20.13.6 MARKINGS

(A) Each flowmeter shall have cast in raised letters at least 2-inch high and 1/8-inch relief on each tube the letters "WSNY", the manufacturer's mark (Logo), flowmeter size, port size, the year of manufacture, D.I., design pressure, country of casting (the letters shall be almost equal to the letter size of WSNY- approximately 2-inch-high 1/8th-inch relief). The casting shall also bear markings identifying the foundry as well as the heat number.

(B) Two stainless steel or copper alloy tags at least 3-inch by 1-inch shall be permanently attached with corrosion resistant screws or rivets on opposite sides of each flange circumference in a horizontal plane indicating the flowmeter serial number for each flowmeter, as approved. The serial number shall be at least 3/8th-inch high raised or punched letters. Each flowmeter shall have a unique serial number. The serial number should include manufacturer's mark & year and month of manufacture. The numbering system shall be explained on the respective drawing. The tag shall not have sharp or raised edges or corners.

20.13.7 FLOW MEASURING AND RECORDING INSTRUMENTATION, VALVES PIPING

(A) The flowmeter shall be supplied complete in all respects with the specified flow measuring and recording instrumentation, valves piping etc. as stated in this specification and the contract.

(B) The Venturi flowmeter manufacturer shall supply the following instrumentation, recorders, piping, tubing etc. in order to measure and record the flow through the flowmeter as required by the specification listed above. The manufacturer shall submit a complete list of all materials required (including those not listed below) to accomplish the purpose of the flowmeter to the subject specification for DEP-BWSO-ME&QA approval. All the instruments including but not limited to power supply, surge suppressor etc. shall be enclosed in water proof NEMA Type 4 enclosures factory assembled and tested.

(1) Differential Pressure Transmitters

Dual pressure sensors system shall be used for these flowmeters. The differential pressure transmitters shall be ABB Inc. Model 264DS. The transmitter shall be complete with all the appurtenances required to operate the system.

(2) Receiver

Each receiver shall be capable of indicating, recording and totalizing the flow or pressure, as specified in accordance with the signal transmitted by means of the telemetry signal circuit connected to each transmitter system. The receiver shall be solid state, full case instrument and shall include a programmable fluorescent display with rate indicator, totalizer and circular chart recorder. The receiver shall be provided with test points and shall have an internal calibrated signal to adjust the indicator, recorder and totalizer. The maximum error of the indicator and totalizer shall be within 0.5% of the actual flow.

(3) Recorder

The chart recorder shall be Chessell Inc., Model 394, six-channel with one pen, one totalizer and math package. The Recorder shall operate on 115-volts, 60-hertz power. It shall be equipped with regulated power supplies to power the internal electronics and the flow or pressure transmitters system within the accuracy specified for each range. Since DEP would like to record the flow data on a computer located away from the instrument room, any other suitable recorder may be submitted for DEP-BWSO-

ME&QA.

(4) Piping

The assemblies shall be made of one (1) inch nominal size stainless steel pipe. The stainless-steel valves shall be ball type rated for at least 300 psig. The piping system including the instruments shall be factory assembled and hydro-tested at 300 psig or air tested at 100 psig; there shall be no leakage. The vent and drainage system shall be submitted for approval by ME&QA Division. Drain cleaning system rods shall be made of non-corroding material suitable for the service.

20.13.8 INSPECTION

(A) The contracted manufacturer shall submit a tentative production schedule to DEP-BWSO-ME&QA or BEDC-QA / DDC-QA (as applicable) within thirty (30) days of receiving the order but not less than fifteen (15) business days before starting production. In general, the purchase orders by DEP / BEDC / DCAS shall be inspected by DEP-BWSO-ME&QA and by BEDC / DDC-QA as applicable.

(B) Each tube shall be given a primer thin coating to reduce corrosion after casting. The machined tube shall not have its thickness less than the calculated thickness as shown on the manufacturing drawing. The casting shall be inspected for any defect to MSS Standard Practice SP-112. The manufacturer shall inform DEP-BWSO-ME&QA as well as BEDC-QA / DDC-QA (if required by the contract) for this inspection. The tube shall not be coated until this inspection is approved by DEP-BWSO-ME&QA or BEDC / DDC-QA (as required).

(C) Any casting showing a defect, however minor, shall be set aside for the City of New York DEP-BWSO-ME&QA or BEDC-QA / DDC-QA engineer / inspector for evaluation and acceptance. Welding repairs, even for cosmetic purposes, are not permitted unless approved by the DEP-BWSO-ME&QA or BEDC-QA / DDC-QA engineer.

20.13.9 TESTING

(A) Each flowmeter tube shall be hydro-tested to 300 psig for at least 20 minutes or as required to verity the integrity of the tube. The pressure shall remain steady at 300 psig.

(B) Each fully assembled flowmeter with the flanges blanked off and taps plugged, shall be hydrostatically tested at 300 psig pressure. There shall be no leakage through any joint or metal for at least twenty (20) minutes or as required for completing the leakage test.

20.13.10 COATING

(A) The inside and outside of ferrous castings shall meet the surface preparation requirements of ANSI/AWWA C550.

(B) Outside & inside surfaces of flowmeters (excluding stainless steel) shall be coated with DEP-BWSO-ME&QA approved epoxy to a dry film thickness of twelve (12) to sixteen (16) mils. Machined surfaces, spot faces and bolt holes shall be coated with DEP-BWSO approved epoxy to a maximum dry film thickness of 4 mils. All coatings shall meet the requirements of Food and Drug Administration (FDA) Document, Title 21 of the Code of Federal Regulations on Food Additives, Sec. 175.300, Resinous and Polymeric Coatings or ANSI/NSF 61, Drinking Water Systems Components-Health Effects.

(C) Pota-Pox Plus Series N 140, beige, as manufactured by the TNEMEC Company, Inc., Kansas City, Missouri is approved. Fusion bonded powder epoxy meeting the ANSI/AWWA C550 is also acceptable). Any other Fusion bonded epoxy shall be approved by DEP-BWSO-ME&QA before application.

(D) The coatings shall pass the holiday tests of NACE Standard RPO 188, latest revision.

20.13.11 WARRANTY PERIOD

Each flowmeter shall be warranted to be free of any material or workmanship defect for twenty-five (25) years from the time of installation, successful testing and acceptance for operation. The appurtenances shall be warranted for five (5) years.

20.13.12 INSTRUCTION MANUALS

(A) For each order of the same size and design flowmeter, six (6) copies of maintenance manuals shall be shipped to the address below at the time the flowmeter is shipped, or earlier as advised in the purchase order.

Chief Mechanical Engineering & Quality Assurance
DEP-BWSO-3rd Floor, Low Rise
59-17 Junction Boulevard
Flushing, NY 11373

(B) Each manual shall contain, at a minimum, the following:

(1) A set of all drawings for the flowmeter and the appurtenances with each part identified by a number or alphanumeric character

(2) Affidavit of Compliance with the flowmeter serial number

(3) Installation procedures

(4) Flow versus pressure differential in inches of water

(5) Maintenance schedule

(6) List of spare parts shipped

(7) Warranty

(8) Copy of the Material Release and Shipping Authorization

20.13.13 PACKING, HANDLING, AND SHIPPING

(A) REQUIRED DOCUMENTATION

(1) The manufacturer shall obtain "Material Release & Shipping Authorization" from DEP-BWSO-ME&QA OR BEDC-QA / DDC-QA, as applicable. after the inspection at the manufacturing plant or after the inspection is waived, but before the Flowmeter is shipped.

(2) To obtain "Material Release & Shipping Authorization" the manufacturer shall submit three (3) copies of all MTRs and certifications as listed below to DEP-BWSO-ME&QA Division and the same to BEDC-QA / DDC-QA (as applicable):

(a) Flowmeter tubes- MTRs and coatings test reports.

(b) Bolts and Nuts - MTRs and certification for Fluoropolymer coating.

(c) Washers - Material certifications for Fluoropolymer coating.

(d) Gaskets - Material certifications.

(e) A duly notarized Affidavit of Compliance stating that the flowmeter with serial number----- meets all the requirements of the DEP-BWSO / DDC specification for the flowmeter dated (Specifications to which the flowmeter is made). All required tests were conducted and were satisfactory.

(B) PACKAGING

(1) The flowmeter shall be fully assembled and ready for installation except for the appurtenances. All piping, valves, flow measuring, transmitting, and recording

devices shall be completely drained of all fluids. All appurtenances shall be covered with vinyl or other water-proof material packed with desiccant and placed in a suitable fully enclosed sturdy box. The proposed method of packing shall be approved by the DEP-BWSO-ME&QA Engineer.

(2) The flowmeter shall be protected against possible damage from atmospheric conditions, vibrations and shock during shipping from the manufacturer's plant to the Bureau's designated storage area or the site designated by the contractor.

(3) Unless directed otherwise, each delivery shall have four copies of the following documents with each shipment:

(a) Shipping document shall contain manufacturer's name, address, telephone number, Flowmeter size and serial number, appurtenances etc. Each report shall be numbered with # 1 for the first shipping report addressed to DCAS / DEP-BWSO OR BEDC / DDC- as applicable.

(b) Affidavit of Compliance and Warranty.

(c) Material Release & Shipping Authorization issued by DEP-BWSO-ME&QA OR BEDC-QA / DDC-QA, as applicable.

(d) Copy of the installation manual

(4) The manufacturer / contractor shall make all arrangements for the transportation, handling, and delivery of all equipment furnished under this purchase order from the manufacturer's plant to the construction site or DEP storage facility. All deliveries shall be done during normal business hours.

(5) All spare parts shall be packed individually or in sets so as to arrive safely to the delivery site. These spare parts, properly identified, packed and marked with the DEP / DCAS order number OR BEDC / DDC contract number, must be delivered to the DEP warehouse at 1201 Metropolitan Avenue, Brooklyn, NY 11237, telephone# 718-326-6903/6906, as soon as the flowmeter is shipped. The flowmeter manufacturer shall notify DEP-BWSO-ME&QA, BEDC-QA, DDC-QA & Contractor of the spare parts delivery to the DEP storage facility at Metropolitan Ave., Brooklyn.

(6) The exterior of each crate shall be marked on at least two opposite sides, as follows:

Property of the City of New York
Bureau of Water and Sewer Operations or Contractor's Name
DEP-BWSO / BEDC / DCAS Purchase Order# or Contractor Purchase Order#
Destination Address
Contents and Size
Manufacturer's Address Month and Year of Manufacture
Gross Weight

(7) The markings shall be at least two (2) inches in height, unless it is not possible to print that large.

20.13.14 INSTALLATION

The flowmeter manufacturer shall provide the services of factory trained technicians to supervise the installation, initial operation, and testing of the flowmeters.

SECTION 21.01 – DEFINITIONS

21.01.1 DEFINITIONAL

All definitions of materials will be in accordance with the Specifications on Nomenclature of ASTM International, Designations C125, C150, E6, and E44, unless otherwise specified herein.

21.01.2 AASHTO

American Association of State, Highway and Transportation Officials.

21.01.3 ACI

American Concrete Institute

21.01.4 AGGREGATE

Mineral materials (sand, gravel, and broken stone).

(A) FINE AGGREGATE - mineral materials all of which pass a three-eighth (3/8) inch sieve.

(B) COARSE AGGREGATE - mineral materials all of which pass a three (3) inch sieve with not more than ten (10) percent passing a Number Four (4) sieve.

21.01.5 AISC

American Institute of Steel Construction

21.01.6 ANSI

American National Standards Institute.

21.01.7 ASPHALT

Any solid natural bitumen or a residue from the distillation of an asphaltic petroleum.

21.01.8 ASTM

ASTM International (formerly the American Society for Testing and Materials)

21.01.9 AWPA

American Wood Preservers Association, Chicago.

21.01.10 AWWA

American Water Works Association.

21.01.11 BITUMEN

Any natural or pyrogenous hydrocarbons soluble in chloroform.

21.01.12 CEMENT, PORTLAND

The product obtained by pulverizing clinkers consisting essentially of hydraulic calcium silicates, to which no additions have been made subsequent to calcination other than water to cool the clinkers while they are hotter than dull red and/or untreated calcium sulfate, except that not to exceed one (1) percent of other materials may be added, provided that such materials have been shown not to be harmful.

21.01.13 CENTRAL PLANT MIX CONCRETE

Concrete produced at an approved plant, ready for use prior to discharge into a transporting vehicle.

21.01.14 CLAY

An earthy or stony mineral aggregate consisting essentially of hydrous silicates of alumina, plastic when sufficiently pulverized and wetted, rigid when dry, and vitreous when fired at a sufficiently high temperature.

21.01.15 CONCRETE

A homogeneous mixture consisting essentially of cement, fine aggregate, coarse aggregate and water.

21.01.16 CONSISTENCY

The degree of workability of freshly mixed concrete as indicated by the slump test.

21.01.17 DEPARTMENT OF ENVIRONMENTAL PROTECTION (NYC DEP)

Department of Environmental Protection of the City of New York.

21.01.18 FIELD MIX

A concrete mixture whose proportions are expressed in terms of a sack of cement (one (1) cubic foot) and of separated volumes of damp-loose aggregates measured on the job. Damp-loose aggregates are considered to be materials as delivered on the job.

21.01.19 FIRE CLAY

Sedimentary clay of low flux content.

21.01.20 GRAVEL

The coarse granular material, larger than sand grains, resulting from the natural erosion of rock.

21.01.21 ICC-ES

International Code Council Evaluation Service, LLC.

21.01.22 ISO

International Standards Organization.

21.01.23 JOB MIX CONCRETE

Concrete whose constituent materials are proportioned at a central plant and mixed at the job, or concrete whose constituent materials are proportioned and mixed at a job plant.

21.01.24 NAAMM

National Association of Architectural Metal Manufacturers.

21.01.25 SAND

The fine granular material (usually less than one-quarter (1/4) inch in diameter) resulting from the natural disintegration of rock or from the crushing of rock.

21.01.26 SHALE

A thinly stratified, consolidated sedimentary clay with well-marked cleavage parallel to the bedding.

21.01.27 SIEVE

An apparatus, in which the apertures are square, for separating sizes of material.

21.01.28 SIEVE ANALYSIS

Analysis of aggregate by sieves in accordance with "Sieve Analysis of Fine and Coarse Aggregates", ASTM C136.

21.01.29 SLUMP

The settlement of the top surface of a truncated cone of freshly mixed concrete as determined in accordance with the "Method of Slump Test for Consistency of Portland Cement Concrete", ASTM C143.

21.01.30 SPIB

Southern Pine Inspecting Bureau.

21.01.31 SURFACE CLAY

An unconsolidated, unstratified clay, occurring on the surface.

21.01.32 SURFACE MOISTURE

All water carried by the aggregate other than that absorbed by the aggregate particles.

21.01.33 TRUCK MIXED CONCRETE

Concrete whose constituent materials are proportioned at a central plant and mixed with water in a transporting vehicle.

21.01.34 WATER/CEMENT RATIO

The total quantity of water entering the mixture including the surface water carried by the aggregate expressed in terms of U.S. gallons per sack (ninety-four (94) pounds) of cement.

21.01.35 WCLIB

West Coast Lumber Inspection Bureau, Seattle, Washington.

21.01.36 STANDARD DRAWINGS AND/OR STANDARD SPECIFICATIONS

Whenever any reference is made to a standard drawing and/or standard specification of any agency, authority or department, it will mean the latest edition or revision in effect at the time of invitation to bid.

SECTION 21.02 – VITRIFIED CLAY PIPE AND FITTINGS

21.02.1 INTENT

This section describes hub and spigot vitrified clay pipe and fittings for sewers and appurtenances.

21.02.2 KIND

Vitrified clay pipe and fittings must be full inside diameter Extra Strength Vitrified Pipe ("E.S.V.P."). Socket sizes must be standard or deep and wide as specified.

21.02.3 SIZE

(A) Vitrified clay pipe must be of the sizes shown in the following table:

FULL INSIDE DIAMETER EXTRA STRENGTH PIPE TABLE 21.02.3.1

(Extra Strength Pipe must conform to ASTM SpecificationC700, except as modified herein.)

TABLE 21.02.3

SIZE (Inches)	MINIMUM LAYING LENGTH (Feet)	MINIMUM THICKNESS OF BARREL (Inches)	INSIDE DIAMETER OF BARREL (Inches)		MINIMUM DEPTH OF SOCKET (Inches)
			MINIMUM	MAXIMUM	
6	2	0.6875	5.8125	6.1875	2.000
8	2	0.8125	7.7500	8.2500	2.250
10	2	1.0000	9.7500	10.2500	2.375
12	2	1.1250	11.6875	12.3125	2.500
15	3	1.5000	14.6875	15.3125	2.625
18	3	1.8750	17.5625	18.4375	2.750
24	3	2.5000	23.4375	24.5625	3.125
30	3	3.0000	29.3750	30.6250	3.375
36	3	3.5000	35.2500	36.7500	3.750

(B) Size of pipe and fittings must be as specified.

21.02.4 BRAND

Each pipe must have clearly impressed on its outer surface the class of pipe, the name of manufacturer, and the factory in which it was made. No more than one (1) brand of pipe for any one (1) size will be permitted.

21.02.5 MATERIAL, WORKMANSHIP AND FINISH

(A) Vitrified pipe must be manufactured from surface clay, fire clay, shale, or a combination of these materials.

(B) Vitrified pipe must be thoroughly and perfectly burned without warps, cracks, or other imperfections, and must be unglazed fully. Only fully unglazed pipe will be acceptable.

21.02.6 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) GENERAL REQUIREMENTS - Pipe and fittings must comply with the requirements of ASTM Specification for Extra Strength Clay Pipe - Designation C700 except as modified herein.

(B) DIMENSIONS - Dimensions must be in accordance with the Full Inside Diameter Extra Strength Pipe Table in **Subsection 21.02.3(A)**.

(C) SHAPE - All pipe must be circular with hubs true and concentric with the barrel of the pipe.

(D) STRAIGHTNESS - Pipe intended to be straight must have a maximum ordinate, as measured from the concave side of the pipe, of not more than one-eighth (1/8) inch per foot of length.

(E) FITTING - Curved pipe must be furnished in one-eighth (1/8) and one-quarter (1/4) bends as shown, specified or required. Slants, branches and split pipe must be in accordance with ASTM C700.

(F) STRENGTH, ABSORPTION AND RESISTANCE TO ACIDS - Crushing strength (by the three-edge bearing method), absorption and resistance to acids must be in accordance with ASTM C700.

(G) SOUNDNESS - When it is broken, vitrified pipe must show dense and solid material, without serious cracks or laminations. It must be of such toughness that it can be worked with a chisel and hammer, and when struck with a hammer, it must have a metallic ring.

21.02.7 JOINTS

Joint material must conform to the requirements of **Section 21.07**, and unless otherwise shown, specified or ordered must be Type 3 - Elastomeric Pipe Joint.

21.02.8 VISUAL INSPECTION

Vitrified pipe and fittings will be subject to visual inspection at the site of the work. Individual imperfect pieces may be rejected on account of any of the following:

(A) DIMENSIONS - Variations in any dimension exceeding the permissible variations given in the Full Inside Diameter Extra Strength Pipe Table in **Subsection 21.02.3(A)**.

(B) BARREL OR SOCKET FRACTURES OR CRACKS - Fractures or cracks passing through the barrel or socket, except that a single crack in the spigot or a single fracture in the socket which will not affect the strength of the joint may be permitted.

(C) INTERIOR CHIPS OR FRACTURES - Chips or fractures on the interior of the pipe or fitting exceeding two (2) inches in length, one (1) inch in width, and of a depth more than one-quarter (1/4) of the thickness of the shell.

(D) BLISTERS - Blisters that are broken or of such size or shape that will impair the strength of the pipe.

(E) FIRE OR HAIR CRACKS - Fire cracks or hair cracks sufficient to impair the strength, durability or serviceability of the pipe.

(F) STRAIGHTNESS - Variation in straightness exceeding permissible variation given in **Subsection 21.02.6(D)**.

(G) SPURS - Insecure attachment of spurs on branches.

SECTION 21.03 – CAST IRON PIPE AND FITTINGS

21.03.1 INTENT

This section describes bell and spigot cast iron pipe and flexible joint cast iron pipe, including fittings and special castings, for sewers and appurtenances.

21.03.2 KIND

(A) Cast iron pipe and fittings must be of the following classes:

BELL AND SPIGOT CAST IRON PIPE AND FITTING CLASS TABLE 21.03.2.1

CLASS	SIZE	CLASS OF FITTING
50, 100 and 150	6 " to 12", Inclusive	D
50 and 100	14" to 24", Inclusive	B
150	14" to 24", Inclusive	D
50	30" to 60", Inclusive	A
100	30" to 60", Inclusive	B
150	30" to 60", Inclusive	C

Note: Class 100 - Flexible Joint Pipe (Metropolitan Type)

(B) Class 50 must be used unless otherwise specified.

21.03.3 SIZE

(A) Cast Iron pipe must be of the sizes shown in ANSI/AWWA C102/A21.2, ANSI/AWWA C106/A21.6, and ANSI/AWWA C108/A21.8.

(B) Size of pipe and fittings must be as specified.

(C) Special castings must be of the sizes and dimensions as shown on the contract drawings, as per specifications, or as directed by the Engineer.

21.03.4 BRAND

(A) Every pipe and fitting must have distinctly cast upon it the initials of the manufacturer's name for identification.

(B) The weight and class letter must be conspicuously painted by the manufacturer, with white oil paint, on the inside of each pipe and fitting after the coating has become hard.

21.03.5 MATERIAL AND WORKMANSHIP

(A) Pipe, fittings, and special castings must be made of cast iron of good quality, and of such character as to make the metal of the castings strong, tough and of even grain, and soft enough to satisfactorily allow for drilling and cutting. The metal must be made without any admixture of cinder iron or other inferior metal and must be re-melted in a cupola or air furnace.

(B) Pipe, fittings, and special castings must be smooth, free from scale, lumps, blisters, sand holes, and defects of every nature which render them unfit for the use for which they are intended. No plugging or filling will be allowed.

21.03.6 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) Iron pipe pit cast must comply with the requirements of ANSI/AWWA C102/A21.2 “American Standard for Cast Iron Pit Cast Pipe for Water or Other Liquids”. Iron pipe centrifugally cast must comply with the requirements of ANSI/AWWA C106/A21.6 “American National Standard for Gray Iron Pipe Centrifugally Cast in Metal Molds for Water or Other Liquids” and ANSI/AWWA C108/A21.8 “American National Standard for Cast Iron Pipe Centrifugally Cast in Sand-Lined Molds for Water or Other Liquids”.

Fittings must comply with the requirements of AWWA C100 “AWWA Standard for Cast Iron Pressure Fittings”.

(B) Dimension, weight and allowable variations of pipe and fittings must be in accordance with the contract drawings, specifications and as directed by the Engineer.

(C) Special castings must comply with the requirements stipulated herein for pipe and fittings.

21.03.7 COATING

Every pipe, fitting, and special casting must be thoroughly and evenly coated inside and outside with an approved coal tar pitch varnish. The coating must be smooth, tough, and tenacious when cold and must not be brittle or have any tendency to scale off.

21.03.8 JOINTS

Joints must comply with the requirements of **Subsection 21.06.5** as defined for ductile iron pipe.

SECTION 21.04 – CAST IRON SOIL PIPE AND FITTINGS

21.04.1 INTENT

This section describes hub and spigot cast iron soil pipe and fittings for sewers and appurtenances.

21.04.2 KIND

Cast iron soil pipe and fittings must be extra-heavy cast iron, must be uniformly coated with coal tar pitch inside and outside, and must conform to ASTM A74 and ANSI A112.51.

21.04.3 JOINTS

Joints for hub and spigot cast iron soil pipe and fittings must be made with positive double seal compression type rubber gaskets conforming to ASTM C564.

21.04.4 SIZE

(A) Cast iron soil pipe must be of the sizes shown in the following table:

HUB AND SPIGOT CAST IRON SOIL PIPE TABLE 21.04.4.1

NOMINAL INSIDE DIAMETER (Inches)	THICKNESS OF BARREL (EXTRA-HEAVY) (Inch)	TOLERANCE FOR THICKNESS OF BARREL (Inch)
6	0.25	-0.03 to +0.06
8	0.31	-0.06 to +0.09
10	0.37	-0.06 to +0.09
12	0.37	-0.06 to +0.09
15	0.44	-0.06 to +0.09

(B) Size of pipe and fittings must be as specified.

21.04.5 MATERIALS AND MANUFACTURE

(A) The pipe and fittings must be iron castings suitable for installation and service in sewer lines and must meet all applicable requirements and tests.

(B) The castings must be made of gray cast iron, produced by an established commercial method that provides adequate control over chemical and physical properties. The castings must be sound, true to pattern, and of compact close grain that permits drilling and cutting by ordinary methods. The interior surface must be reasonably smooth and free from defects that would make the castings unfit for the use for which they are intended.

21.04.6 COATING

The pipe and fittings must be uniformly coated with coal tar pitch; or similar material suitable for the purpose; that is adherent, not brittle, and without a tendency to scale. The coating must be evenly and smoothly applied to all surfaces.

21.04.7 MARKING

Each length of pipe and each fitting must be plainly marked with the manufacturer's initials or registered trademark by which the manufacturer can be readily identified, and with letters to indicate the proper classification. **(ex. XH - Extra-Heavy)**

The marking may be cast, stenciled, or otherwise applied on the pipe so as to be clear and legible at the time of installation. The marking must be cast on fittings and must be located away from the spigot end so as not to interfere with proper joining upon installation.

21.04.8 CERTIFICATION

The Contractor must submit to the Engineer the Manufacturer's sworn statement that the inspection and all specified tests have been made and the results thereof comply with the requirements of ASTM A74.

21.04.9 INSPECTION

Pipe and fittings must be subject to visual inspection at the site of the work. Individual imperfect pieces that are not sound or are not free from cracks, sand holes, blowholes, and cold spots will be rejected.

SECTION 21.05 – PRECAST REINFORCED CONCRETE PIPE

21.05.1 INTENT

This section describes unlined precast reinforced concrete pipe for sewers and appurtenances.

21.05.2 KIND

(A) Precast reinforced concrete pipe must be of the kinds and classes prescribed in ASTM C76, except as otherwise noted.

(B) Kind and class of pipe must be as specified.

21.05.3 SIZE

(A) Precast reinforced concrete pipe must be of the sizes prescribed in ASTM C76.

(B) Size of pipe must be as specified.

21.05.4 MATERIALS, WORKMANSHIP, AND FINISH

(A) CONCRETE - The Concrete must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**, and be a homogeneous mixture of such proportions and quality that the pipe will conform to the design and test requirements of these specifications.

(B) CEMENT - Cement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**, and must be Portland Cement (Type II - Moderate Sulfate Resistant).

(C) AGGREGATES - Fine aggregate and coarse aggregate must conform to the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(D) CONCRETE REINFORCEMENT - Reinforcing steel must be steel bars or steel wire fabric conforming to the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**. Steel reinforcing must be circular. Elliptical or Quadrant reinforcing will not be permitted for Class III, IV, or V pipe.

(E) FORMS - Pipe must be cast with perfectly machine-faced castings for forming the bell and spigot so that they will be true circles, and when laid together, the annular space must be perfectly uniform. The inner and outer castings must be sheet steel fitted to the top and bottom rings. Shell casings must be accurately formed to true concentric cylinders with tight joints. Approved sockets for spurs must be cast or cut to the sizes specified and approved with approved covers. The bells of the pipe must be reinforced with a single cage of steel in which the circumferential members are the same gage as those in the body of the pipe but spaced no more than one (1) inch on centers.

(F) CASTING PIPE - The pipe must be made by a manufacturer who has previous experience in the manufacture of reinforced concrete pipe.

(G) FINISH - Inside surface of pipe must be smooth.

(H) Holes drilled or cast into pipe for lifting bolts must be adequately plugged with a suitable precast concrete plug that must be properly grouted and sealed before backfill is placed.

21.05.5 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) All requirements of ASTM C76 must be conformed to in the manufacture of precast reinforced concrete pipe including Section 9.3 - External Load Crushing Strength Test Requirements and Section 9.4 - Concrete Test Requirements, except as modified herein.

(B) DIMENSIONS - Dimensions must be in accordance with the following table and notes:

1- No individual length of pipe will be less than four (4) feet.

2- **MINIMUM SHELL THICKNESS TABLE 21.05.5.1**

INTERNAL DIAMETER (Inches)	MINIMUM SHELL THICKNESS (Inches)
24	3.00
30	3.50
36	4.00
42	4.50
48	5.00
54	5.50
60	6.00
66	6.50
72	7.00
78	7.50
84	8.00
90	8.50
96	9.00

NOTES: (Variation in shell thickness of minus five (5) percent at any point will be permitted.

3. Variations of the internal diameter must not exceed the following:

SIZE OF PIPE	CULVERT PIPE (ASTM C76)
36 Inch and Smaller	1.00%
Over 36 Inch	0.75%

4. For intermediate sizes interpolate from ASTM tables.

5. Mating pipe sections, whose dimensions lie within the tolerances herein before specified, resulting in joints which are not smooth, prevent easy and proper assembly, or prevent close jointing will not be accepted.

6. Mating pipe sections must have diameters of tapered bell and spigot surfaces that do not vary more than one-sixteenth (1/16) inch from the theoretical diameters.

(C) SHAPE - All pipe must be circular. The planes of the ends of the pipe must be perpendicular to the longitudinal axis.

All steel reinforcing must be circular, at no time will elliptical or quadrant reinforcing be acceptable. When greater strength test requirements are specified, the thickness of pipe and the area of circular steel reinforcement must be increased, or elliptical steel reinforcement may be added to the circular steel reinforcement, all as approved by the Engineer.

(D) JOINTS - Pipe must be constructed with approved lap or bell and spigot joints that will permit watertight, smooth, and permanent joints. The joint must not project beyond the barrel of the pipe for pipes greater than forty-two (42) inches in diameter. Pipe with butt or square ends will not be accepted.

The following type joint will be acceptable:

TYPE 4 JOINT - Ring Rubber Gasket of Circular Cross Section and Grooved Spigot Joint.

For Type 4 Joint (Ring Rubber Gasket of Circular Cross Section and Grooved Spigot Joint), the thickness of the pipe at the root of the bell or socket must not be less than one-half (1/2) the thickness of the pipe barrel. The length of the spigot and the depth of the bell or socket must be equal and must be a minimum of three (3) inches. The conic surfaces of the inside of the bell or socket and the outer surface of the spigot must be parallel and the angle of taper on these conic surfaces with respect to the longitudinal axis of the pipe must not exceed two (2) degrees. The spigot end of the pipe must be grooved a minimum distance of three-quarter (3/4) inch from the end of the spigot to the edge of the groove. The dimensions of the groove must be such that the area of the groove plus the annular space immediately adjacent to the groove must be ten (10) percent to fifteen (15) percent smaller than the area of the ring gasket when the gasket is in position in the groove prior to the joining of the pipe sections.

(E) STRENGTH AND ABSORPTION - Crushing strength by the three-edge bearing method and absorption must be in accordance with ASTM C76, except as otherwise noted.

21.05.6 VISUAL INSPECTION

Precast reinforced concrete pipe will be subject to visual inspection at the site of the work. Individual imperfect pieces may be rejected on account of any of the following:

(A) FRACTURES OR CRACKS - Fractures or cracks passing through the shell, except that a single end crack that does not exceed the depth of the joint will not be cause for rejection. However, if such single end cracks exist in more than ten (10) percent of the pipe inspected, all of the defective pipe will be rejected.

(B) MIXING AND MOLDING IMPERFECTIONS - Defects that indicate imperfect mixing and molding.

(C) SURFACE DEFECTS - Surface defects indicating honeycombed or open texture.

(D) SPALLS - Spalls deeper than one-half (1/2) the depth of the joint or extending more than four (4) inches around the circumference. However, if spalls not deeper than one-half (1/2) the depth of the joint or extending not more than four (4) inches around the circumference exist in more than ten (10) percent of the pipe, all the defective pipes will be rejected.

(E) MISPLACED REINFORCEMENT - Exposure of the circumferential reinforcement when such exposure would indicate that the reinforcement is misplaced.

(F) WATER DEFICIENCY - The complete absence of distinct web-like markings, which is indicative of a possible deficiency of water in the concrete mix, on the external surface of pipe made by any process in which the forms are removed immediately after the concrete has been placed.

21.05.7 MARKING

Each length of pipe must be plainly marked with the manufacturer's initials or registered trademark by which the manufacturer can be readily identified, the lot number, and the size and class of pipe. The marking may be stenciled, or otherwise applied on the pipe so as to be clear and legible at the time of installation.

SECTION 21.06 – DUCTILE IRON PIPE

21.06.1 INTENT

This section describes ductile iron pipe for sewers and appurtenances.

21.06.2 KIND

Pipe must be centrifugally cast Ductile Iron Pipe, 60-42-10 grade to be complied with ASTM E32 and AWWA C151, and must be ceramic epoxy lined. Ductile Iron Pipe must be Class 56 unless otherwise indicated.

21.06.3 BRAND

The weight, class or nominal thickness, and casting period must be shown on each pipe. The manufacturer's mark, the year of manufacture, and the letters "DI" or "DUCTILE" must be cast or stamped. All markings must be clear and legible and cast on or painted on or near the bell with an approved durable paint that will withstand field handling. Markings must be in accordance with ANSI Specification A21.51.

21.06.4 MATERIAL

Pipe must be centrifugally cast Ductile Iron Pipe, 60-42-10 grade and Class 56, in conformance with ANSI/AWWA C151/A21.51, unless otherwise indicated.

All inside surfaces of ductile iron pipes and fittings must be ceramic epoxy lined (amine cured novolac epoxy containing at least twenty percent (20%) by volume of ceramic quartz pigment as manufactured by US Pipe “PROTECTO 401 Ceramic Epoxy”, or an approved equivalent.).

All outside surfaces of ductile iron pipe and fittings must be coated with an asphaltic coating in conformance with ANSI/AWWA C151/A21.51.

Laying lengths must not exceed twenty (20) feet.

21.06.5 JOINTS

Unless otherwise specified all joints for Ductile Iron Pipe must be Push-On Joints.

The following type joints must be used as specified:

(A) PUSH-ON JOINTS - Push-on joints must be the Tyton Joint of U.S. Pipe and Foundry Company, the Fastite Joint of the American Cast Iron Company or such other joint as may be approved as equal by the City. For each bell, there must be furnished a rubber gasket. All of the above must conform to the applicable provisions of ANSI Specification A21.11.

Unless otherwise specified, push-on joints must be used for catch basin connections.

(B) MECHANICAL JOINTS - The joint material must conform to requirements of ANSI Specification A21.11. The mechanical joint installation must conform to ANSI Specifications. Surface of joint in contact with rubber gasket seal must be brushed thoroughly with a wire brush just prior to assembly and all loose rust or foreign material must be removed. The cleaned surface must be brushed with soapy water just prior to slipping with torque indicating wrenches. The applied torque must be within the ranges shown below:

SIZE OF BOLT	TORQUE (Foot-Pounds)
5/8"	40-60
3/4"	50-90
1"	70-100

When tightening bolts, the flanges must be brought up toward the pipe flanges evenly by partially tightening first the bottom bolt, then the top bolt, then the side bolts, and repeating the cycle until all bolts are within the specified torque range. Over stressing of bolts to obtain tightening will not be permitted.

Mechanical joints showing visible leakage at the maximum permitted torque must be disassembled, thoroughly cleaned, and reassembled.

(C) FIELD LOK GASKET SYSTEM - Field Lok Gasket Systems must be as manufactured by the U.S. Pipe and Foundry Company or approved equal.

These gaskets must be installed on Tyton Joint Pipe (4" thru 12") and Fittings where specified in the contract documents.

(D) TR FLEX RESTRAINED JOINT - TR Flex Restrained Joint Pipe must be as manufactured by the U.S. Pipe and Foundry Company or approved equal.

These joints must be employed where specified in the contract documents.

TR Flex Pipe must conform to applicable requirements of ANSI/AWWA C151/A21.51. TR Flex Fittings must conform to applicable requirements of ANSI/AWWA C110/A21.10.

21.06.6 LINING

All ductile iron pipe sewers must be ceramic epoxy lined. Ceramic epoxy lining must be applied in accordance with the pipe manufacturer's recommendations and procedures. The thickness of the lining must be a minimum of forty (40) mils thick.

21.06.7 INSPECTION AND ACCEPTANCE

Final acceptance will be based on tests and values conforming to ANSI/AWWA C151/A21.51. NYC DEP amends the text in ANSI/AWWA C151/A21.51 on Sampling to read as follows: "At least one (1) tensile sample and six (6) $70^oF \pm 10^oF$ ($21^oC \pm 6^oC$) Charpy impact samples must be taken from pipe during each casting period of approximately three (3) hours, such that each hour of production is equally represented. As an alternate, one (1) tensile and two (2) $70^oF \pm 10^oF$ ($21^oC \pm 6^oC$) Charpy impact samples must be taken from pipe made from every fifth ladle in which inoculations for ductile iron had been done, provided that less than three (3) hours have elapsed between the first and fifth ladle inoculations. Samples must be selected to properly represent extremes of pipe diameters and thicknesses."

If ductile iron pipe being made for New York City is intermixed with pipe being made for others, the New York City pipe must be the source of the sample, as closely located as possible to the above criteria of time or ladle.

Rejected New York City pipe must have all New York City identifying cast on or painted on markings removed as soon as possible after rejection.

From the last length of pipe poured from each ladle in which inoculation for ductile iron is done, a ring must be cut from the spigot end. A ring section from such ring, at least one (1) inch wide, must be subjected to pressure along a diameter and the deflection measured. Preliminary evidence of ductility will be presumed if the minimum deflection without failure is as follows:

NOMINAL SIZE OF PIPE	MINIMUM DEFLECTION
6"	0.500"
8"	0.625"
10”	0.750”
12"	0.875"
16"	1.125"
18"	1.250"
24"	1.625"
30"	2.000"
36"	2.375"
42"	2.750"
48"	3.125"

If a ring does not meet the above deflection test, a second ring will be cut and tested. If both rings fail, either all pieces of pipe from that ladle will be rejected by the manufacturer; or each New York City pipe from that ladle successively preceding that pipe during manufacture must be tested as above for preliminary acceptance. When a pipe from that ladle is reached which passes the deflection test, that pipe and the other pipes from that ladle preceding it will be considered acceptable, subject to final acceptance tests.

Pipe failing the deflection test must have all New York City identifying marks removed. If all pipe made from that ladle fail, a pipe cast from the last previous and first subsequent ladle must be retested to assure that the failures are confined to the bracketed ladle.

In lieu of ring tests for preliminary evidence of ductility, the City may accept an alternate test offered by a manufacturer, provided that, in the opinion of the City, it gives such evidence of ductility and that the frequency of such test during manufacture is acceptable to the City.

In addition to such inspection, the Contractor must furnish certified physical test reports to the Engineer. In lieu of in-plant inspection the Engineer may accept such certified physical test reports as evidence of compliance with this specification. Factory inspection by the City, waiving, or furnishing of certificates will in no way be construed as relieving the Contractor of responsibility for compliance with the requirements of the above specification.

21.06.8 FIELD CUTTING

Ductile Iron Pipe must be cut only by means of abrasive saws, hacksaws, wheel-type cutters, or milling-type cutters. The use of "squeeze" type pipe cutters and cutting torches will not be permitted. The use of diamond points and dog chisels will not be permitted.

SECTION 21.07 – JOINT MATERIALS FOR PIPE

21.07.1 INTENT

This section describes materials for jointing vitrified clay pipe, concrete pipe, and cast iron pipe for sewers and appurtenances.

21.07.2 KIND

(A) Joints must be of the following types:

Type 1 - Gasket and Mortar Joint
Type 2 - Premoulded Bituminous Compound Joint
Type 3 - Elastomeric Pipe Joint
Type 4 - Ring Rubber Gasket of Circular Cross Section and Grooved Spigot Joint
Type 5 - Flexible Butyl Gasket

(B) Type must be as specified.

21.07.3 MATERIAL

(A) TYPE 1 - Gasket and Mortar Joint must consist of a caulked jute or oakum gasket, and cement mortar packing.

(B) TYPE 2 - Premoulded Bituminous Compound Joint must consist of collars of bituminous compound cast in the bell and on the spigot ends of the pipe. Each of the collars must have a minimum thickness of one-quarter (1/4) inch and their surfaces must be concentric with the pipe. Immediately prior to joining the pipes, the collars must be suitably treated.

(C) TYPE 3 - The design of the joint must conform to ASTM C425 Type I, II, or III.

The elastomeric material in the joint must conform to the gasket specified in ASTM C361, except that for Type I and Type II joints the tensile strength must not be less than six hundred (600) pounds per square inch and the elongation at break must not be less than three hundred (300) percent.

The semiflexible material used in the Type II or Type III joint must be a polyester resin.

(D) TYPE 4 - The ring rubber gasket must conform to the requirements of ASTM C443. The outer diameter of the spigot surface must be grooved. The inner diameter of the bell surface must be such that when a round rubber gasket is snapped into the spigot groove and the two (2) pipes drawn together, the gasket must completely fill the annular space at the groove between the bell and spigot.

(E) TYPE 5 - The flexible butyl gasket joint material must conform ASTM C990, and be of either rectangular or circular shape with a minimum cross-sectional area of 0.78-square inches. The pipe joint material must be applied to both circumferential planes of the pipe joint, utilizing a primer specifically designed by the pipe joint manufacturer for such purpose. The joints must be hand cleaned of all foreign material prior to placing the joint material and primer. The joint material must be overlapped (not butted) to assure a complete seal.

21.07.4 CHEMICAL AND PHYSICAL REQUIREMENTS, INGREDIENT MATERIALS

(A) PREMOULDED BITUMINOUS COMPOUND - The compound must be a homogeneous mixture of asphaltic cement derived from processed natural asphalt or derived from the distillation of asphaltic petroleum with inert mineral flour. The mineral flour must be slate, limestone, dolomite,

or the mineral matter contained in natural asphalt.

(1) The compound must contain not less than thirty-five (35) or more than fifty-five (55) percent by weight of mineral flour. The mineral flour must be free from lumps and foreign material, and must be thoroughly dry when used. It must pass the following sieve analysis:

Pass No. 200 Sieve - 99% to 100%
Pass No. 325 Sieve - 95% to 100%

(2) The compound must comply with the following requirements:

Softening Point (Ring and Ball Method)	230°F minimum
Penetration at - 77°F, 100-gm., 5-sec.	4 to 15-cm.
115°F, 50-gm., 5-sec.	15-cm. maximum
Total Bitumen Soluble in Chloroform	45% to 65%

(B) MORTAR - Mortar must be Non-Air Entrained Portland Cement Mortar (Maximum 4% entrapped air) for spaces less than one (1) inch and must comply with the requirements of **Section 23.03**.

SECTION 21.08 – POLYMER CONCRETE PIPE

21.08.1 INTENT

This section describes polymer concrete pipe for use in microtunneling/pipe jacking installation operations of sewers and appurtenances. Polymer concrete pipe must be manufactured in accordance with ASTM D6783. Where requirements herein specified are more stringent than ASTM requirements, the more stringent specification will apply.

21.08.2 KIND

(A) Polymer concrete pipe must be a very dense, nonporous, corrosion-resistant and homogeneous composite structure of the classes prescribed in ASTM D6783.

(B) Unless otherwise specified, pipe must be Class V.

21.08.3 SIZE

(A) Polymer concrete pipe must be of the sizes prescribed in ASTM D6783.

(B) Size of pipe must be as specified.

21.08.4 MATERIALS, MANUFACTURE AND PRODUCT CONSTRUCTION

(A) POLYMER CONCRETE: The Polymer Concrete must be a very dense, corrosion-resistant and homogeneous mixture of cured thermosetting resin and kiln-dried silicate aggregate in such proportions and quality that the pipe will conform to the design and test requirements of these specifications. It may also contain curing agents, granular or platelet fillers, thixotropic agents, pigments, or dyes.

(B) THERMOSETTING RESIN: Thermosetting Resin must comply with the requirements of ASTM D6783. Unless otherwise approved prior to manufacture, only polyester or vinyl-ester resin systems must be used. Pipe must not contain Portland cement or other corrodible elements.

(C) FILLER: Kiln-dried silicate aggregates, sand and quartz powder must conform to the requirements of ASTM C33.

(D) ADDITIVES: Resin additives, such as curing agents, granular or platelet fillers, thixotropic agents, pigments and or dyes, when used, must not be detrimental to the pipe.

(E) FORMS: Pipe must be cast with perfectly machine-faced castings for forming the joint so that they will be true circles, and when laid together, the annular space must be perfectly uniform. The inner and outer castings must be sheet steel fitted to the top and bottom rings. Shell casings must be accurately formed to true concentric cylinders with tight joints. Approved sockets for spurs must be cast or cut to the sizes specified and approved with approved covers.

(F) CASTING PIPE: Pipe must be manufactured by the vibratory vertical casting process resulting in a dense, nonporous, corrosion-resistant, and homogeneous material.

(G) ELASTOMERIC GASKETS: All Gaskets must meet the requirements of ASTM F477. Gaskets must be Ethylene Propylene Diene Monomer (EPDM) or Styrene Butadiene Rubber (SBR) and suitable for the service intended.

(H) STAINLESS STEEL SLEEVE COUPLING: Stainless steel joint sleeve couplings must meet the requirements of ASTM A276.

(I) JOINTS: Joints must meet the requirements of ASTM D4161. The pipe must be connected with a stainless steel sleeve coupling. This coupling must either be mounted integral to the pipe at one end and utilize an elastomeric sealing gasket at the other end or must utilize elastomeric sealing gaskets at both ends as the means to maintain water-tightness. The joints must have an outside diameter equal to or slightly less than the outside diameter of the pipe. When the pipe is assembled, the joints must be essentially flush with the outside diameter of the pipe. Joints at tie-ins must be as approved in writing by the Engineer.

(J) FITTINGS: Fittings must be of the same structural design and materials as adjoining pipe. Fittings must be manufactured with mitered sections of pipe and joined by epoxy bonding.

(K) SPECIAL REQUIREMENTS: When specifically required by the contract polymer concrete pipe must be provided with threaded injection ports and check valves with stainless steel threaded plugs for the

introduction of an external bentonite lubricant for long bores/drives or for the introduction of grout for the filling of void between the outside of the pipe and the soil

(L) FINISH: Inside surface of pipe must be smooth.

(M) LIFTING BOLT HOLES: Holes drilled or cast into pipe for lifting bolts must be adequately plugged with a suitable polymer concrete plug that must be properly glued and sealed before backfill is placed.

(N) MANUFACTURER'S EXPERIENCE: The pipe manufacturer must have employed manufacturing methods and material formulations in the manufacture of polymer concrete pipe for a minimum of five (5) years. The manufacturer must provide a list of references that demonstrate the successful installation of a minimum of one thousand (1,000) feet of polymer concrete pipe by using pressurized face microtunneling/pipe jacking equipment with a closed face tunnel shield and positive controlled face pressure within the United States. The Manufacturer must submit such references, which must include, at a minimum the description of the project(s), a listing of the location(s), date of project(s), owner, pipe class and size, type of installation equipment utilized, maximum line and grade deviations and other information relevant to the issue of the successful installation of polymer concrete pipe.

21.08.5 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) The polymer concrete pipe must conform to the minimum structural standards as follows:

Axial Compressive Strength	12,000-psi	ASTM C579, Method B
Flexural Modulus Of Elasticity	3,600,000-psi	ASTM D790
Tensile Strength	800-psi	ASTM D638
Flexural Strength	2,600-psi	ASTM D790
Absolute Roughness	0.4×10^{-4}-ft.	

(B) WORKMANSHIP:

(1) Each pipe must be free from all defects, including indentations, cracks, foreign inclusions, and resin-starved areas that, due to their nature, degree, or extent, detrimentally affect the strength and serviceability of the pipe. The pipe must be as uniform as commercially practicable in color, opacity, density, and other physical properties.

(2) The inside surface of the pipe must be free of bulges, dents, ridges, and other defects that result in a variation of inside diameter of more than one-eighth (1/8) inch from that obtained on adjacent unaffected portions of the surface.

(3) Joint sealing surfaces must be free of dents, gouges, and other surface irregularities that will affect the integrity of the joint.

(C) DIMENSIONS AND TOLERANCES: All pipes must be circular.

(1) Inside Diameters - Inside Diameters and tolerances on inside diameters for pipe must be in accordance with ASTM D6783.

(2) Lengths - Pipe must be supplied in nominal lengths of eight (8) or ten (10) feet. Tolerance on nominal length for pipe must be ±1-inch.

(3) Wall Thickness - Wall thicknesses and tolerances on wall thicknesses for polymer concrete pipe must be in accordance with ASTM D6783. The minimum wall thickness, measured at the narrowest point along the pipe, must provide sufficient axial compression strength to withstand anticipated loads. Unless otherwise specified, the minimum factor of safety against ultimate jacking load must be 3:1.

(4) End Squareness - The planes of the ends of the pipe must be perpendicular to the longitudinal axis within a tolerance of 0.06-inch for nominal diameters through 39-inches, 0.12-inch for nominal diameters 42-inches through 102-inches, and 0.20-inch for nominal diameters 108-inches through 144-inches when measured in accordance with ASTM D6783.

(5) Pipe Straightness - The pipe must not deviate from straight by more than 0.04-inch/foot for nominal diameters through 39-inches, 0.06-inch/foot for nominal diameters 42-inches through

78-inches, and 0.08-inch/foot for nominal diameters 84-inches through 144-inches when measured in accordance with ASTM D6783.

(6) Pipe Roundness - The outside diameter must not vary from true circle by more than one percent (1.0%) when measured in accordance with ASTM D6783.

21.08.6 SAMPLING AND TESTING

All sampling and production testing (for workmanship, dimensional, and physical requirements), qualification testing (for hydrostatic pressure, chemical resistance, joint tightness), and control testing (for chemical resistance) must be done in accordance with ASTM D6783.

21.08.7 INSPECTION

(A) PLANT INSPECTION: The City and/or the City's designated representative must be entitled to inspect and witness the manufacturing process of the pipe.

(B) VISUAL INSPECTION: Polymer concrete pipe must be subject to visual inspection at the site of the work by the Engineer. The Engineer may reject any individual imperfect pieces on account of any chemical and/or physical defects in workmanship as stated in **Subsection 21.08.5**. However, if such chemical and/or physical defects exist in more than ten (10) percent of the pipe inspected, the entire lot of defective pipe must be rejected.

21.08.8 MARKING

Each length of pipe must be plainly marked with the manufacturer's initials or registered trademark by which the manufacturer can be readily identified, the lot number and the size and class of pipe. The marking may be stenciled, or otherwise applied on the pipe so as to be clear and legible at the time of installation.

21.08.9 PACKAGING, HANDLING, AND SHIPPING

Packaging, handling and shipping must be performed in accordance with the Manufacturer's instructions or ASTM D6783; whichever is more stringent.

SECTION 22.01 – IRON CASTINGS, GRAY AND MALLEABLE

22.01.1 INTENT

This section describes Gray Iron and Malleable Iron Castings in the borough in which the work is being performed for sewers and appurtenances.

Gray iron and malleable iron are not to be used for valves, cast iron pipes, or castings subject to high temperatures.

22.01.2 KIND

(A) Iron castings must be of the following types:

Type 1 - Gray Iron Castings

Type 2 - Malleable Iron Castings

(B) Gray iron castings must be at least Class No. 30B, with a minimum tensile strength of thirty thousand (30,000) pounds per square inch as per ASTM A48.

(C) Malleable iron must be Grade 32510, ASTM A47.

22.01.3 SIZE, WEIGHT AND LOT NUMBER

(A) Castings must conform to either the drawings or patterns or both as specified.

(B) The weight of each casting must be conspicuously painted thereon in white oil paint.

(C) Each casting must have the initials of the manufacturer's name, the date of manufacture, and the initials of the plant of manufacture integrally cast on it at time of manufacture.

22.01.4 MATERIALS, WORKMANSHIP, AND FINISH

(A) The iron must make castings, which are of close and even grain and easily machined.

(B) Casting must be true to pattern, free from cracks, gas holes, flaws, and excessive shrinkage. Surfaces of castings must be free from burnt on sand and must be reasonably smooth after cleaning. Runners, risers, fins and other cast on pieces must be removed. Plugging and filling will not be allowed.

(C) When "machining" is specified or shown on the drawings, it will mean the use of a machine or machines having cutting tool or tools to produce such surfaces and dimensions to a true and even surface.

(D) The underside of the seating rim of manhole covers must be machined. The upper side of the cover seating rims of manhole heads must also be machined.

22.01.5 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) Gray iron castings must comply with the requirements of ASTM A48.

(B) Malleable iron castings must comply with the requirements of ASTM A47.

(C) When a particular chemical composition is required in gray iron castings, it must be as specified.

SECTION 22.02 – WROUGHT IRON

22.02.1 INTENT

This section describes Wrought Iron for sewers and appurtenances.

22.02.2 KIND

Wrought iron must be of one kind.

22.02.3 MATERIAL

Wrought iron must be tough, fibrous, uniform in quality, ductile and malleable, thoroughly welded in rolling, and free from surface defects.

22.02.4 CHEMICAL AND PHYSICAL REQUIREMENTS

Wrought iron must comply with the requirements of ASTM A207.

SECTION 22.03 - GALVANIZING

22.03.1 INTENT

This section describes Galvanizing.

22.03.2 KIND

All galvanizing must be done by the hot-dip process or by the electrolytic process.

22.03.3 MATERIAL AND WORKMANSHIP

(A) Zinc coating must be adherent, smooth, continuous, and thorough. It must be free from such imperfections as lumps, blisters, gritty areas, uncoated spots, acid and black spots, dross, and flux.

(B) Metal to be galvanized must be thoroughly cleaned and pickled.

(C) Threading must be done before galvanizing. The coating must not interfere with the intended use of the material.

22.03.4 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) GENERAL REQUIREMENTS - Galvanizing must comply with the requirements of ASTM A123.

(B) WEIGHT OF COATING - The weight of zinc coating per square foot of actual surface must average not less than two (2.0) ounces and no individual specimen must show less than one and eight-tenth (1.8) ounces as determined in accordance with ASTM A90.

(C) UNIFORMITY OF COATING - Coating must be uniform as determined by visual inspection. If, in the opinion of the Engineer, visual examination is not conclusive, uniformity of coating must be determined in accordance with ASTM A239. Galvanized articles, so tested, must withstand seven (7) - one (1) minute dips without exposing base metal or showing adherent copper deposit.

(D) ADHERENCE - The coating must adhere so as not to be removable by any reasonable handling and erection. Light blows with a one-half (1/2) pound hammer must not cause peeling of the coating adjacent to the area deformed by the hammer blows.

SECTION 22.04 – STEEL CASTINGS

22.04.1 INTENT

This section describes Steel Castings for sewers and appurtenances.

22.04.2 KIND

(A) Steel castings must be of one (1) type.

(B) Steel must be Grade B-1, Full Annealed.

22.04.3 SIZE, WEIGHT AND LOT NUMBER

(A) Castings must conform to either the drawings or patterns or both, as specified.

(B) The actual measured weight of each casting must be conspicuously painted thereon in white oil paint.

(C) Each casting must have a lot number integrally cast on it at time of manufacture.

22.04.4 MATERIAL, WORKMANSHIP, AND FINISH

(A) The steel must make castings that are of close and even grain and easily machined.

(B) Casting must be true to pattern, free from cracks, gas holes, flaws and excessive shrinkage. Surfaces of castings must be free from burnt on sand and must be reasonably smooth after cleaning. Runners, risers, fins and other cast on pieces must be removed. Plugging and filling will not be allowed.

(C) When "machining" is specified or shown on the drawings, it will mean the use of a machine or machines having cutting tool or tools to produce such surfaces and dimensions to a true and even surface.

22.04.5 CHEMICAL AND PHYSICAL REQUIREMENTS

Steel castings must comply with the requirements of ASTM A27.

SECTION 22.05 – ALUMINUM GRATING

22.05.1 DESCRIPTION

This section describes Aluminum Gratings.

22.05.2 TYPE OF GRATING

(1) IN WATER MAIN STRUCTURES

Only riveted type gratings must be installed by the Contractor in water main structures. Grating designs must be in accordance with applicable Water Main Standard Drawings or as shown on the contract drawings. Other designs of equal strength, rigidity and serviceability may be submitted to the Engineer for approval.

(2) IN SEWER STRUCTURES

The Contractor may use either Type A or Type B gratings in sewer structures. Grating designs must be in accordance with Sewer Design Standards or as shown on the contract drawings. Other designs of equal strength, rigidity and serviceability may be submitted to the Engineer for approval.

Only one type of aluminum grating must be used exclusively throughout the project.

(A) TYPE A - Extruded shape assembly must consist of parallel extruded bearing members, spaced one (1) inch apart (clear distance), laterally braced by extruded members spaced alternately four (4) inches on centers to give the grating the required strength, rigidity and durability. At supports, lateral bracing between members must be in continuous line for the full width of the grating.

(B) TYPE B - Pressure locked assembly must consist of parallel bearing bars spaced not more than one (1) inch apart (clear distance) joined by cross bars spaced not more than four (4) inches on centers to form rectangular openings. Cross and bearing bars must be slotted for joining. Slots in bearing bars must terminate with dovetail recesses above the neutral axis. Slots in cross bars must terminate below the neutral axis. Cross bars must be forced down into the slots of the bearing bars and their bottoms spread into the dovetail recesses to make tight rigid joints.

22.05.3 MATERIAL AND CONSTRUCTION

(1) IN WATER MAIN STRUCTURES

(A) ALUMINUM GRATING - The riveted type grating assembly must consist of parallel main or bearing bars spaced not more than one and one-eighth inches (1-1/8”) apart joined by crimp or lacing bars attached by cold driven rivets spaced not more than seven inches (7”) on center in accordance with the ANSI/NAAMM MBG 531-00 Metal Bar Grating Manual, Designation R-18-7. Grating finish must be mill finish as fabricated. The minimum allowable main or bearing bar size must be 2” x 3/16”.

Aluminum gratings must conform to the requirements specified herein and to the following specifications:

Main or Bearing Bars	ASTM B221 Aluminum Alloy 6061-T6
Crimp or Lacing Bars	ASTM B221 Aluminum Alloy 6063-T5
Rivets	ASTM B316 Aluminum Alloy 6053-T61

(B) STEEL FRAME - The steel frames for aluminum gratings must conform to **Section 23.05**.

(2) IN SEWER STRUCTURES

Aluminum gratings, anchored frames and accessories must conform to the requirements specified herein and to the following specifications or approved equal:

Type A Grating	ASTM B221 Aluminum Alloy No. 6063-T5
Type B Grating - Main Bars	ASTM B221 Aluminum Alloy No. 6061-T6
- Cross Bars	ASTM B221 Aluminum Alloy No. 6063-T5
Angles - Extruded	ASTM B221 Aluminum Alloy No. 6063-T5
- Structural	ASTM B221 Aluminum Alloy No. 6061-T6
Anchors and Accessories	ASTM B221 Aluminum Alloy No. 6061-T6

22.05.4 GENERAL

The Contractor must check all dimensions in the field after all piping and equipment are set in place and determine the exact dimensions and locations of openings and cutouts. Templates must be made where required.

22.05.5 CONTRACTOR'S WORKING DRAWINGS

Gratings that are specified in the Water Main Standard Drawings and Sewer Design Standards will not require detailed working drawing submittal.

Completely detailed drawings of all other gratings shown on the contract drawings, and which are not specified as Water Main Standard Drawings and Sewer Design Standards, must be submitted by the Contractor for approval of the Engineer in accordance with the specifications. These gratings must not be manufactured until the Contractor's working drawings have been approved.

22.05.6 WORKMANSHIP

Gratings must be accurately fabricated, free from warps, twists or other defects which affect the appearance and serviceability of the grating. The tops of the main or bearing bars, crimp or lacing bars, and cross bars must be in the same plane.

Gratings must be installed with each section readily removable and replaceable. Adjacent units must be neatly fitted together. The clearance at the ends and between sections of grating must be a maximum of one-quarter (1/4) inch. Gratings must be set with a full and uniform end bearing on the supports to preclude rocking movement. Wedges or similar shimming devices must not be used. Edges of gratings must be neatly banded with bearing bars.

22.05.7 FASTENING DEVICES

Approved aluminum fastening devices must be installed to hold the gratings rigidly to the supports with means for easy removal. Fastening devices must not protrude above the walking surface of the grating. Fasteners must be installed in accordance with the manufacturer's directions.

22.05.8 CUTOUTS

Cutouts must be provided in the grating as directed by the Engineer for the passage of pipe, valve stems, columns and similar work. Where more than four (4) bearing bars are included in the cutout, banding bars of the same dimensions as the bearing bars must be provided around the opening and welded or electric forged to the component parts of the grating.

22.05.9 CONTACT SURFACES - COATING

Aluminum surfaces in contact with concrete or dissimilar metals must be thoroughly protected with a heavy coating of bituminous paint or other approved insulating material.

22.05.10 PAYMENT

(1) IN WATER MAIN STRUCTURES

Payment for furnishing and installing the aluminum grating in water main structures must be included in the price bid for Item No. 65.51PC - FURNISHING AND PLACING CAST-IN-PLACE CONCRETE CLASS 40 AND PRECAST CONCRETE CLASS 50. No separate or additional payment will be made for the aluminum grating.

(2) IN SEWER STRUCTURES

Payment for furnishing and installing the aluminum grating and the anchored aluminum frame in sewer structures must be included in the prices bid for all items of the contract. No separate or additional payment will be made for the aluminum grating and anchored aluminum frame.

22.05.11 SEPARATE PAYMENT

IN WATER MAIN STRUCTURES - Separate payment will be made for furnishing and installing the anchored steel frame for the aluminum grating under the price bid for Item No. 65.61SS - FURNISHING, DELIVERING AND PLACING STRUCTURAL, REINFORCING AND MISCELLANEOUS STEEL.

SECTION 23.01 – CONCRETE

23.01.1 DESCRIPTION

This section describes the concrete work required for the construction of the sewers, water main, manholes, chambers and all incidental and appurtenant work shown on the drawings or required by the specifications.

23.01.2 GENERAL REQUIREMENTS

(A) The "General Specification 11 - Concrete" and “Instructions To Architect/Engineer For Specifications For Concrete” of the Department of Environmental Protection is declared to be part of this specification, the same as if fully set forth elsewhere herein. Copies of these specifications may be obtained from the Department of Design and Construction, Division of Infrastructure, Design Services, Specifications, 30-30 Thomson Avenue, Long Island City, New York, 3rd Floor. Concrete work must conform to all requirements of these specifications except as modified by this detailed specification.

(B) The reference numbers in this detailed specification are keyed to the section numbers of the "General Specification 11 - Concrete" and prefixed with a "D". The detailed specifications supplement "General Specification 11 - Concrete" unless there is conflict in which case the detailed specification must govern.

23.01.3 MODIFICATIONS

D 1.4.1.6 For purposes of this section the Supervising Engineer for Concrete Construction will be considered the Engineer, and will be assigned by the Department. The Engineer will be responsible for all testing and inspection of concrete.

D 1.4.2 DELETE 1.4.2 of General Specification 11 - Concrete (GS11) and SUBSTITUTE the following:

The New York City Building Department does not have jurisdiction over the work of this contract. All references to the New York City Building Department, or the Commissioner thereof, must be considered as references to the New York City Department of Design and Construction and its Commissioner.

D 1.4.3 DELETE 1.4.3 of GS11.

D 1.7 Field Reference - The references noted in "General Specification 11 - Concrete" must be furnished on all contracts over five million ($5,000,000.00) dollars.

D 2.6.1 ADD the following to 2.6.1 of GS11:

Coarse and Fine Aggregate for concrete must be well graded in accordance with 2.6.1.1. Size of Coarse Aggregate must be three-quarter (3/4) inch (No. 67), unless smaller size aggregate is required due to the nature of the work.

D 2.6.1.1 DELETE 2.6.1.1 Subparagraphs (c), (d), (e), and (f) of GS11.

D 2.6.1.2 DELETE 2.6.1.2 of GS11.

D 2.6.1.3 DELETE 2.6.1.3 of GS11.

D 3.1 ADD the following to 3.1 of GS11:

The following tolerances will be permitted during the production of the concrete:

Slump ---------- + 1-Inch
Air (Air Entrained Concrete) ---------- ± 1.5%
Unit Weight ---------- ± 2%

D 3.2.1 DELETE 3.2.1 to 3.2.9 of GS11 and SUBSTITUTE the following:

All concrete mix designs must be subject to approval by NYCDDC’s Quality Assurance and Construction Safety (QACS) Bureau and in accordance with their “MIX DESIGN, LABORATORY AND PLANT APPROVAL PROTOCOL”. Copies of this protocol may be obtained at the preconstruction meeting or from the Engineer. Before the Contractor begins to manufacture concrete, the Contractor must secure NYCDDC’s QACS approval of the mix design the Contractor proposes to use.

The Contractor must submit for this purpose a statement, in writing, of the sources of all ingredient materials, the type and brand of the cement and the number of pounds of each

of the materials in a saturated surface-dry condition making up one (1) cubic yard of concrete. The range of water/cement ratios within which the concrete will be manufactured and the method of mixing to be employed must also be stated. The mix design submittal must include gradation of aggregates, specific gravities of ingredients, unit weight, mix proportion for each batch (a minimum of four (4) batches except in case of precast plants where one specific mix may be proposed), compressive strength test results for each mix at 7-days, 28-days (high-early strength mixes may require 6-hours, 24-hours, 3-days and shrinkage test as per the requirements), and graphical representation of strength vs. W/C projected in hours/days.

The Contractor may submit for approval concrete mixes that (within one (1) year of the contract) have been previously approved and used on other jobs with any Bureau of the Department of Environmental Protection or the Department of Design and Construction. Such submittals must contain evidence that the concrete mix was approved within one (1) year of this contract and must show that the concrete will be produced at the same mix plant, that the cement and admixtures are the same type (though not necessarily the same brand), that the water/cement ratio is the same and that adjustments have been made in the mix for air content, specific gravity and gradation of the aggregates.

If the Contractor elects to submit a concrete mix that was not previously approved, the Contractor must submit the new concrete mix in accordance with **Chapters 2 and 3 of General Specification 11 - Concrete, as modified herein**.

D 3.3 ADD the following:

Unless otherwise shown, specified or required by the Engineer, all concrete must be Class 40, 4,000-psi, non-air entrained concrete. The concrete mix for all structures, except for concrete cradles and encasements, must contain six hundred sixty (660) pounds per cubic yard of cementitious material of which eighty-five percent (85%) must be cement (Type 2, ASTM C150) and fifteen percent (15%) an approved mineral admixture Class F (Fly Ash, ASTM C618). The concrete mix for concrete cradles and encasements must contain six hundred sixty (660) pounds per cubic yard of cementitious material of which one hundred percent (100%) must be cement (Type 2, ASTM C150); no Fly Ash will be permitted in concrete used for cradles and encasements. The concrete mix must contain a water-reducing admixture or, if desired and approved by the Engineer, a high range water reducer (super-plasticizer). Other admixtures, air entraining agents, retarding or accelerating admixtures may be used if required and approved by the Engineer.

No additional payment will be made for any admixture used. The concrete mix must be proportioned using a maximum water/cement ratio of 0.42. Design slump must be in accordance with 3.6 of GS11. Coarse and Fine Aggregates must be proportioned so that the percent (%) mortar is in accordance with 2.6.1.4. of GS11 and yield is in accordance with 3.9.1.1 of GS11. In computation of yield, non-air entrained concrete must be assumed to have an entrapped air content of one (1) percent.

D 3.5.1 DELETE the first sentence of 3.5.1 and SUBSTITUTE the following:

Where specifically shown or specified normal weight concrete must contain entrained air as indicated in Table 3.5.1.

D 3.9.2.1 DELETE the last part of Paragraph 3.9.2.1 of GS11 starting with the words "in the schedule..." and ending with the words ".... as applicable."

D 3.9.2.3 DELETE 3.9.2.3 of GS11.

D 3.9.2.4 DELETE 3.9.2.4 of GS11.

D 3.9.2.5 DELETE 3.9.2.5 of GS11.

D 4.2 All shop drawings, data and design for formwork must be submitted to the Engineer for review.

D 4.7 Removal of Forms - ADD the following:

4.7.7 - Forms must not be removed without the permission of the Engineer. In general, forms must not be removed until the concrete has hardened sufficiently to safely support its own load plus any superimposed loads that might be placed thereon.

Forms must be left in place the minimum length of time specified below, from the date of placing concrete. The Contractor must be fully responsible for the concrete at all times, and any damage to the work, including any caused by premature removal of forms, must be repaired or replaced by the Contractor, to the satisfaction of the Engineer and without any cost to the City of New York. However, in any event, forms must be left in place the minimum lengths of time specified below, from the time of placing concrete:

(1) Columns ---------- 48-Hours
(2) Side Forms for Girders and Beams ---------- 48 Hours
(3) Bottom Forms of Slab:
    (a) Up to Ten (10) Feet of Clear Span ---------- 72-Hours
    (b) Over Ten (10) Feet of Clear Span ---------- 96-Hours
(4) Bottom Forms of Beams and Girders ----------120-Hours
(5) Walls ---------- 48-Hours
(6) Monolithic Concrete Pipe (Circular) ---------- 48-Hours
(7) Cradle and Encasement ---------- 24-Hours

In lieu of the above minimum lengths of time for stripping of forms the Contractor may elect to use the Windsor Probe Test System or approved equal method of nondestructive testing of concrete in place as follows:

(A) On monolithic sewers with clear spans not exceeding sixteen (16) feet, a minimum time of forty (40) hours is required after placing the concrete before testing the concrete by the Windsor Probe Test System or approved equal. For clear spans not exceeding sixteen (16) feet, forms must remain in place until the concrete has obtained a minimum compressive strength of one thousand six hundred (1,600) pounds per square inch as determined by the Windsor Probe Test System or approved equal. The test must consist of the average of three (3) single probes for each six hundred (600) square feet of roof area or thirty (30) linear feet of sewer, whichever produces the least spacing between probes. The Contractor must submit the proposed probe locations to the Engineer for approval.

(B) If any individual test indicates a strength lower than that specified, then the concrete represented by this test must be subject to further testing as directed by the Engineer to determine when the formwork may be removed.

If any one (1) individual probe indicates a strength below that required, two (2) additional probes must be taken at that location. For monolithic structures with a minimum clear height of five (5) feet or more, tests must be taken on the underside of the roof surface. All other structures must be tested on the top surface of the roof. When tests are taken on the top surface of the structure the results must be corrected to indicate the strength on the underside of the surface by reducing test results by ten (10) percent.

(C) No separate payment will be made for the testing of the concrete and the testing device as described above. The cost of this work must be included in the prices bid for all sewer and water main items for which there are contract prices.

The removable portion of form ties must be removed from the concrete immediately after removing the forms.

Care must be taken in removing forms, wales, shoring supports and form ties to avoid spalling or marring the concrete.

Subsequent to the removal of forms, all slabs, girders and beams, subject to their own weight only, must continue to be adequately supported by bracing and/or shoring for a minimum period of four (4) days from the date of placing concrete. Members subject to additional loads during construction must be adequately shored, to the satisfaction of the Engineer, to support both the members own weight and such additional construction loads in such a manner as will protect the members from damage by the loads. This shoring must not be removed until the member has acquired sufficient strength to support safely its weight and the loads upon it.

D 5.3 Unless otherwise shown or specified, steel reinforcing bars must comply with the requirements of ASTM A615, Grade 60, billet steel bars for concrete reinforcement, deformed, intermediate grade.

D 6.2 DELETE 6.2 of GS11.

D 7.3.1 After 7.3.1 of GS11, ADD the following:

For all concrete, it is the Contractor's responsibility to see that the concrete producer must:

(a) Verify that batched weights conform to the required weights and proportions, and to the water/cement ratio established in the approved mix adjusted for moisture content, fineness modulus and gradation of aggregates.

(b) Verify that the quality and condition of the materials conform to the applicable standards.

(c) Attest, on a ticket accompanying each load, to the specified strength of the concrete, the actual weights of the batched ingredients, the gradation of the aggregates, the weight, or volume, of water charged into the mixer at the batch plant or to be added at the job site. A statement that subparagraph (a) and (b) above have been complied with must also be included.

(d) A copy of the computer recording of the batched weights must also be included.

D 7.3.3 ADD the following to Subsection 7.3.3 of GS11:

Each Portland cement concrete batching plant must be subject to approval by NYCDDC's Quality Assurance and Construction Safety (QACS) Bureau and in accordance with their "MIX DESIGN, LABORATORY AND PLANT APPROVAL PROTOCOL". Copies of this protocol may be obtained at the preconstruction meeting or from the Engineer. The minimum requirement for approval is that the proposed Portland cement concrete batching plant must be on the New York State Department of Transportation (NYSDOT) approved list for the current construction season.

The minimum requirement for approval of a precast concrete plant is that the proposed plant must be on the NYSDOT approved list. A waiver for this requirement may be granted by the NYCDDC's Quality Assurance and Construction Safety (QACS) Director for special products that no NYSDOT approved plant is capable of producing.

Each Portland cement concrete batching plant must also be subject to auditing and approval of the NYCDDC's Director of Quality Assurance and Construction Safety (QACS). The Director of QACS may at any time discontinue the use of any previously approved equipment if nonconformance with the specifications results during the progress of the work. When the Director of QACS discontinues the use of the plant, production will not be acceptable for Department work until corrective measures satisfactory to the Director of QACS are carried out

D 8.2 DELETE 8.2 of GS11.

D 8.5 Depositing - ADD the following:

8.5.7 - All concrete must be poured against forms unless otherwise specified in the contract documents or approved by the Engineer.

Sheeting used as forms must be provided with approved protection placed between the concrete and the sheeting. In addition, where sheeting is used as forms an additional three (3) inches of concrete must be added to all surfaces of structures in contact with the sheeting. The cost for this additional concrete and protection must be included in the prices bid for all items of the contract. No separate or additional payment will be made for this work.

D 8.11.1 DELETE in first line of 8.11.1 the words "Section 8.9.4" and SUBSTITUTE the following words "Section 8.10.4".

D 9.2 DELETE 9.2 of GS11.

D 10.2 DELETE 10.2 of GS11.

D 11.2 DELETE 11.2 of GS11.

D 12.2 DELETE 12.2 of GS11.

D 16.3 Testing Service - ADD the following:

The Contractor must retain the services of an independent testing laboratory to provide for the services outlined in 16.3.1.4 to 16.3.1.11 of GS11, with the exception of those tests specified herein to be performed by the Engineer and the City Retained Laboratory.

All laboratories are subject to approval by NYCDDC's Quality Assurance and Construction Safety (QACS) Bureau and in accordance with their "MIX DESIGN, LABORATORY AND PLANT APPROVAL PROTOCOL". Copies of this protocol may be obtained at the preconstruction meeting or from the Engineer. The minimum requirement for approval is that the laboratory must have the current AMRL/AASHTO R-18 accreditation in the category of service proposed and must be currently licensed by the NYC Department of Buildings ("NYCDOB").

D 16.3.1.5-(a)-3.1.2 The Engineer is responsible for testing for slump.

D 16.3.1.10 From 16.3.1.10 of GS11, DELETE "by the New York City Building Code"

D 16.8 Responsibilities and Duties of Contractor - ADD the following:

The Contractor may, if the Contractor so desires, take cylinders corresponding to those taken by the Engineer for the City Retained Laboratory. However, determination of payment will be based solely on the cylinders taken by the Engineer for the City Retained Laboratory.

CONCRETE TEST CYLINDERS

The Contractor will be responsible for safe delivery of concrete cylinders to the NYCDDC Laboratory, within two (2) days after molding, where they will be properly stored and cured until the date of test, and tested by others, upon removal from the curing room. The NYCDDC testing laboratory will provide the services for the curing and breaking of the test cylinders.

The Contractor must provide empty cylinder molds and facilities for the proper care of these cylinders while on the site, and must safeguard them against injury and protect them from the elements.

The Engineer will be responsible for the preparation, documentation and labeling of the cylinders and for notifying the Contractor, at least twenty-four (24) hours in advance, when a shipment of cylinders is ready for delivery, so that cylinders can be tested for the standard twenty-eight (28) day and seven (7) day tests. Cylinders are to be delivered by the Contractor to a designated area near 30-30 Thomson Avenue, Long Island City, New York, or where otherwise directed within the City of New York.

The Contractor must make arrangements to protect all cylinders from damage during loading, transport to, and unloading at a Department of Design and Construction designated testing laboratory, and must obtain a receipt for delivered cylinders, which must be submitted to the Engineer.

D 18.1.2 At the end of 18.1.2 of GS11, ADD the following:

Class 40 concrete must be accepted without qualification if the strength of the concrete, as determined from the average cylinder strength is not less than 4,000-psi. For Class 40 concrete that tests below 4,000-psi but above 3,200-psi, the sum of 0.125 dollars per cubic yard per psi of deficiency must be permanently retained from the payment due the Contractor. Whenever Class 40 concrete tests less than 3,200-psi it must be rejected and removed. All other concrete must be evaluated in accordance with the procedures outlined in Chapter 18 of GS11.

D 18.8 DELETE 18.8 in its entirety and SUBSTITUTE the following:

18.8 Retainage

For concrete that tests below 4,000-psi, permanent retainage from payment due the Contractor must be as specified in Section D 18.1.2.

Concrete that is potentially deficient for reasons other than for strength of concrete as specified in Section D 18.1.2 and that cannot be brought into compliance and is nevertheless accepted by the Commissioner will be subject to the following permanent retainage. For every cubic yard of concrete so placed, the sum of one hundred (100) dollars per cubic yard must be permanently retained from the payment due the Contractor.

D 19.2 DELETE paragraph B and SUBSTITUTE the following:

B. Department of Design and Construction, Division of Infrastructure

Class 40 (7-bag) Sewers, manholes, cradles, encasements, chambers, thrust blocks, basins, additional concrete. (1:1-1/2:3 mix)

D 19.7 DELETE this Section in its entirety and SUBSTITUTE the following:

19.7 Drainage and Water Main Structures

Unless otherwise shown, detailed or specified, concrete drainage and water main structures (sewers, manholes, cradles, encasements, chambers, thrust blocks, basins and similar type structures) must be built in accordance with the Sewer Design Standards, Water Main Standard Drawings and Standard Sewer and Water Main Specifications.

SECTION 23.02 – BRICK

23.02.1 INTENT

This section describes brick for use in water main installation, sewer construction, appurtenances, and for lining of sewers.

23.02.2 KIND

(A) Brick must be of the following types:

Type 1 - Manhole Brick and General Brick Masonry Use and Construction
Type 2 - Sewer and Liner Brick

(B) Unless otherwise specified, Type 1 must be used and must be either solid or cored, as directed by the Engineer.

23.02.3 SIZE

Brick must be of standard size as approved.

23.02.4 BRAND

Brick need not be branded.

23.02.5 MATERIAL AND MANUFACTURE

Brick must be made from clay or shale and burned so that they are free from cracks, warpage and exposed stones, pebbles or particles of lime.

23.02.6 CHEMICAL AND PHYSICAL REQUIREMENTS

Except as otherwise provided herein, brick must comply with the following requirements:

Type 1 Brick, ASTM C32, Grade MS
Type 2 Brick, ASTM C32, Grade SS

23.02.7 VISUAL INSPECTION

Brick must be subject to visual inspection. Individual imperfect brick will be rejected for any of the following causes:

(1) DEFECTS - The presence of cracks, warpage, stones, pebbles or particles of lime that would affect the serviceability of the brick.

(2) IRREGULAR SHAPE - Brick not of rectangular cross-section with substantially straight square corners or where ends and at least one (1) edge do not have plain surfaces.

(3) VARIATION IN SIZE - Brick which vary from specified size by more than plus or minus one-eighth (1/8) inch in either transverse dimension or by more than plus or minus one-quarter (1/4) inch in length.

(4) VARIATION FROM APPROVED SAMPLES - Brick that must vary from the standard of comparison as established from the approved samples.

23.02.8 REJECTION

(A) Approximately one (1) percent of each type of brick must be taken at random for visual inspection. If five (5) percent of the sample is NOT ACCEPTABLE on the basis of visual inspection, the entire delivery will be rejected. The Contractor, however, may cull such a delivery at the Contractor's own expense and resubmit the delivery for acceptance.

(B) Brick may be inspected either (a) at the place of manufacture, or (b) at the dock or siding as unloaded, before delivery on the street, or (c) at both locations. All deliveries will be subjected to further inspection at the place of use, and brick that do not comply with the specification requirements will be rejected.

23.02.9 CONSTRUCTION METHODS, BRICK MASONRY

(A) The bricks must be wet when laid and each brick must be laid in cement mortar so as to form full bed, end and side joints at one operation. The joints must not be wider than three-eighth (3/8) inch, except when the bricks are laid radially, in which case the narrowest part of the joint must not exceed one-quarter (1/4) inch. Brickwork must be smoothly coated both inside and outside with a layer of cement mortar one-half

(1/2) inch thick. Brickwork must be laid with a satisfactory bond, and as it progresses must be racked back in courses, unless otherwise permitted.

(B) All fresh brickwork must be carefully protected from freezing and from the drying effects of the sun and wind, and if required, it must be sprinkled with water at such intervals and for such time as may be directed. Brickwork must be protected from injuries of all sorts, and all portions that may become damaged or may be found defective must be repaired or if directed, be removed and rebuilt. In freezing weather bricks must be heated sufficiently to remove all ice and frost before laying.

SECTION 23.03 – MORTAR, PORTLAND CEMENT

23.03.1 INTENT

This section describes Portland Cement Mortar.

23.03.2 KIND

(A) Mortar must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(B) Unless otherwise specified, mortar must be either Non-Air Entrained Mortar (maximum 4% entrapped air) for spaces less than one (1) inch or Non-Air Entrained Mortar (maximum 4% entrapped air) for spaces one (1) inch or more as specified by mortar bedding or joint requirements. (See **General Specification 11 - Concrete, as modified in Section 23.01**.)

23.03.3 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) Mortar must consist of sand mixed with Portland Cement, water and additives when required in definite proportions so as to produce a stiff mixture. Proportions must be in accordance with **General Specification 11 - Concrete, as modified in Section 23.01**.

(B) Portland Cement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**. Type II cement must be used unless otherwise specified.

(C) Sand for mortar must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(D) Water must be drawn from mains owned by or supplying water to the City of New York.

23.03.4 MANUFACTURE

(A) PROPORTIONING INGREDIENTS - The materials must be measured in accordance with **General Specification 11 - Concrete, as modified in Section 23.01**.

(B) MIXING INGREDIENTS - Mortar must be mixed in a suitable box or on a tight platform, and never upon pavement or ground. Cement and Sand must be thoroughly mixed dry, until the mixture has a uniform color. Clean, fresh water must then be added and the mass worked until a mortar, which is uniform and of the required consistency, is produced. Mortar must be mixed in no greater quantity than is required for the work in hand. Mortar that has set sufficiently to require retempering must not be used.

When required by the Engineer, ingredient materials, after measuring, must be mixed in an approved rotating drum type batch mixer. Mixing must be for a period of not less than one and one-half (1-1/2) minutes at a rate of not less than fourteen (14) nor more than twenty-two (22) revolutions per minute and must be continued until a homogeneous mixture is produced. The mortar must be kept constantly agitated until used.

23.03.5 FREEZING WEATHER

The mixing and use of mortar in freezing weather must be subject to the same requirements as herein specified for mixing and placing concrete under similar conditions.

SECTION 23.04 – GROUT, PORTLAND CEMENT

23.04.1 INTENT

This section describes Portland Cement Grout.

23.04.2 KIND

(A) Grout must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(B) Unless otherwise specified grout must be Cement Grout composed of neat cement and water.

23.04.3 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) Cement Grout must consist of neat cement and water mixed to a consistency suitable for the work on hand.

(B) Cement and Sand Grout must consist of sand mixed with Portland Cement, water and additives when required in definite proportions so as to produce a mixture of cream like consistency. Proportions must be in accordance with **General Specification 11 - Concrete, as modified in Section 23.01**.

(C) Portland Cement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**. Type II cement must be used, unless otherwise specified.

Cement for dilute grout must be screeded, if so directed, to remove the coarser particles.

(D) Sand for grout must comply with the requirement of **General Specification 11 - Concrete, as modified in Section 23.01**.

(E) Water must be drawn from mains owned by or supplying water to the City of New York.

23.04.4 MANUFACTURE

(A) PROPORTIONING INGREDIENTS - The materials must be measured in accordance with **General Specification 11 - Concrete, as modified in Section 23.01**.

(B) MIXING INGREDIENTS - Grout must be mixed in a suitable box or on a tight platform, and never upon pavement or ground. Cement and Sand Grout must be thoroughly mixed dry, until the mixture has a uniform color. Clean, fresh water must then be added and the mass worked until a mixture, which is uniform and of the required consistency, is produced. Grout must be mixed in no greater quantity than is required for the work in hand. Grout that has set sufficiently to require retempering must not be used.

When required by the Engineer, ingredient materials, after measuring, must be mixed in an approved rotating drum type batch mixer. Mixing must be for a period of not less than one and one-half (1-1/2) minutes at a rate of not less than fourteen (14) nor more than twenty-two (22) revolution per minute and must be continued until a homogeneous mixture is produced. The grout must be kept constantly agitated until used.

23.04.5 FREEZING WEATHER

The mixing and use of grout in freezing weather must be subject to the same requirements as herein specified for mixing and placing concrete under similar conditions.

SECTION 23.05 – STRUCTURAL, REINFORCING, AND MISCELLANEOUS STEEL

23.05.1 INTENT

This section describes structural, reinforcing and miscellaneous steels such as steel I-beams, expanded metal or any other structural steel or steel shapes, bands, and other steel work required by the drawings or ordered by the Engineer.

23.05.2 STRUCTURAL STEEL

23.05.2.1 KIND

Structural steel must be of one kind, and unless otherwise specified, must have minimum yield strength (Fy) of thirty-six thousand (36,000) pounds per square inch.

23.05.2.2 SIZE AND SHAPE

Structural steel sizes and shapes must be as shown, specified or required.

23.05.2.3 BRAND

Test specimens and every finished piece of steel must be stamped with melt or blow number, except that small pieces may be shipped in bundles securely wired together, with melt or blow number on a metal tag attached.

23.05.2.4 MATERIAL AND WORKMANSHIP

The requirements of ASTM A6 apply.

All delivered material must be new, unused and not part of previously fabricated structures.

23.05.2.5 CHEMICAL AND PHYSICAL PROPERTIES

Structural steel must conform to the requirements of ASTM A36. Steel for structural rivets must comply with the requirements of ASTM A141.

23.05.2.6 IDENTIFICATION

Markings must be in accordance with the requirements of ASTM A36.

23.05.2.7 METHODS OF TEST

Structural steel plates, shapes and bars must be tested in accordance with the test methods prescribed by ASTM, provided, however, any applicable method of test or examination as approved by the Engineer may be employed.

23.05.3 REINFORCING STEEL FOR CONCRETE REINFORCEMENT

Reinforcement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

23.05.4 MISCELLANEOUS STEELS

Steel for round stock for connecting lugs and bands must conform to ASTM A36, Standard Specification for Carbon Structural Steel.

Unless otherwise specified, bolts and studs must conform to ASTM A307, Grade B, and nuts must be A563, Grade B.

23.05.5 PAINTING

Steel surfaces must be satisfactorily cleaned and painted as follows:

(1) PRIOR TO ERECTION - All steel work (except reinforcing bars and fasteners) must be shop cleaned and given one (1) thorough shop coat of red oxide alkyd base primer.

(2) AFTER ERECTION AND PRIOR TO ENCASEMENT - All steel work (except reinforcing bars and fasteners) must be cleaned and receive another thorough coat of red oxide alkyd base primer. (Where shop coating is damaged during shipping, handling or installation, the areas damaged must be recleaned and receive a base coat prior to receiving this second coat.)

23.05.6 PACKING

Packing of all steels must be in accordance with the best commercial practice.

SECTION 23.06 – TIMBER AND LUMBER

23.06.1 INTENT

This section describes timber and lumber.

23.06.2 KIND

All timber and lumber must be yellow pine or Douglas fir.

23.06.3 SIZE

Timber and lumber must be of the sizes shown, specified or required. Sizes given are nominal sizes.

23.06.4 BRAND

Each piece of wood must be stamped with standard grade marks.

23.06.5 MATERIAL, WORKMANSHIP, AND FINISH

(A) YELLOW PINE - Yellow pine timber and lumber must be either Structural Square Edge and Sound Longleaf or Dense Structural Square Edge and Sound Shortleaf grade.

(B) DOUGLAS FIR - Douglas fir timber and lumber must be Select Structural grade.

23.06.6 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) YELLOW PINE - Yellow pine timber and lumber must conform to the requirements of the Southern Pine Association Standard Specifications.

(B) DOUGLAS FIR - Douglas fir timber and lumber must conform to the requirements of the West Coast Lumberman's Association Standard Grading and Dressing Rules.

SECTION 23.07 – GRANITE SLABS

23.07.1 INTENT

This section describes granite slabs to be used in drop-pipe manholes and junction chambers for sewers and appurtenances.

23.07.2 MATERIAL AND WORKMANSHIP

Granite slabs must be sound, durable, fine grained and free from rifts and laminations. Granite slabs must be saw cut to the required dimensions and continuous dovetail groves must be cut into the back faces of the slabs to receive the silicone bronze bolt heads.

23.07.3 SETTING

The granite slabs must be set in a full bed of fresh mortar, in compliance with the requirements of **Section 23.03**.

SECTION 24.01 – STEEL SHEETING

24.01.1 INTENT

This section describes Steel Sheet Piling.

24.01.2 KIND

Steel sheet piling must be the continuous interlock type and of an approved type and shape.

24.01.3 SIZE

(A) Sections of piling must be of the shapes and sizes shown, specified or required.

(B) Piles must be in single lengths as required in the work.

(C) At changes in direction and at closures, special fabricated or rolled steel sheet piles must be furnished as shown, specified or required.

24.01.4 BRAND

Each length of steel sheet piling must be stamped with a steel die or rolled with the following information: Manufacturer's Name or Mark, Date of Manufacture and Inspector's Mark.

24.01.5 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) Steel sheet piling for use in construction applications other than those specified in **Paragraph (B)** below must comply with the requirements of ASTM A328.

(B) Permanent steel sheet piling for use in construction of dock walls, sea walls, bulkheads, excavations and like applications that are exposed to marine environments must comply with the requirements of ASTM A690.

SECTION 24.02 – TIMBER PILES

24.02.1 INTENT

This section describes timber piles to be used, treated in accordance with **Section 24.03**.

24.02.2 KIND

Piles must be treated yellow pine or Douglas fir.

24.02.3 SIZE

(A) DIAMETERS - Diameters of piles, measured under the bark, must conform to the minimum diameters specified in the following table: 24.02.3.1.

LENGTH (Feet)	BUTT, TWO (2) FEET FROM END (Inches)	BUTT AT CUTOFF (Inches)	POINT (Inches)
Less than 20	10	10	6
Over 20 to 30	11	10	6
Over 30 to 40	12	11	6
Over 40 to 50	13	12	6
Over 50 to 90	14	13	6
Over 90	14	13	5

(B) LENGTHS - Piles, sixty (60) feet or less in length must be in one (1) piece. Piles longer than sixty (60) feet in length may be spliced in the manner shown or approved but not more than one (1) splice per pile will be permitted. Points of follower piles must be not less than ten (10) inches in diameter.

24.02.4 MATERIAL AND WORKMANSHIP

(A) MATERIAL, GENERAL - Piles must be cut from sound, live trees or from fire-killed, blight-killed, or wind-felled timber that has not been attacked by decay or insects. Piles must have a gradual taper from the place of butt measurement to the point and must be cut above the ground swell.

(B) WORKMANSHIP, GENERAL - Knots and limbs must be trimmed or cut smoothly, flush with the surface, and butt and point must be sawed square with the axis of the pile.

(C) PILES FOR TREATMENT - In addition to the requirements given under (A) and (B) above, piles for treatment must be free from splits and must have minimum sapwood thicknesses at the butt of not less than one and one-half (1-1/2) and one (1) inch for yellow pine and Douglas fir, respectively. Bark, including not less than eighty (80) percent of the inner skin, must be removed as soon as practicable after piles are cut. Care must be taken not to remove or damage the sapwood but to leave it smooth and clean. No piece of inner skin left on a pile must be more than three-quarter (3/4) inch wide or eight (8) inches long, and there must be not less than one (1) inch of clean wood surface between strips.

(D) DRIVING SHOES - When driving shoes are required, they must be of an approved design and securely fastened to the piles whose end must be suitably pointed.

24.02.5 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) GENERAL - Timber piles must comply with the requirements of ASTM D25 for Round Timber Piles, Class B, except as otherwise specified herein. Driving shoes must be malleable iron or cast steel conforming to the requirements of **Section 22.01** and **Section 22.04**, respectively.

(B) SOUNDNESS - Piles must be straight and sound. They must be free from decay, red heart, twist of grain exceeding one-half (1/2) of the circumference in any twenty (20) feet of length, unsound knots, numerous knots, sound knots in clusters, numerous holes, shake more than one-third (1/3) of the diameter of the pile, scars from turpentine scores except scars not exceeding thirty-six (36) inches from scoring of recent date which is sound and free from insect damage, pronounced short bends, reversed bends, crooks greater than one-half (1/2) of the diameter of the pile at the middle of the bend, and from all other defects which might impair their strength or durability.

(C) SOUND KNOTS - In piles fifty (50) feet and less in length and in the sections between mid-lengths and the butts of piles more than fifty (50) feet in length, sound knots must not be greater in diameter than one-third (1/3) of the least diameter of the pile at the section where they occur, except that no knot may

exceed four (4) inches in diameter. In the sections between mid-lengths and the points of piles more than fifty (50) feet in length, sound knots must be not greater in diameter than one-half (1/2) of the least diameter of the pile at the section where they occur, except that no knot must exceed five (5) inches in diameter.

(D) STRAIGHTNESS - A straight line joining the centers of the butt and point must lie within the body of the pile.

(E) SHORT BENDS - Short bends must not exceed the following: The distance from the center of the pile to a line joining the centers of the pile above and below the bend must not exceed four (4) percent of the length of the bend nor two and one-half (2-1/2) inches.

SECTION 24.03 – WOOD PRESERVATIVE AND TREATMENT

24.03.1 INTENT

This section describes wood preservative and treatment of timber, lumber and timber piles.

24.03.2 KIND

(A) Wood preservative must be CCA for yellow pine and ACZA for Douglas fir.

(B) Treatment of timber, lumber and timber piles must be the impregnation of these materials with CCA or ACZA by the pressure process.

24.03.3 MATERIALS AND WORKMANSHIP

(A) CCA - CCA must be Chromated Copper Arsenate Type C.

(B) ACZA - ACZA must be Ammoniacal Copper Zinc Arsenate.

(C) PEELING PILES - Bark, including not less than eighty (80) percent of the inner skin, must be removed as soon as practicable after piles are cut. Care must be taken not to remove or damage the sapwood but to leave it smooth and clean. No piece of inner skin left on a pile must be more than three-quarter (3/4) inch wide or eight (8) inches long and there must be not less than one (1) inch of clean wood surface between strips.

(D) CUTTING AND DRILLING - Insofar as practicable, all cutting and drilling must be done before the timber, lumber or piles are treated.

(E) COATING CUT SECTIONS - The exposed wood of timber, lumber and piles cut or drilled on the job must be painted with copper naphthenate preservative containing a minimum of 2.0% copper metal, or other preservative approved under AWPA Standard M4.

(F) INCISING - Before treatment, all Douglas fir timber three (3) inches and over in thickness and lumber must be incised in an approved manner, except when incising will unfit lumber for the use intended.

24.03.4 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) GENERAL REQUIREMENTS - The wood preservative must conform to AWPA Standard P5 for waterborne preservatives.

(B) TREATMENT - The treatment of timber, lumber and timber piles must be in accordance with the AWPA specifications for the various materials as listed in the following table 24.03.4.1.

AWPA SPEC. NO.	MATERIAL		SEASONING	RETENTION OF OXIDES (Lbs. per cu. ft.)	
	YELLOW PINE	DOUGLAS FIR	KILN DRY	GROUND CONTACT	MARINE USE
C1, C3 (UC4C, UC5B)	Piles		X	1	2.50
C1, C3 (UC4C, UC5B)		Piles	X	1	2.50
C1, C2, C18 (UC4C, UC5A)	Timber and Lumber, all Thicknesses		X	1	2.50
C1, C2, C18 (UC4C, UC5A)		Timber and Lumber Under 5" Thick	X	1	2.50
		5" and Over	X	1	2.50

(C) RETENTION OF OXIDES - The retention of oxides must be as specified.

(D) WOOD - Timber and lumber must conform to the requirements of **Section 23.06**. Timber piles must conform to the requirements of **Section 24.02**.

SECTION 25.01 – HOUSE SERVICE CONNECTIONS

25.01.1 DESCRIPTION

This section describes the materials required for new house service connections or parts thereof on water mains. New house service pipe may be required to extend an existing service to a new water main, to repair a damaged service or to install a new service as required and as approved by the Engineer. All works must also conform to NYC DEP requirements.

25.01.2 MATERIALS

Only new materials must be used for installation or repair of service pipes. New service pipes of two (2) inches in diameter or less may be brass (with the exception mentioned below) or copper tubing. Service pipes larger than two (2) inches in diameter may be brass (with the exception mentioned below), or ductile iron. Except for the gooseneck, as specified in **Subsection 64.12.3(D)**, the material and diameter of a new service pipe must be the same from the tap up to and into the building or to a point where service is fully metered.

Where the existing house service connection is lead, galvanized steel, or galvanized iron, house service lines must not be extended or partially replaced, and must be fully replaced to the house control valve, per Section 20-03 (s) of the NYC DEP Rules Governing and Restricting the Use and Supply of Water (RCNY Title 15 Chapter 20). This requirement will not apply to replacing or reconnecting the corporation stop, gooseneck, or offset swing joints where the house service connection remains intact. The connection to the intact house service connection must be made using the Lead-Pak Coupling manufactured by the Ford Meter Box Co, Inc. or approved equal.

The Department must individually approve fittings and pipe of material other than specified in these specifications. Pipe approved for use must conform to the following types and their applicable specification, as hereinafter given:

TYPE OF PIPE	APPLICABLE SPECIFICATIONS
Brass	Dept. of Citywide Administrative Services 32-P-3:93
Copper Tubing	Dept. of Citywide Administrative Services 32-T-3:03
Ductile Iron	ANSI/AWWA C151/A21.51 Class 2 (3 and 4 inch only Diameter) Class 6 (Over 4 inch Diameter)

25.01.3 INSULATION

Insulation where required must be FOAMGLAS cellular glass insulation manufactured in accordance with ASTM C552 "Standard Specification for Cellular Glass Thermal Insulation", by Pittsburgh Corning Corporation whose quality system for manufacturing, inspecting and testing of FOAMGLAS insulation is certified to meet the requirements of ISO-9002. The FOAMGLAS or approved equal insulation must be fabricated in half sections wherever possible. For large diameter piping where half sections are not practical, curved sidewall segments are preferred. Wherever possible, the insulation should be factory jacketed with PITWRAP-SS-Jacketing - a 70-mil (1.7-mm) thick self-sealing high polymer asphaltic membrane with an integral glass scrim and aluminized Mylar film on the surface or approved equal.

Mastic - PITCOTE-300-Finish, an asphalt cutback mastic or approved equal.

Reinforcing Fabric - PC-Fabric-79 open mesh polyester fabric with a 6 x 5.5 mesh/inch configuration or approved equal.

Sealant - PITTSEAL-444N sealant, a nonsetting butyl sealant with a minimum eighty-five percent (85%) solids content or approved equal.

SECTION 25.02 – POLYETHYLENE SLEEVE

25.02.1 POLYETHYLENE ENCASEMENT - SCOPE

This standard covers materials for polyethylene encasement to be applied to underground installations of ductile-iron pipe water mains. This standard also may be used for polyethylene encasement of fittings, valves, and other appurtenances to ductile-iron pipe water main systems.

25.02.2 DEFINITION

Polyethylene encasement: The encasement of piping with polyethylene film in tube or sheet form.

25.02.3 MATERIALS

25.02.3.1 POLYETHYLENE

Polyethylene film must be manufactured of virgin polyethylene material conforming to the following requirements of ASTM D1248, Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.

TABLE 25.02.3.1

POLYETHYLENE TUBE AND SHEET SIZES

NOMINAL PIPE DIAMETER (inches)	MINIMUM POLYETHYLENE WIDTH (inches (cm))	
	FLAT TUBE	SHEET
3	14 (35)	28 (70)
4	16 (41)	32 (82)
6	20 (51)	40 (102)
8	24 (61)	48 (122)
10	27 (69)	54 (137)
12	30 (76)	60 (152)
14	34 (86)	68 (172)
16	37 (94)	74 (188)
18	41 (104)	82 (208)
20	45 (114)	90 (229)

25.02.3.2 POLYETHYLENE FILM

Tensile Strength: 1200-psi (8.3-MPa) minimum
Elongation: 300-percent minimum
Dielectric Strength: 800-V/mil (31.5-V/µm) thickness minimum

25.02.3.3 THICKNESS

Polyethylene film must have a nominal thickness of 0.008-inch (8-mil or 200-µm). The minus tolerance on thickness is ten (10) percent of the nominal thickness.

25.02.3.4 TUBE SIZE OR SHEET WIDTH

Tube size or sheet width for each pipe diameter must be as listed in Table 25.02.3.1.

SECTION 25.03 – FILTER FABRIC

25.03.1 DESCRIPTION

This section describes the material for ground stabilization filter fabric to be installed in water main trenches and to be installed in sewer trenches where shown, specified or ordered.

25.03.2 MATERIAL

The filter fabric must be composed of a strong polymer type fiber, resistant to both rot and insects, and formed into a nonwoven geotextile fabric with the following requirements:

Grab Tensile Strength at Ultimate (ASTM D4632) ----------120-lbs. minimum
Elongation at Break (ASTM D4632)---------- 50% minimum
Trapezoidal Tear Strength (ASTM D4533)---------- 50-lbs. minimum
Puncture Strength (ASTM D4833) ---------- 65-lbs. minimum
CBR Puncture Strength (ASTM D6241) ----------300-lbs. minimum
Apparent Opening Size (ASTM D4751)---------- No. 70 US Sieve
Permittivity (ASTM D4491) ----------1.4 to 1.8-sec^{-1}
Flow Rate (ASTM D4491) ---------- 110 to 135-gal./min./ft^2

The fabric must be free of any treatment which might significantly alter its physical properties. During all periods of shipment and storage, the fabric must be wrapped in a heavy-duty protective covering to protect it from direct sunlight, mud, dirt, dust and other debris. The information on the packaging material must warn against exposing the filter fabric to sunlight.

The manufacturer must submit certified test data to cover each shipment of material.

SECTION 25.04 – WATERSTOPS

25.04.1 DESCRIPTION

Waterstops must be provided in all construction joints in water bearing structures and at other such locations as required by the contract drawings or as directed by the Engineer.

25.04.2 MATERIAL

Waterstops for construction joints must be polyvinyl chloride (PVC).

Waterstops in expansion joints must be PVC and must be installed where shown on the contract drawings or as determined by the Engineer.

The polyvinyl chloride must be extruded from an elastomeric plastic compound of which the basic resin must be polyvinyl chloride (PVC). The compound must contain any additional resins, plasticizers, stabilizers or other materials needed to insure qualities that will meet the requirements of the Corps of Engineer's Specifications CRD-C-572-65.

The required minimum physical characteristics for this material are:

Tensile Strength:	1,400-psi
Ultimate Elongation:	not less than 280%.

No reclaimed PVC must be used for the manufacturing of the waterstops.

The Contractor must furnish certification that the Contractor's proposed waterstops meet the above requirements.

Waterstops for construction joints must be flat ribbed type, six (6) inches wide with a minimum thickness at any point of three-eighth (3/8) inches.

25.04.3 PLACEMENT

Waterstops must be carefully positioned so that they are embedded to an equal depth in concrete on both sides of the joint. They must be kept free from oil, grease, mortar and other foreign matter. Where necessary, PVC waterstops must be braced or supported. Such method must be submitted to the Engineer for review.

Splices in PVC waterstops must be made with a thermostatically controlled heating element. Splices must be made in strict accordance with the manufacturer's recommended instructions and procedures. At least three (3) satisfactory sample splices must be made on the site. The Engineer may require tests on these splices by an approved laboratory. The splices must exhibit not less than eighty percent (80%) of the strength of the unspliced material.

25.04.4 PAYMENT

Payment for furnishing and installing the waterstops must be deemed included in the prices bid for all items of work. No separate or additional payment will be made for waterstops.

SECTION 25.05 – WATERPROOFING

25.05.1 DESCRIPTION

Waterproofing for water main chambers must consist of four (4) layers of woven glass fabric treated with bituminous waterproofing material on all exterior surfaces of the water main chambers including that of the floor slab, as shown on the water main contract and standard drawings, and as ordered by the Engineer.

25.05.2 MATERIAL

Woven glass fabric treated with bituminous material must conform to the requirements of ASTM D1668, Type I. All woven glass fabric supplies must have the same width. Bituminous material must conform to the requirements of ASTM D449, Type I.

25.05.3 PREPARATION

Prepared surface must be clean and dry immediately prior to the application of the hot bituminous material. Surfaces must be reasonably smooth and free from projections and holes.

Bituminous material must be heated to a temperature not less than three hundred fifty (350) degrees Fahrenheit and not more than four hundred (400) degrees Fahrenheit in a heating kettle equipped with a thermometer, and must be stirred frequently to avoid local overheating. The hot bituminous material must be applied in an even coating by mopping, rolling or spraying. It must be applied to dry surfaces in two (2) equal coats at right angles to each other and must not be applied in wet weather or when ambient temperature is below thirty-five (35) degrees Fahrenheit. The treated glass fabric strips must be carefully set into place, immediately following the hot bituminous coating.

25.05.4 PAYMENT

Payment for furnishing and installing the waterproofing of water main chambers must be included in the prices bid for all items of work. No separate or additional payment will be made for waterproofing of water main chambers.

SECTION 25.06 – NEOPRENE PAD

25.06.1 DESCRIPTION

A neoprene pad must be provided where shown on the contract drawings and the Water Main Standard Drawings.

25.06.2 MATERIAL

Neoprene Pad must be one (1) inch (25-mm.) thick, and must comply with the requirements of ASTM D2000 and Rubber Manufacturers Association RMA3BC-608-A14-E03.

25.06.3 PAYMENT

Payment for furnishing and installing the neoprene pad must be included in the prices bid for all items of work. No separate or additional payment will be made for neoprene pad.

SECTION 26.01 – BACKFILL MATERIAL

26.01.1 DESCRIPTION

This section describes the material required to backfill sewer and water main trenches and excavations.

26.01.2 MATERIAL

(A) GENERAL - All material for backfilling must have a moisture content and gradation suitable for attaining the required density.

All material for backfilling must be free from frost at the time of placement.

Miscellaneous fill material removed from the trenches and excavations must not be considered as acceptable backfill material unless found acceptable and approved in writing by the Engineer.

The project site subsurface conditions may consist partially of variable thickness layers of Unsuitable Material. This material may not be considered as acceptable backfill material as described herein, or as determined by the Engineer.

(B) SELECT GRANULAR FILL - Select granular fill material must be approved clean earth or sand of low silt and clay content (less than five (5) percent passing the No. 200 sieve), free from bricks, blocks, excavated pavement materials and debris, stumps, roots and other organic matter, as well as ashes, oil and other perishable or foreign matter and must not contain particles larger than one-quarter (1/4) inch in diameter. For the purpose of this contract, this backfill material must be called Select Granular Fill.

(C) APPROVED EXCAVATED SUITABLE FILL - All approved excavated suitable fill material within the project limits must be utilized for backfill as specified in **Subsection 40.06.2(C)**. Approved excavated suitable fill material must be approved earth, free of bricks, blocks, excavated pavement materials and debris, stumps, roots and other organic matter, as well as ashes, oil and other perishable or foreign matter and must not contain stones larger than six (6) inches in their largest dimension. Stones must be so distributed that all interstices are filled with fine material. The percentage of silt and clay or fines (portion of material passing a No. 200 sieve) for approved excavated suitable fill material must not exceed the limits stipulated below. For the purpose of this contract, this backfill material must be called Approved Excavated Suitable Fill.

All excavated material meeting the parameters specified above with a fine content equal to or less than twenty (20) percent (portion of material passing a No. 200. sieve) must be reused. All excavated material meeting the parameters specified above with a fine content greater than twenty (20) percent and equal to or less than thirty (30) percent (portion of material passing a No. 200. sieve) can be reused if the Contractor can demonstrate that the material can be compacted to a Standard Proctor Dry Density of ninety-five (95) percent. Excavated materials with a fine content exceeding twenty (20) percent as defined above are extremely sensitive to moisture and the Contractor must be responsible for keeping the material dry, and for determining and maintaining the proper moisture content to achieve the required level of compaction. All excavated material with a fine content exceeding thirty (30) percent must be discarded.

(D) CLEAN FILL - Clean fill material must be approved clean earth or sand of low silt and clay content (less then twelve (12) percent passing No. 200 sieve), free from bricks, blocks, excavated pavement materials and debris, stumps, roots and other organic matter, as well as ashes, oil and other perishable or foreign matter and must not contain stones larger than six (6) inches in their largest dimension. Stones must be so distributed that all interstices are filled with fine material. For the purpose of this contract, this backfill material must be called Clean Fill.

(E) PROCESSED FILL - If approved in writing by the Engineer, excavated material determined to be unsuitable may be processed (i.e. screened, blended and/or crushed) to produce select granular fill material or clean fill material. Such processed materials must be in compliance with the materials specifications in **Subsection 26.01.2(B) - Select Granular Fill** and in **Subsection 26.01.2(D) - Clean Fill**. No separate or additional payment will be made for the cost of all labor, materials, plant, equipment, samples, tests and insurance necessary or required to perform this processing work.

SECTION 26.02 – RIPRAP, STONE BALLAST, SCREENED GRAVEL AND BROKEN STONE, BROKEN STONE, SLOPE PAVEMENT, AND CRUSHED STONE

26.02.1 INTENT

This section describes riprap; stone ballast; screened gravel and screened broken stone; broken stone; slope pavement; and crushed stone.

26.02.2 MATERIALS

(A) RIPRAP - Riprap must consist of stones of acceptable size and quality, placed in embankments or to form foundations. All riprap must be granite, dolomite, gneiss, traprock or other approved hard and durable stone. No riprap stone may be smaller than the commercial two and one-half (2-1/2) inch stone. In general, riprap stone must be graded from two and one-half (2-1/2) inches to eighteen (18) inches so that the smaller stones must fill voids between the larger stones. When available and suitable for the purpose larger stones will be permitted. Larger stones will be required for slope facing.

(B) STONE BALLAST - Stone ballast must be broken stone, sound, hard and roughly cubical in shape, or gravel of sizes known as commercial two and one-half (2-1/2) inch.

(C) SCREENED GRAVEL AND SCREENED BROKEN STONE - Screened gravel and screened broken stone must be clean, well-graded, sound, hard, roughly cubical in shape and free from organic and other deleterious materials. They must have a maximum size of one and one-half (1-1/2) inches and a minimum size of one-quarter (1/4) inch.

(D) BROKEN STONE - Broken stone must be broken stone, sound, hard and roughly cubical in shape, or gravel of sizes known as commercial one and one-half (1-1/2) inch.

(E) SLOPE PAVEMENT - Slope pavement must be not less than eighteen (18) inches in depth, normal to the slope and must be composed of sound, hard and durable quarried or split stones. Except when used for pinning or wedging, the stones must be not less than six (6) inches thick and from twelve (12) to eighteen (18) inches long.

(F) CRUSHED STONE - Crushed stone must be broken stone, sound, hard and roughly cubical in shape and must comply with ASTM C33, Size No. 67. Crushed stone must have a maximum size of three-quarter (3/4) inch and a minimum size of one-quarter (1/4) inch with the following gradation:

100% passing the 1-inch sieve
90-100% passing the 3/4-inch sieve
20-55% passing the 3/8-inch sieve
0-10% passing the No. 4 sieve
0-5% passing the No. 8 sieve

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THE CITY OF NEW YORK

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF WATER AND SEWER OPERATIONS

DIVISION III – INSPECTION OF MATERIALS, SAMPLING, AND METHOD OF TEST

SECTIONS 30.01 TO 30.04

(NO TEXT ON THIS PAGE)

SECTION 30.01 – INSPECTION OF MATERIALS

30.01.1 GENERAL

(A) The Contractor will be required to retain the services of an independent New York State Licensed Testing Laboratory to perform all materials testing on this project, except as otherwise specified. Prior to the start of manufacture the Contractor must submit the name of a Testing Laboratory for approval to the Engineer. Upon approval, this laboratory will be required to set up a program for the testing of all materials to be utilized on this project. All costs associated with the testing of materials must be borne by the Contractor and the costs thereof must be deemed included in the prices bid for all items of work.

All materials, as well as the plant and methods of manufacture, must be subject at all times to the inspection and approval of the Engineer. All materials inspected and approved at place of manufacture, quarry, dock or siding may be subject to further inspection at the place of use, and any materials failing to comply with the specification requirements will be rejected.

The Engineer may at any time order such other and further inspection, examination, and tests, as the Engineer may deem necessary and proper to satisfy the Engineer that the work and materials are in compliance with these specifications.

The Contractor must give the Engineer sufficient advance notice prior to starting the manufacture of the materials. The Engineer must have free entry at all times, while work on the contract is being performed to all parts of the manufacturer's works which concern the manufacture of the materials. The manufacturer must afford the Inspector, without charge, all reasonable facilities to satisfy the Inspector that the material is being furnished in accordance with these specifications. In the absence of an Inspector at the plant during manufacture, the Engineer may accept a certificate of test.

(B) METALS - Certificates of mill tests of chemical and physical properties of metals must be furnished on all deliveries, unless otherwise permitted. The Contractor must indicate in the shipping invoices the heat or melt numbers that will permit positive identification of the mill tests with the materials delivered.

(C) CONCRETE - The manufacture of concrete must be subject to inspection at all times. The Contractor must give the Engineer at least forty-eight (48) hours advance notice prior to starting the manufacture. All apparatus, applicable specifications and other facilities needed for making the required tests or examinations including scales, sieves and facilities for moisture tests, must be provided at the plant by the Contractor. All testing apparatus and equipment must be of standard and approved type.

(D) TREATED WOOD - Timber, lumber and timber piles to be treated must be inspected and tested before and after treatment at the plant. No shipment of treated material must be made unless it has been accepted by the Engineer as satisfactory under the Inspector's report. The Inspector must seal or stamp accepted treated material prior to shipment.

(E) TREATED TIMBER PILES - Before delivery on the site of the work, all piles must be inspected. An independent Testing Laboratory approved by the Commissioner must perform the inspection. The expense for the inspection will be borne by the Contractor.

(F) APPROVAL OF MATERIALS AND MANUFACTURERS - The names of proposed manufacturers, materialmen and dealers who are to furnish materials, fixtures, equipment, appliances or other fittings must be submitted as early as possible to the Department of Design and Construction for approval, to afford proper investigation and checking. Approval of the material suppliers to the job should be obtained from the Department of Design and Construction far enough in advance so that lack of such approval will not delay shop drawing processing.

30.01.2 IDENTIFICATION

Each delivery must be accompanied by the required number of delivery tickets, stating the name, type and grade of the material, quantity contained in the delivery, name of Contractor, and Contract Number.

Each bag of Portland Cement must be plainly marked with the name and brand of the manufacturer. The type must be identified on each bag by name by a suitable mark, tag, ribbon or similar device that will permit positive identification with the delivery tickets.

Invoices for bulk shipments of Portland Cement must contain information that will permit positive identification of the material delivered.

30.01.3 NEW DELIVERIES

Whenever, during the course of the work, the Contractor receives new deliveries of materials, their use will not be permitted until they have been examined and approved by the Engineer. Mixed lots varying in origin, brands or trademarks will not be accepted on any contract unless specifically permitted by the Engineer.

The Contractor must furnish the Engineer with facilities and laborers to assist in the inspection and sampling of the materials in use or to be used at any time before the start and during the course of the work.

30.01.4 MATERIALS TO BE EQUAL TO SAMPLES

Samples taken from the various deliveries during the progress of the work, when tested and analyzed, must conform to the requirements of the specifications and must have qualities equal to those of the approved samples submitted. No material other than that equal to the approved samples must be used without the written permission of the Engineer.

SECTION 30.02 -- SAMPLING

30.02.1 SAMPLES AND AFFIDAVITS

The Contractor must furnish and deliver as directed, without charge, samples, affidavits, and other information required of the materials intended to be used, as follows:

(A) FINE AND COARSE AGGREGATES - A statement in writing of the specific sources of the fine and coarse aggregates the Contractor proposes to use.

(B) TYPE 1 - MANHOLE BRICK AND GENERAL BRICK MASONRY USE AND CONSTRUCTION; TYPE 2 - SEWER AND LINER BRICK - Twelve bricks proposed to be used on the work, accompanied by a certificate giving the name and location of the plant from which it is proposed to obtain brick for use on the work, together with a copy of a report from an approved laboratory giving results of tests of such bricks.

(C) VITRIFIED CLAY PIPE - Specimens of sound, full size pipe, up to one (1) percent of the number of pipe in each size of pipe furnished, except that in no case must less than one (1) specimen of each size be furnished.

(D) PRECAST REINFORCED CONCRETE PIPE - One (1) percent of each size of reinforced concrete pipe must be selected by the Director of the Laboratory and moved to the laboratory at the expense of the Contractor for test for ultimate loading. Additional field tests may be made by the Director of the Laboratory for first crack loading. After testing, the Contractor must remove any reinforced concrete pipe from the laboratory.

(E) JOINT MATERIALS FOR PIPE - Two (2) pounds of Type 2, Premoulded Bituminous Compound, in suitable containers properly labeled with the name or brand, Contract Number and Title, Contractor's name and date.

(F) OTHER MATERIALS - Samples of adequate size and quantity of any of the other materials, in suitable containers, each properly labeled with the name or brand and specified source of the contents and name of the Contractor.

(G) ADDITIONAL SAMPLES - Additional samples as required.

30.02.2 METHODS

(A) The Engineer must select all samples of materials for testing. Except as herein otherwise specified, sampling of materials must be in accordance with the methods prescribed by the following and other applicable requirements of ASTM International:

TITLE	DESIGNATION
(1) Brick	C279, C32
(2) Cement, Portland	C183, C184, C187, C188, C190, C191
(3) Concrete Cylinders, Standard Method of Making and Storing Compression Test Specimens of Concrete in the Field	C31
(4) Iron Castings	A47, A48
(5) Steel Castings	A27
(6) Stone, Slag, Gravel, Sand and Stone Block	D75

(B) COARSE AGGREGATE

(1) BARGE LOAD - A gross sample must be taken from at least four (4) points, at a depth of at least one (1) foot below the surface of the stone on the boat and at equal distance along a diagonal line from bulkhead to bulkhead. These samples must be consolidated into one (1) sample for test purposes.

(2) TRUCK LOAD PILE - A gross sample must be taken from at least four (4) points, at a depth of at least one (1) foot below the surface of the pile, at equal distance between base and top. These samples must be consolidated into one (1) sample for test purposes.

(3) SIZE OF SAMPLE - The gross sample must be not less than twice the weight of the laboratory sample, and it must be quartered down to the size of a laboratory sample.

At least one (1) laboratory sample of the aggregate weighing not less than fifty (50) pounds must be taken from each size as representing the delivery thereof.

(C) CONCRETE TEST CYLINDERS - All work related to Concrete Test Cylinders must be in accordance with **General Specification 11 - Concrete, as modified in Section 23.01**.

(D) STEEL BARS FOR CONCRETE REINFORCEMENT - Three (3) pieces at least twenty-four (24) inches in length must be taken from each size and heat number delivered.

SECTION 30.03 – METHODS OF TEST

30.03.1 METHODS OF TEST

Except as herein otherwise specified, methods of test must be as prescribed under the various sections of Division II and by the following and other applicable requirements of ASTM International:

TITLE	DESIGNATION
(1) Brick	C279, C32
(2) Compressive Strength (Mortars)	C109, C780 Annex 6
(3) Cement, Portland	C183, C184, C187, C188, C190, C191, C114, C151
(4) Clay Lumps in Aggregate	C142
(5) Concrete, Standard Methods of Making Compression Tests of Concrete	C39
(6) Consistency of Portland Cement Concrete (Slump Test)	C143
(7) Fineness by Air Permeability	C204
(8) Flow Test of Mortar	C230
(9) Iron Castings	A47, A48
(10) Los Angeles Machine Test	C131
(11) Material Finer Than No. 200 Sieve (Mineral Flour)	C117
(12) Organic Impurities (Sand)	C40
(13) Precast Reinforced Concrete Pipe	C76
(14) Sieve Analysis of Fine and Coarse Aggregates, Cinders & Topsoil	C136
(15) Soundness (Aggregate)	C88
(16) Specific Gravity, Coarse Aggregate	C127
(17) Specific Gravity, Fine Aggregate	C128
(18) Steel Bars for Concrete Reinforcement	A615
(19) Steel Castings	A27
(20) Steel Plates	A283
(21) Steel Pipe	A134
(22) Structural Strength (Sand)	C183, C184, C187, C188, C190, C191
(23) Surface Moisture in Fine Aggregate	C70
(24) Tension Tests of Metallic Materials	E8
(25) Unit Weight of Aggregate	C29
(26) Vitrified Clay Pipe	C700
(27) Cast Iron Pipe	A74
(28) Ductile Iron Pipe	A377
(29) Water and Sediment	D96

30.03.2 VITRIFIED CLAY PIPE

(A) INSPECTION - All pipe must be inspected at the manufacturer's yard for compliance with the requirements of ASTM C700. An independent Testing Laboratory retained by the manufacturer must perform this inspection. The Testing Laboratory must be licensed in both the State where the inspection and testing are to be performed, and also in the State of New York.

(B) TESTING - The Testing Laboratory must assign an identifying number for each lot of one hundred (100) lengths of pipe for every size manufactured for the project and must also affix said lot number to each pipe length.

For crushing strength tests, the Testing Laboratory must select one (1) pipe length from each lot. Where less than one hundred (100) lengths of pipe are to be required for any pipe diameter, at least one (1) pipe length will be selected for testing purposes; however, the Laboratory with the approval of the Engineer may waive this requirement at their discretion.

The specimens selected must be tested for crushing strength by the three-edge bearing method in accordance with ASTM C301, Standard Methods of Testing Clay Pipe. This test must be under the

supervision of the Testing Laboratory. The minimum crushing strength required will be those strengths listed in ASTM C700, under Table I, for Extra Strength Clay Pipe.

The Testing Laboratory will reject all pipe of the lot from which the tested length specimen has been taken if the actual strength of the pipe tested fails to meet the minimum three-edge bearing strength. However, the manufacturer may request that the Testing Laboratory select two (2) other lengths of pipe representing that lot from which the original pipe tested was selected from, to be tested. Should the tests on these two (2) lengths of pipe prove satisfactory, the lot represented by these lengths of pipe will be accepted. Should the tests on one (1) or both of these lengths of pipe prove unsatisfactory, no other test on any other lengths of pipe from this lot will be made and all other pipe in this particular lot will be rejected.

Pipe must not be released from the manufacturer's plant for shipment to the job site until the Testing Laboratory has certified the results of the tests.

Rejected New York City pipe must have all New York City identifying cast on or painted on markings removed as soon as possible after rejection.

The Testing Laboratory must submit a report in quadruplicate that must bear the name of the Laboratory and the seal and signature of an authorized representative of the Laboratory and must include the following information determined from the test specimens:

(1) Ultimate Load – lbs./ft.
(2) Barrel Thickness, Minimum - inches
(3) Inside Diameter of Barrel - inches
(4) Variation in Length
(5) Inside Diameter of Socket - inches
(6) Depth of Socket - inches
(7) Thickness of Socket - inches
(8) Absorption - percentage
(9) Variation in Straightness
(10) Type of Joint
(11) Kiln Number

In addition, the report must include the specification requirements for the above items, where applicable. The reports must be submitted to the Engineer within three (3) days after testing, and no pipe must be incorporated into the work until these reports have been received and accepted by the Engineer.

The cost of all of the above must be deemed included in the prices bid for all items of work.

30.03.3 PRECAST REINFORCED CONCRETE PIPE

All requirements of ASTM C76, must conform to the manufacture of precast reinforced concrete pipe including ASTM C497 regarding Standard Methods of Testing.

(A) INSPECTION - All pipe must be inspected at the manufacturer's yard for compliance with the requirements of ASTM C76. An independent Testing Laboratory retained by the manufacturer must perform the inspection. The Testing Laboratory must be licensed in both the State where the inspection and testing are to be performed, and also in the State of New York.

(B) TESTING - For pipe testing purposes, the Laboratory will select one (1) length from each one hundred (100) lengths of each pipe diameter manufactured for this contract. Where less than one hundred (100) lengths of pipe are required for any pipe diameter, at least one (1) length will be selected for testing purposes; however, the Laboratory with the approval of the Engineer may waive this requirement at their discretion. The Laboratory must witness all tests on pipe.

The Testing Laboratory will reject all pipe of the lot from which the tested length has been taken if the actual or corrected strength of the pipe tested fails to meet the three-edge load bearing strength test requirement. However, the manufacturer may request that two (2) other lengths of pipe, representing that lot from which the original pipe was selected, be tested. The Laboratory will select these two (2) lengths of pipe. Should the tests of these two (2) lengths of pipe prove satisfactory, the lot represented by these lengths of pipe will be accepted. Should the test on one or both of these lengths of pipe prove unsatisfactory, no further tests on any lengths of pipe from this lot may be made, and all the pipe in this particular lot will be rejected. Pipe cannot be released from the Manufacturer's plant for shipment to the site of the work, until the Testing Laboratory certifies the results of the tests.

The pipe manufacturer must provide an approved and certified testing machine with a hydraulically operated jack and direct reading gauges requiring no calibration.

Rejected New York City pipe must have all New York City identifying cast on or painted on markings removed as soon as possible after rejection.

(C) HYDROSTATIC TEST ON PIPE AND ON RUBBER GASKET JOINTS - The manufacturer must perform hydrostatic tests on pipe and rubber gasket joints in accordance with ASTM C361, Section 8. - Hydrostatic Tests. Hydrostatic tests must be for a hydrostatic head of twenty-five (25) feet or as otherwise specified. The hydrostatic pressure tests on joints must be made on the joint of two (2) sections of pipe assembled and properly connected in accordance with the joint design submitted on the shop drawing and approved by the Department of Design and Construction.

The manufacturer must bulkhead the outer ends of the two (2) joined pipe sections and conduct hydrostatic tests on both the pipe and the pipe joint concurrently. The manufacturer must retain the services of an independent Testing Laboratory licensed in both the State where the testing is to be performed and also in the State of New York to witness the hydrostatic tests and to certify the results. Prior to the date of testing, the manufacturer must give two (2) weeks' notice in writing, to the Department of Design and Construction which reserves the right to have an inspector or authorized representative present at the time of testing.

All manufacturers supplying Reinforced Concrete Pipe to the Department of Design and Construction must, for each size pipe and gasket combination submitted for approval, have on file with the Department a Certified Statement attested thereto by the City Inspector/Representative or Testing Laboratory that the Hydrostatic Test on Pipe and on Rubber Gasket Joint called for was performed in accordance with ASTM C361 and passed.

The cost of all of the above must be deemed included in the prices bid for all items of work.

(D) SHOP DRAWINGS

(1) On all shop drawings submitted to the Department of Design and Construction for approval, the following statement must be made thereon:

   (a) All requirements of ASTM Specifications for Precast Reinforced Concrete Pipe as called for in the specifications have been complied with in the manufacture of the pipe.

   (b) A statement that a satisfactory Hydrostatic Test has been performed on the pipe in accordance with ASTM C361 during the last twenty-four (24) months and is on file in the Department of Design and Construction. Statement must include date of test and copy of Certification.

(2) All shop drawings submitted must be in conformity with the latest master drawings submitted by the manufacturer and on file with the Department of Design and Construction.

   The following dimensions must be called for on shop drawings:

   (a) Diameter of Pipe
   (b) Area of all cages of reinforcing steel.
   (c) A minimum clearance of one (1) inch for each case of circumferential reinforcing steel shown.
   (d) Angle of the joint.
   (e) Length and thickness of joint.
   (f) Length and thickness of bell.
   (g) Manufacturer's size and type gasket.
   (h) Manufacturer's recommendation for gap dimension and tolerance for joint for properly installed pipe.
   (i) Signature of professional authorized representative of manufacturer and title.

(3) The Department of Design and Construction is to be allowed a minimum of two (2) weeks to review shop drawings. Jobs of greater complexity are to receive proportionately more time for review.

SECTION 30.04 – INSPECTION, SAMPLING, AND TESTING OF WATER MAIN MATERIALS

The inspection, sampling and testing of the following water main materials must be done in accordance with the following sections of this specification:

MATERIAL	SECTION
(1) Ductile Iron Pipe And Accessories	20.01
(2) Ductile Iron Fittings And Accessories	20.02
(3) Butterfly Valves With Manual Actuators	20.03
(4) Pressure Reducing Valves	20.04
(5) Resilient-Seated Gate Valves With Various End Connections	20.05
(6) Tapping Valves	20.05
(7) Double Disc Gate Valves With Various End Connections	20.06
(8) Iron Castings	20.07
(9) Dry Barrel Fire Hydrants And Extension Kits	20.08
(10) Stainless Steel Tapping Sleeves With Branch Connections For Flanged Tapping Valve Or Mechanical Joint Tapping Valve	20.09
(11) Corporation Stops And Quarter Bends	20.10
(12) Steel Pipe And Appurtenances	20.11

NOTE: To perform trunk main work the Contractor must acquire the trunk main material, fabrication, inspection, sampling, testing, delivery, installation and construction procedures specifications **Section 20.11** (latest revisions) specified above from the Department of Design and Construction, Division of Infrastructure, Design Services, Specifications, 30-30 Thomson Avenue, 3rd Floor, Long Island City, NY 11101.

CITY OF NEW YORK

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF WATER AND SEWER OPERATIONS

DIVISION IV – GENERAL CONSTRUCTION PROVISIONS

SECTIONS 40.01 TO 40.14

(NO TEXT ON THIS PAGE)

SECTION 40.01 – SCOPE OF WORK

40.01.1 DESCRIPTION

The description and location of the work for this contract are specified in the Contract Documents.

40.01.2 PROSECUTION OF WORK AND STAGING OPERATIONS

The Contractor must conduct the Contractor's operations so as to cause a minimum interference to vehicular and pedestrian traffic. The time, place and manner in which the work is to be performed must be as directed by the Engineer. Only as much of the roadway as the Engineer must designate, may be closed to traffic and only for as long as the Engineer may prescribe. The work must be prosecuted simultaneously at one or more places as ordered by the Engineer.

SECTION 40.02 – TRENCHES - GENERAL

40.02.1 OPEN CUT, NO TUNNELING

All work must be done in open trenches or excavations except where construction by tunneling methods is specifically provided for in the contract documents.

40.02.2 PROTECTION OF PERSONS AND PROPERTY

The Contractor, in order to prevent damage to subsurface structures and adjacent buildings, to safeguard persons and property and to minimize inconvenience to traffic and the public, also to protect the structure to be installed and to provide suitable and safe working conditions, must adequately sheet and brace trenches or excavations. Except as otherwise provided, deviations from the above will be permitted only where, in the judgment of the Engineer, such exception will not result in any of the hazards described above.

40.02.3 TRENCHES

(A) All trenches in earth must be excavated with vertical sides, and must be supported by close sheeting, properly braced, unless otherwise permitted. Sheeting and bracing must extend from at least the existing surface of the ground to an adequate depth below the subgrade of the structure, except where otherwise specified on the plans, or permitted by the Engineer in writing. Sheeting must be driven below the area of the pilot cut. Driving of sheeting above the pilot cut is subject to the directions of the Engineer.

Pilot cuts for trenches must not exceed five (5) feet at any time. The Engineer may reduce the depth of the pilot cut should soil and subsurface conditions warrant such action.

The Engineer may direct the Contractor to use other types of equipment, and to revise the procedure during the excavation of the pilot trench and the driving of the sheeting should it be found necessary to do so.

Trenches, five (5) feet in depth or less, need not be sheeted and braced, except where the trenches are in close proximity to existing structures or subsurface structures or where the Engineer, in writing, specifically prohibits the use of a nonsheeted trench.

(B) Where shown, specified or permitted in writing by the Engineer, the sides of the trenches must be sloped to elevations approved by the Engineer. Side slopes must be stable and must be, in the dry, at least one and one-half (1-1/2) vertical on one (1) horizontal. In all cases, the sides of the trench excavations must not be sloped to the elevations lower than two (2) feet above the top of the water main and sewer pipe, poured-in-place sewers and box shaped or other nonpipe sewers. The maximum width of trench must be in conformity with **Subsection 40.02.4**.

40.02.4 WIDTHS AND DEPTHS OF TRENCHES

(A) FOR SEWER TRENCHES AND EXCAVATIONS

(1) Minimum Widths - Unless otherwise specified or approved by the Engineer, the minimum widths of sewer trenches must be such as to meet the following:

(a) The minimum width in earth between inner faces of the lowest stage of sheeting, from subgrade of sewer trench to a minimum height of two (2) feet above the top of the pipe, for circular pipe sewers, elliptical pipe sewers, basin connections, house connections, and other circular pipe drains must not be less than the standard width of the cradle plus six (6) inches minimum each side. This minimum must be maintained at all times, except where sheeting is to be used as formwork. Where sheeting is to be used as formwork the minimum width of trench must be determined by the Engineer.

(b) The minimum width in earth between inner faces of the lowest stage of sheeting, from subgrade of sewer trench to a minimum height of two (2) feet above the top of poured-in-place sewers and box shaped or other nonpipe sewers, or to a minimum height specified on the sheeting and bracing drawings for other structures (i.e. manholes, chambers, etc.), must not be less than the greatest external width of the poured-in-place sewers, box shaped or other nonpipe sewers, and other structures plus six (6) inches minimum each side. This minimum must be maintained at all times, except where sheeting is to be used as formwork. Where sheeting is to be used as formwork the minimum width of trench must be determined by the Engineer.

(c) The minimum width in rock between faces of the lowest stage of vertical rock cut lines from subgrade of sewer trench to a minimum height of two (2) feet above the top of all circular

pipe sewers, basin connections, house connections, other circular pipe drains, elliptical pipe sewers, poured-in-place sewers and box shaped or other nonpipe sewers, or to a minimum height specified on the sheeting and bracing drawings for other structures (i.e. manholes, chambers, etc.), must not be less than the standard width of the cradle or the greatest external width of the poured-in-place sewers, box shaped or other nonpipe sewers, and other structures plus eight (8) inches minimum each side.

(2) Maximum Widths - Unless otherwise approved by the Engineer, the maximum widths of sewer trenches must be such that the maximum width in earth or in rock between inner faces of the lowest stage of sheeting or faces of the lowest stage of vertical rock cut lines from subgrade of sewer trench to a minimum height of two (2) feet above the top of all circular pipe sewers, basin connections, house connections, other circular pipe drains, elliptical pipe sewers, poured-in-place sewers and box shaped or other nonpipe sewers, or to a minimum height specified on the sheeting and bracing drawing for other structures (i.e. manholes, chambers, etc.) must not be greater than the standard width of the cradle or the greatest external width of the poured-in-place sewers, box shaped or other nonpipe sewers, and other structures plus eighteen (18) inches maximum each side.

(3) Minimum Depth - The minimum depth of sewer trench must be the depth required in order to construct the sewer structures, together with foundations, complete to the lines and grades and to the elevations shown and specified on the contract documents and as directed by the Engineer.

(4) Additional Requirements:

(a) The Contractor is advised that for pipe sewers and precast box or other sewers, the minimum width of trenches and clearances on each side of the sewers that the Contractor elects to use must be such as to permit for a good and workmanlike caulking and sealing of all joints.

(b) In rock trenches the Contractor may, with the written permission of the Engineer, omit the use of side forms. Rocks cannot project inside the minimum width vertical rock cut lines herein specified. Where provisions for future house connections are specified in the contract or required by the Engineer, the rock cut line must be a minimum of one (1) foot outside the side of the pipe sewers, poured-in-place sewers, box shaped or other nonpipe sewers and other structures.

(c) Where the Contractor elects to cut the Contractor's sewer trench in rock by means that will result in overbreakage, rather than resorting to means which will insure adherence to the maximum allowable width of sewer trench, the Contractor must be required to fill the spaces between the edges of the pipe sewer cradle or the external neat line of the poured-in-place sewers and box shaped or other nonpipe sewers and the sides of the rock cut with concrete, from subgrade of trench to a minimum height of two (2) feet above the top of the sewer. Should the overbreakage result in an additional width of trench sufficient to overload the sewer, the Contractor must, at the Contractor's own expense, provide additional strength or concrete encasement and/or reinforcement for the sewer, as required by the Engineer.

(d) If the Contractor elects to carry the excavation in earth below the required subgrade of the sewer trench, the Contractor must backfill the sewer trench to the required subgrade with either properly compacted stone ballast or with concrete, as directed by the Engineer. If the Contractor elects to carry the excavation in rock below the required subgrade of the sewer trench, the Contractor must backfill the trench to the required subgrade with concrete or stone ballast as directed by the Engineer. No separate or additional payment will be made for such backfilling where required, nor for any additional excavation and sheeting, the cost thereof must be included in the prices bid for all contract items of work.

(B) FOR WATER MAIN TRENCHES AND EXCAVATIONS

(1) The widths and depths of water main trenches in earth must be in conformance with the requirements of **Section 60.12 - Laying Ductile Iron Pipe And Fittings** and **Section 60.21 - Furnishing, Delivering And Laying Steel Pipe And Appurtenances**.

(2) Rock must be excavated throughout the entire length and depth of the water main trench two (2) feet wider than the outside diameter of the pipe and at least six (6) inches deeper than the outside diameter of 30-inch and smaller pipe, nine (9) inches deeper than the outside diameter of 36-inch pipe and twelve (12) inches deeper than the outside diameter of 42-inch and larger pipe. (Where the bottom of trench is in rock, the pipe must be supported on a minimum of six (6) inches of select granular fill bedding in ground

stabilization filter fabric wrap, or on concrete cradle, carried to the rock bed, as shown on the Water Main Standard Drawings or as directed by the Engineer.) Projections of rock, which come within six (6) inches of the outside of any portion of the pipe barrel or bell, or within one (1) foot of any hydrant standpipe or elbow, must be removed. (See **Section 70.61**.)

(3) Excavation Limits In Connection With Various Water Main Construction Operations:

(a) For Construction Of Valve Chambers, Etc. - For the building of valve chambers and other structures, the limits of excavation will be based upon areas two (2) feet outside of the outside faces of walls of such structures.

(b) For Making Connection To Or Setting Valves Upon Existing Mains - Where cuts are made in existing mains for the purpose of making connections to existing mains or for setting valves upon existing mains, the limits of excavation will be based upon a length five (5) feet longer than the distance between the extreme joints run as made by the Contractor and a width of trench as allowed for the laying of new mains of the same nominal diameter of the existing mains as specified in **Section 60.12 - Laying Ductile Iron Pipe And Fittings**.

(c) For Removing Existing Main - Where the existing main to be removed is in the same trench and alongside the new main an additional allowance equal to the nominal diameter of the existing pipe to be removed will be added to the width of trench as allowed for the laying of new mains specified in **Section 60.12 - Laying Ductile Iron Pipe And Fittings**.

Where the existing main to be removed does not come within the limits of the trench excavated for laying the new main an amount of one-half (1/2) foot must be deducted from the width of trench as allowed for the laying of new mains specified in **Section 60.12 - Laying Ductile Iron Pipe And Fittings**.

(d) For Setting Valve And Valve Boxes - No additional excavation over the regular pipe trench will be allowed for setting valve and valve boxes.

(e) For Making Wet Connections - For the making of wet connections the limits of excavation will be based upon a length three (3) feet longer than the distance from the back of the sleeve to the extreme end of the tapping apparatus after same is in position and ready for operation, and a width five (5) feet greater than the maximum length of the split sleeve.

(f) For Removing Valve Boxes - For removing valve boxes from abandoned mains that are left in place the limits of excavation will be four (4) feet square for large boxes and two (2) feet square for hydrant boxes.

(g) For Extending House Service Connections - Where the service is transferred from an existing main to a new main or to a parallel existing main, the limits of excavation outside the limits of the pipe trench will be based upon a width of three (3) feet.

(h) For Locating Taps - For locating existing taps on existing mains to be abandoned the limits of excavation will be based upon a width of trench as allowed for the laying of new mains of the same nominal diameter of the existing mains as specified in **Section 60.12 - Laying Ductile Iron Pipe And Fittings** and for a length parallel to the axis of the existing pipe one (1) foot more than actually needed to locate the existing tap, as determined by the Engineer.

For making taps on an existing main which is to be retained in service the limits of excavation will be based upon widths five (5) feet greater than the nominal diameter of the existing main to be tapped and a length parallel to the axis of the existing main of four (4) feet for a single tap.

Where an existing main to be abandoned lies sufficiently close to a parallel main, so that they can both be exposed in the same trench, the limits of excavation will be based upon the following: The Contractor must first excavate along the existing main to be abandoned to locate the tap; when the tap is found, the trench must be widened, where and as directed by the Engineer to uncover the main to be adapted. The allowable width perpendicular to the axes of the mains will be five (5) feet greater than the distance between the outside of the mains and the allowable length parallel to the axes of the mains will be four (4) feet for a single tap. Where two or more taps are located on the existing main to be abandoned or made in the new main or retained existing main, in one trench, the allowable length parallel to the axes of the mains will be four (4) feet greater than the distance between the extreme taps.

(4) Additional Requirements:

(a) Where surface or subsurface structures are encountered in the prosecution of the work, the water main pipe must be laid in such a manner as to avoid them, as directed by the Engineer. In such cases, the above specified width of trench may be reduced, safety requirements permitting, as ordered or approved by the Engineer.

(b) The trench must be excavated at each water main pipe joint of such width and depth as may be necessary to give adequate room for making up the water main joints.

(c) Where ground water or ledge rock is encountered, the water main must be laid with a cover of not less than three (3) feet, unless otherwise directed by the Engineer.

(d) Where an existing water main and appurtenances, which are to be removed and replaced by a new main, are removed first, the trench must be excavated to suit the requirements for the laying of the new water main.

(e) Where the new water main is to be laid in the trench alongside of an existing water main, which is to be removed or abandoned, the trench must be excavated to such width that there is about one (1) foot of clear space between the existing water main pipe and the new water main pipe.

(C) ADDITIONAL REQUIREMENTS FOR ALL TRENCHES AND EXCAVATIONS

(1) Where the structures are to be supported on piles and the Contractor deems it necessary to widen the trench beyond the maximum widths herein specified in order to permit the driving of such piles, the Contractor must apply to the Engineer in writing for permission to widen the trench.

(2) Any widening or enlargement of excavation permitted in writing by the Engineer upon the request of the Contractor in order to perform the work as specified in the contract documents and/or to expedite the Contractor's construction operations, will not be measured for any separate or additional payment, but the costs thereof must be included in the prices bid for all contract items of work.

40.02.5 PROTECTION

In cases where sheeting and bracing will not adequately protect adjacent structures from damage and settlement, the Contractor will be required to use such methods as are necessary to safely support and maintain adjacent and abutting property and structures and to maintain the work safe to life, limb and property.

40.02.6 SHEETING AND BRACING AND FORMWORK

Sheeting and Bracing of the trenches must be done in accordance with **Section 40.05 - Sheeting And Bracing**.

Unless otherwise specified in the plans or these specifications or specifically permitted in writing by the Engineer, the Contractor must remove all sheeting and bracing throughout this project as per **Subsection 40.05.7**.

When sheeting is specifically shown on the plans or specifically described in the specifications or specifically ordered in writing by the Engineer to be left in place all work must be done in accordance with **Subsection 40.05.2**.

All formwork must be removed prior to the backfilling of trenches and excavations.

40.02.7 LENGTH OF TRENCH

Unless otherwise specified in the contract documents or ordered in writing by the Engineer, there must not be more than six hundred (600) feet of open trench in a roadway at any one time. (Trenches backfilled but not yet temporarily paved are considered open trenches.)

Unless otherwise specified in the contract documents or ordered in writing by the Engineer, all trenches in rock must be excavated to its full depth for a minimum distance of twenty (20) feet in advance of the length of water main pipe and sewer conduit permitted to be laid; however, the total length of trench must not be less than fifty (50) feet. The only exception to this is at its upper end or ends, where rock must be excavated to its full depth to a distance of not less than five (5) feet beyond the water main pipe and sewer conduit to be built. (See **Section 70.61**.)

Trenches for basin connections and house services must not be opened on both sides of the street at the same time unless permission has previously been given to close the street. Unless otherwise directed,

each trench for basin connections and house services must be fully excavated for its entire length before any pipe is laid therein.

40.02.8 TREES AND STUMPS

The Contractor must clear and grub the surface over the trenches and excavations of all trees and stumps and remove the same from the site of work. All work associated with tree stump removal must be done in accordance with **Subsection 10.06** of the specifications and as specified by the Department of Parks and Recreation permits.

40.02.9 MATERIALS TO BE DISINFECTED

If required, any or all of the excavated material must be satisfactorily disinfected or deodorized prior to removal from the site of work.

40.02.10 ROADWAY, SIDEWALKS, ETC. TO BE KEPT CLEAR

Materials of construction must be so deposited, and the work must be so conducted as to leave open and free for traffic all crosswalks and a space on each sidewalk not less than one-third (1/3) the width of such sidewalk but not less than five (5) feet in width. A roadway not less than one-third (1/3) of the width of the total roadway but not less than eleven (11) feet must be provided for the free passage of vehicles, unless otherwise specified in **Subsection 10.30** or permitted in writing by the Engineer. Street hydrants, water gates, fire alarm boxes and letter boxes must be kept accessible for use at all times. Not more than two hundred (200) feet of available sidewalk must be used at any time for storage of materials of construction. During the progress of the work the Contractor must maintain all crosswalks, sidewalk, driveways and roadways in a safe, neat, clean and satisfactory condition. The work must at all times be so conducted as to cause a minimum of inconvenience to public travel and permit safe access to private and public property along the line of the work. All work must be done in accordance with **Subsection 10.30** and Department of Transportation permits.

40.02.11 NO EXCAVATED MATERIAL STORED ALONG THE LINE OF THE WORK

Excavated material must not be stored at any time along the line of the work.

The work may be conducted in the following way:

(1) All material excavated from the first one hundred (100) feet of trench must be carted away by the Contractor as soon as excavated. The material subsequently excavated, if suitable for backfill in accordance with **Section 40.06**, may be used to backfill the trench in which the water main pipe and sewer conduit has been built and for which permission to backfill has been given.

(2) Where deficiency of acceptable backfill material occurs, the required amount of suitable backfill material must be brought to the work and used to backfill the trench.

(3) All excess excavated material must be removed from the site of work immediately upon excavation. Work must be done in accordance with **Subsection 10.08**.

40.02.12 SUBGRADE OF TRENCHES

The subgrade of all trenches and excavations must be constructed neat and compacted to the elevations and grades required as shown or specified in the contract documents, and as directed by the Engineer.

For Sewer Trenches And Excavation Only - Upon completion of the sewer trenches and excavations and prior to placement of structures, the Contractor must take in-place soil density tests of the subgrade (the number and locations of these tests must be as directed by the Engineer), and must compact the subgrade, as directed by the Engineer, to a minimum of ninety-five (95) percent of Standard Proctor Maximum Dry Density (as determined by AASHTO T-99 Test Method). All soil density testing must be done in accordance with **Subsection 40.06.4 - Soil Density Testing**.

40.02.13 FENCE

The Contractor must completely enclose by temporary fences all trenches and excavations and all other potentially hazardous locations as determined by the Engineer, as soon as such conditions exist. Fences must be constructed, placed, maintained, measured and payment made for in accordance with **Section 70.31** of the specifications.

40.02.14 TEMPORARY WALKS AND BRIDGES

Where specified or required, the Contractor must construct and maintain, as directed, suitable temporary walks and bridges for pedestrians and vehicles. Temporary walks and/or bridges must be installed across trenches at all active hydrant locations and crosswalks specified, required or ordered. Where specified or required, temporary bridges must be installed across trenches in order to provide vehicles access to driveways. Where specified or required, street intersections and/or sidewalk areas must be temporarily bridged or decked over and kept open to vehicular and pedestrian traffic.

The Contractor must work one-half (1/2) of an intersection at a time and must keep the other one-half (1/2) of the intersection open to vehicular traffic at all times, unless otherwise specified.

The Contractor must, at each intersection, maintain open for pedestrian traffic at least one (1) pedestrian crossing, unless otherwise specified or ordered in writing by the Engineer.

If a trench runs between the lane designated for emergency traffic and a hydrant(s), a walkway over the trench at each hydrant location must be installed and maintained by the Contractor.

All designated pedestrian walks, crosswalks and bridges must be protected from the excavation area and the construction operation through the use of an approved barrier, temporary fence, or other temporary devices and in a manner approved by the Engineer. As a minimum requirement, pedestrian crossings over excavations must be constructed with steel plates and lined on both sides of the plates with temporary fence attached to timber curbs. Where steel plates cannot be used a substantial timber walk or bridge must be constructed with temporary fence attached to timber curbs on both sides of the walk or bridge. Such crossings must have a clear distance between timber curbs with fencing of not less than three (3) feet in width.

All temporary walks, crosswalks and bridges must be maintained in a safe, neat, clean and satisfactory condition and must be suitably lighted at night. All walks, bridging and decking must be firmly secured so as to eliminate any possible shift or movement.

The removal of the pavement and the placing of the temporary walkways, bridging or decking must be done during the hours of the day or night designated by the Engineer, which will cause the least inconvenience to business properties along the line of the improvement and to public travel in general. If approved in writing by the Engineer, during certain hours of the day or night designated by the Engineer, sections of walks, bridging or decking, no more than eight (8) feet in length may be temporarily removed for the purpose of removing excavated material or receiving materials of construction or for backfilling. All timber walks, bridging and decking together with their supporting structures must be submitted for approval prior to commencement of construction operations in accordance with **Subsection 40.05.5** and **Subsection 40.05.6** and must be constructed in accordance with the approved drawings on file with the Engineer.

All work must be done in accordance with **Subsection 10.30**, Department of Transportation Permits and as directed by the Engineer.

40.02.15 DISPOSAL OF WATER FROM TRENCHES

The Contractor must at all times during the progress of the work keep the trenches and excavations free from water. The water from the trenches and excavations must be disposed of in such a manner as will not cause injury to the public health, nor to public or private property, nor to the work completed or in progress, nor to the surface of the streets, nor cause any interference with the use of the same by the public. All sewers used for disposal of water from the trenches and excavation during construction must be acceptably cleaned.

When in order to comply with the above, it is deemed necessary to widen sewer trenches and excavations beyond the allowable maximum width, to permit the installation of well points, the Contractor must, as directed by the Engineer, provide either pipe of additional strength or concrete encasement at no additional cost to the City.

The Contractor must, with the Contractor's own equipment, provide dewatering where required at no additional cost to the City. The cost for all labor, equipment, materials, etc. required to dispose of water from the trenches and excavations must be deemed included in the prices bid for all items of the contract.

All dewatering and discharge pipes and hoses which cross traveled roadways must be placed in such a manner so as to eliminate any disruption of traffic flow. If so ordered by the Engineer, the Contractor must place the pipes and hoses in shallow trenches that will then be plated over. All header pipes must be buried below existing roadway grade at driveways in order to maintain access to driveways.

All plates must be firmly secured so as to eliminate any possible shift or movement.

All pumps used in the dewatering operation must be electric and must be powered directly from a Con Edison drop, unless otherwise unavailable.

Dewatering by means of well points or deep wells will not be allowed in the Boroughs of Brooklyn or Queens where the rate of pumping exceeds forty-five (45) gallons per minute unless the appropriate permit has been secured from the New York State Department of Environmental Conservation.

SECTION 40.03 – EARTH EXCAVATION

40.03.1 DEFINITION, EARTH EXCAVATION

(A) Earth Excavation must include the removal and disposal of all materials of whatever nature encountered in the prosecution of the work, unless otherwise specified. All materials of whatever nature encountered must be defined as including, but not be limited to, the following:

(1) soil;
(2) stones;
(3) soft weathered rock that can be excavated by mechanical means other than air hammer or drilling and blasting;
(4) miscellaneous fill and refuse, anything thrown away or rejected as worthless or useless (both organic and inorganic material) that can be excavated by mechanical means other than air hammer or burning and cutting;
(5) sidewalk pavements (all types) and curbs (all types) within limits of trenches and excavations and cutbacks;
(6) existing man-made objects or structures within the trenches and excavations, which objects or structures are shown on the contract drawings or indicated in the specifications, or if not shown or specified could reasonably have been anticipated by the Contractor and which do not materially affect the cost of removal and disposal to the Contractor, as determined by the Commissioner; and,
(7) existing man-made objects or structures outside the trenches and excavations, which objects or structures are shown on the contract drawings or indicated in the specifications to be removed and disposed of by the Contractor.

(B) Earth Excavation must not include the following:

(1) boulders in open cut as defined in **Subsection 40.04.1**;
(2) rock as defined in **Subsection 70.61.2**;
(3) roadway pavements (i.e., asphaltic concrete pavements, concrete pavements, composite pavements, reinforced concrete pavements, granite/brick pavements) within limits of trenches and excavations and cutbacks (**See Section 71.21**);
(4) contaminated or hazardous materials that materially affect the cost of removal and disposal to the Contractor; and,
(5) existing man-made objects or structures that are not shown on the contract drawings or indicated in the specifications, that could not reasonably have been anticipated by the Contractor, were not anticipated by the City, and which materially affect the cost of removal and disposal to the Contractor, as determined by the Commissioner.

(C) If the City anticipates that any of the items in paragraph (B) above need to be excavated and disposed of, a separate contract item will be included in this contract.

If a separate contract item is not included in the contract and the City determines: (1) that the Contractor could not have reasonably anticipated that such materials would need to be excavated and disposed of; and (2) that such excavation and disposal would materially affect the Contractor's costs; then such excavation and disposal must be paid for as Extra Work.

40.03.2 WIDTHS OF TRENCHES

The widths of trenches in earth and the dimensions of excavations in earth must be in accordance with **Section 40.02** of the specifications.

40.03.3 DEPTH OF TRENCHES

(A) The trenches in open cut must be excavated to the depth required for the foundations of the water main pipe, sewer conduit and appurtenances. Where conditions are such as to make it necessary to excavate to additional depths, as directed by the Engineer, (except conditions described in **Subsection 40.03.3(B)** below) separate payment must be made under the item(s) labeled "ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS", and as described in **Section 73.31 - Additional Earth Excavation Including Test Pits**.

All irregularities in the bottom of the water main trenches and excavations must be filled to the required subgrade with either Select Granular Fill or Screened Gravel or Screened Broken Stone as directed by the Engineer.

All irregularities in the bottom of the sewer trenches and excavations must be filled to the required subgrade with Stone Ballast as directed by the Engineer.

Backfill of the trench to subgrade, must be as described in **Section 65.71 - Furnishing, Delivering And Placing Screened Gravel Or Screened Broken Stone Bedding** and **Section 73.41 - Additional Select Granular Backfill** for water main trenches and excavations and payment must be made under Items No. 65.71SG - FURNISHING, DELIVERING AND PLACING SCREENED GRAVEL OR SCREENED BROKEN STONE BEDDING or Item No. 73.41AG - ADDITIONAL SELECT GRANULAR BACKFILL; and, **Section 70.71 - Riprap, Stone Ballast, Broken Stone And Slope Pavement** for sewer trenches and excavations and payment must be made under Item No. 70.71SB - STONE BALLAST.

(B) Where the subgrade of the sewer trenches and excavations cannot be maintained in a dry condition, except in locations where the sewers and appurtenances are on piles, the Contractor must excavate the trenches and excavations to an additional depth of six (6) inches below the subgrade of the sewers and appurtenances and backfill the trenches and excavations to the subgrade of the sewers and appurtenances with Stone Ballast.

The cost for this additional excavation, sheeting, installation of stone ballast, labor, materials, plant, equipment and insurance required or necessary to complete this work must be deemed included in the prices bid for the respective sewer or appurtenance items.

No payment will be made under any other items of this contract, nor will any separate payment be made for this work.

SECTION 40.04 – EXCAVATION OF BOULDERS IN OPEN CUT

40.04.1 DEFINITION

Excavation of boulders in open cut must include the excavation, removal and disposal of boulders or parts thereof from within the limits of the sheeted and unsheeted trenches and excavations, more than one-half (1/2) cubic yard in volume. The term boulders as used herein must include riprap, rock fill, thrust blocks and loose masonry.

40.04.2 REMOVAL

The Contractor may elect to remove an entire boulder when partly extending into the trench. Boulders must be removed from the site of the work immediately after being excavated and measurements taken by the Engineer. Excavated boulders will become the Contractor's property and must be properly disposed of at the Contractor's expense.

40.04.3 NO SEPARATE PAYMENT

No separate or additional payment will be made for excavating, removal and disposal of boulders one-half (1/2) cubic yard or less in volume, or for demolishing and removing existing water main chambers and sewer structures; the cost thereof must be included in the prices bid for all items of this contract.

No separate or additional payment will be made whenever the Contractor elects to remove an entire boulder that extends partly into the trench or excavation. Payment will only be made for that volume of the boulder that is within the limits of the sheeted and unsheeted trench or excavation. No separate or additional payment will be made for the removal of boulders or for the filling of voids left by the removal of boulders beyond the limits of the sheeted and unsheeted trench or excavation.

SECTION 40.05 – SHEETING AND BRACING

40.05.1 SHEETING AND BRACING

(A) The sides of the trenches and excavations must be supported by adequate sheeting and properly braced. All sheeting and bracing systems the Contractor elects to use or are ordered by the Engineer or the Department must comply with these specifications and must receive the approvals stated herein. Timber sheeting and bracing must be vertical sheeting with rangers and braces or horizontal sheeting supported by vertical steel soldier beams and the necessary bracing.

(B) Where the material to be excavated is of such character as to render it necessary, the sheeting must be tongued and grooved and driven to such depths below the subgrade as may be directed.

(C) Where the nature of the material encountered or the safety of the adjacent structure render it necessary, the Contractor may resort to the use of steel sheet piling with prestressed bracing or the Contractor may underpin the structure or buildings.

(D) Other sheeting systems may be permitted upon approval of the Department of Design and Construction. (Trench Boxes will not be permitted for use in trenches and excavations that exceed twelve (12) feet in depth. (See **Subsection 40.05.4(E)**.))

(E) In general, sheeting and bracing in trenches and excavations must be designed and installed so that the sheeting must not be braced or blocked against any part of the new structure, or manholes, or chambers. When conditions warrant, bracing against such structures may be permitted following the approval of drawings prepared and submitted by a Professional Engineer licensed in the State of New York, showing the assumed design loads and stresses, and details of such bracing.

(F) If, in the opinion of the Engineer, any of the approved temporary or permanent supporting structures are inadequate or unsuitable for the actual conditions in the field, the Engineer may direct the Contractor to strengthen the supporting structures at no additional cost to the City. The Contractor is responsible for the sufficiency of all temporary and permanent supporting structures whether or not directed by the Engineer to strengthen them.

(G) Unless otherwise specified in the plans or these specifications, the Contractor must remove all sheeting and bracing throughout this project as per **Subsection 40.05.7**.

40.05.2 SHEETING LEFT IN PLACE

When sheeting is specifically shown on the plans or specifically described in the specifications or specifically ordered in writing by the Engineer to be left in place, it refers to all sheeting and bracing in trench excavations for water main pipe and sewer conduit including manholes, valves and chambers. Excavations for catch basins, basin connections, house services and other excavations not considered part of the trench excavation for water main pipe and sewer conduit must have their sheeting and bracing removed entirely.

When sheeting is to be left in place, all elements such as rangers and braces, of the sheeting used, must be left in place, except for such temporary braces that require removal in order to make way for the structure. Where it is necessary to remove such temporary braces, the sheeting must be rebraced in a manner approved by the Engineer; however, in no case may the sheeting be braced against the side of the structure unless approved in writing by the Engineer. Where lagging and soldier beams are used, the soldier beams and all the rangers and braces must also be left in place. Where steel sheeting is used, the rangers and braces must also be left in place.

When sheeting is to be left in place, the Contractor must cut sheeting at the elevations ordered in writing by the Engineer; however, in general such cutoffs must not be less than four (4) feet below the final grade. Timber sheeting must be cut off by sawing. Steel sheeting or soldier beams must be cut off by burning. Breaking off of sheeting will not be permitted. The Contractor must remove from the trench and away from the site of work, to the Contractor's own place of disposal, all cut sheeting and soldier beams together with all rangers, lagging and braces above the ordered elevation of cut. Where the removal of rangers and braces above the ordered elevation of cut is determined by the Engineer to render the sheeting system unstable, rangers and braces must be placed prior to cutting at a level below the ordered elevation of cut and left in place.

(A) FOR SHEETING OF WATER MAIN TRENCHES AND EXCAVATIONS

Additional payment will be made for sheeting and bracing that is specifically shown on the plans or specifically described in the specifications or ordered in writing by the Engineer, to be left in place in water main trenches and excavations. Payment will be made in accordance with **Section 70.91**.

(B) FOR SHEETING OF SEWER TRENCHES AND EXCAVATIONS

No separate or additional payment will be made for sheeting and bracing that is specifically shown on the plans or specifically described in the specifications to be left in place in sewer trenches and excavations, regardless of the type used nor for the removal from the trench and excavation and the disposal away from the job site of the cut sheeting, bracing and rangers. The cost thereof must be included in the prices bid for all sewer contract items of work, except when separate payment for sheeting and bracing is provided, in this case the cost must be included therein. When sheeting is specifically ordered by the Engineer, to be left in place in sewer trenches and excavations, the cost for all labor, materials, cutting, removal, disposal, insurance and work required to leave sheeting in place must be determine in accordance with **Articles 25 and 26** of the Contract.

40.05.3 MATERIALS

(A) Timber sheeting and bracing must be of new or acceptable used timber free from injurious defects.

(B) Steel soldier beams must comply with the requirements of **Section 23.05 - Structural, Reinforcing And Miscellaneous Steel**, except that approved used material will be permitted. Steel sheet piling must comply with the requirements of **Section 24.01 - Steel Sheeting**, except that approved used materials will be permitted. Timber and lumber for bracing, shoring, fencing, bridging, and decking must conform to the requirements of **Section 23.06 - Timber And Lumber**. Steel used for sheeting systems or for any other purposes herein must conform to the requirements of the ASTM A36 and all other applicable requirements of ASTM.

(C) Steel Plates for use as sheeting will be permitted provided that they are properly installed and supported. The use of steel bracing frames which partially support the steel plates will be permitted up to a depth of twelve (12) feet. The use of steel plates in conjunction with trench boxes will not be permitted (trench boxes cannot be considered as steel bracing frames).

(D) Steel Sheeting must conform to the requirements of **Section 24.01** and must be installed with continuous interlock.

40.05.4 CONSTRUCTION METHODS

(A) GENERAL - Timber sheeting and bracing and other sheeting systems must be of sufficient dimensions and strength, and steel sheeting must be of sufficient type, size and weight, to support adequately the sides of the trenches and excavations and insure the safety of adjacent structures and must be installed in accordance with the approved sheeting details. The Contractor must be solely responsible for the adequacy and sufficiency of all sheeting and bracing used.

(B) SHEETING - Unless otherwise specified, timber sheeting and bracing must be driven or placed ahead of the excavation in such a manner as to prevent the loss or slippage of ground in order to safeguard adjacent surface and subsurface structures. The sheeting must be driven to adequate depth below subgrade. As the work progresses, any voids back of the sheeting must be filled and compacted in accordance with **Section 40.06** and as directed by the Engineer.

(C) Sheeting can be used as forms for concrete work. Whenever sheeting is used as formwork as specified or approved by the Engineer only timber sheeting will be permitted unless otherwise approved or specified in writing by the Engineer. When sheeting is used as formwork, an approved protection must be placed between the sheeting, bracing or soldier beams and the concrete. In addition, when sheeting is used as formwork for any structure or portion thereof, the thickness of that structure or portion of such structure must be increased by three (3) inches beyond the original neat line of such structure or portion thereof. The sheeting, soldier beams or other bracing cannot encroach upon the original neat line of the structure. In such instances when sheeting, soldier beams or other bracing is found to encroach upon the neat line of the structure, the Engineer must direct the Contractor to remove such sheeting, soldier beams or other braces and redrive and/or replace the sheeting, soldier beams or other braces outside the neat line of the structure. All sheeting used as formwork must be removed.

(D) All open cuts must be excavated with vertical sides and properly supported with close sheeting and bracing in conformity with the requirements of **Section 40.03 - Earth Excavation** and with 23 NYCRR -

"Protection of Persons Employed in Construction and Demolition Work" and 16 NYCRR Part 753 - "Protection of Underground Facilities" of the State of New York, Department of Labor, Board of Standards and Appeals.

(E) The Contractor is advised that trench boxes will be permitted for use as a sheeting system provided that the depth of trench does not exceed twelve (12) feet. The use of trench boxes to partially sheet trenches that are greater than twelve (12) feet in depth, will be strictly prohibited.

Should trench boxes meeting the above requirements be utilized, the trench will not have to be sheeted completely to subgrade. The trench box will be permitted to “hang up” to a maximum of two (2) feet above subgrade provided that the existing soil in the area of the subgrade can “stand up” on its own without sheeting. Should running ground be encountered or should the soil in the subgrade area begin to slough off, the Contractor will be required to extend the trench box to subgrade. The Engineer must always maintain the right to order the Contractor to lower the trench box to subgrade as required.

No deductions will be made from any payment for not sheeting the bottom two (2) feet of trench if approved by the Engineer and no additional payment will be made should the Contractor be directed to sheet completely to subgrade.

All sheeting and bracing drawings submitted for approval which indicate trench boxes must be designed for the full depth of trench (to subgrade) and must show the trench box extending to subgrade.

(F) SLOPED SIDES OF TRENCHES OR EXCAVATIONS - Where the Contractor requests permission not to sheet a trench or excavation, and offers to slope the sides of such trench or excavation in accordance with OSHA Regulations in lieu of such sheeting, the Contractor’s request must be reviewed by the Engineer.

If the Engineer deems such sloping to be acceptable the Engineer must so notify the Contractor in writing.

Pavement excavation and restoration requirements must be governed by the width of the trench measured at the bottom of the pavement foundation. Pavement excavation and restoration in excess of those required in connection with standard trench excavation, as specified, must not be paid for.

In those cases where the Contractor does not request permission to side slope, but the Engineer determines that side sloping is in the best interests of the City, the Engineer must order the Contractor to proceed using such side sloping. In these cases, the additional pavement excavation and restoration will be paid for at the appropriate bid unit price.

In both of the above cases it must be presumed that side sloping a trench or excavation is done to obtain a lower cost for the work to be performed. The City must, therefore, take an appropriate credit to cover the difference in overall costs resulting from the use of side sloping instead of timber sheeting.

(G) SHEETING METHODS

The following methods of sheeting trenches are acceptable:

(a) Vertical Wood Sheeting
(b) Steel Soldier Beams with Horizontal Wood Lagging
(c) Interlocking Steel Sheeting
(d) Trench Boxes for trench depths up to twelve (12) feet
(e) Steel Soldier Beams with Steel Plates continually supported
(f) Steel Frames with Steel Plates for trench depths up to twelve (12) feet
(g) Krings and Icon Type Sheeting Frames and Plates

40.05.5 SHOP DRAWINGS

The Contractor will be required to submit Shop Drawings detailing the sheeting system whenever the depth of cut exceeds five (5) feet.

(A) Before commencing any excavating operation the Contractor must have approved drawings from the Department of Design and Construction for all types of sheeting and bracing systems, cofferdams, shoring, underpinning, bridging, decking and all other temporary or permanent supporting structures required.

(B) The Contractor must submit for approval five (5) copies of sheeting and bracing drawings, and other structures (i.e. decking, bridging) drawings that the Contractor proposes to use for the work.

(C) The Contractor must have these drawings prepared by a Licensed Professional Engineer, currently registered in the State of New York. Such drawings must be submitted together with design calculations, references, tables and charts. Both drawings and design calculations must bear the imprint of the Licensed Professional Engineer's seal and signature.

(D) In designing the sheeting stated above, the Contractor's Engineer must take note of the standard minimum load diagram requirements for Watertight and Non-Watertight sheeting structures. (See Sewer Design Standards.)

(E) The following notes must be required on all sheeting detail submissions:

(1) If the actual surcharge is in excess of three hundred thirty (330) pounds per square foot the Contractor must adequately reinforce the sheeting and bracing as required at no additional cost to the City.

(2) Maximum pilot cut must be five (5) feet.

The sheeting and bracing drawings must also include but not be limited to the following: the density of the soil, the internal angle of friction of the soil, the stress grade and type of lumber, the allowable steel stresses and the sequence of construction operation where required.

(F) Shop drawings of sheeting, bracing and other structures used by the Contractor must be signed by and carry the seal of a Professional Engineer licensed in the State of New York. These drawings must be submitted together with proper design computations bearing the same seal and signature. Shop drawings must be on sheets twenty-seven (27) inches by forty (40) inches with a one-half (1/2) inch marginal space on three (3) sides and a two (2) inch marginal space for binding on the left side.

Shop drawings must be numbered consecutively and must accurately and distinctly present the following:

(1) All working and erection dimensions.

(2) Arrangement and sectional views.

(3) Necessary details, including complete information for making connections between work under this contract and work under other contracts.

(4) Kinds of materials.

(G) Each shop drawing must be dated and contain:

(1) The name of this project and this contract number.

(2) The description name of classified contract item number or numbers under which it is or they are required.

(3) The locations or points at which the sheeting is to be installed in the work.

(H) All sheeting submissions must reflect the means and methods chosen by the Contractor and approved by the Engineer. Whenever steel sheeting systems (including trench boxes, frames and plates, etc.) are submitted which would render the crossing of Utilities (i.e. water mains and sewers) impossible the Contractor must also submit, for approval, a system which can be utilized to permit such crossings (i.e. wood sheeting).

(I) The submission of multiple sheeting systems must be kept to a minimum. Whenever the Contractor submits multiple systems they must be accompanied with a Location Plan shop drawing to indicate the exact location where these various systems are to be installed. Since the approval of multiple systems will delay the sheeting approval process the Contractor is requested to submit a schedule indicating the time frame that these systems are required. In addition, the Contractor will be required to install these multiple systems at the locations indicated on the submitted Location Plan. Should the Contractor request to change the sheeting system at any particular location the Contractor will be required to resubmit the sheeting drawing, for approval, even though the revised sheeting system may have been approved at another location within the project area. The Contractor is reminded that the approval time for any given sheeting system may require up to four (4) weeks.

40.05.6 DESIGN CRITERIA

The following criteria must be used in calculating the required sheeting, bracing and/or decking systems.

(A) All compression members (struts) must be designed with a factor of safety of two (2.0). The factor of safety of two (2.0) must be a value above and beyond the allowable value for compressive stresses for steel as designated in the "AISC Manual of Steel Construction", and for wood as designated in the "National Design Specification for Stress-Grade Lumber and its Fastening". All other allowable stresses (not including compression members) may be increased by thirty-three and one-third (33-1/3 %) percent where sheeting and bracing is deemed a temporary structure.

(B) A factor of safety must be used to determine the minimum embedment for sheeting as follows:

Vertical Timber - 15%
Soldier Beams - 20%
Steel Sheeting - 30%

(C) Embedment must be calculated in accordance with the procedures and standard minimum load diagrams specified herein. The maximum allowable embedment for vertical timber sheeting must not exceed three feet six inches (3'-6"). The minimum embedment must be two (2) feet.

(D) The Contractor is advised that the maximum allowable bending stress (F_b) for all timber members must not exceed one thousand seven hundred fifty (1,750) pounds per square inch. If the Contractor elects to use a bending stress higher than F_b = 1,750-psi, written certification of bending stress test results must be submitted to the Engineer prior to use of such material in construction.

(E) Where it is anticipated that heavier crane or equipment loads will fall within the influence line of the trench, design loads must be increased accordingly.

(F) The Contractor must compute and include in the Contractor's submission of drawings and calculations the following:

(1) Maximum bending stress
(2) Maximum horizontal shear in wale
(3) Compression perpendicular to grain
(4) Maximum vertical shear stress

(G) DECKING

(1) Unless otherwise specified in the contract documents or approved in writing by the Engineer, the minimum live load on decking must be AASHTO HS20-44 or Contractor's equipment or heaviest truck loading (i.e. concrete trucks) whichever is greater plus an impact factor of thirty-three (33) percent.

(2) Unless otherwise approved, timber mats must extend a minimum of three (3) feet from sheeting line on either side of trench.

(3) Unless otherwise approved, a minimum one thousand (1,000) pounds per square foot surcharge load must be used for sheeting below decking.

(H) Maximum trench widths shown on sheeting details must not exceed those allowed by the standards or specifications.

(I) The Contractor must provide an individual cross-sectional sheeting (trench) detail for each size water main pipe and sewer conduit to be constructed unless permission to do otherwise is granted.

(J) Where the water table lies above the subgrade of trench and a well point or deep well dewatering system is not used, the Contractor must include the effect of hydrostatic loading in calculations for both watertight and non-watertight sheeting.

(K) Sheeting details must accurately depict actual field operations. The Contractor must be restricted to a maximum five (5) feet deep pilot cut and all details must reflect this. Additional braces and wales may be required to install sheeting due to the five (5) feet maximum pilot cut restriction. The Contractor must not assume that additional pilot cut depths will be allowed.

40.05.7 REMOVAL OF SHEETING

All sheeting design and requirements must be in strict conformance with this section and all appropriate Addenda to the specifications.

Unless otherwise specified in the plans or these specifications, the Contractor must remove all sheeting and bracing throughout this project.

(A) The sheeting must be removed in lifts during the backfilling operation in order to permit proper placement and compaction of material against the structure and the earth bank. This work must be accomplished in conjunction with the removal of wales and braces. The lifts for sheeting must not exceed the specified or otherwise approved depth of compaction layer.

(B) The Contractor must submit to the Engineer, for approval, the Contractor's method for installation and removal of sheeting and the method for backfilling the trench. The submission must specify if there are any location(s) where sheeting cannot be removed and detail the reasons why the sheeting cannot be removed. The submission must be signed by and carry the seal of a New York State Licensed Professional Engineer. These methods must be strictly adhered to.

(C) The Contractor is advised that the Contractor will be responsible for and must, solely at the Contractor's own expense, repair, replace and/or relocate all City owned utilities that are damaged and/or disturbed due to the Contractor's removal of sheeting operation.

(D) If the Contractor is required to leave the sheeting system in place in order to protect City owned utility crossings and structures, payment will be made in accordance with **Subsection 40.05.2(A)** and **Subsection 40.05.2(B)**.

(E) This section must not be construed to relieve the Contractor of the Contractor's obligation under the contract to maintain, protect and support (temporarily and permanently) all City owned utilities within the influence lines of the excavated trenches. The Contractor in accordance with the standards of the agencies having jurisdiction thereof must perform such maintenance, protection and support.

(F) The cost of maintenance, protection and support (temporarily and permanently) of City owned utilities must be included in the prices bid for all items for which there are bid prices.

(G) If a soldier beam and lagging sheeting system is utilized then all parts of the system (i.e. soldier beams, bracing, wales and lagging) must be removed.

(H) There must be no additional payment made for repairing, replacing and/or relocating City owned utilities that may be damaged and disturbed due to the Contractor's removal of sheeting operation, or for work performed by the Contractor as directed in **Subsection 40.05.7(E)** above.

40.05.8 NO SEPARATE PAYMENT

No separate payment or additional payment will be made for the sheeting and bracing of trenches and excavation of water mains larger than 20-inches in diameter and appurtenances thereto including valve chambers, regulator chambers, etc.; and for the sheeting and bracing of trenches and excavation of all sewer conduits and appurtenances thereto including manholes, chambers, catch basins, etc. The cost of all labor, material, plant, equipment and insurance necessary or required to furnish and install all timber and steel sheeting together with all necessary rangers, bracing, lagging, soldier beams, etc., excavation for the placing of sheeting, backfill and compaction behind sheeting to prevent loss of ground, cut off of sheeting as specified, together with all work incidental thereto, all in accordance with the plans and specifications and as directed by the Engineer, must be deemed included in the prices bid for the respective contract items.

Separate payment or additional payment will only be made for the sheeting of water mains 20-inches and smaller in diameter accordance with Items under **Section 70.91**.

SECTION 40.06 -- BACKFILLING

40.06.1 BACKFILLING

All trenches and excavations must be backfilled immediately after the structures are built and inspected, and the Engineer has given permission to backfill.

40.06.2 MATERIAL FOR BACKFILLING

(A) GENERAL - All material for backfilling must have a moisture content and gradation suitable for attaining the required density.

In general, it is expected that material excavated from a trench must be used to backfill only the upper portion of the trench. It is not expected that such material will be used to backfill the lower portion of the trench.

The project site subsurface conditions may consist partially of variable thickness layers of Unsuitable Material. This material may not be considered as acceptable backfill material as described herein, or as determined by the Engineer. No separate or additional payment will be made for the removal, testing and off-site disposal of such unsuitable materials, the cost of which must be included in the prices bid for all contract items of work.

The Contractor must take such borings, excavate such test pits and make such sieve analyses as the Contractor may deem necessary to schedule the Contractor's operations consistent with the need of having an adequate supply of satisfactory backfill material available along the line of the installation work so that the Contractor may proceed without undue interruptions. No payment will be awarded to the Contractor for delays or other expenses incurred because the satisfactory backfill material is not available at the proper time and place, and no other allowance will be made to the Contractor for disposing of the unsatisfactory excavated material, the cost of which must be included in the prices bid for all contract items of work.

All material for backfilling must be free from frost at the time of placement.

Miscellaneous fill material removed from the trenches and excavations will not be considered as acceptable backfill material unless found acceptable and approved in writing by the Engineer.

(B) SELECT GRANULAR FILL

(1) Select Granular Fill material must meet the requirements of **Subsection 26.01.2(B)**.

(2) For Sewer Trenches And Excavations - Select Granular Fill material must be placed in the lower portion of the sewer trench within the following limits: full width of trench, and from subgrade of trench to a point not less than two (2) feet above the top of the sewer conduit (i.e. sewer pipes on cradles or encasements, reinforced concrete sewers, basin and house connections, culverts, etc.). Select Granular Fill material must also be placed around all catch basins.

(3) For Water Main Trenches - Select Granular Fill material must be placed in the lower portion of the water main trench within the following limits: full width of trench but not less than one (1) foot on either side of the water main pipe, not less than six (6) inches below the barrel of the water main pipe, and not less than twelve (12) inches above the top of the barrel of the water main pipe.

(4) For All Trenches And Excavations - Select Granular Fill material must also be placed within any area less than two (2) feet wide in its least dimension (i.e. space between face of trench and outside face of structure, cavities behind sheeting left in place, filling of voids left by removal of boulders beyond the limits of sheeted trench, etc.) and within eighteen (18) inches around all underground facilities (i.e. pipes, mains, conduit, cable, etc.)

(5) The cost of providing select granular fill material as specified hereinabove, together with all labor, materials, plant, equipment, samples, tests and insurance necessary and required for delivering, placing, compacting and testing of select granular fill material all in accordance with the specifications and as directed by the Engineer, must be included in the prices bid for all contract items of work. Also included in the prices bid for all contract items of work must be the cost of removing and disposing of that portion of the excavated material that cannot be reused. No separate or additional payment will be made for this work.

(C) APPROVED EXCAVATED SUITABLE FILL

(1) Approved Excavated Suitable Fill material must meet the requirements of **Subsection 26.01.2(C).**

(2) All approved excavated suitable fill material within the project limits must be utilized for backfilling the remainder of the trenches and excavations. Approved excavated suitable fill material will be accepted for backfill within the following limits:

(a) For Sewer Trenches - Full width of trench and from a point not less than two (2) feet above the top of the sewer conduit (i.e. sewer pipes on cradles or encasements, reinforced concrete sewers, basin and house connections, culverts, etc.) to the underside of the pavement.

(b) For Water Main Trenches - Full width of trench and from a point not less than twelve (12) inches above the top of the barrel of the water main pipe to the underside of the pavement.

(3) The cost of providing approved excavated suitable fill material as specified hereinabove, together with all labor, materials, plant, equipment, samples, tests and insurance necessary and required for the hauling, storing, placing, compacting and testing of approved excavated suitable fill material all in accordance with the specifications and as directed by the Engineer, must be included in the prices bid for all contract items of work. No separate or additional payment will be made for this work.

(D) CLEAN FILL

(1) Clean Fill material must meet the requirements of **Subsection 26.01.2(D).**

(2) Clean fill material must be used when ordered in writing by the Engineer where there is a deficiency of acceptable backfill. Clean fill material must be required in order to fill voids caused by the removal of boulders, unsuitable backfill materials, existing conduits, existing pipes, existing structures, and any other underground facilities or structures within the following limits:

(a) For Sewer Trenches - Full width of trench and from a point not less than two (2) feet above the top of the sewer conduit (i.e. sewer pipes on cradles or encasements, reinforced concrete sewers, basin and house connections, culverts, etc.) to the underside of the pavement.

(b) For Water Main Trenches - Full width of trench and from a point not less than twelve (12) inches above the top of the barrel of the water main pipe to the underside of the pavement.

(3) This backfill must be exclusive of the normal backfill required in the trenches and excavations for proposed conduits, pipes and associated structures for which payment is included therein. Payment must be made in accordance with **Subsection 40.06.6**.

(E) PROCESSED FILL

(1) Processed fill material must meet the requirements of **Subsection 26.01.2(E)**.

(2) If approved by the Engineer, processed fill material may be used as select granular fill material or clean fill material.

(3) Payment for the costs of all labor, material, equipment and insurance necessary and required to furnish and deliver, and to place, compact, sample and test these processed acceptable backfill materials must be in accordance with **Subsection 40.06.6**. (Excavated material that is hand groomed and/or groomed with the use of excavating equipment of bricks, blocks, pavement materials, debris, stumps, roots, stones, boulders, timber, wood, etc., so as to render the excavated material acceptable for backfill; whether ordered by the Engineer or at the Contractor's own discretion; must not be considered as processed material but must be considered as approved excavated suitable material. No separate or additional payment will be made for the use of this groomed excavated material as backfill, the cost of all labor and material must be included in the prices bid for all contract items of work.)

40.06.3 METHOD OF DEPOSITING ALL BACKFILL

At the preconstruction meeting, the Contractor must submit for approval a full description of the Contractor's proposed methods to be used for all backfilling operations including, but not limited to, equipment, backfill material, depth of compaction layers, and trench locations where each is to be employed. In the field, the Contractor must be required to demonstrate that the Contractor's methods of backfilling and compaction must obtain a minimum of ninety-five (95) percent of Standard Proctor Maximum Dry Density.

Water main pipes and sewer conduits for which permission to backfill has been given must be covered before the completion of each day's work to the following depths:

(A) For Sewer Trenches - From subgrade of trench to a point not less than two (2) feet above the top of the sewer conduit (i.e. sewer pipes on cradles or encasements, reinforced concrete sewers, basin and house connections, culverts, etc.).

(B) For Water Main Trenches - From subgrade of trench to a point not less than twelve (12) inches above the top of the barrel of the water main pipe.

Unless otherwise approved in writing by the Engineer, this backfill must be progressively deposited to equal depths on all sides of the water main pipe and sewer conduit in uniform and successive horizontal layers not exceeding six (6) inches in depth for the entire width of the trench or excavation and each successive layer must be solidly compacted by mechanical tamping or other approved means in such a manner as to avoid injury to the water main pipe and sewer conduit and so as to achieve the required density.

Unless otherwise approved in writing by the Engineer, backfilling of the remainder of the trenches and excavations from a point not less than two (2) feet above the top of the sewer conduit (i.e. sewer pipes on cradles or encasements, reinforced concrete sewers, basin and house connections, culverts, etc.) to the underside of the pavement, and from a point not less than twelve (12) inches above the top of the barrel of the water main pipe to the underside of the pavement must be progressively deposited in uniform and successive horizontal layers not exceeding twelve (12) inches in depth for the entire width of the trench or excavation and each successive layer must be solidly compacted by mechanical tamping or other approved means so as to achieve the required density. In deep trenches defined as those requiring sheeting, the Contractor may submit to the Engineer, for approval, an alternate backfill method (i.e. jetting, deeper deposited layers not exceeding twenty-four (24) inches, etc.) for depositing and compacting the backfill from two (2) feet above the top of the sewer conduit to a plane five (5) feet below final surface elevation, and from twelve (12) inches above the top of the barrel of the water main pipe to a plane five (5) feet below final surface elevation. However, approval of any alternate backfill method must not relieve the Contractor from obtaining a minimum of ninety-five (95) percent of Standard Proctor Maximum Dry Density. Should the Engineer determine that the specified density is not being obtained, the area must be re-excavated and backfilled at the Contractor's own cost until the required compaction density is achieved.

The use of backhoe buckets for the compaction of backfill material in all trenches and excavations will not be permitted.

All backfill must be carefully deposited and spread by approved methods.

Backfill must proceed simultaneously with the withdrawal of sheeting but at no time may the withdrawal of sheeting exceed a height of six (6) inches above the deposited backfill. Withdrawal of sheeting below levels previously backfilled and compacted is prohibited.

Each layer must be compacted to a minimum of ninety-five (95) percent of Standard Proctor Maximum Dry Density (as determined by AASHTO T-99 Test Method), before a successive layer is deposited.

The Contractor must retain the services of a testing laboratory, in accordance with **Subsection 40.06.4 - Soil Density Testing,** to make all compaction tests of backfill materials used and placed. All compaction tests must be witnessed and verified by the Engineer.

The Contractor must furnish to the Engineer, copies of in-process compaction reports certified by an Independent Testing Laboratory. These certified compaction reports must be submitted as directed by the Engineer.

Compaction to a minimum of ninety-five (95) percent of Standard Proctor Maximum Dry Density must be attained by the use of impact rammers, plate or small drum vibrators, or pneumatic button head compaction equipment. The equipment must be capable of exerting a pressure equivalent to two hundred fifty (250) to three hundred (300) pounds per inch width of compression roll, or an equivalent pressure if other than smooth wheel or pneumatic tired rollers are permitted. In areas inaccessible to power rolling or adjacent to construction that may be damaged, other types of approved compaction equipment may be used.

Hand tamping is not permitted except in the immediate area of underground facilities. The backfill within the immediate area of underground facilities must be deposited progressively in layers not exceeding six (6) inches in depth on all sides of the underground facilities, wetted (except where clay) in lifts of six (6) inches and lightly hand tamped with as many strokes as required to achieve ninety-five (95) percent of Standard Proctor Maximum Dry Density. Where no specific written information is available to the Engineer, the definition of the immediate area must be the area within eighteen (18) inches around all underground facilities.

The Contractor is responsible for the proper compaction of all backfill in accordance with the specifications. The Contractor is also responsible for determining and maintaining the proper moisture content of the backfill material at all times during the compaction process.

The Contractor must backfill with material that has the optimum moisture content, as result of Proctor Analyses, so as to provide for the proper compaction of that material. In order to obtain the optimum moisture content, water must be added, as required, and must be thoroughly incorporated into the soil. Manipulation must be provided whenever necessary to attain uniform moisture distribution to the soil. When the moisture content of a layer about to be compacted exceeds the required optimum moisture content, compaction must be deferred until the required optimum moisture content is achieved or, if directed by the Engineer, a more suitable material must be substituted. No separate or additional payment will be made for any costs associated with the achievement of optimum moisture content, including any additional excavation due to the removal of any layer not meeting the specified requirements and for the replacement of any layers with suitable material. Costs must be included in the prices bid for all items of work.

In-place soil density tests are required to ensure that the soil compaction requirements of the specifications are met. In-place soil density tests must be taken for each and every layer of backfill placed, at a maximum of one hundred (100) foot intervals along the length of each layer. However, the location of the tests must vary horizontally along each successive layer, such that no two (2) tests are conducted at the same station location as any previous layers. The number and locations of in-place soil density tests must be as directed by the Engineer.

Up to each one thousand (1,000) cubic yards of each type of backfill soil utilized, for which in-place soil density tests are to be performed, must undergo a minimum of one (1) Proctor analysis in order to determine the maximum dry density and optimum moisture content of the soil material to be tested. Due to varying soil conditions, additional Proctor analyses may be required by the Engineer. The number and locations of all samples to undergo Proctor analysis must be as directed by the Engineer.

Proctor analyses and in-place soil density tests must be performed in accordance with **Subsection 40.06.4 - Soil Density Testing**.

No separate or additional payment will be made for the depositing, compacting and sampling of backfill or for the services of the approved testing laboratory, the costs thereof, must be included in the prices bid for all items of work.

Where sheeting has been used for the excavation, it must be pulled when the excavation has been filled or backfilled to the maximum unsupported depth allowed by New York State Department of Labor Industrial Code Rule 23 and Title 29 Code of Federal Regulations Part 1926, Safety and Health Regulations for Construction. Where a difference exists between regulations, the more stringent requirement applies.

Select granular fill material, approved excavated suitable fill material and clean fill material must not be used to fill voids in the subgrade of the trenches and excavations for proposed water main pipes, sewer conduits and associated structures unless otherwise specified on the plans or in the contract documents, or as ordered in writing by the Engineer.

40.06.4 SOIL DENSITY TESTING

(A) INTENT - This section describes the performance of Proctor analyses of designated soils and the testing of designated soils for in-place density, to ensure that soil compaction requirements for the project are met. The Contractor must retain the services of an independent Soils Testing Laboratory, subject to the prequalification requirements hereinafter specified, to perform the work under this section.

(B) PREQUALIFICATION OF TESTING LABORATORY

(1) Prior to start of work, the Contractor must submit to the Commissioner the name, address and phone number of each of three (3) independent testing laboratories, for consideration as the Soils Testing Laboratory for this project.

(2) All proposed testing laboratories must be completely independent from the Contractor or any subsidiary thereof.

(3) All proposed testing laboratories must be duly licensed by NYCDOB, such license to be maintained for the duration of the project. Testing laboratories licensed outside of New York may be considered subject to the prior approval of the Commissioner.

(4) All proposed testing laboratories must have a proven record of performance in providing the soil testing services specified under this section.

(5) The Commissioner will select one (1) testing laboratory from the list of three (3) submitted, to perform the work required under this section. The Commissioner reserves the right to select an alternate testing laboratory if all proposed laboratories are deemed unacceptable.

(6) It is understood that no subcontract for the performance of required soil testing work will release the Contractor from the Contractor's responsibility under the contract to execute all work in conformance with the project plans and specifications.

(C) SCOPE OF WORK - Under this section, the Contractor and approved Laboratory must furnish all labor, materials, plant, equipment, insurance, and necessary incidentals required to: obtain soil samples from the site or other locations, transport to Laboratory, perform Proctor analyses of soil samples and submit written documentation of results; perform in-place soil density tests and submit written documentation of results; and perform all work incidental thereto, all in accordance with the specifications and as directed by the Engineer.

(1) PROCTOR ANALYSIS OF SOIL SAMPLES - Soils for which in-place density tests are to be performed must undergo a Proctor analysis to determine the maximum dry density and optimum moisture content of the soil material to be tested. Soils designated for Proctor analysis may include existing subgrade materials as well as proposed fill material, as directed by the Engineer. The number and locations of soil samples to undergo Proctor analyses must be as specified and as directed by the Engineer.

Each soil sample designated for Proctor analysis must be recovered from the site or other location (stockpile, etc.) and transported to the Laboratory, in a manner acceptable to the Laboratory and the Engineer.

The maximum dry density and the optimum moisture content of each soil sample must be determined by the Standard Proctor Test in accordance with AASHTO T-99 (ASTM D698). If, in the opinion of the Laboratory, a soil sample is too granular to achieve realistic maximum dry density and optimum moisture content readings by the Standard Proctor Test method, other appropriate test methods (Vibratory Table, etc.) may be substituted, subject to the approval of the Engineer.

Written documentation on Laboratory stationery of the results of each Proctor analysis must be furnished to the Engineer, such documentation to include the following:

(a) Date Sample was Tested.
(b) Location and Date Sample was Obtained.
(c) Brief Description of Sample (Soil Type, Color, Consistency, etc.) or other identification.
(d) Maximum Dry Density (pounds per cubic foot).
(e) Optimum Moisture Content (percent).
(f) Test Method (If other than Standard Proctor Test).
(g) Signature and Seal of Qualified Laboratory Representative.

Distribution of copies of Proctor analysis results must be as directed by the Engineer.

(2) IN-PLACE SOIL DENSITY TESTS - In-place soil density tests will be required to ensure that soil compaction requirements for the project are met. In-place soil density tests and results must be performed and completed on site by the approved testing laboratory.

Test locations may include: existing subgrade material upon which fill material is to be placed, or upon which sewer conduits, water main pipes, catch basins, basin connection pipes or other structures are to be constructed; compacted fill material for pavement construction or for backfill of sewer conduits, water main pipes, catch basins, basin connection pipes or other structures; and other locations as directed by the Engineer. The number and locations of in-place soil density tests must be as specified and as directed by the Engineer.

The Contractor's attention is directed to the fact that it will be necessary in some cases to excavate through temporary pavements in order to test the compaction of backfill over sewer conduits, water main pipes, etc., and upon completion of the test, backfill and place new temporary pavement as necessary. No separate or additional payment will be made for such excavation, backfill or replacement of temporary pavement. All costs must be included in the prices bid for all items of work.

The preferred test method for determining the in-place dry density and moisture content of the soil is the Sand Cone Test, in accordance with AASHTO T-191, T-205. Other approved types of density tests (nuclear, etc.) are permitted, provided that density values corresponding to those obtained by

the Sand Cone Test method are established to the satisfaction of the Engineer. Such alternate density test methods must be checked at least once every fifty (50) tests against the Sand Cone Test method, as directed by the Engineer, to minimize equipment calibration errors. No separate or additional payment will be made for additional density tests taken solely for calibration purposes. All costs must be included in the prices bid for all items of work.

After the in-place dry density of the soil is determined, the Degree of Compaction must be computed by the following formula:

$$\text{Degree of Compaction (\%)} = \frac{\text{In-Place Dry Density (lbs./cu. ft.)}}{\text{Maximum Dry Density (lbs./cu. ft.)}} \times 100$$

Written documentation on Laboratory stationery of the results of each in-place soil density test must be furnished to the Engineer, such documentation to include the following:

(a) Date of Field Test.
(b) Location of Field Test.
(c) Brief Description of Tested Soil (Soil Type, Color, Consistency, etc.) or other identification.
(d) In-Place Dry Density (pounds per cubic foot).
(e) In-Place Moisture Content (percent).
(f) Density Test Method (If other than Sand Cone Test).
(g) Maximum Dry Density (pounds per cubic foot) from corresponding Proctor analysis of same soil type.
(h) Degree of Compaction (percent).
(I) Signature and Seal of Qualified Laboratory Representative.

Distribution of copies of Density Test results must be as directed by the Engineer.

(D) EVALUATION OF SOIL TEST RESULTS - All natural earth subgrade, fill and backfill material under this contract must be compacted to a minimum of ninety-five (95) percent of Standard Proctor Maximum Dry Density.

The Degree of Compaction, as determined above, will be used for control purposes in determining compliance with project compaction requirements. However, it will be the responsibility of the Engineer to evaluate the results of the soil tests performed and determine the acceptability of subgrade preparation and fill construction.

(E) METHOD OF PAYMENT - The cost of all labor, materials, plant, equipment, insurance and necessary incidentals required to perform all Proctor Analyses including the obtaining of soil samples, transportation of samples to the Laboratory, providing of written documentation of all results, and performing all work incidental thereto, all in accordance with the specifications and as directed by the Engineer, must be included in the prices bid for all contract items of work. No separate or additional payment will be made for any costs associated with the performing of all Proctor Analyses of soil samples.

The cost of all labor, materials, plant, equipment, insurance and necessary incidentals required to perform all In-Place Soil Density Tests including the providing of written documentation of all results, and performing all work incidental thereto, all in accordance with the specifications and as directed by the Engineer, must be included in the prices bid for all contract items of work. No separate or additional payment will be made for any costs associated with the performing of all In-Place Soil Density Tests.

40.06.5 BACKFILLING AROUND SHEETING

When sheeting is withdrawn all cavities remaining in or adjoining the trench and excavation must be filled and meet all the requirements of **Subsections 40.06.2 and 40.06.3**. When sheeting is left in place all cavities behind such sheeting must be filled as directed and in such a manner so as to ensure compliance with all the requirements of **Subsections 40.06.2 and 40.06.3**.

40.06.6 DEFICIENCY OF BACKFILL MATERIAL

Unless otherwise shown on or specified in the contract documents, the Contractor must backfill and compact all trenches and excavations to the underside of the pavement. Where deficiency of acceptable backfill material occurs, the trenches and excavations must be backfilled with the acceptable backfill materials as specified in **Subsection 40.06.2**. Payment for the cost of all labor, material, equipment and insurance necessary and required to furnish and deliver these acceptable backfill materials, where a deficiency of acceptable backfill material occurs, must be made as follows:

(A) For providing acceptable select granular fill material (whether natural or processed) to satisfy the requirements of **Subsection 40.06.2(B)** payment for the cost must be included in the prices bid for all contract items of work. No separate or additional payment will be made for this work.

Payment will be made for Select Granular Fill material when ordered, in writing, by the Engineer in accordance with **Section 73.41** of the specifications.

(B) For providing acceptable clean fill material (whether natural or processed) to satisfy the requirements of **Subsection 40.06.2(D):**

(1) To fill voids left by the removal of ledge rock payment must be included in the price bid under the contract item(s) labeled "ROCK EXCAVATION". The Contractor's attention is directed to **Section 70.61 - Rock Excavation** of the specifications.

(2) To fill voids left by removal of non-contaminated and non-hazardous excavated material deemed not suitable for backfill and which requires replacement with clean backfill, payment will be made under Item No. 70.81CB - CLEAN BACKFILL. The Contractor's attention is directed to **Section 70.81 - Clean Backfill** of the specifications, and the cost of rehandling and acceptably disposing of the unsuitable material must be included in the price bid for Item No. 70.81CB - CLEAN BACKFILL.

(3) To fill voids left by removal of non-contaminated and non-hazardous material that does not have a satisfactory Beneficial Use Determination (BUD) per NYSDEC Part 360.12, payment will be made under Item No. 70.81CB - CLEAN BACKFILL. The Contractor's attention is directed to **Section 70.81 - Clean Backfill** of the specifications, and the cost of rehandling and acceptably disposing of the unsuitable material must be included in the price bid for Item No. 70.81CB - CLEAN BACKFILL.

(4) To fill voids left by removal of contaminated and/or hazardous material, payment will be made under Item No. 70.81CB - CLEAN BACKFILL. The costs for rehandling and acceptably disposing of the contaminated and/or hazardous material must be included in the prices bid for the appropriate 8.01 Items.

The cost for all labor, materials, equipment and insurance necessary and required to place, compact, sample and test provided acceptable backfill material must be included in the prices bid for all contract items of work. No separate or additional payment will be made for this work.

40.06.7 TEMPORARY BULKHEADS

For retaining compacted backfill, only temporary bulkheads will be allowed over sewer conduits, water main pipes, basin connection pipes, etc. Such temporary bulkheads must not be constructed of stone, and they must be removed as the adjacent trenches and excavations are backfilled. This removal of temporary bulkheads along with the backfilling of adjacent trenches and excavations must proceed simultaneously and must be accomplished in strict accordance with **Subsections 40.06.2 and 40.06.3**.

40.06.8 REMOVAL OF SURPLUS MATERIAL

As the trenches are backfilled, the Contractor must remove all surplus material, and regrade and leave free, clear and in good order all roadways and sidewalks adjacent to the completed work and within fifty (50) feet of the end of the completed work. During the progress of and until the final acceptance of the work, the Contractor must maintain in good and safe condition the surface of roadways and sidewalks over and adjoining all the trenches and excavations, and promptly fill in depressions over and adjoining the trenches and excavations caused by the settlement of the backfill. All surplus material or any part thereof must be deposited, if required by the Engineer and at the Engineer's direction, on the streets and avenues within the limits of this contract where they are below grade or contain depressions. Such work must be performed in such a manner so as to leave the surfaces of the backfill compact and even with the adjoining surfaces, and must be done in accordance with **Subsection 40.06.3**.

SECTION 40.07 – CONSTRUCTION OF ADJACENT CONDUITS AND/OR PIPES IN THE SAME TRENCH

40.07.1 DESCRIPTION

The criteria for construction of adjacent conduits and/or pipes in the same trench must be defined as follows:

(A) When shown on the plans, specified in the contract documents or ordered in writing by the Engineer, conduits and/or pipes must be constructed within the same excavation between two (2) lines of sheeting or between two (2) lines of sheeting with an intermediate line of sheeting between the conduits and/or pipes.

(B) When the clear distance between the closest side faces (i.e. walls, edge of pipe, cradles) of the two (2) conduits and/or pipes is 4'-6" or less for a continuous distance of at least ten (10) feet, the conduits and/or pipes may be constructed (with the written permission of the Engineer) within the same excavation between two (2) lines of sheeting or between two (2) lines of sheeting with an intermediate line of sheeting between the conduits and/or pipes.

(C) Conduits and/or pipes that transverse each other are not eligible for construction as adjacent conduits and/or pipes in the same trench.

The conduits and/or pipes to be constructed under this section must be constructed in accordance with the respective specifications that pertain to each, and payment for the work of each constructed as adjacent parallel conduits and/or pipes in the same trench must be paid for under the contract item bid for each of the respective conduits and/or pipes.

40.07.2 CONSTRUCTION REQUIREMENTS

Where the Contractor is permitted to use a common trench for the installation of two (2) or more adjacent conduits and/or pipes, the Contractor must excavate to the subgrade of the higher-level conduit and/or pipe first.

While excavating for the lower level conduit and/or pipe, the Contractor must install intermediate sheeting within the common trench in order to maintain the undisturbed subgrade of the higher-level conduit and/or pipe.

In the event the subgrade is over excavated or otherwise disturbed, the Contractor must replace the disturbed or over excavated subgrade with well-compacted crushed stone complying with **Subsection 26.02.2(F)**. No separate or additional payment will be made for the placing and compaction of this crushed stone.

Under no condition is the Contractor permitted to install any conduits, pipes or associated structures on disturbed subgrade.

40.07.3 PRICE INCLUDED

The contract price for construction of adjacent conduits and/or pipes in the same trench must be paid at the respective unit prices per linear foot for each size and type of conduit and/or pipe to be constructed adjacent to each other in the same trench and each must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required or necessary to construct each of the conduits and/or pipes of the sizes, types, materials and dimensions shown by the normal sections and special sections and to the lines and grades shown, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); all sheeting and bracing (except when there is a contract item for sheeting); pumping; fluming; bridging; break down and filling in of abandoned appurtenances; connections; maintaining flow in conduits; backfilling; cleaning up; and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans, specifications and standards, and as directed by the Engineer.

The Contractor, after obtaining the written permission of the Engineer, may elect, at the location(s) specified, to construct the adjacent conduits and/or pipes in separate trenches, or at different times. When the Contractor elects to do this, no additional sums will be paid for constructing the conduits and/or pipes individually in separate trenches or at different times. Where conduits and/or pipes are not adjacent, they will be constructed in separate trenches as required and will also be paid for at the respective unit prices bid for each size and type of conduit and/or pipe.

The cost of placing the intermediate sheeting as specified herein must be included in the prices bid for all items of the contract.

SECTION 40.08 – TEMPORARY RESTORATION AND CLEANING UP

40.08.1 RESTORATION OF PAVEMENT SURFACE

Unless otherwise specified or directed, in all areas where an existing roadway pavement of any type is disturbed by the work done under this contract (i.e. over trenches, excavations, test pits) but not permanently restored immediately thereafter, the Contractor must temporarily restore the surface as follows:

(A) Roadway pavements – Boroughs of Brooklyn, the Bronx, Manhattan and Queens: The pavement must be temporarily restored where disturbed with not less than four (4) inches of 6FRA asphaltic concrete mixture, or as specified by the Engineer. The asphaltic concrete mixture must be placed on compacted dirt backfill immediately after completion of backfilling and compaction.

(B) Roadway pavements – Borough of Staten Island: The pavement must be temporarily restored where disturbed by the work done under this contract (i.e. over trenches, excavations, test pits) but not permanently restored immediately thereafter, the Contractor must temporarily restore the surface of roadway pavements as follows:

- Water main trenches: Not less than four (4) inches of 6FRA top asphaltic concrete mixture. The water mains must be backfilled to the underside of the asphalt with Select Granular Fill, meeting the requirements of **Section 26.01.2.(B)**.
- Sewer trenches and other excavations: Not less than four (4) inches of 6FRA top asphaltic concrete mixture. The sewers must be backfilled to the underside of the asphalt with clean fill, meeting the requirements of **Section 26.01.2.(D)**.

(C) Sidewalks- All Boroughs: The sidewalk must be temporarily restored where disturbed with not less than two (2) inches of 6FRA asphaltic concrete mixture or as specified by the Engineer. The asphaltic concrete mixture must be placed on compacted dirt backfill immediately after completion of backfilling and compaction.

All temporary restoration must be maintained in acceptable condition until replaced by final restoration.

All temporary pavement must be thoroughly compacted and laid flush with the surrounding pavement.

40.08.2 TEMPORARY RESTORATIONS

All temporary pavement restoration must be done in conformance with **Section 71.31**.

40.08.3 MAINTENANCE OF TEMPORARY RESTORATIONS

The Contractor must maintain all temporary restoration, in a suitable and safe condition for traffic until the final restorations have been made or the work finally accepted.

Should settlement occur or other defect develop in temporary pavement, which in the opinion of the Engineer may cause hazards or undue inconvenience to pedestrian or vehicular traffic, the Contractor must immediately restore such pavement to proper grade or otherwise repair the defects.

40.08.4 CLEANING UP

At such times as may be directed, the Contractor must remove from the street and site of the work all materials which were placed thereon by the Contractor as a consequence of performing this work and which are not required by the contract to be left as part of the finished work. The entire work and portions of the street affected thereby must be left clean and in a satisfactory condition. Payment for cleanup must be deemed included in the price bid under the NYCDOT Highway contract item(s) labeled “MAINTENANCE OF SITE”. No separate or additional payment will be made for any required cleanup work.

40.08.5 COLOR CODING

The Department of Design and Construction has been assigned the following marker colors:

(1) AQUA - For Sewer Work
(2) BRIGHT SILVER - For Water Supply Work

Markers must be placed six (6) inches adjacent to the curbside of the trench upon placing temporary restoration. Spacing must be every twenty-five (25) linear feet if trench is over seventy-five (75) feet in length. For trenches under seventy-five (75) feet in length markers must be placed approximately one-third (1/3) the length apart. A minimum of two (2) markers must be required for all trenches over ten (10) feet

long. For trenches or cuts less than ten (10) feet, one (1) marker in the linear center of the cut must be required.

Markers must be painted in the shape and size of a three (3) inch diameter solid circle.

Marker colors must correspond to Federal Specification #TT-P-115F and AMS-STD-595.

Traffic Base White must be stained or tinted to match the assigned colors as per AMS-STD-595 (color standards).

Material Requirements must be satisfied under Section 3.1 through 3.3 of the Federal Specification #TT-P-115F.

Qualitative Requirements must be satisfied under Section 3.4 through 3.5.10 of the Federal Specification #TT-P-115F.

40.08.6 TIMING OF TEMPORARY RESTORATION

(A) Temporary restoration must be performed immediately after the Contractor completes work.

(B) If a trench is inactive for a period of thirty (30) days, temporary restoration must be performed at the Contractor's sole cost and will be deemed included in the price bid for "MAINTENANCE OF SITE." Maintenance of the street plates and asphalt ramping does not qualify as work activity for the purposes of this provision.

(C) If a trench must remain inactive for more than thirty (30) days, the Contractor may be entitled to postpone the temporary restoration, subject to the following notifications and approval by the Commissioner:

1. The Contractor must notify the Engineer of the conditions that prevent timely temporary restoration. This notification must be provided within fifteen (15) days of when the Contractor becomes aware or should become reasonably aware of the conditions preventing temporary restoration. Conditions arising from the Contractor's means and methods or from private agreements with third parties will not qualify for postponement of the temporary restoration. The Commissioner may grant a postponement of the temporary restoration, in writing, up to thirty (30) days.
2. If the conditions that prevent timely temporary restoration persist, the Contractor must notify the Engineer within fifteen (15) days of the Commissioner's approval of postponement. The Commissioner may grant a postponement of the temporary restoration, in writing, up to thirty (30) days.

(D) Failure of the Contractor to comply with the requirements of this Subsection 40.08.6 may result in:

1. Maintenance of Site liquidated damages per NYCDOT Standard Highway Specifications **Section 7.13**.
2. The Commissioner declaring the contractor in default as per Article 48 of the Contract.

SECTION 40.09 – FINAL RESTORATION OF PAVEMENTS

40.09.1 DESCRIPTION

Restoration of permanent roadway pavement must include the restoration of each kind of roadway pavement shown, specified or required. The Contractor must obtain the Standard Details of Construction and the Standard Highway Specifications of the New York City Department of Transportation.

40.09.2 MATERIALS

The materials for roadway pavement to be restored must conform in all respects to the requirements set forth in the Standard Details of Construction and the Standard Highway Specifications of the New York City Department of Transportation.

40.09.3 CONSTRUCTION METHODS

(A) SAWCUTTING - All saw cutting of pavements must be done in conformance with **Section 71.11**.

(B) REMOVAL OF EXISTING PAVEMENT - All pavement excavation must be done in conformance with **Section 71.21**.

(C) FINAL RESTORATION - All Final Restoration must be done in conformance with **Section 71.41**.

40.09.4 NOTIFICATION OF RESTORATION

At least forty-eight (48) hours before making any restoration of pavements destroyed during the construction of the sewers and/or water mains in this contract the Contractor must notify the Department of Transportation that the Contractor intends to make such restoration so that the necessary inspection can be provided.

40.09.5 RESTORATION OF UNPAVED ROADWAYS, SIDEWALKS, ETC.

Unless otherwise shown, specified or directed, all unpaved roadways, unpaved gutters and unpaved sidewalk areas affected by the work done under this contract must be restored by the Contractor to the same condition in which they were at the time of the opening of bids for this contract, as determined by the Department of Design and Construction. The cost for this restoration must be included in the prices bid for all items of work. No separate or additional payment will be made for any restoration of unpaved areas.

40.09.6 TRENCHES AND EXCAVATIONS

Before laying any final pavements, sidewalks, crosswalks, curbs, etc., the trenches and excavations must have been filled and compacted all in accordance with **Section 40.06**.

40.09.7 CLEANING UP

At such times as may be directed, the Contractor must remove from the streets all materials which were placed thereon by the Contractor as a consequence of performing this work, and which are not required by the contract to be left as part of the finished work. The entire work and portions of the streets affected thereby must be left in a satisfactory condition. The sidewalks and crosswalks must be swept clean of all material that may have come thereon by reason of the work under this contract, and if required, they must be sprinkled with water during the sweeping. Payment for cleanup must be included in the price bid under the NYCDOT Highway contract item(s) labeled “MAINTENANCE OF SITE”. No separate or additional payment will be made for any required cleanup work.

40.09.8 BROOM CLEANING

The Contractor must broom clean all streets after final restoration has been made.

40.09.9 THICKNESS OF PAVEMENT AND COMPOSITION, ETC., OF PAVEMENT BY CORES

Cores will determine the thickness of all pavements. Tests for composition and all other testing required by the Department of Design and Construction will be determined from cores. Unless otherwise specified, cores must be taken and tested at the Contractor's expense by an approved independent New York State Licensed Testing Laboratory. The taking of all cores and all tests to be performed must be in accordance with the requirements of the Department of Transportation. The results of all measurements and tests must be certified by the Testing Laboratory and must be submitted to the Department of Design and Construction.

One (1) core must be taken for each two hundred (200) linear feet of trench up to one thousand (1,000) feet of trench and thereafter one (1) core must be taken for each three hundred (300) feet of trench, except

that not less than three (3) cores must be taken per contract. Deductions in contract payments will be made for core deficiencies in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specification Section 5.04 - Deficiencies In Bituminous Pavements And Concrete**. Such deductions must be transferred to the Department of Transportation in order to provide for the cost of repairs.

40.09.10 GUARANTEE AND MAINTENANCE PERIOD

The guarantee and maintenance period must be eighteen (18) months after the date of substantial completion of the work as certified by the Department of Design and Construction. The guarantee must cover failure of any kind of the restored pavement, curb, sidewalk and etc., from whatever cause. In the event that a pavement failure is not maintained in a manner satisfactory to the Department of Transportation, repairs of pavement, curbs and sidewalks will be made by the Department of Transportation. Where seeding, sodding, etc., is not maintained in a manner satisfactory to the Department of Transportation, repairs will be made by the Department of Transportation. All cost associated with work performed by the Department of Transportation will be deducted from the Contractor's payments. The cost of this work must be determined at the sole discretion of the Department of Transportation.

40.09.11 ACCEPTANCE OF FINAL RESTORATION

The Department of Design and Construction will secure acceptance of final restoration from the Department of Transportation as a condition for final payment to the Contractor and before release of monies deposited for the guarantee period.

40.09.12 COLOR CODING

The Department of Design and Construction has been assigned the following marker colors:

(1) AQUA - For Sewer Work
(2) BRIGHT SILVER - For Water Supply Work

Markers must be placed in the center line of the trench upon placing permanent restoration. Spacing must be every twenty-five (25) linear feet if trench is over seventy-five (75) feet in length. For trenches under seventy-five (75) feet in length markers must be placed approximately one-third (1/3) the length apart. A minimum of two (2) markers must be required for all trenches over ten (10) feet long. For trenches or cuts less than ten (10) feet, one (1) marker in the geometric center of the cut is required.

Markers must be painted in the shape and size of a three (3) inch diameter solid circle.

Marker colors must correspond to Federal Specification #TT-P-115D and Federal Standard Booklet #595.

Traffic Base White must be stained or tinted to match the assigned colors as per Federal Standard #595 (color standards).

Material Requirements must be satisfied under Section 3.1 through 3.3 of the Federal Specification #TT-P-115D.

Qualitative Requirements must be satisfied under Section 3.4 through 3.5.10 of the Federal Specification #TT-P-115D.

SECTION 40.10 – PROJECT SIGN, PROJECT RENDERING SIGN, AND TEMPORARY NOTIFICATION SIGNS

40.10.1 DESCRIPTION

The Contractor is required to provide a “PROJECT SIGN” in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 1.06.46 - Project Sign**.

The Contractor (when directed in an Addendum to this project) is required to provide a “PROJECT RENDERING SIGN” in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 1.06.46 - Project Sign**.

The Contractor is required to provide “TEMPORARY NOTIFICATION SIGNS” in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 1.06.46A - Temporary Notification Signs**.

SECTION 40.11 – LEAKAGE AND LEAKAGE TESTS FOR SEWER LINES

40.11.1 WHEN TESTS ARE REQUIRED

Sewers must be tested for leakage when specified, required or ordered by the Engineer. When sewers are to be tested for leakage, the methods of testing must be in accordance with the requirements herein.

40.11.2 ALLOWABLE LEAKAGE

All sewers, whether tested or not, must be constructed so the quality of leakage or infiltration must not exceed the quantities herein specified.

The quantity of leakage or infiltration for gravity sewer pipe lines with rubber gasket or other joint materials, for gravity sewer pipe lines entirely encased in concrete and for gravity monolithic concrete sewer lines must not exceed two hundred fifty (250) gallons per inch of inner diameter, per mile of sewer, per day.

The quantity of leakage for concrete pressure sewer lines must not exceed one hundred fifty (150) gallons per inch of inner diameter, per mile of sewer, per day.

No individual joint in any completed sewer under test must leak an amount in excess of one-eighth (1/8) gallon per hour per inch of inner diameter.

Outfall sewers must be classed as pressure sewer lines.

Leakage in sewers of other than circular section must not exceed an amount based on a circular section having an equivalent inner perimeter.

40.11.3 GRAVITY PIPE SEWERS - SPECIFIC REQUIREMENTS

Leakage tests for precast concrete, vitrified clay and cast iron gravity pipe sewers under thirty-six (36) inches in diameter must be made by the internal pressure test method. The Contractor must make them as the construction progresses, before any backfilling material is placed, unless otherwise directed by the Engineer. All joints of pipe under test must be entirely free from earth or other foreign material. The trench must be dewatered and kept dry for the duration of such test.

To determine the leakage in gravity pipe sewers by the internal pressure method, the section of the sewer to be tested must be plugged and bulkheaded at both heads. The sewer section and the manhole or a riser not less than six (6) inches in diameter must be filled with water until the internal pressure in the sewer pipe is equivalent to a pressure head of not less than four (4) feet above the exterior crown of the sewer section at the upstream end, unless otherwise specified in the specifications. Such hydrostatic head must be maintained for the duration of the test by adding water.

Leakage by the internal pressure test method must be determined by measuring the amount of water used to maintain the required water level in the manhole or riser.

Leakage tests for gravity pipe sewers thirty-six (36) inches in diameter or over must be made by the infiltration test method in accordance with **Subsection 40.11.4** except where sewers are constructed above the ground water level. In this case, leakage tests must be made by the internal pressure test method.

40.11.4 GRAVITY MONOLITHIC SEWERS - SPECIFIC REQUIREMENTS

Leakage tests on monolithic sewers must be made by the infiltration test method after backfilling and upon return of the ground water to its normal level, unless otherwise directed by the Engineer.

Infiltration must be measured by using low measuring weirs in the invert of the sewer or by other approved methods.

Leakage tests on monolithic sewers constructed above the ground water level must be made by the internal pressure test method in accordance with **Subsection 40.11.3**.

40.11.5 PRESSURE SEWERS - SPECIFIC REQUIREMENTS

Leakage tests for all pressure sewers, including outfall sewers, but excluding tunnel sewers, must be made by the internal pressure test method as specified for gravity pipe sewers under thirty-six (36) inches in diameter in **Subsection 40.11.3** except that the Contractor must maintain at the upstream end of the sewer section under test a hydrostatic head of ten (10) feet above the crown of the sewer for the duration of the test, unless otherwise specified in the specifications.

40.11.6 TUNNEL SEWERS - SPECIFIC REQUIREMENTS

Leakage tests for sewers constructed in tunnel must be made by the infiltration method in accordance with **Subsection 40.11.4**.

40.11.7 DURATION OF TESTS

An eight (8) hour test for leakage will be required for all sewers, tested by the internal pressure method and not less than a twenty-four (24) hour test for all sewers tested for infiltration before any sewer is accepted, unless the Engineer directs otherwise.

40.11.8 EQUIPMENT FOR TESTS

The Contractor must furnish the necessary supply of clean water and all temporary weirs, bulkheads, pumps, valves, plugs, piping, gages and other approved appliances graduated finely enough to readily indicate drop in pressure, required in the test. Internal pressure tests must be made promptly and as often as necessary to expedite backfilling and completion of sections of the work.

40.11.9 REPAIRING LEAKS

Leakage or infiltration in excess of the specified amount must be located and stopped and all visible leaks must be stopped to the satisfaction of the Engineer. When this work is completed the structure must again be tested. These procedures must continue until the leakage requirement is met. If, in the opinion of the Engineer, the leakage or infiltration requirements are not met and all visible leaks are not stopped by the Contractor's repairs, the Contractor, at the Contractor's own expense, must remove, take out and reconstruct as much of the original work as the Engineer may direct.

40.11.10 WAIVER OF LEAKAGE TEST

The Engineer may waive leakage tests by the infiltration method. Such waiver must be in writing by the Engineer and will generally be based on indications from observations by the Engineer that the leakage is well below allowable amounts.

40.11.11 NO SEPARATE PAYMENT

No separate or additional payment will be made for fulfilling the requirements specified above and the costs thereof must be deemed included in the prices bid for all items of work.

SECTION 40.12 – CRUSHED STONE BEDDING FOR SEWERS

40.12.1 DESCRIPTION

Where shown, specified or approved, sewers must be laid on crushed stone bedding or completely encased in crushed stone.

40.12.2 MATERIALS

Crushed stone must comply with **Subsection 26.02.2(F)**.

Truck receipts showing the size of the stone must accompany all stone delivered on the project. The Contractor will be responsible for and must bear the cost of periodic testing of the stone by sieve analysis. An approved independent testing laboratory that is approved by the City must perform testing. The Engineer may request testing of the stone gradation whenever the Engineer deems it applicable. Reports on the sieve analysis must be submitted to the Department of Design and Construction no later than ten (10) days after the analysis request.

Crushed stone not meeting the aforementioned gradation will not be accepted and stone that has been placed and was found unacceptable must be excavated and replaced at no additional cost to the City.

40.12.3 CONSTRUCTION METHODS

(1) Excavate to Subgrade.
(2) Place graded stone for the full trench width and a minimum of six (6) inches below the pipe barrel.
(3) Excavate bell holes and lay the pipe barrel on the stone bedding.
(4) Pipe stubs from twelve (12) inches to eighteen (18) inches must extend from manhole walls or other wall faces.
(5) The bedding must be shovel sliced under the haunches of the pipe to fill the voids in this area. Slicing should be done when the bedding material is no higher than one-fourth (1/4) of the pipe diameter.
(6) Wyes and Tees must be bedded to prevent shear loading.
(7) When encasement is required backfill the trench with the specified stone bedding by hand to a point twelve (12) inches above the top of the pipe being careful not to disturb the pipe alignment and protect the pipe from damage.
(8) Where sheeting is removed, the void left must be filled with the specified stone bedding.
(9) When removing the sheeting the Contractor will be responsible to maintain the sewer at the true alignment.
(10) Place backfill in accordance with the specifications.

40.12.4 WIDTH OF TRENCH

(A) MINIMUM WIDTH - As per Sewers Design Standards and Specifications.
(B) MAXIMUM WIDTH - As per Sewers Design Standards and Specifications.

40.12.5 REQUIREMENTS

The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** must apply to the work, except where otherwise described in this section.

The requirements of **Sections 50.31, 50.41, 50.51, 52.11 and 52.41** must also apply with the exception of references to concrete cradle and concrete encasement.

As per the specifications the Contractor must be responsible for maintaining true line and grade. Whenever true line and grade is not attained it will be the Contractor's sole responsibility to remove and reinstall any and all sewer pipe deemed required by the City and must be done at the Contractor's expense.

SECTION 40.13 – TEMPORARY STOCKPILING OF EXCAVATED MATERIAL

40.13.1 DESCRIPTION

This Section provides requirements for temporary stockpiles of excavated construction materials, including siting, protection, monitoring, and cleanup. All stockpiles must meet the requirements of NYCDOS Interpretive Memorandum #2, which is attached to the end of this Section.

This Section applies to stockpiles of construction materials from NYCDDC projects that:

A) Are within the five boroughs of New York City;
B) Are not licensed as a transfer station by NYCDOS;
C) Do not contain contaminated or hazardous materials regulated by the NYS Department of Environmental Conservation ("NYSDEC").

40.13.2 DEFINITIONS

NYCDOS:	New York City Department of Sanitation.
NYSDEC:	New York State Department of Environmental Conservation.
Construction materials:	Dirt, concrete, asphalt, rock, gravel and similar materials that are not contaminated or hazardous as defined by NYSDEC. Also referred to as "materials."
On-site materials:	Construction materials in the work zone on the right-of-way, adjacent to an excavation or trench (on the same block).
Temporary stockpiling site:	A Contractor's facility where material is either: (1) stockpiled off the right-of-way, or (2) stockpiled on the right-of-way, not adjacent to the excavation where the construction materials were generated.
Sensitive receptor:	A school, park, playground, medical facility, place of worship, residential home or building, or similar as deemed by the Engineer.

40.13.3 STOCKPILE SITING

No temporary stockpiling site will be permitted within 400 feet of a sensitive receptor, or within 800 feet of a school, unless approved by the Associate Commissioner, or the Associate Commissioner's designee.

The Contractor must submit the location of the temporary stockpiling site to the Engineer for approval. The submittal must include:

1. A map of the proposed temporary stockpiling site, showing all surrounding properties and structures within 800 feet;
2. An initial topographical survey of the proposed temporary stockpiling site, with elevations on a 50 foot grid. The survey must be prepared and sealed by a~~n~~ NYS licensed Professional Engineer or Land Surveyor;
3. Access routes (truck routes) for delivering and shipping materials;
4. Photos of the site's existing condition;
5. A copy of the lease (if on private property) or permit/agreement (if on public property);
6. A signed and sealed certification from a NYS licensed Professional Engineer that the temporary stockpiling site is not within or adjacent to a NYSDEC Wetland or Adjacent Area;
7. A Wetland Protection Plan, if the temporary stockpiling site is within a NYSDEC Wetland or Adjacent Area;
8. A Dust Mitigation Plan meeting the requirements of 15 RCNY Chapter 13.

Approval of a location as a temporary stockpiling site on a previous NYCDDC contract does not guarantee approval.

No separate approval will be required for on-site materials.

40.13.4 STOCKPILE OPERATION AND PROTECTION

Trucking to or from a temporary stockpiling site will not be permitted on streets fronting or adjacent to a school, unless the work location is on the same block as the school.

Stockpiles must be covered or wetted as required by the Dust Mitigation Plan. If dust is being emitted from the piles due to prevailing winds (not from a momentary gust), the stockpile must be wetted. Adequately secured tarps, plastic, or other material may be required by the Engineer to further reduce dust emission.

If the temporary stockpiling site will have material stored from multiple projects, the material from each different project must be stockpiled separately to comply with the requirements of the NYCDOS Interpretive Memo (attached at the end of this Section). The separate stockpiles must have signage identifying the contract name and project ID associated with each stockpile, and the DDC approval letter must be posted on-site.

Material storage facilities must be adequately fenced. Fence to be no less than 8' high. If chain link fence is used, it must be covered with fabric.

Any Wetland or Adjacent Area protections must be installed and maintained per the approved Wetland Protection Plan.

40.13.5 STOCKPILE MONITORING

The Contractor must monitor the conditions of all stockpiles and material storage facilities to ensure that they remain in compliance with these specifications. For stockpiles and material storage facilities not in continuous use, the Contractor's inspection must be at least every two weeks.

40.13.6 STOCKPILE CLEANUP

When the stockpiles at the temporary stockpiling site are removed and the area cleaned, the Contractor must submit the following documentation to the Engineer for approval:

1. Photos of the site's final condition;
2. An as-built final topographical survey of the temporary stockpiling site, with elevations on a 50' grid. The survey must be prepared and sealed by a NYS licensed Professional Engineer or Land Surveyor.

40.13.7 NO SEPARATE PAYMENT

No separate or additional payment will be made for fulfilling the requirements specified above and the costs thereof must be included in the prices bid for all items of work.

THE CITY OF NEW YORK Department of Sanitation

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Department of Sanitation Rules and Regulations Governing Non-Putrescible Solid Waste Transfer Stations

INTERPRETIVE MEMORANDUM # 2
February 14, 1995

Subject: Temporary Storage and Processing of Construction and Demolition Debris by New York City Agency Contractors

Contractors performing construction work for New York City agencies may be required to excavate dirt, concrete, rock, gravel and similar materials ("construction materials") from a contract site or to remove from a contract site construction materials resulting from construction, demolition, alteration, repair or renovation of structures, streets or buildings. On street construction projects, construction materials required to be excavated or removed may also include asphalt. The purpose of this Interpretive Memorandum is to (a) define the circumstances under which the Department of Sanitation (the "Department") will not deem its Rules and Regulations Governing Non-Putrescible Solid Waste Transfer Stations (the "Rules") to apply to the temporary storage, processing and/or stockpiling (collectively, "stockpiling") of such construction materials and (b) the procedure for ensuring such exemption. It is the responsibility of the contracting agency to oversee its contractors' compliance with the Rules and with this Interpretive Memorandum.

1. When No Transfer Station Permit is Required

Where a City contractor has:

(a) set aside an area of a contract site for stockpiling construction materials excavated from and/or intended for that site; or

(b) received written approval from the contracting agency for an off-site stockpiling location,

the Department will not deem such stockpiling location a transfer station and will not require the contractor to obtain a transfer station permit so long as:

(c) no construction materials or debris from off the contract site are received at the designated location for subsequent transfer to another location (other than the contract site); and

(d) the temporary stockpiling location is clearly described as such in the contract or clearly approved by the construction agency and designated as such in writing to the Department by the agency; and

(e) the construction agency represents in writing to the Department that such agency will monitor the temporary stockpiling location and ensure its clean-up and restoration pursuant to the procedures set out in this memorandum.

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Example: Street Construction Projects

As part of a contract for street construction, the contractor may be working at one end of a street and using an area at the other end of the street for the temporary stockpiling of construction materials. Both ends of the street are part of the construction contract site. In addition, the contractor may have leased an off-site location for temporary stockpiling of materials, which, following processing, will be reincorporated into the contract site, with some portion of the remainder designated for delivery to a Department disposal facility. Neither location will be regulated by the Department as a transfer station so long as the procedures set out in this memorandum are followed.

2. Procedure for Exception.

Upon a City construction agency's approval of any location to be designated as a temporary processing, storage or stockpiling area, that agency must determine that (a) its contract with the contractor provides for clean-up and restoration of such area by, for example, the contractor's posting of a restoration bond and/or by contractual set-off and (b) the agency has adequate procedures for monitoring the designated area to ensure that it does not violate the provisions set forth in this memorandum and that such location is cleaned up and restored at the completion of the contract work.

The City construction agency must submit an official letter to the Department acknowledging compliance with both (a) and (b) immediately above and representing that the agency will ensure the contractor's compliance. The letter to be submitted must be in substantially the following form, addressed to the Director, Bureau of Waste Disposal, Department of Sanitation, 125 Worth Street, Room 726, New York, NY 10013:

"The New York City Department of _____ (the "Agency") has awarded a construction contract to _____(Contractor)_____ _____ (the "Contractor") for work to be performed at _____(Contract Site)_____ .

a. This Agency has approved the following locations to be used by the Contractor for the temporary storage, processing and/or stockpiling of construction materials (the "Stockpiling Locations") excavated from the construction site or intended for the construction site:

_____

_____

_____

_____

b. The terms of the contract require the Contractor to clean up and restore the Stockpiling Locations, whether on or off the contract site, at or before the completion of the contract work.

c. This Agency assumes responsibility for the monitoring of Stockpiling Locations to ensure that only materials received from and/or intended for the construction site are stockpiled at such locations and we will enforce clean-up and restoration of such Locations at the end of their use for temporary stockpiling or at the termination of the contract, whichever occurs earlier, through restoration

bonding requirements and/or contractual set-off provisions such that the costs of clean-up and restoration will not become a charge to the Department or the City. "

3. When a Transfer Station Permit is Required

A transfer station permit will be required under any circumstances other than those outlined above. Except in the specifically defined circumstances set forth in this memorandum, any operator of a location or facility which receives, processes, stores or stockpiles construction and demolition debris or fill material for purposes of transfer to another location, including to a New York City Department of Sanitation facility, and whether or not under contract to the Department for the delivery of such materials, will be fully subject to the Department's transfer station rules and liable for enforcement for violations.

SECTION 40.14 – WATER MAIN LOCK-OUT / TAG-OUT (LOTO)

40.14.1 DESCRIPTION

When work is to be performed in the water distribution system, multiple valve closures remote from the work location are required to stop the flow of water. Most of these valves are not capable of being locked in a practical manner because the valves are several feet below the ground in a narrow access box. Work that requires the LOTO of trunk water mains must follow this procedure except that “trunk water main valve locking devices” may be used in lieu of “valve cans”.

40.14.2 DEFINITIONS

Lock-Out / Tag-Out (LOTO)	Practices and procedures to safeguard workers from hazardous energy releases.
Color-Coded Tag	Different groups working on the water distribution system have been assigned different color-coded tags: NYCDEP Operations – Orange NYCDEP Construction – Green NYCDEP Distribution – Yellow NYCDDC – Blue
ECC	NYCDEP Emergency Communications Center, 212-589-1520 / 1620
LOTO Competent Person	The Contractor’s employee responsible for LOTO operations.
LOTO Group Leader	Authorized person in charge of the water main work. For DDC contracts, the LOTO Group Leader is the Engineer or the Engineer’s designee, such as an inspector.
LOTO Device	A “valve can” or equivalent blocking / tagging device with a color-coded tag that reads: “ACTIVE LOTO DO NOT OPEN VALVE WITHOUT AUTHORIZATION OF LOTO GROUP LEADER: *[NAME OF GROUP LEADER]* CALL ECC 212-689-1520 (1620).”
LOTO Terminated	When the repair work is completed, valve cans (or equivalent devices) are removed, the LOTO termination section of the LOTO form has been signed, and the LOTO Group Leader determines that there will be no hazard caused by re-pressurizing the system.
Trunk Water Main	Generally, a water main with a diameter greater than 20”.
Trunk Water Main Valve Locking Device	A locking device capable of locking valves on trunk water mains.

40.14.3 MATERIALS

(A) Valve Cans – Valve cans are sheet metal covers meeting sketch M-161 at the end of this Section.

(B) Locks – Locks must be of a type intended for LOTO. Locks to be padlock type and have blue plastic bodies.

(C) Tags - Tags to be blue Tyvek, #8 size (6-1/4” x 3-1/8”), with an eyelet. Tags must be pre-printed matching the sketch at the end of this Section. Tags to be filled out with a fine point permanent marker, and secured with wire ties or plastic zip ties.

40.14.4 LOTO PROCEDURE

The Resident Engineer will coordinate the LOTO procedure and checklist with NYCDEP. The responsibilities of the Contractor in the LOTO process are as follows:

(A) General LOTO Requirements

In all phases of LOTO, the Contractor must:

1. Maintain their own OSHA-compliant LOTO logs and forms, independent of the forms kept by the LOTO Group Leader.
2. Provide a designated LOTO Competent Person, who:
    a. Is responsible for ensuring that all LOTO requirements are met;
    b. Must coordinate LOTO activities with the LOTO Group Leader;
    c. Must be available 24/7 to address LOTO issues.
3. Train all affected employees on LOTO procedures, including that valve cans and LOTO devices are not to be removed without confirming with the LOTO Competent Person that the LOTO is released. This training must be documented.

(B) Initiating a Shutdown

1. The Contractor must provide all necessary LOTO devices with blue color-coded tags for all valves requiring LOTO.
2. The Contractor must ascertain the exposure status of individual members working at the site, and coordinate with the Group Leader to ensure continuity of lockout protection as long as any employee may be exposed to potential harm from re-pressurization.
3. After the shutdown is complete, the Contractor must:
    a. Verify the system is closed (i.e. verify that there is no stored energy in main by opening a hydrant or tap to confirm main shutdown) in the presence of the Group Leader.
    b. Place appropriate LOTO devices on the appropriate valves.
    c. Apply blue color-coded tags to all LOTO devices, fully filled out with a permanent marker.
    d. Provide the Group Leader with any information necessary for the Group Leader to complete the NYCDEP LOTO form.
4. If the shutdown continues over multiple shifts, the Contractor must confirm the LOTO information with the Group Leader at every shift change.

(C) Reopening a Shutdown when LOTO is fully released

1. The Contractor must assist the LOTO Group Leader in verifying that the system is ready for re-pressurization, including verification that all of the Contractor's employees are out of the way of potential harm before re-pressurizing the system.
2. The Contractor must remove LOTO devices from valves to be re-opened before re-opening.
3. The Contractor must provide the information to the LOTO Group Leader for filling out the LOTO form, including which valves have been re-opened.
4. The Group Leader must inform the Maintenance Yard that the valves have been re-opened and provide the LOTO form. Maintenance Yard staff will verify the valves are properly opened and service is fully restored.

(D) Reopening a Shutdown when LOTO is not fully released (Partial reopening for advancing work zones)

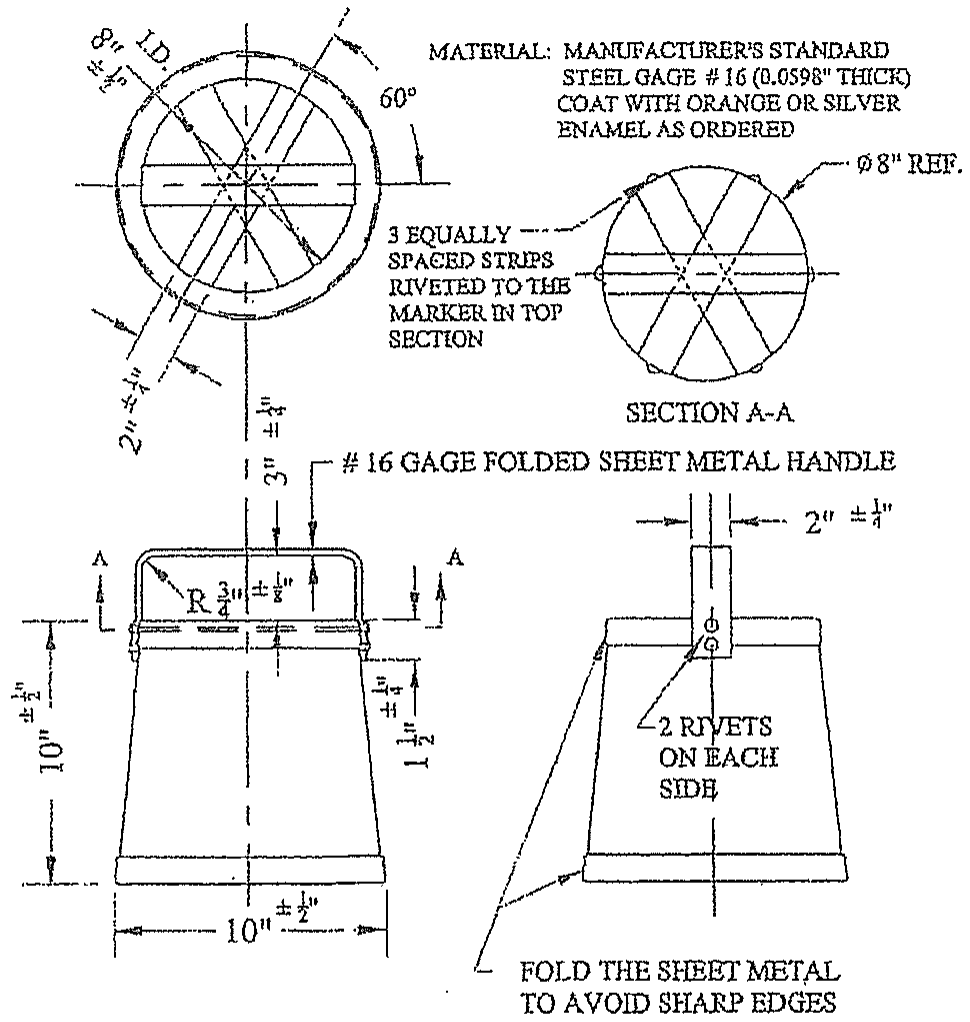
1. The Contractor must assist the LOTO Group Leader in verifying that the system is ready for re-pressurization, including verification that all of the Contractor's employees are out of the way of potential harm before re-pressurizing the system.
2. The Contractor must remove LOTO devices from valves to be opened before reopening.
3. The Contractor must provide the information to the LOTO Group Leader for filling out the LOTO form, including which valves have been re-opened and which valves are still locked out;
4. The Group Leader must inform the Maintenance Yard of any re-opened valves and provide the LOTO form. Maintenance Yard staff will verify which valves are open or remain closed, as reported on the LOTO form, to confirm where service has been restored or remains shutdown.

40.14.5 NO SEPARATE PAYMENT

No separate or additional payment will be made for fulfilling the requirements specified above and the costs thereof must be deemed included in the prices bid for all items of work.

Valve Can Sketch

M-161 REV. # 3 SUPERSEDES DWG # M-161-4 M-161 REV. # 3



REV. #	REVISION	DATE
3	CHANGED RED TO ORANGE AND ADDED THIRD STRIP TO CROSS	2/10
2	PLACED CROSS INSIDE MARKER	2/10
1	CHANGED GAGE FROM # 11 TO # 16	3/09

DEP

BUREAU OF WATER & SEWER OPERATIONS

Drawn By: MM

Approved By & Date: 2/11/2010

VALVE MARKER

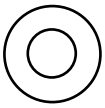
NOT TO SCALE DWG. # M-161 REV. # 3

LOTO Tag Sketch

ACTIVE LOTO

NYC DDC PROJECT ID:_____

DO NOT OPEN VALVE WITHOUT AUTHORIZATION OF LOTO GROUP LEADER



GROUP LEADER NAME **PHONE**

RESIDENT ENGR NAME **PHONE**

CALL ECC: 212-689-1520 (1620)

SECTION 40.15– PRICES TO COVER

40.15.1 COST TO COVER

Unless otherwise specified, the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to furnish, deliver, install and perform all work as specified in **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS, from Sections 40.02 to 40.14, inclusively**, must be included in the prices bid for all contract items of work.

40.15.2 NO SEPARATE OR ADDITIONAL PAYMENT

No separate or additional payment will be made for any of the materials and work described in **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS, from Sections 40.02 thru 40.14, inclusively**, except as otherwise specified.

(NO TEXT ON THIS PAGE)

CITY OF NEW YORK

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF WATER AND SEWER OPERATIONS

DIVISION V – CLASSIFIED SECTIONS OF SEWER WORK

SECTIONS 50.11 TO 55.11

(NO TEXT ON THIS PAGE)

SECTION 50.11 – REINFORCED CONCRETE SEWERS

50.11.1 DESCRIPTION

Reinforced concrete sewers must be constructed of the sizes and shapes shown.

50.11.2 MATERIALS

(A) Concrete must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(B) Reinforcement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(C) Pipe for spurs and risers must comply with the requirements of **Section 21.02** for vitrified clay pipe, or **Section 21.04** for cast iron soil pipe, or **Section 21.06** for ductile iron pipe.

(D) Cement mortar must comply with the requirements of **Section 23.03**.

50.11.3 CONSTRUCTION METHODS

(A) GENERAL - Reinforced concrete sewers must be constructed to the sizes and dimensions shown by the normal sections and special sections and to the lines and grades shown on the plans or ordered. Transverse and longitudinal construction joints must be located where approved by the Engineer.

(B) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** must apply to the work to be done hereunder.

(C) INVERTS - Inverts of reinforced concrete sewers must be formed between transverse templates and must be screeded. Where the radii of inverts are too small to permit screeding between templates, the inverts must be shaped by means of interior forms. The concrete for inverts must be deposited continuously for the entire cross section and for such longitudinal distances as approved. Inverts must be carefully protected from all injury during the progress of the work. The inverts of reinforced concrete sewers must be troweled smooth. Unless otherwise permitted or ordered, not less than twelve (12) feet of invert for reinforced concrete sewer must be built at one operation.

(D) SIDE WALLS - Concrete in the sidewalls of sewers must be deposited continuously to the height, to the thickness and for such longitudinal distances as approved.

(E) ROOFS - Concrete in the roofs of sewers must be deposited continuously for the full depths and for the entire widths of the roofs and for such longitudinal distances as approved. The outer surfaces of roofs must be finished true and smooth.

(F) BULKHEADS - Approved construction joint bulkheads with provisions for keying and doweling adjoining sections must be provided, where required.

(G) REINFORCEMENT AND STRUCTURAL STEEL - The steel reinforcement must be of the dimensions and shapes shown and installed in the manner specified in **General Specification 11 - Concrete, as modified in Section 23.01**. Structural steel must be of the shapes and sizes shown and installed as directed.

(H) CONNECTIONS - Connections and branches must be built where shown on the plans or where directed. All unconnected branches must be closed with bulkheads of brick masonry eight (8) inches thick unless otherwise shown on the plans or specified.

(I) SPURS AND RISERS - Spurs and Risers must be built to the details shown on the plans or as directed. Locations of spurs and risers and height of risers are not shown on the plans. Need for and location of spurs and risers and height of risers will be determined by the Engineer at time of construction. Unconnected dead ends of spurs and risers must be closed with approved tile or precast concrete plugs or with hand tightening (wing nut type) expandable plugs to provide a watertight seal. The threads are to be greased prior to tightening to ensure a proper seal without stripping.

(J) REMOVAL OF FORMS - Forms must be removed in accordance with **General Specification 11 - Concrete, as modified in Section 23.01**.

(K) WATERSTOPS - Waterstops must be provided between each successive pour in accordance with **Section 25.04**. Details must be submitted for waterstops as part of the shop drawings.

50.11.4 PRECAST REINFORCED CONCRETE SEWER

(A) DESCRIPTION - When specifically stated in the contract documents the Contractor will be permitted to use precast sections in lieu of pouring the proposed reinforced concrete sewer in place.

The precast section must be a four (4) sided box section with open ends to be monolithically cast of reinforced concrete. All inside surfaces must be smooth so as not to restrict flow. All curves and bends must be poured in place.

(B) MATERIALS

(1) Concrete must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01** except that the concrete must have a concrete design mix of five thousand (5,000) pounds per square inch (minimum twenty-eight (28) day compressive strength of four thousand (4,000) pounds per square inch). The maximum allowable chloride content in the concrete must not exceed one-tenth (1/10) of one percent by weight of cement. The maximum water/cement ratio must not exceed forty-seven (47) percent by weight.

(2) Portland Cement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01** and must be Type II unless otherwise specified. Coarse and Fine Aggregate for concrete must be well graded in accordance with **Subsection 2.6.1.1 of General Specification 11 - Concrete, as modified in Section 23.01**. Size of Coarse Aggregate must be three-quarter (3/4) inch unless smaller size aggregate is required due to nature of work.

(3) Reinforcement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(4) Welded Steel Wire Fabric must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01** and must have a minimum specified yield strength of sixty-five thousand (65,000) pounds per square inch.

(5) High range water reducing admixtures meeting the requirements of ASTM C494 Type F and having been previously approved by the New York State Department of Transportation may be used.

(C) DETAILS - The minimum dimensions and minimum reinforcement utilized for the construction of box sewers must be those shown on the contract documents. However, the Contractor will be required to submit computer printouts for the design of precast box sections that may result in additional concrete thickness and/or additional steel.

The design submitted must be in general conformance with ASTM C1433 and ACI 318-05 Specification. The following design parameters must be used:

(1) Unit Weight of Soil - 120-lbs./cu. ft. (minimum)
(2) Minimum Live Load - AASHTO HS20-44
(3) Impact Loading (Dependent upon depth)
(4) Exterior Groundwater Elevation

A design must be submitted for loadings based upon depth of water in the section equal to interior height and for no water in the section.

(D) JOINTS AND GASKETS - Each section of box sewer must have an approved lap and spigot joint that will permit water tight smooth and permanent joints. The minimum lap must be four (4) inches. Sections with butt or square ends will only be permitted where connections are made to poured-in-place sections.

Each spigot end must be manufactured with a groove or step to accept a gasket. The gasket must be a one (1) inch diameter neoprene ring gasket and must be cemented to the spigot groove of each section. In lieu of a one (1) inch diameter neoprene gasket the Contractor will be permitted to request alternate gaskets provided that they are a one (1) piece continuous ring, manufactured of neoprene rubber and pass the hydrostatic test.

(E) TESTING - Concrete utilized in the construction of precast box sewers must be tested in conformance with **General Specification 11 - Concrete, as modified in Section 23.01**, with the exception that the concrete, steel reinforcement, fabrication, and manufacture must be tested and certified as to compliance by an independent Testing Laboratory licensed in the State of New York and approved by the Department of Design and Construction.

Hydrostatic tests, identical to those performed for reinforced concrete pipe and as defined in these specifications, must be performed and must be satisfactorily completed prior to acceptance. The gasket must conform to ASTM C443 and must be tested for a joint deflection of one (1) inch.

Testing must also conform to all applicable sections of **DIVISION III - INSPECTION OF MATERIALS, SAMPLING, AND METHODS OF TEST** of these specifications.

In addition, all manufacture of sections must be witnessed by an approved licensed independent Testing Laboratory and Certified as to Compliance with the standard drawings and specifications.

The costs of all testing as described above must be deemed included in the price(s) bid per linear foot of item(s) labeled "REINFORCED CONCRETE SEWER".

(F) LATERAL CONNECTIONS TO PRECAST SECTIONS - Connections to the walls of precast sections for which the opening is greater than ten (10) inches must be provided integral with the precast sections at the time of manufacture, and must have a minimum additional steel reinforcement of two (2) number five (5) reinforcement bars on each face around the opening.

Connections to the walls of precast sections for which the opening size is ten (10) inches or less may be made by core drilling holes in the field.

Openings in walls for connections must be placed so that a minimum distance of one (1) foot is provided between the inner top of the precast section and the inner top of the opening. In addition, a minimum distance of one (1) foot must be maintained between the edge of the opening and the end of the section.

Openings in roofs required for risers must be provided at time of manufacture and must be shown on the shop drawings.

Locations of openings are not shown on the plans. The Engineer will determine the need for and location of openings at the time of construction. The Contractor must provide openings as required by the field conditions and as directed by the Engineer.

Lateral pipes (i.e. spurs, risers, drains) must be installed flush with the inside face of the box section and all annular spaces must be filled with nonshrink grout that must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(G) CONNECTIONS TO POURED-IN-PLACE SECTIONS, ETC. - At locations where precast sections are to be connected to poured-in-place sections, manholes, and/or chambers the precast section must be provided with a keyway and a four (4) inch waterstop. In general, the location of this connection must be at least eighteen (18) inches from the poured-in-place structure. Threaded inserts must be provided in the precast section at twelve (12) inches on center located in the center of the walls, roof, and invert. These inserts must be nine (9) inches in depth and provided with eighteen (18) inch long No. 6 reinforcement bars which must extend into the monolithically poured-in-place section. Details of all connections to poured-in-place structures, including modifications to these poured-in-place structures, must be included in the shop drawings.

(H) INSTALLATION - All precast box sections must be laid on a well-compacted six (6) inch thick layer of crushed stone, the material must be in conformance with **Section 40.12** of these specifications. In addition, two (2) rows of 2" x 8" pressure treated wood planks must be laid parallel and continuous along the entire length of the trench. The planks must be laid so that their outer edges align with the inside walls of the precast section. The planks must be laid within the stone bedding to line and grade in order that when the sections are placed on the planks the required line and grade will be met.

After the bedding has been prepared, the initial box section must be placed on the prepared base. Coil inserts and lifting slings, or their equivalent, must be used in the placing of all sections. After the initial section is in place, successive precast sections must be lowered into position and slid upon the planks as close as possible to the previous section. Pipe pullers or their equivalent must then be utilized to bring the pipe to within one-half (1/2) inch of the previous section. All internal annular spaces and external roof annular spaces must then be filled with a nonshrink grout.

(I) SHOP DRAWINGS - The Contractor will be required to submit five (5) sets of shop drawings depicting all details regarding the manufacture and installation of precast boxes. The shop drawings must show dimensions, reinforcement details, connection details, design parameters, and construction procedures.

All shop drawings and calculations must bear the seal and signature of a New York State Licensed Professional Engineer. Shop drawings must show the Contractor's name, the manufacturer's name, the project number, the project title, the drawing description, the drawing number, and the date.

(J) MARKINGS - The manufacturer must mark each individual piece with permanent markings on the inside of the box section. The following minimum information must be listed:

(1) Date of Manufacture
(2) Manufacturer's Logo
(3) Individual Piece Identification
(4) ASTM Designation

(K) DELIVERY OF SECTIONS – Sections cannot be delivered to the job site until they have attained the specified twenty-eight (28) day compressive strength as evidenced by cylinder testing. In addition five (5) copies of all test results, steel supplier certifications, independent Testing Laboratory certifications, and fabrication and manufacture certifications must be submitted to the Engineer prior to delivery or at the time of delivery.

(L) MANUFACTURE - Precast box sewers must be built in conformance with approved drawings and must be cast in steel forms.

Devices used to position reinforcement must be made of, or coated with, material so that corrosion of the device will not occur. Sufficient devices to position the reinforcement for required concrete cover must be provided. Tack welding or any other welding of specified steel reinforcement will not be permitted. Redundant steel reinforcement may be tied or fastened.

Concrete must be thoroughly consolidated by internal or external vibration or a combination of both.

(M) CURING - All precast sections must be subjected to curing by one of the following methods:

(1) STEAM CURING - Sections may be placed in a curing chamber, free from outside drafts, and cured in a moist atmosphere maintained at a temperature between one hundred (100) degrees Fahrenheit and one hundred sixty (160) degrees Fahrenheit, by the injection of steam for a period of not less than twelve (12) hours or, when necessary, for such additional time as may be needed to enable the pipe to meet the strength requirements. Steam curing must not commence until at least two (2) hours have elapsed since completion of placement of concrete in the forms. When a curing chamber is not available, sections may be placed in an enclosure of canvas and subjected to steam around the entire section at the temperature and for the time specified above. The enclosure must be so erected as to allow full circulation of steam around the entire section. The interior surfaces of the curing room or canvas jackets and the surfaces of the section must be entirely moist at all times.

(2) WATER SPRAY CURING - Under the conditions of enclosure described in the above paragraph on "Steam Curing", sections may be cured by subjecting it to a continuous fine spray of water in an enclosure maintained at a temperature of not less than seventy (70) degrees Fahrenheit for a period of not less than seventy-two (72) hours or such additional time as may be necessary to meet the strength requirements.

(3) SATURATED COVER CURING - The sides and top of each section must be covered with heavy burlap or other suitable material saturated with water before applying and kept saturated at a temperature of not less than seventy (70) degrees Fahrenheit for seventy-two (72) hours or such additional time as may be necessary to meet the strength requirements.

Precast Sections must not be subjected to freezing temperatures until the required twenty-eight (28) day compressive strength is achieved.

(N) TELEVISION INSPECTION AND RECORDING - Upon completion of all work, the Contractor must perform a television inspection and digital audio-visual recording of all sewers reconstructed in accordance with **Section 53.11** of the specifications. Payment for television inspection and digital audio-visual recording must be made under Item No. 53.11DR - TELEVISION INSPECTION AND DIGITAL AUDIO-VISUAL RECORDING OF SEWERS.

50.11.5 MEASUREMENT

The quantities of reinforced concrete sewers to be measured for payment must be the number of linear feet of each size and type of sewer, incorporated in the work, complete, as shown, specified or required, measured horizontally along the center lines of sewers.

Payment must be based on the measurement from inside face of manhole or chamber to inside face of manhole or chamber, unless otherwise shown or specified in the contract documents.

50.11.6 PRICE TO COVER

The contract price for “REINFORCED CONCRETE SEWERS” must be the unit price bid per linear foot for each size and type of sewer and must cover the cost of all labor, materials, plant, equipment, samples, tests, and insurance required and necessary to construct the reinforced concrete sewers of the sizes and dimensions shown by the normal sections and special sections and to the lines and grades shown, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); all sheeting and bracing; pumping; fluming; bridging; breaking down and filling in of abandoned sewer appurtenances; connections; spurs as required (except when there is a contract price for Spurs); maintaining flow in sewers, backfilling, cleaning up, and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans and specifications and as directed by the Engineer.

Unless otherwise shown, reducers or conformers will be paid for at the contract price for the sewer at the larger ends thereof.

Where precast reinforced concrete sewers are specifically permitted on the contract documents, the cost for furnishing, delivery and installation of precast reinforced concrete sewers, complete as shown, specified, or ordered together with additional excavation and sheeting associated with the widening and deepening of a trench due to increased width of precast reinforced concrete sewer and due to the placement of a continuous crushed stone and plank grade pad, crushed stone, planks, connections and all work incidental thereto all in accordance with the plans, specifications and standards must be included in the contract price(s) bid for item(s) labeled “REINFORCED CONCRETE SEWERS". No additional or separate payments will be made for any work associated with the installation of precast reinforced concrete sewers.

Included in the price hereunder must be the cost for all labor and materials required to provide all the openings in the precast reinforced concrete sewer for spurs, risers and drains, where shown on the plans or as directed by the Engineer, all in accordance with the specifications.

In addition, included in the price hereunder must be the cost of all labor and materials necessary to remove all specified or ordered existing sewers, manholes, structures, and appurtenances that may be in the line of the work and do all work incidental thereto, all in accordance with **Subsections 10.13 and 10.28** of the specifications and as directed by the Engineer.

Payment for Reinforced Concrete Sewers will be made under the Item Number as calculated below:

The Item Numbers for Reinforced Concrete Sewers have thirteen characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Flat Top Reinforced Concrete Sewers:

50.11

(2) The sixth character must define the Type of Sewer Effluent:

S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer

(3) The seventh character must define the Number Of Barrels of the Sewer:

S - Single Barrel
D - Double Barrel
T - Triple Barrel

(4) The eighth, ninth, and tenth characters must define the Width of the Sewer. (The eighth and ninth characters representing the unit of feet and the tenth character representing the unit of inches (in three (3) inch increments) for the Width of the Sewer.) See examples below:

040 - 4’-0”W
093 - 9’-3”W
146 - 14’-6”W

(5) The eleventh, twelfth, and thirteenth characters must define the Height of the Sewer. (The eleventh and twelfth characters representing the unit of feet and the thirteenth character

representing the unit of inches (in three (3) inch increments) for the Height of the Sewer.) See examples below:

050 - 5’-0”H
089 - 8’-9”H
126 - 12’-6”H

(6) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
50.11SS040040	4’-0”W X 4’-0”H SINGLE BARREL FLAT TOP REINFORCED CONCRETE SANITARY SEWER	L.F.
50.11SS053043	5’-3”W X 4’-3”H SINGLE BARREL FLAT TOP REINFORCED CONCRETE SANITARY SEWER	L.F.
50.11MS079046	7’-9”W X 4’-6”H SINGLE BARREL FLAT TOP REINFORCED CONCRETE STORM SEWER	L.F.
50.11MD100073	10’-0”W X 7’-3”H DOUBLE BARREL FLAT TOP REINFORCED CONCRETE STORM SEWER	L.F.
50.11MT126079	12’-6”W X 7’-9”H TRIPLE BARREL FLAT TOP REINFORCED CONCRETE STORM SEWER	L.F.
50.11CS080053	8’-0”W X 5’-3”H SINGLE BARREL FLAT TOP REINFORCED CONCRETE COMBINED SEWER	L.F.
50.11CD110066	11’-0”W X 6’-6”H DOUBLE BARREL FLAT TOP REINFORCED CONCRETE COMBINED SEWER	L.F.
50.11CT070049	7’-0”W X 4’-9”H TRIPLE BARREL FLAT TOP REINFORCED CONCRETE COMBINED SEWER	L.F.

SECTION 50.21 – PRECAST REINFORCED CONCRETE PIPE SEWER

50.21.1 DESCRIPTION

Precast reinforced concrete pipe sewers must be constructed of the sizes and classes shown.

50.21.2 MATERIALS

(A) Precast reinforced concrete pipe must comply with the requirements of **Section 21.05**. Kind, class, and size of pipe must be as shown or specified.

Approved openings with covers for spurs or risers must be provided where shown or required.

(B) Cement mortar must comply with the requirements of **Section 23.03**.

(C) Ring rubber gasket and grooved spigot joint must comply with the requirements of **Section 21.07**, Type 4, and as specified herein.

(D) Flexible butyl gasket must comply with the requirements of **Section 21.07**, Type 5, and as specified herein.

(E) Concrete for cradle and encasement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

50.21.3 CONSTRUCTION METHODS

(A) GENERAL - Precast reinforced concrete pipe sewers must be constructed of the sizes and classes and to the lines and grades shown on the plans or as ordered.

(B) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** must apply to the work to be done hereunder.

(C) JOINTS - All pipe forty-eight (48) inches and larger in its least dimension must have all interior and exposed exterior joints completely filled with cement mortar. Joints must be watertight. They must be troweled or otherwise finished to make them smooth and flush with the interior surface of the pipe.

The following type joints must be acceptable:

(1) Type 4 - Ring Rubber Gasket of Circular Cross Section and Grooved Spigot Joint must be used for Circular Reinforced Concrete Pipe joints. Pipe for which these types of joints are specified must be cast with perfectly machined castings for forming the bells and spigots so that they will be true circles and when laid together the annular space for the rubber gasket must be perfectly uniform.

The design of the joint must conform to the requirements of ASTM C361.

Rubber Gaskets must be manufactured in accordance with the following:

(a) Physical Properties: ASTM C443.
(b) Design Criteria: ASTM C443.

The manufacturer of the rubber gaskets to be used must be submitted for approval before pipe laying begins.

For Type 4 - Ring Rubber Gasket and Grooved Spigot Joints, the following must apply:

(a) Immediately before laying the pipe, a round rubber gasket must be snapped into the spigot groove and must be completely covered with soap or wax compound or other approved lubricant.
(b) The pipe must be properly aligned in the trench to avoid any possibility of fouling the gasket.
(c) The spigot with gasket attached must be entered into the heel of the previously laid pipe and forced home. Approved tackle and apparatus must be used to draw the joints home. When the pipe is laid, the shoulders of the bell and spigot must touch.
(d) Rubber gaskets must not be exposed to the sun either before or after placing on the pipe spigots.

(2) Elliptical Reinforced Concrete Pipe Joint Material must be Type 5 - Flexible Butyl Gasket, conforming to ASTM C990. The pipe joint material must be of either rectangular or circular shape with a minimum cross-sectional area of 0.78-square inches. The joint material must be applied to both circumferential planes of the pipe joint, utilizing a primer specifically designed by the pipe joint material manufacturer for such purpose. The joints must be hand cleaned of all foreign material prior to placing the joint material and primer. The joint material must be overlapped (not butted) to assure a complete seal.

(3) Inspection - Unless otherwise directed by the Engineer, the finished joint must be left exposed for inspection and approval by the Engineer. A suitable ladder affording easy access for such inspection must be provided.

(D) LAYING - The pipe must be laid with the male ends toward the outlet. The pipes must be fitted together and matched so that when laid in the work they will form a sewer with a smooth and uniform invert. Unless otherwise directed, not less than fifteen (15) feet of pipe sewer must be laid in one operation.

During the progress of the work, the exposed ends of pipe sewers must be provided with approved temporary covers fitted to the pipe so as to exclude earth and other materials.

The ends of the pipe that enter masonry walls must be cut to fit the inner face of the masonry. Unless otherwise directed, such cutting must be done before the pipes are built in.

(E) CRADLES - Precast reinforced concrete pipe sewers must be laid in continuous concrete cradles. Concrete cradles for pipe must be cast in one (1) pour and must be of the dimensions shown on the Sewer Design Standards and as directed by the Engineer.

Concrete sills of approved shapes and dimensions must be used for the temporary support of pipes that are to be permanently supported on concrete cradles. Such sills must be completely embedded in the concrete cradle. Working drawings of these sills must be submitted to the Engineer for approval before pipe laying begins. The use of wood blocks or fieldstones will not be permitted.

Forms must be removed in accordance with **General Specification 11 - Concrete, as modified in Section 23.01**.

(F) CONCRETE ENCASEMENT - Where shown, specified or required, precast reinforced concrete pipe sewers must be fully encased in concrete.

(G) DAMAGED PIPE - Pipe damaged from handling or any cause whatsoever, whether in or out of the trench, must be replaced and removed from the site of the work by and at the sole expense of the Contractor.

(H) OPENINGS FOR SPURS OR RISERS - Precast reinforced concrete pipe must have openings to receive Tee-Branches and Wye-branches at such points as the Engineer may designate and the size and shape of the openings must be such as to provide a continuous and smooth inside surface with the branch pipe. A socket must be formed in the shell of the pipe to receive spur or riser pipe, which will permit an annular space of five-eighths (5/8) inch around the spur pipe for caulking, with an approved non shrink and watertight compound. The depth of the socket must at least be two (2) inches. Unconnected openings for spurs and risers, or dead ends of spurs and risers, must be closed with approved tile or precast concrete plugs or with hand tightening (wing nut type) expandable plugs to provide a watertight seal. The threads are to be greased prior to tightening to ensure a proper seal without stripping.

Location of openings for spurs and risers and height of risers are not shown on the plans. The Engineer will determine need for and location of openings for spurs and risers, and height of risers, The Contractor must provide openings as required by the field conditions and as directed by the Engineer.

(I) FIELD CUTTING - Precast reinforced concrete pipe must be cut only by means of wheel type cutters, milling type cutters, or as approved by the Engineer. The use of diamond points and dog chisels will not be permitted.

(J) CONNECTION TO EXISTING SEWER - Wherever the proposed sewer is to connect with an existing manhole in which there is a branch pipe that is damaged or of unsuitable size or in improper position to receive the new sewer, such pipe must be removed and be replaced with a pipe of suitable size in the proper position. The ends of pipe that enter masonry must be neatly cut to fit the inner face of the masonry. Unless otherwise directed, such cutting must be done before the pipes are built in. Inverts of existing manholes must be modified according to the new pipe size and position in accordance with the plans or as ordered by the Engineer. The cost of such connections and modifications to existing manholes must be deemed included in the prices bid per linear foot of the respective sewer items.

(K) TELEVISION INSPECTION AND RECORDING - Upon completion of all work, the Contractor must perform a television inspection and digital audio-visual recording of all sewers reconstructed in accordance with **Section 53.11** of the specifications. Payment for television inspection and digital audio-visual recording must be made under Item No. 53.11DR - TELEVISION INSPECTION AND DIGITAL AUDIO-VISUAL RECORDING OF SEWERS.

50.21.4 MEASUREMENT

The quantities of precast reinforced concrete pipe sewers to be measured for payment must be the number of linear feet of each size, kind, and class of sewer incorporated in the work, complete, as shown, specified or required, measured horizontally along the center lines of sewers.

Payment will be made from inside face of manhole or chamber to inside face of manhole or chamber, unless otherwise shown or specified in the contract documents. When circular precast manholes are incorporated into the work, the inside face of the manhole must be the vertical plane at which the sewer's outside diameter transverse to the horizontal center line of the sewer intersects the inside wall of the circular precast manhole.

50.21.5 PRICE TO COVER

The contract price for "PRECAST REINFORCED CONCRETE PIPE SEWERS" must be the unit price bid per linear foot for each size, kind, and class of sewer and must cover the cost of all labor, materials, plant, equipment, samples, tests, and insurance required and necessary to construct the precast reinforced concrete pipe sewers of the sizes and to the lines and grades shown, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**), all sheeting and bracing; pumping, fluming, bridging, breaking down and filling in of abandoned sewer appurtenances; connections, concrete cradle and encasements, maintaining flow in sewers, backfilling, cleaning up, and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans, specifications and standards and as directed by the Engineer.

Included in the price hereunder must be the cost for all the labor and materials required to provide all the openings in the precast reinforced concrete pipe sewers for house connection drains and risers, where shown on the plans or as directed by the Engineer, all in accordance with the specifications.

In addition, included in the price hereunder must be the cost of all labor and materials necessary to remove all specified and ordered existing sewers, manholes, structures and appurtenances that may be in the line of the work and do all work incidental thereto, all in accordance with **Subsections 10.13 and 10.28** of the specifications and as directed by the Engineer.

Payment for Precast Reinforced Concrete Pipe Sewers will be made under the Item Number as calculated below:

The Item Numbers for Precast Reinforced Concrete Pipe Sewers have twelve characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Precast Reinforced Concrete Pipe Sewers:

50.21

(2) The sixth character must define the Type of Sewer Effluent:

S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer

(3) The seventh character must define the Class of Sewer Pipe:

3 - Class III or Class HE-III
4 - Class IV or Class HE-IV
5 - Class V

(4) The eighth character must define the Kind of Bedding for Sewer Pipe:

C - On Concrete Cradle
E - Encased In Concrete

(5) The ninth, tenth, and eleventh characters must define either the Diameter of the Pipe for Circular Sewers or the Width of the Pipe for Horizontal Elliptical Sewers. (The ninth, tenth, and eleventh characters representing the unit of inches for either the Diameter of the Pipe for Circular Sewers or the Width of the Pipe for Horizontal Elliptical Sewers.) See examples below:

024 - 24"
121 - 121"

(6) The twelfth character must define the Shape of Sewer Pipe:

D - Circular Pipe (Diameter)
W - Horizontal Elliptical Pipe (Width)

(7) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
50.21S3C024D	24" R.C.P. CLASS III SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.21S3E030D	30" R.C.P. CLASS III SANITARY SEWER, ENCASED IN CONCRETE	L.F.
50.21S4C036D	36" R.C.P. CLASS IV SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.21S4E042D	42" R.C.P. CLASS IV SANITARY SEWER, ENCASED IN CONCRETE	L.F.
50.21S5C030D	30" R.C.P. CLASS V SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.21S5E048D	48" R.C.P. CLASS V SANITARY SEWER, ENCASED IN CONCRETE	L.F.
50.21S3C023W	23"W X 14"H R.C.P. CLASS HE-III SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.21S3E038W	38"W X 24"H R.C.P. CLASS HE-III SANITARY SEWER, ENCASED IN CONCRETE	L.F.
50.21S4C030W	30"W X 19"H R.C.P. CLASS HE-IV SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.21S4E045W	45"W X 29"H R.C.P. CLASS HE-IV SANITARY SEWER, ENCASED IN CONCRETE	L.F.
50.21M3C048D	48" R.C.P. CLASS III STORM SEWER, ON CONCRETE CRADLE	L.F.
50.21M3E060D	60" R.C.P. CLASS III STORM SEWER, ENCASED IN CONCRETE	L.F.
50.21M4C054D	54" R.C.P. CLASS IV STORM SEWER, ON CONCRETE CRADLE	L.F.
50.21M4E066D	66" R.C.P. CLASS IV STORM SEWER, ENCASED IN CONCRETE	L.F.
50.21M5C060D	60" R.C.P. CLASS V STORM SEWER, ON CONCRETE CRADLE	L.F.
50.21M5E072D	72" R.C.P. CLASS V STORM SEWER, ENCASED IN CONCRETE	L.F.
50.21M3C053W	53"W X 34"H R.C.P. CLASS HE-III STORM SEWER, ON CONCRETE CRADLE	L.F.
50.21M3E068W	68"W X 43"H R.C.P. CLASS HE-III STORM SEWER, ENCASED IN CONCRETE	L.F.
50.21M4C060W	60"W X 38"H R.C.P. CLASS HE-IV STORM SEWER, ON CONCRETE CRADLE	L.F.
50.21M4E076W	76"W X 48"H R.C.P. CLASS HE-IV STORM SEWER, ENCASED IN CONCRETE	L.F.
50.21C3C072D	72" R.C.P. CLASS III COMBINED SEWER, ON CONCRETE CRADLE	L.F.
50.21C3E084D	84" R.C.P. CLASS III COMBINED SEWER, ENCASED IN CONCRETE	L.F.
50.21C4C078D	78" R.C.P. CLASS IV COMBINED SEWER, ON CONCRETE CRADLE	L.F.
50.21C4E090D	90" R.C.P. CLASS IV COMBINED SEWER, ENCASED IN CONCRETE	L.F.
50.21C5C084D	84" R.C.P. CLASS V COMBINED SEWER, ON CONCRETE CRADLE	L.F.
50.21C5E096D	96" R.C.P. CLASS V COMBINED SEWER, ENCASED IN CONCRETE	L.F.
50.21C3C083W	83"W X 53"H R.C.P. CLASS HE-III COMBINED SEWER, ON CONCRETE CRADLE	L.F.
50.21C3E098W	98"W X 63"H R.C.P. CLASS HE-III COMBINED SEWER, ENCASED IN CONCRETE	L.F.
50.21C4C091W	91"W X 58"H R.C.P. CLASS HE-IV COMBINED SEWER, ON CONCRETE CRADLE	L.F.
50.21C4E106W	106"W X 68"H R.C.P. CLASS HE-IV COMBINED SEWER, ENCASED IN CONCRETE	L.F.
50.21C4E113W	113"W X 72"H R.C.P. CLASS HE-IV COMBINED SEWER, ENCASED IN CONCRETE	L.F.
50.21C4E121W	121"W X 77"H R.C.P. CLASS HE-IV COMBINED SEWER, ENCASED IN CONCRETE	L.F.

SECTION 50.31 – VITRIFIED PIPE SEWERS

50.31.1 DESCRIPTION

Vitrified pipe sewers must be constructed of the sizes and kinds shown.

50.31.2 MATERIALS

(A) Vitrified pipe must comply with the requirements of **Section 21.02**. Kind, class, and size of pipe must be as shown or specified.

(B) Cement mortar must comply with the requirements of **Section 23.03**.

(C) Cement grout must comply with the requirements of **Section 23.04**.

(D) Gasket and mortar joint must comply with the requirements of **Section 21.07**, Type 1, and as specified herein.

(E) Premolded bituminous compound joint must comply with the requirements of **Section 21.07**, Type 2, and as specified herein.

(F) Elastomeric pipe joint must comply with the requirements of **Section 21.07**, Type 3, and as specified herein.

(G) Ring rubber gasket and grooved spigot joint must comply with the requirements of **Section 21.07**, Type 4, and as specified herein.

(H) Concrete for cradle and encasement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

50.31.3 CONSTRUCTION METHODS

(A) GENERAL - Vitrified pipe sewers must be constructed of the sizes and kinds and to the lines and grades shown on the plans or as ordered.

The Contractor must furnish and have available on the project site E.S.V.P. in various lengths to ensure that the final spur locations are properly aligned with the new house connections or reconnections.

(B) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** must apply to the work to be done hereunder.

(C) JOINTS

(1) Unless otherwise specified, or approved in writing by the Engineer, all joints for vitrified pipe sewers must be either Type 3 - Elastomeric Pipe Joint, Type 4 - Ring Rubber Gasket of Circular Cross Section and Grooved Spigot Joint, or must be a Compression Ring of a Resilient Material and Grooved Spigot Joint, and the following applies:

(a) Vitrified pipe joints of elastomeric material must be factory applied. The method employed to mold the joint must ensure even distribution of material, smooth contact surfaces, and tight joints when the pipe is laid. Care must be taken in transporting and handling pipe to prevent deformation or damage to the joint material.

Immediately before inserting the spigot end into pipe previously laid, the contact surfaces of both the spigot and bell of the pipe must be cleaned by effective means and then coated with a lubricating agent recommended by the manufacturer of the joint material being used.

The pipe must then be drawn up home so that the inner edge of the jointing material on the spigot edge must be approximately flush with the outer edge of the jointing material in the bell and the joint material must remain in continuous compression around the full circumference of the pipe. None of the jointing material on the spigot end must be exposed beyond the bell.

(b) If the Contractor employs a joint that relies upon a ring rubber gasket and grooved spigot joint or a compression ring of a resilient material having a controlled and calculated shape that will be compressed within the annular space to form a closing seal, the gasket or compression ring is to be kept in its container until required. Immediately before inserting the spigot end into pipe previously laid, the contact surfaces of both the spigot and bell of the pipe must be cleaned by effective means and then coated with a lubricating agent recommended by the manufacturer of the joint material being used. Before snapping the gasket or compression ring into the spigot

groove, the gasket or compression ring must also be coated with the same lubricating agent. The pipe must then be drawn up home. After the joint has been assembled a check is to be made to see if the gasket or compression ring is looped out of the groove due to misalignment on showing home before successive pipe lengths are installed. If the gasket or compression ring is looped out, the joint must be reassembled with a new gasket or compression ring.

(2) When specified or approved in writing by the Engineer, the following joints will be acceptable, and the following applies:

(a) Type 1 - Gasket and Mortar Joint must be made in the following manner: A closely-twisted hemp or oakum gasket of adequate diameter and in one (1) piece of sufficient length to pass around the pipe and lap at the top must be solidly rammed into the annular space between the pipes with a suitable caulking tool. Before being placed, the gasket must be saturated with neat cement grout. The remainder of the space must then be completely filled with mortar and the joint wiped inside and finished to a smooth bevel outside.

(b) Type 2 - Premolded Bituminous Compound may be made at the site or in the yard of the pipe supplier. The methods employed to mold the joint must ensure even distribution of material, smooth contact surfaces, and tight joints when the pipe is laid. Care must be taken in transporting and handling pipe to prevent deformation or damage to the premolded bituminous joint material.

The bell and spigot of the pipe must be cleaned by effective means and then coated with an approved primer. The joint material must be cast on the pipe using approved metal forms.

Before inserting spigot into pipe previously laid, contact surfaces must be cleaned and coated with an approved solvent or adhesive on both surfaces. An approved mechanical device must then draw up the pipe so that the spigot edge is within at least one-quarter (1/4) inch of the shoulder of the bell.

(3) Inspection - Unless otherwise directed by the Engineer, the finished joint must be left exposed for inspection and approval by the Engineer. A suitable ladder affording easy access for such inspection must be provided.

(D) LAYING - The pipe must be laid with the male ends toward the outlet. The pipes must be fitted together and matched so that when laid in the work they will form a sewer with a smooth and uniform invert. Unless otherwise directed, not less than fifteen (15) feet of pipe sewer must be laid in one operation.

During the progress of the work the exposed ends of pipe sewers must be provided with approved temporary covers fitted to the pipe so as to exclude earth and other materials.

The ends of the pipe that enter masonry walls must be cut to fit the inner face of the masonry. Unless otherwise directed, such cutting must be done before the pipes are built in.

(E) CRADLES - Vitrified pipe sewers must be laid in continuous concrete cradles. Concrete cradles for pipe must be cast in one (1) pour and must be of the dimensions shown on the Sewer Design Standards, and as directed by the Engineer.

Concrete sills of approved shapes and dimensions must be used for the temporary support of pipes that are to be permanently supported on concrete cradles. Such sills must be completely embedded in the concrete cradle. Working drawings of these sills must be submitted to the Engineer for approval before pipe laying begins. The use of wood or other material shims will be required as directed by the Engineer.

Forms must be removed in accordance with **General Specification 11 - Concrete, as modified in Section 23.01**.

(F) CONCRETE ENCASEMENT - Where shown, specified or required, vitrified pipe sewers must be fully encased in concrete.

(G) DAMAGED PIPE - Pipe damaged from handling or any cause whatsoever, whether in or out of the trench, must be replaced and removed from the site of the work by and at the sole expense of the Contractor.

(H) SPURS AND RISERS The Engineer will determine need for and location of openings for spurs and risers, and height of risers.

Unconnected dead ends of spurs and risers must be closed with approved tile or precast concrete plugs or with hand tightening (wing nut type) expandable plugs to provide a watertight seal. The threads are to be greased prior to tightening to ensure a proper seal without stripping.

(I) FIELD CUTTING - Vitrified pipe must be cut only by means of wheel type cutters, milling type cutters, or as approved by the Engineer. The use of diamond points and dog chisels will not be permitted.

(J) CONNECTION TO EXISTING SEWER - Wherever the proposed sewer is to connect with an existing manhole in which there is a branch pipe that is damaged or of unsuitable size or in improper position to receive the new sewer, such pipe must be removed and be replaced with a pipe of suitable size in the proper position. The ends of pipe that enter masonry must be neatly cut to fit the inner face of the masonry. Unless otherwise directed, such cutting must be done before the pipes are built in. Inverts of existing manholes must be modified according to the new pipe size and position in accordance with the plans or as ordered by the Engineer. The cost of such connections and modifications to existing manholes must be deemed included in the prices bid per linear foot of the respective sewer items.

(K) TELEVISION INSPECTION AND RECORDING - Upon completion of all work, the Contractor must perform a television inspection and digital audio-visual recording of all sewers reconstructed in accordance with **Section 53.11** of the specifications. Payment for television inspection and digital audio-visual recording must be made under Item No. 53.11DR - TELEVISION INSPECTION AND DIGITAL AUDIO-VISUAL RECORDING OF SEWERS.

50.31.4 MEASUREMENT

The quantities of vitrified pipe sewers to be measured for payment must be the number of linear feet of each size, kind, and class of sewer incorporated in the work, complete, as shown, specified or required, measured horizontally along the center lines of sewers.

Payment will be made from inside face of manhole or chamber to inside face of manhole or chamber, unless otherwise shown or specified in the contract documents. When circular precast manholes are incorporated into the work, the inside face of the manhole must be the vertical plane at which the sewer's outside diameter transverse to the horizontal center line of the sewer intersects the inside wall of the circular precast manhole.

50.31.5 PRICE TO COVER

The contract price for “VITRIFIED PIPE SEWERS” must be the unit price bid per linear foot for each size, kind, and class of sewer and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to construct the vitrified pipe sewers of the sizes and to the lines and grades shown, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**), all sheeting and bracing, pumping, fluming, bridging, breaking down and filling in of abandoned sewer appurtenances, connections, concrete cradle and encasements, crushed stone bedding and encasements, maintaining flow in sewers, backfilling, cleaning up, and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans, specifications and standards and as directed by the Engineer.

In addition, included in the price hereunder must be the cost of all labor and materials necessary to remove all specified and ordered existing sewers, manholes, structures, and appurtenances that may be in the line of the work and to do all work incidental thereto, all in accordance with **Subsections 10.13 and 10.28** of the specifications and as directed by the Engineer.

Payment for Vitrified Pipe Sewers will be made under the Item Number as calculated below:

The Item Numbers for Vitrified Pipe Sewers have nine characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Vitrified Pipe Sewers:

50.31

(2) The sixth character must define the Type of Sewer Effluent:

S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer

(3) The seventh character must define the Kind of Bedding for Sewer Pipe:

C - On Concrete Cradle
E - Encased In Concrete
S - On Crushed Stone Bedding
T - Encased in Crushed Stone

(4) The eighth and ninth characters must define the Diameter of the Sewer Pipe. (The eighth and ninth characters representing the unit of inches for the Diameter of the Sewer Pipe.) See examples below:

08 - 8”
15 - 15”

(5) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
50.31SC08	8” E.S.V.P. SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.31SC10	10” E.S.V.P. SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.31SC12	12” E.S.V.P. SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.31SC15	15” E.S.V.P. SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.31SC18	18” E.S.V.P. SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.31SE10	10” E.S.V.P. SANITARY SEWER, ENCASED IN CONCRETE	L.F.
50.31SE12	12” E.S.V.P. SANITARY SEWER, ENCASED IN CONCRETE	L.F.
50.31SE15	15” E.S.V.P. SANITARY SEWER, ENCASED IN CONCRETE	L.F.
50.31SE18	18” E.S.V.P. SANITARY SEWER, ENCASED IN CONCRETE	L.F.
50.31SS10	10” E.S.V.P. SANITARY SEWER, ON CRUSHED STONE BEDDING	L.F.
50.31SS12	12” E.S.V.P. SANITARY SEWER, ON CRUSHED STONE BEDDING	L.F.
50.31SS15	15” E.S.V.P. SANITARY SEWER, ON CRUSHED STONE BEDDING	L.F.
50.31SS18	18” E.S.V.P. SANITARY SEWER, ON CRUSHED STONE BEDDING	L.F.
50.31ST10	10” E.S.V.P. SANITARY SEWER, ENCASED IN CRUSHED STONE	L.F.
50.31ST12	12” E.S.V.P. SANITARY SEWER, ENCASED IN CRUSHED STONE	L.F.
50.31ST15	15” E.S.V.P. SANITARY SEWER, ENCASED IN CRUSHED STONE	L.F.
50.31ST18	18” E.S.V.P. SANITARY SEWER, ENCASED IN CRUSHED STONE	L.F.
50.31MC10	10” E.S.V.P. STORM SEWER, ON CONCRETE CRADLE	L.F.
50.31MC12	12” E.S.V.P. STORM SEWER, ON CONCRETE CRADLE	L.F.
50.31MC15	15” E.S.V.P. STORM SEWER, ON CONCRETE CRADLE	L.F.
50.31MC18	18” E.S.V.P. STORM SEWER, ON CONCRETE CRADLE	L.F.
50.31ME12	12” E.S.V.P. STORM SEWER, ENCASED IN CONCRETE	L.F.
50.31ME15	15” E.S.V.P. STORM SEWER, ENCASED IN CONCRETE	L.F.
50.31ME18	18” E.S.V.P. STORM SEWER, ENCASED IN CONCRETE	L.F.
50.31MS12	12” E.S.V.P. STORM SEWER, ON CRUSHED STONE BEDDING	L.F.
50.31MS15	15” E.S.V.P. STORM SEWER, ON CRUSHED STONE BEDDING	L.F.
50.31MS18	18” E.S.V.P. STORM SEWER, ON CRUSHED STONE BEDDING	L.F.
50.31MT12	12” E.S.V.P. STORM SEWER, ENCASED IN CRUSHED STONE	L.F.
50.31MT15	15” E.S.V.P. STORM SEWER, ENCASED IN CRUSHED STONE	L.F.
50.31MT18	18” E.S.V.P. STORM SEWER, ENCASED IN CRUSHED STONE	L.F.
50.31CC12	12” E.S.V.P. COMBINED SEWER, ON CONCRETE CRADLE	L.F.
50.31CC15	15” E.S.V.P. COMBINED SEWER, ON CONCRETE CRADLE	L.F.

Item No.	Description	Pay Unit
50.31CC18	18” E.S.V.P. COMBINED SEWER, ON CONCRETE CRADLE	L.F.
50.31CE15	15” E.S.V.P. COMBINED SEWER, ENCASED IN CONCRETE	L.F.
50.31CE18	18” E.S.V.P. COMBINED SEWER, ENCASED IN CONCRETE	L.F.
50.31CS15	15” E.S.V.P. COMBINED SEWER, ON CRUSHED STONE BEDDING	L.F.
50.31CS18	18” E.S.V.P. COMBINED SEWER, ON CRUSHED STONE BEDDING	L.F.
50.31CT15	15” E.S.V.P. COMBINED SEWER, ENCASED IN CRUSHED STONE	L.F.
50.31CT18	18” E.S.V.P. COMBINED SEWER, ENCASED IN CRUSHED STONE	L.F.

SECTION 50.41 – DUCTILE IRON PIPE SEWERS

50.41.1 DESCRIPTION

Ductile iron pipe sewers must be constructed of the sizes and classes shown.

50.41.2 MATERIALS

(A) Ductile iron pipe must comply with the requirements of **Section 21.06** and must be Class 56 unless otherwise specified.

(B) Joints must comply with the requirements of **Subsection 21.06.5**.

(C) Concrete for cradle and encasement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(D) All fittings required must be ductile iron or gray iron rated for two hundred fifty (250) pounds per square inch in accordance with ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11.

(E) Crushed stone must comply with the requirements of **Section 40.12**.

50.41.3 CONSTRUCTION METHODS

(A) GENERAL - Ductile iron pipe sewers must be constructed of the sizes and classes and to the lines and grades shown on the plans or as ordered.

(B) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** must apply to the work to be done hereunder.

(C) JOINTS

(1) Joints must be made in accordance with the requirements of **Subsection 21.06.5**. Unless otherwise specified in the specifications and standards, or ordered by the Engineer, all joints for ductile iron pipe sewers must be "push-on" joint type.

(2) Inspection - Unless otherwise directed by the Engineer, the finished joint must be left exposed for inspection and approval by the Engineer. A suitable ladder affording easy access for such inspection must be provided.

(D) LAYING - The pipe must be laid with the male ends toward the outlet. The pipes must be fitted together and matched so that when laid in the work they will form a sewer with a smooth and uniform invert. Unless otherwise directed, not less than twenty-four (24) feet of pipe sewer must be laid in one operation.

During the progress of the work the exposed ends of pipe sewers must be provided with approved temporary covers fitted to the pipe so as to exclude earth and other materials.

The ends of the pipe that enter masonry walls must be cut to fit the inner face of the masonry. Unless otherwise directed, such cutting must be done before the pipes are built in.

(E) STONE CRADLE AND ENCASEMENT - Ductile iron pipe sewers must be laid in a crushed stone bedding or encasement as shown on the plans and as shown on the Sewer Design Standards for ductile iron pipe alternate. The requirements of **Section 40.12** must apply to the work done hereunder.

(F) CONCRETE CRADLE AND ENCASEMENT - When specifically shown, specified, or required, ductile iron pipe sewer must be laid in a continuous concrete cradle or fully encased in concrete. Concrete cradles for pipe must be cast in one (1) pour and must be of the dimensions shown, specified, or directed.

Concrete sills of approved shapes and dimensions must be used for the temporary support of pipes that are to be permanently supported on concrete cradles. Such sills must be completely embedded in the concrete cradle. Working drawings of these sills must be submitted to the Engineer for approval before pipe laying begins. The use of wood blocks or fieldstones will not be permitted.

Forms must be removed in accordance with **General Specification 11 - Concrete, as modified in Section 23.01**.

(G) DAMAGED PIPE - Pipe damaged from handling or any cause whatsoever, whether in or out of the trench, must be replaced and removed from the site of the work by and at the sole expense of the Contractor.

(H) SPURS AND RISERS - The Engineer will determine need for and location of openings for spurs and risers, and height of risers. Unconnected dead ends of spurs and risers must be closed with approved tile or precast concrete plugs or with hand tightening (wing nut type) expandable plugs to provide a watertight seal. The threads are to be greased prior to tightening to ensure a proper seal without stripping.

(I) FIELD CUTTING - Ductile iron pipe must be cut only by means of abrasive saws, hack saws, wheel type cutters, milling type cutters, or as approved by the Engineer. The use of "squeeze" type pipe cutters and cutting torches will not be permitted. The use of diamond points and dog chisels will not be permitted. The outside of the cut end must be beveled about one-quarter (1/4) inch at an angle of about thirty (30) degrees all around the pipe, with a coarse file or a portable grinder.

(J) CONNECTION TO EXISTING SEWER - Wherever the proposed sewer is to connect with an existing manhole in which there is a branch pipe that is damaged or of unsuitable size or in improper position to receive the new sewer, such pipe must be removed and be replaced with a pipe of suitable size in the proper position. The ends of pipe that enter masonry must be neatly cut to fit the inner face of the masonry. Unless otherwise directed, such cutting must be done before the pipes are built in. Inverts of existing manholes must be modified according to the new pipe size and position in accordance with the plans or as ordered by the Engineer. The cost of such connections and modifications to existing manholes must be deemed included in the prices bid per linear foot of the respective sewer items.

(K) TELEVISION INSPECTION AND RECORDING - Upon completion of all work, the Contractor must perform a television inspection and digital audio-visual recording of all sewers reconstructed in accordance with **Section 53.11** of the specifications. Payment for television inspection and digital audio-visual recording must be made under Item No. 53.11DR - TELEVISION INSPECTION AND DIGITAL AUDIO-VISUAL RECORDING OF SEWERS.

50.41.4 MEASUREMENT

The quantities of ductile iron pipe sewers to be measured for payment must be the number of linear feet of each size, kind, and class of sewer incorporated in the work, complete, as shown, specified or required, measured horizontally along the center lines of sewers.

Payment will be made from inside face of manhole or chamber to inside face of manhole or chamber, unless otherwise shown or specified in the contract documents. When circular precast manholes are incorporated into the work, the inside face of the manhole must be the vertical plane at which the sewer's outside diameter transverse to the horizontal center line of the sewer intersects the inside wall of the circular precast manhole.

50.41.5 PRICE TO COVER

The contract price for “DUCTILE IRON PIPE SEWERS” must be the unit price bid per linear foot for each size, kind, and class of sewer and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to construct the ductile iron pipe sewers of the sizes and to the lines and grades shown, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); all sheeting and bracing; pumping, fluming, bridging, breaking down and filling in of abandoned sewer appurtenances, connections, concrete cradle and encasements; crushed stone bedding and encasements, maintaining flow in sewers, backfilling, cleaning up, and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans, specifications and standards and as directed by the Engineer.

In addition, included in the price hereunder must be the cost of all labor and materials necessary to remove all specified and ordered existing sewers, manholes, structures, and appurtenances that may be in the line of the work and to do all work incidental thereto, all in accordance with **Subsections 10.13 and 10.28** of the specifications and as directed by the Engineer.

Payment for Ductile Iron Pipe Sewers will be made under the Item Number as calculated below:

The Item Numbers for Ductile Iron Pipe Sewers have ten characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Ductile Iron Pipe Sewers:

50.41

(2) The sixth character must define the Type of Sewer Effluent:

S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer

(3) The seventh character must define the Class of Sewer Pipe. (Note: All Ductile Iron Pipe for Sewers is Class 56. Class 54 is provided on a special case basis only.):

6 - Class 56
4 - Class 54

(4) The eighth character must define the Kind of Bedding for Sewer Pipe:

C - On Concrete Cradle
E - Encased In Concrete
S - On Crushed Stone Bedding
T - Encased in Crushed Stone

(5) The ninth and tenth characters must define the Diameter of the Sewer Pipe. (The ninth and tenth characters representing the unit of inches for the Diameter of the Sewer Pipe.) See examples below:

08 - 8”
16 - 16”
30 - 30”

(6) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
50.41S6C08	8” D.I.P. CLASS 56 SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.41S6C10	10” D.I.P. CLASS 56 SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.41S6C12	12” D.I.P. CLASS 56 SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.41S6C16	16” D.I.P. CLASS 56 SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.41S6C18	18” D.I.P. CLASS 56 SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.41S6C24	24” D.I.P. CLASS 56 SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.41S6C30	30” D.I.P. CLASS 56 SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.41S6C36	36” D.I.P. CLASS 56 SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.41S6C42	42” D.I.P. CLASS 56 SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.41S6C48	48” D.I.P. CLASS 56 SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.41S6E10	10” D.I.P. CLASS 56 SANITARY SEWER, ENCASED IN CONCRETE	L.F.
50.41S6E12	12” D.I.P. CLASS 56 SANITARY SEWER, ENCASED IN CONCRETE	L.F.
50.41S6E16	16” D.I.P. CLASS 56 SANITARY SEWER, ENCASED IN CONCRETE	L.F.
50.41S6E18	18” D.I.P. CLASS 56 SANITARY SEWER, ENCASED IN CONCRETE	L.F.
50.41S6E24	24” D.I.P. CLASS 56 SANITARY SEWER, ENCASED IN CONCRETE	L.F.
50.41S6E30	30” D.I.P. CLASS 56 SANITARY SEWER, ENCASED IN CONCRETE	L.F.
50.41S6E36	36” D.I.P. CLASS 56 SANITARY SEWER, ENCASED IN CONCRETE	L.F.
50.41S6E42	42” D.I.P. CLASS 56 SANITARY SEWER, ENCASED IN CONCRETE	L.F.
50.41S6E48	48” D.I.P. CLASS 56 SANITARY SEWER, ENCASED IN CONCRETE	L.F.
50.41S6S10	10” D.I.P. CLASS 56 SANITARY SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41S6S12	12” D.I.P. CLASS 56 SANITARY SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41S6S16	16” D.I.P. CLASS 56 SANITARY SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41S6S18	18” D.I.P. CLASS 56 SANITARY SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41S6S24	24” D.I.P. CLASS 56 SANITARY SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41S6S30	30” D.I.P. CLASS 56 SANITARY SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41S6S36	36” D.I.P. CLASS 56 SANITARY SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41S6S42	42” D.I.P. CLASS 56 SANITARY SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41S6S48	48” D.I.P. CLASS 56 SANITARY SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41S6T10	10” D.I.P. CLASS 56 SANITARY SEWER, ENCASED IN CRUSHED STONE	L.F.
50.41S6T12	12” D.I.P. CLASS 56 SANITARY SEWER, ENCASED IN CRUSHED STONE	L.F.
50.41S6T16	16” D.I.P. CLASS 56 SANITARY SEWER, ENCASED IN CRUSHED STONE	L.F.
50.41S6T18	18” D.I.P. CLASS 56 SANITARY SEWER, ENCASED IN CRUSHED STONE	L.F.

Item No.	Description	Pay Unit
50.41S6T24	24” D.I.P. CLASS 56 SANITARY SEWER, ENCASED IN CRUSHED STONE	L.F.
50.41S6T30	30” D.I.P. CLASS 56 SANITARY SEWER, ENCASED IN CRUSHED STONE	L.F.
50.41S6T36	36” D.I.P. CLASS 56 SANITARY SEWER, ENCASED IN CRUSHED STONE	L.F.
50.41S6T42	42” D.I.P. CLASS 56 SANITARY SEWER, ENCASED IN CRUSHED STONE	L.F.
50.41S6T48	48” D.I.P. CLASS 56 SANITARY SEWER, ENCASED IN CRUSHED STONE	L.F.
50.41M6C10	10” D.I.P. CLASS 56 STORM SEWER, ON CONCRETE CRADLE	L.F.
50.41M6C12	12” D.I.P. CLASS 56 STORM SEWER, ON CONCRETE CRADLE	L.F.
50.41M6C16	16” D.I.P. CLASS 56 STORM SEWER, ON CONCRETE CRADLE	L.F.
50.41M6C18	18” D.I.P. CLASS 56 STORM SEWER, ON CONCRETE CRADLE	L.F.
50.41M6C24	24” D.I.P. CLASS 56 STORM SEWER, ON CONCRETE CRADLE	L.F.
50.41M6C30	30” D.I.P. CLASS 56 STORM SEWER, ON CONCRETE CRADLE	L.F.
50.41M6C36	36” D.I.P. CLASS 56 STORM SEWER, ON CONCRETE CRADLE	L.F.
50.41M6C42	42” D.I.P. CLASS 56 STORM SEWER, ON CONCRETE CRADLE	L.F.
50.41M6C48	48” D.I.P. CLASS 56 STORM SEWER, ON CONCRETE CRADLE	L.F.
50.41M6E12	12” D.I.P. CLASS 56 STORM SEWER, ENCASED IN CONCRETE	L.F.
50.41M6E16	16” D.I.P. CLASS 56 STORM SEWER, ENCASED IN CONCRETE	L.F.
50.41M6E18	18” D.I.P. CLASS 56 STORM SEWER, ENCASED IN CONCRETE	L.F.
50.41M6E24	24” D.I.P. CLASS 56 STORM SEWER, ENCASED IN CONCRETE	L.F.
50.41M6E30	30” D.I.P. CLASS 56 STORM SEWER, ENCASED IN CONCRETE	L.F.
50.41M6E36	36” D.I.P. CLASS 56 STORM SEWER, ENCASED IN CONCRETE	L.F.
50.41M6E42	42” D.I.P. CLASS 56 STORM SEWER, ENCASED IN CONCRETE	L.F.
50.41M6E48	48” D.I.P. CLASS 56 STORM SEWER, ENCASED IN CONCRETE	L.F.
50.41M6S12	12” D.I.P. CLASS 56 STORM SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41M6S16	16” D.I.P. CLASS 56 STORM SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41M6S18	18” D.I.P. CLASS 56 STORM SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41M6S24	24” D.I.P. CLASS 56 STORM SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41M6S30	30” D.I.P. CLASS 56 STORM SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41M6S36	36” D.I.P. CLASS 56 STORM SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41M6S42	42” D.I.P. CLASS 56 STORM SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41M6S48	48” D.I.P. CLASS 56 STORM SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41M6T12	12” D.I.P. CLASS 56 STORM SEWER, ENCASED IN CRUSHED STONE	L.F.
50.41M6T16	16” D.I.P. CLASS 56 STORM SEWER, ENCASED IN CRUSHED STONE	L.F.
50.41M6T18	18” D.I.P. CLASS 56 STORM SEWER, ENCASED IN CRUSHED STONE	L.F.
50.41M6T24	24” D.I.P. CLASS 56 STORM SEWER, ENCASED IN CRUSHED STONE	L.F.
50.41M6T30	30” D.I.P. CLASS 56 STORM SEWER, ENCASED IN CRUSHED STONE	L.F.
50.41M6T36	36” D.I.P. CLASS 56 STORM SEWER, ENCASED IN CRUSHED STONE	L.F.
50.41M6T42	42” D.I.P. CLASS 56 STORM SEWER, ENCASED IN CRUSHED STONE	L.F.
50.41M6T48	48” D.I.P. CLASS 56 STORM SEWER, ENCASED IN CRUSHED STONE	L.F.
50.41C6C12	12” D.I.P. CLASS 56 COMBINED SEWER, ON CONCRETE CRADLE	L.F.
50.41C6C16	16” D.I.P. CLASS 56 COMBINED SEWER, ON CONCRETE CRADLE	L.F.
50.41C6C18	18” D.I.P. CLASS 56 COMBINED SEWER, ON CONCRETE CRADLE	L.F.
50.41C6C24	24” D.I.P. CLASS 56 COMBINED SEWER, ON CONCRETE CRADLE	L.F.
50.41C6C30	30” D.I.P. CLASS 56 COMBINED SEWER, ON CONCRETE CRADLE	L.F.
50.41C6C36	36” D.I.P. CLASS 56 COMBINED SEWER, ON CONCRETE CRADLE	L.F.
50.41C6C42	42” D.I.P. CLASS 56 COMBINED SEWER, ON CONCRETE CRADLE	L.F.
50.41C6C48	48” D.I.P. CLASS 56 COMBINED SEWER, ON CONCRETE CRADLE	L.F.
50.41C6E16	16” D.I.P. CLASS 56 COMBINED SEWER, ENCASED IN CONCRETE	L.F.
50.41C6E18	18” D.I.P. CLASS 56 COMBINED SEWER, ENCASED IN CONCRETE	L.F.
50.41C6E24	24” D.I.P. CLASS 56 COMBINED SEWER, ENCASED IN CONCRETE	L.F.
50.41C6E30	30” D.I.P. CLASS 56 COMBINED SEWER, ENCASED IN CONCRETE	L.F.
50.41C6E36	36” D.I.P. CLASS 56 COMBINED SEWER, ENCASED IN CONCRETE	L.F.
50.41C6E42	42” D.I.P. CLASS 56 COMBINED SEWER, ENCASED IN CONCRETE	L.F.
50.41C6E48	48” D.I.P. CLASS 56 COMBINED SEWER, ENCASED IN CONCRETE	L.F.
50.41C6S16	16” D.I.P. CLASS 56 COMBINED SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41C6S18	18” D.I.P. CLASS 56 COMBINED SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41C6S24	24” D.I.P. CLASS 56 COMBINED SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41C6S30	30” D.I.P. CLASS 56 COMBINED SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41C6S36	36” D.I.P. CLASS 56 COMBINED SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41C6S42	42” D.I.P. CLASS 56 COMBINED SEWER, ON CRUSHED STONE BEDDING	L.F.

Item No.	Description	Pay Unit
50.41C6S48	48” D.I.P. CLASS 56 COMBINED SEWER, ON CRUSHED STONE BEDDING	L.F.
50.41C6T16	16” D.I.P. CLASS 56 COMBINED SEWER, ENCASED IN CRUSHED STONE	L.F.
50.41C6T18	18” D.I.P. CLASS 56 COMBINED SEWER, ENCASED IN CRUSHED STONE	L.F.
50.41C6T24	24” D.I.P. CLASS 56 COMBINED SEWER, ENCASED IN CRUSHED STONE	L.F.
50.41C6T30	30” D.I.P. CLASS 56 COMBINED SEWER, ENCASED IN CRUSHED STONE	L.F.
50.41C6T36	36” D.I.P. CLASS 56 COMBINED SEWER, ENCASED IN CRUSHED STONE	L.F.
50.41C6T42	42” D.I.P. CLASS 56 COMBINED SEWER, ENCASED IN CRUSHED STONE	L.F.
50.41C6T48	48” D.I.P. CLASS 56 COMBINED SEWER, ENCASED IN CRUSHED STONE	L.F.

SECTION 50.51 – CAST IRON PIPE SEWERS

50.51.1 DESCRIPTION

Cast iron pipe sewers must be constructed of the sizes and classes shown.

50.51.2 MATERIALS

(A) Cast iron pipe must comply with the requirements of **Section 21.03**. Kind, class, and size of pipe must be as shown or specified.

(B) Joints must comply with the requirements of **Subsection 21.06.5** as defined for ductile iron pipe.

(C) Concrete for cradle and encasement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(D) All fittings required must be ductile iron or gray iron rated for two hundred fifty (250) pounds per square inch in accordance with ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11.

(E) Crushed stone must comply with the requirements of **Section 40.12**.

50.51.3 CONSTRUCTION METHODS

(A) GENERAL - Cast iron pipe sewers must be constructed of the sizes and classes and to the lines and grades shown on the plans or as ordered.

(B) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** must apply to the work to be done hereunder.

(C) JOINTS

(1) Joints must be made in accordance with the requirements of **Subsection 21.06.5** as defined for ductile iron pipe. Unless otherwise specified in the specifications and standards, or ordered by the Engineer, all joints for cast iron pipe sewers must be "push-on" joint type.

(2) Inspection - Unless otherwise directed by the Engineer, the finished joint must be left exposed for inspection and approval by the Engineer. A suitable ladder affording easy access for such inspection must be provided.

(D) LAYING - The pipe must be laid with the male ends toward the outlet. The pipes must be fitted together and matched so that when laid in the work they will form a sewer with a smooth and uniform invert. Unless otherwise directed, not less than twenty-four (24) feet of pipe sewer must be laid in one operation.

During the progress of the work the exposed ends of pipe sewers must be provided with approved temporary covers fitted to the pipe so as to exclude earth and other materials.

The ends of the pipe that enter masonry walls must be cut to fit the inner face of the masonry. Unless otherwise directed, such cutting must be done before the pipes are built in.

(E) STONE CRADLE AND ENCASEMENT - Cast iron pipe sewers must be laid in a crushed stone bedding or encasement as shown on the plans and as shown on the Sewer Design Standards for ductile iron pipe alternate. The requirements of **Section 40.12** must apply to the work done hereunder.

(F) CONCRETE CRADLE AND ENCASEMENT - When specifically shown, specified, or required, cast iron pipe sewer must be laid in a continuous concrete cradle or fully encased in concrete. Concrete cradles for pipe must be cast in one (1) pour and must be of the dimensions shown, specified, or directed.

Concrete sills of approved shapes and dimensions must be used for the temporary support of pipes that are to be permanently supported on concrete cradles. Such sills must be completely embedded in the concrete cradle. Working drawings of these sills must be submitted to the Engineer for approval before pipe laying begins. The use of wood blocks or fieldstones will not be permitted.

Forms must be removed in accordance with **General Specification 11 - Concrete, as modified in Section 23.01**.

(G) DAMAGED PIPE - Pipe damaged from handling or any cause whatsoever, whether in or out of the trench, must be replaced and removed from the site of the work by and at the sole expense of the Contractor.

(H) SPURS AND RISERS - The Engineer will determine need for and location of openings for spurs and risers, and height of risers.

Unconnected dead ends of spurs and risers must be closed with approved tile or precast concrete plugs or with hand tightening (wing nut type) expandable plugs to provide a watertight seal. The threads are to be greased prior to tightening to ensure a proper seal without stripping.

(I) FIELD CUTTING - Cast iron pipe must be cut only by means of abrasive saws, hack saws, wheel type cutters, milling type cutters, or as approved by the Engineer. The use of "squeeze" type pipe cutters and cutting torches will not be permitted. The use of diamond points and dog chisels will not be permitted. The outside of the cut end must be beveled about one-quarter (1/4) inch at an angle of about thirty (30) degrees all around the pipe, with a coarse file or a portable grinder.

(J) CONNECTION TO EXISTING SEWER - Wherever the proposed sewer is to connect with an existing manhole in which there is a branch pipe that is damaged or of unsuitable size or in improper position to receive the new sewer, such pipe must be removed and be replaced with a pipe of suitable size in the proper position. The ends of pipe that enter masonry must be neatly cut to fit the inner face of the masonry. Unless otherwise directed, such cutting must be done before the pipes are built in. Inverts of existing manholes must be modified according to the new pipe size and position in accordance with the plans or as ordered by the Engineer. The cost of such connections and modifications to existing manholes must be deemed included in the prices bid per linear foot of the respective sewer items.

(K) TELEVISION INSPECTION AND RECORDING - Upon completion of all work, the Contractor must perform a television inspection and digital audio-visual recording of all sewers reconstructed in accordance with **Section 53.11** of the specifications. Payment for television inspection and digital audio-visual recording must be made under Item No. 53.11DR - TELEVISION INSPECTION AND DIGITAL AUDIO-VISUAL RECORDING OF SEWERS.

50.51.4 MEASUREMENT

The quantities of cast iron pipe sewers to be measured for payment must be the number of linear feet of each size, kind, and class of sewer incorporated in the work, complete, as shown, specified, or required, measured horizontally along the center lines of sewers.

Payment will be made from inside face of manhole or chamber to inside face of manhole or chamber, unless otherwise shown or specified in the contract documents. When circular precast manholes are incorporated into the work, the inside face of the manhole must be the vertical plane at which the sewer's outside diameter transverse to the horizontal center line of the sewer intersects the inside wall of the circular precast manhole.

50.51.5 PRICE TO COVER

The contract price for “CAST IRON PIPE SEWERS” must be the unit price bid per linear foot for each size, kind, and class of sewer and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to construct the cast iron pipe sewers of the sizes and to the lines and grades shown, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**), all sheeting and bracing, pumping, fluming, bridging, breaking down and filling in of abandoned sewer appurtenances, connections, concrete cradle and encasements, crushed stone bedding and encasements, maintaining flow in sewers, backfilling, cleaning up, and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans, specifications, and standards, and as directed by the Engineer.

In addition, included in the price hereunder must be the cost of all labor and materials necessary to remove all specified and ordered existing sewers, manholes, structures, and appurtenances that may be in the line of the work and to do all work incidental thereto, all in accordance with **Subsections 10.13 and 10.28** of the specifications and as directed by the Engineer.

Payment for Cast Iron Pipe Sewers will be made under the Item Number as calculated below:

The Item Numbers for Cast Iron Pipe Sewers have ten characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Cast Iron Pipe Sewers:

(2) The sixth character must define the Type of Sewer Effluent:

S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer

(3) The seventh character must define the Class of Sewer Pipe. (Note: All Cast Iron Pipe for Sewers is Class 50. Class 100 is provided on a special case basis only.):

5 - Class 50
1 - Class 100

(4) The eighth character must define the Kind of Bedding for Sewer Pipe:

C - On Concrete Cradle
E - Encased In Concrete
S - On Crushed Stone Bedding
T - Encased in Crushed Stone

(5) The ninth and tenth characters must define the Diameter of the Sewer Pipe. (The ninth and tenth characters representing the unit of inches for the Diameter of the Sewer Pipe.) See examples below:

08 - 8”
16 - 16”
30 - 30”

(6) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	**Description**	**Pay Unit**
50.51S5C08	8” C.I.P. CLASS 50 SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.51S5C10	10” C.I.P. CLASS 50 SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.51S5C16	16” C.I.P. CLASS 50 SANITARY SEWER, ON CONCRETE CRADLE	L.F.
50.51S5E12	12” C.I.P. CLASS 50 SANITARY SEWER, ENCASED IN CONCRETE	L.F.
50.51S5E18	18” C.I.P. CLASS 50 SANITARY SEWER, ENCASED IN CONCRETE	L.F.
50.51S5S10	10” C.I.P. CLASS 50 SANITARY SEWER, ON CRUSHED STONE BEDDING	L.F.
50.51S5S16	16” C.I.P. CLASS 50 SANITARY SEWER, ON CRUSHED STONE BEDDING	L.F.
50.51S5T12	12” C.I.P. CLASS 50 SANITARY SEWER, ENCASED IN CRUSHED STONE	L.F.
50.51S5T18	18” C.I.P. CLASS 50 SANITARY SEWER, ENCASED IN CRUSHED STONE	L.F.
50.51M5C12	12” C.I.P. CLASS 50 STORM SEWER, ON CONCRETE CRADLE	L.F.
50.51M5C16	16” C.I.P. CLASS 50 STORM SEWER, ON CONCRETE CRADLE	L.F.
50.51M5C24	24” C.I.P. CLASS 50 STORM SEWER, ON CONCRETE CRADLE	L.F.
50.51M5C36	36” C.I.P. CLASS 50 STORM SEWER, ON CONCRETE CRADLE	L.F.
50.51M5C48	48” C.I.P. CLASS 50 STORM SEWER, ON CONCRETE CRADLE	L.F.
50.51M5E18	18” C.I.P. CLASS 50 STORM SEWER, ENCASED IN CONCRETE	L.F.
50.51M5E30	30” C.I.P. CLASS 50 STORM SEWER, ENCASED IN CONCRETE	L.F.
50.51M5E42	42” C.I.P. CLASS 50 STORM SEWER, ENCASED IN CONCRETE	L.F.
50.51M5S12	12” C.I.P. CLASS 50 STORM SEWER, ON CRUSHED STONE BEDDING	L.F.
50.51M5S16	16” C.I.P. CLASS 50 STORM SEWER, ON CRUSHED STONE BEDDING	L.F.
50.51M5S24	24” C.I.P. CLASS 50 STORM SEWER, ON CRUSHED STONE BEDDING	L.F.
50.51M5S36	36” C.I.P. CLASS 50 STORM SEWER, ON CRUSHED STONE BEDDING	L.F.
50.51M5S48	48” C.I.P. CLASS 50 STORM SEWER, ON CRUSHED STONE BEDDING	L.F.
50.51M5T18	18” C.I.P. CLASS 50 STORM SEWER, ENCASED IN CRUSHED STONE	L.F.
50.51M5T30	30” C.I.P. CLASS 50 STORM SEWER, ENCASED IN CRUSHED STONE	L.F.
50.51M5T42	42” C.I.P. CLASS 50 STORM SEWER, ENCASED IN CRUSHED STONE	L.F.
50.51C5C16	16” C.I.P. CLASS 50 COMBINED SEWER, ON CONCRETE CRADLE	L.F.
50.51C5C24	24” C.I.P. CLASS 50 COMBINED SEWER, ON CONCRETE CRADLE	L.F.
50.51C5C36	36” C.I.P. CLASS 50 COMBINED SEWER, ON CONCRETE CRADLE	L.F.

Item No.	Description	Pay Unit
50.51C5C48	48” C.I.P. CLASS 50 COMBINED SEWER, ON CONCRETE CRADLE	L.F.
50.51C5E18	18” C.I.P. CLASS 50 COMBINED SEWER, ENCASED IN CONCRETE	L.F.
50.51C5E30	30” C.I.P. CLASS 50 COMBINED SEWER, ENCASED IN CONCRETE	L.F.
50.51C5E42	42” C.I.P. CLASS 50 COMBINED SEWER, ENCASED IN CONCRETE	L.F.
50.51C5S16	16” C.I.P. CLASS 50 COMBINED SEWER, ON CRUSHED STONE BEDDING	L.F.
50.51C5S24	24” C.I.P. CLASS 50 COMBINED SEWER, ON CRUSHED STONE BEDDING	L.F.
50.51C5S36	36” C.I.P. CLASS 50 COMBINED SEWER, ON CRUSHED STONE BEDDING	L.F.
50.51C5S48	48” C.I.P. CLASS 50 COMBINED SEWER, ON CRUSHED STONE BEDDING	L.F.
50.51C5T18	18” C.I.P. CLASS 50 COMBINED SEWER, ENCASED IN CRUSHED STONE	L.F.
50.51C5T30	30” C.I.P. CLASS 50 COMBINED SEWER, ENCASED IN CRUSHED STONE	L.F.
50.51C5T42	42” C.I.P. CLASS 50 COMBINED SEWER, ENCASED IN CRUSHED STONE	L.F.

SECTION 50.61 – SEWERS IN JACKED STEEL SLEEVES

50.61.1 INTENT

This section describes construction of sewer carrier pipe in a jacked steel sleeves.

50.61.2 DESCRIPTION

(A) GENERAL

(1) The sleeves and sewer carrier pipes must be constructed to the sizes, kinds, classes, and wall thicknesses of pipe specified and in accordance with the details shown on the contract drawings. The construction of the sewers herein must be by means of the jacking of a steel sleeve with the use of microtunneling techniques and the insertion of a carrier pipe.

Microtunneling must be defined as the trenchless installation of the pipe by jacking the pipe behind a remotely controlled tunnel boring machine. The Microtunnel Boring Machine (MTBM) must be capable of adequately and safely counter-balancing prevailing hydrostatic conditions and must be a slurry shield tunnel boring machine or an earth pressure-balanced shield tunnel boring machine or an approved equal.

(2) The Contractor will be permitted to submit for written approval by the Engineer an alternate method of jacking of a steel sleeve other than by microtunneling techniques specified in **Subsection 50.61.2(A)(1)**. Such alternate method must comply with all applicable specifications of this **Section 50.61**, the determination as to which specifications are applicable must be the sole authority of the Engineer. If the alternate pipe jacking tunneling method is not capable of tunneling through rock and boulders of all sizes, and requires the manual excavation, removal, and disposal of rock and boulders at the tunnel face, then no separate or additional payment will be made for this manual rock and boulder excavation, removal, and disposal. If the alternate pipe jacking tunneling method is not capable of performing in saturated ground, and requires the installation of a dewatering system so as to work in “the dry”, then no separate or additional payment will be made for this dewatering system installation, operation, and removal. The cost for all labor, materials, plant, equipment and insurance required and necessary to excavate, remove, and dispose of all rock and boulders within the tunnel section, and to install, operate, and remove the dewatering system must be included in the prices bid per linear foot for the respective “SEWER IN JACKED STEEL SLEEVE” items.

The Contractor will be permitted to submit for written approval by the Engineer a direct jacking of precast concrete pipe alternative. Such alternative must be in accordance with **Section 50.62 - Direct Jacked Precast Concrete Pipe Sewers**. With the exception that all costs for all labor, materials, plant, equipment, and insurance required and necessary to construct the direct jacked precast concrete pipe sewer, complete, as shown, specified, ordered, or approved must be included in the prices bid per linear foot for the respective “SEWER IN JACKED STEEL SLEEVE” items.

(3) It is the Contractor’s responsibility to choose the shaft excavation and support methods, and the type of tunnel boring machine and its equipment and accessories to be used to complete the tunnel bore.

The Contractor must replace any equipment deemed necessary in order to complete the tunnel bore. This includes the rock or soil cutter head and any other required equipment. No additional or separate payment will be made for any equipment replacement that is required to complete the tunnel bore, with the exception of that allowed under **Section 70.53 - Allowance For Boulder Removal**.

(B) GEOTECHNICAL CONDITIONS

Geotechnical data provided by the City is for information purposes only. The Contractor must perform the Contractor’s own geotechnical investigations to ensure that the type of tunnel boring machine (together with equipment and accessories) the Contractor chooses to use is capable of completing the tunnel bore and remove all materials (i.e. soil, boulders, rock, etc.) encountered.

The Contractor must thoroughly investigate the geotechnical conditions of the strata through which the tunnel boring is to be accomplished. After performing this thorough investigation the Contractor must prepare a construction report in accordance with **Section 76.11 - Construction Report** for the approval of the Engineer. (See **Subsection 50.61.3 - Submittals, paragraph (1)**).

50.61.3 SUBMITTALS

The Contractor must submit the following:

(1) Before commencing any operations associated with the construction of sewers in jacked steel sleeves, the Contractor must submit the construction report specified above. In addition to the requirements specified in **Section 76.11**, the construction report must contain all investigative geotechnical information and determinations as to tunnel boring feasibility, and all means, and methods of construction that will be required to complete the tunnel bore. The Construction Report must also state the Contractor's assumptions regarding the subsurface conditions to be encountered during shaft and microtunnel construction.

(2) Details of tunneling machine the Contractor chooses to use together with required equipment and accessories. Include the following:

  (a) Machine specifications (including but not limited to equipment, accessories, means, and methods of spoil removal) together with a letter from the microtunneling machine manufacturer demonstrating that the selected machine together with equipment, accessories, means, and methods of spoil removal is capable of progressing through the anticipated subsurface conditions, and capable of removing spoils effectively.

  (b) For Slurry Shield System: Details of MTBM slurry system and soil separation methods including proposed slurry formulations and calculations of the system capacity to handle flows at all proposed distances and changes of elevations to and from the MTBM.

  (c) For Earth Pressure-Balance System: Details of MTBM conveyance system and material transport methods including calculations of the system capacity to handle removal or flows at all proposed distances and changes of elevations to and from the MTBM.

  (d) Jacking system details (jacks and jacking frames), method of operation, thrust capacity, and sleeve details. Describe method of control to prevent the maximum allowable jacking force from being exceeded.

  (e) Description of lubrication mix equipment and procedure for lubricating the pipe during jacking operations, including estimated volume for the anticipated soils.

  (f) Active Direction Control details and means of controlling line and grade.

(3) Before commencing any operations associated with the construction of sewers in jacked steel sleeves the Contractor must submit a detailed description of the proposed method of installation including locations and dimensions of launching/receiving shafts (including intermediate launching shafts), insertion procedures, and all shop drawings required for review and approval by the Engineer. These submittals must include procedural details to allow the Engineer to evaluate the procedure to be used. All pertinent dimensions, material properties, and design calculations must be shown.

(4) Theoretical jacking force calculations and pipe material calculations must be prepared and submitted. It is the sole responsibility of the Contractor to determine the maximum anticipated construction loads, including maximum jacking forces, Factor of Safety, and to ensure that the anticipated loads are implemented in the manufacturer's design of the pipe. These calculations must be submitted to the Engineer for review and approval, and must bear the signature and seal of a Licensed Professional Engineer, currently registered in the State of New York.

(5) Prepare and submit a proposed contingency plan for potential situations that may occur during tunneling operations. This submittal must at a minimum address the following scenarios:

  (a) The MTBM hits an obstruction.

  (b) Cuttings do not settle/separate with the equipment on site.

  (c) The target laser is distorted by heat and/or humidity or has been knocked out of alignment. Describe which operational parameters will be observed/measured/recorded so that it can be determined if the above are occurring or have just occurred.

  (d) The jacking pressures start to increase rapidly and there is reasonable concern for completing jacking operations to the receiving shaft.

  (e) The MTBM "freezes" during jacking operations.

(6) Unless otherwise provided for in the contract documents, a proposed plan showing locations of required geotechnical instrumentation and any other Contractor proposed instrumentation. Include product information indicating the instrumentation sizes, material types, specifications, installation procedures, locations, and other pertinent data. The instrumentation installation specialist performing the installation of the geotechnical instrumentation must have adequate experience; proof of this experience must be included with this plan.

(7) Shaft Excavation and Support submittal, bearing the signature and seal of a Licensed Professional Engineer, currently registered in the State of New York, must include:

(a) Detailed narrative outlining the construction sequence.

(b) Engineering calculations, assumptions, and methodologies for the design of the shaft excavation support system. The Contractor must design excavation support systems and working slabs to withstand earth and hydrostatic pressures, bottom heave, equipment loads, applicable traffic and construction loads, and other surcharge loads to allow the safe construction of the tunnel and associated structures without excessive movement or settlement of the ground, and to prevent damage to adjacent structures, streets, and utilities. Use lateral earth pressures consistent with ground conditions, soil properties (type, composition, compaction, moisture content, etc.), water table, etc., described in the contract documents and in accordance with NYC, AISC and ACI code provisions, as applicable. Each component of the shaft excavation and support system must be designed to safely support the maximum combination of loads and other conditions that may occur during construction. These submittals must consider all beginning, intermediate, and final construction stages of shaft installation. The Contractor must also submit the Contractor's groundwater control system.

(c) Break-out and Break-in plans indicating type of support installed to transfer loads and maintain excavation support, groundwater control, and stability of the excavation when a MTBM exits or enters a shaft. Contractor must utilize shaft launch and exit seals to prevent inflow of groundwater, slurry, lubrication, and soil. Seals must be sized to accommodate microtunneling boring machine and jacking pipe and must not impair the performance of the shaft excavation support system. Groundwater inflows at each seal must be less than five (5) gallons per minute and total soil inflows at each seal must be less than two (2) cubic feet for the entire duration of the jacking operation. Seal design/installation must incorporate localized ground improvement as necessary to meet these criteria.

(d) Microtunneling machine thrust block design and details for the launching shaft. The thrust block must be perpendicular to the proposed pipe alignment. The thrust block must be designed to support the maximum jacking pressure developed by the main jacking system.

Note that review of the Contractor's Shaft Excavation and Support submittal by the Engineer does not relieve the Contractor and its design consultants of their responsibility to provide and maintain an adequate support system achieving the specified requirements.

(8) Excess Materials Disposal Plan: Excess materials disposal plan must include treatment (as applicable), transportation methods and routes, disposal location details for excess excavated materials (soil, rock, etc.), and disposal methods for groundwater generated during construction of tunnel and shafts. Included in this plan must be estimated quantities for disposal of all excess excavated materials and groundwater.

(9) Proposed insertion plan for grout fill of annular space between the sewer carrier pipe and steel sleeve. Grouting fill of annular space plan must include details of grout fill materials (including source), installation procedures, equipment utilized, grout fill quality control measures, and means of protecting new sewer facilities during grout fill placement. Such method must be capable of filling all voids between the steel sleeve and the carrier pipe for the entire length, and must not be capable of damaging the sewer carrier pipe and it's jointing, nor capable of damaging or misaligning the brace and support spacers installed to align and insulate the sewer carrier pipe, nor cause any leakage of grout to the outside soil area of the steel sleeve.

(10) Shop drawings must be submitted in accordance with all applicable provisions of **Subsection 40.05.5 - Shop Drawings**, as required. Design criteria must be submitted in accordance with all applicable requirements of **Subsection 40.05.6 - Design Criteria**, as required.

(11) The Contractor must allow a minimum of four (4) weeks for review.

(12) All the above must be submitted as a complete package. All designs must bear the signature and seal of a Licensed Professional Engineer, currently registered in the State of New York.

(13) No work associated with the construction of sewers in jacked steel sleeves must commence until the Contractor receives all required approved shop drawing from the Department of Design and Construction, Division of Infrastructure.

(14) Upon the completion of microtunneling/pipe-jacking activities the Contractor will be required to submit a report that will include copies of all Daily Logs along with a description of any unusual events or problems encountered during microtunneling/pipe-jacking operation. In addition, all numerical data must be entered into Excel Format. A copy of the Excel file must be submitted along with this report.

50.61.4 MATERIALS

(A) Precast reinforced concrete carrier pipe must comply with the requirements of **Section 21.05**. The minimum class and thickness of pipe must be Class V, Wall B. Size of pipe must be as shown or specified. Precast reinforced concrete carrier pipe must be protectively coated in accordance with **Subsection 50.61.11**.

(B) Vitrified carrier pipe must comply with the requirements of **Section 21.02**. Kind, class, and size of pipe must be as shown or specified.

(C) Ductile iron carrier pipe must comply with the requirements of **Section 21.06** and must be Class 56 unless otherwise specified.

(D) Steel Sleeves must have an outer diameter (O.D.) as shown or specified and must have a minimum sleeve thickness as specified in table below. The steel must conform to ASTM A1097 (plates: ASTM A283, Grade C) API std. 5L, Grade B. The jacked steel sleeve must be designed to withstand jacking thrust as well as external loads (including but not limited to skin friction, friction due to weight of pipe, face pressure due to strata type, and face pressure required to counteract slurry pressure). A factor of safety of 2.5 must be used for jacking thrusts. Hydrostatic tests will not be required for steel sleeves.

MINIMUM SLEEVE O.D.	MINIMUM SLEEVE THICKNESS
30”	0.532”
36”	0.563”
42”	0.594”
48”	0.625”
54”	0.688”
60”	0.750”
66”	0.875”
72”	1.000”

All connections between successive steel sleeve pipe lengths must be continuously butt welded. Welds must be made in conformance with AWS D1.1. However, mechanical Permalok joint connections will be permitted in lieu of butt-welded joints between successive steel casing pipe providing this joint can be shown to be capable of withstanding the installation loads.

(E) Cement mortar for joints must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(F) Ring rubber gasket and grooved spigot joint must comply with the requirements of **Section 21.07**, Type 4, and for precast reinforced concrete pipe with **Subsection 50.21.3(C)**, and for vitrified pipe with **Subsection 50.31.3(C)**.

(G) Elastomeric pipe joint must comply with the requirements of **Section 21.07**, Type 3, and for vitrified pipe with **Subsection 50.31.3(C)**.

(H) Joints for ductile iron pipe must comply with the requirements of **Subsection 21.06.5**.

(I) Grout utilized to fill the voids between the steel sleeve and the sewer carrier pipe must be Low Weight Cement Grout as described below:

Low Weight Cement Grout:

(a) Grout must consist of neat Portland cement, water, Mearlcrete Foam Liquid concentrate, and other materials as manufactured and recommended by the Aerix Industries or approved equal..

(b) Portland cement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**, and must be Type II.

(c) Mixing water must be a maximum of six (6) gallons per bag of cement (water/cement ratio is 0.53), and be potable, free from deleterious amounts of acid, alkali, salts, oils and organic materials. Each bag of cement must be deemed to be one (1) cubic foot.

(d) Wet Density must be 95-lb/ft^3 maximum.
Dry Density must be 90-lb/ft^3 maximum.
Minimum 7-Day Compressive Strength must be 300-psi.
Minimum 28-Day Compressive Strength must be 1,000-psi.

(J) Grout utilized to fill the voids between the outside of the jacked sleeve and the soil/rock must be Pressure Grout as described below:

Pressure Grout:

(a) Pressure grout must consist of neat Portland cement or it must be mixed in a proportion by volume of one (1) part Portland cement and one (1) part sand or it must be mixed by volume of one (1) part Portland cement to one and one-half (1-1/2) parts lime flour and one-fiftieth (1/50) part Interplast IV.

(b) All parts must be mixed with clean fresh water to the desired consistency. In no case must more than eight (8) gallons of water be mixed per bag of cement.

50.61.5 METHODS

(A) GENERAL

The Contractor must install launching and receiving shafts at the locations and in accordance with the requirements shown, specified, ordered, or approved. Excavation support system for each shaft must be as shown, specified, ordered, or approved. Shafts must be properly constructed and braced to withstand both external loads (soil, water, etc.), and internal jacking loads. The Contractor must furnish, install, and remove to the extent required; thrust blocks or whatever provisions may be required in driving the sleeve forward. A jacking frame with integrated pipe guides, steel rails, or beams embedded in concrete must be used in the launching shaft for placement and alignment of each piece of sleeve during installation procedures. Special care must be taken when setting the pipe guide rails to ensure correctness of the alignment, grade, and stability. Jacking operations must not commence until the concrete thrust block has attained the required strength.

The steel sleeve must be jacked into position by the use of jacks of sufficient capacity to push the pipe and microtunneling machine through the existing strata (soil and/or rock). Intermediate launching shafts must be provided as required. Upon completion of each jacked section (launching shaft to receiving shaft), the Contractor must immediately pressure grout from the interior of the steel sleeve in conformance with **Subsection 50.61.10**.

The Contractor must follow the recommendations of the pipe manufacturer regarding the installation of the sewer carrier pipe. The recommended installation method used by the Contractor must be such that no damage will occur to the carrier pipe when it is inserted.

The Contractor must install the sewer carrier pipe to the line and grade required within the steel sleeve. Sewer carrier pipe must be properly braced and supported with spacers that are electrically insulated from the steel sleeve. The brace and support spacers must be installed and positioned in accordance with the manufacturer's recommendations and must not inhibit the flow of grout. The Contractor must submit design and method of bracing (including but not limited to type and location of spacers, and floatation design concerns) prior to installation of carrier pipe for approval by the Engineer. Proper precautions must be taken by the Contractor to prevent floatation or motion of the carrier pipe during the grouting operation.

The excavated shafts must be dewatered wherever required due to groundwater conditions. Dewatering activities must not impair the performance of the microtunneling equipment or process. The Contractor must lower and maintain the groundwater level below the invert of the steel sleeve at all times during

construction by dewatering means to prevent inflow of water or water and soil into the shafts. The Contractor must meet all applicable requirements for groundwater treatment and disposal.

(B) CONTROL OF LINE AND GRADE

(1) Lines and grades must conform to the requirements of **Subsection 10.09** and as amended herein. The Contractor must establish the baselines and benchmarks in accordance with this contract.

(2) The Contractor must submit to the Engineer copies of field notes used to establish all lines and grades. However, the Contractor remains fully responsible for the accuracy of the Contractor's work. All survey work must be performed under the direction of a New York State Licensed Surveyor and all submissions must be sealed and signed by the Licensed Surveyor.

(3) If there is any movement during construction, it must be the Contractor's responsibility to detect and correct it as required. When the excavation is off line or off grade, the Contractor must return to the design line and/or grade over the remaining portion of the drive at a rate of no more than one (1) inch per twenty-five (25) feet.

(4) The microtunnel excavation and run of jacked pipe must be controlled in such a manner that the deviation from grade is not more than one (1) inch nor from line more than three (3) inches. The Contractor must make note of all possible encumbrances and structures in the line of work, which may restrict clearances.

(5) Record the exact position of the microtunnel boring machine a minimum of once per shift to ensure the alignment is within the specified tolerances. Make the survey at the microtunnel boring machine to allow immediate correction of misalignment before allowable tolerances are exceeded. The tunnel guidance system may be used; however, select times to measure and record this information after the air temperatures have stabilized throughout the pipe to ensure accurate readings.

(C) EQUIPMENT

(1) The microtunnel boring machine must be capable of controlling the volume of excavated material removed from the excavation face at all times. In addition, the microtunnel boring machine must:

(a) Be capable of maintaining the excavation face under wet, dry, and adverse soil conditions and prevent loss of ground through the machine. The MTBM must provide satisfactory support of the excavation face at all times.

(b) Be articulated to allow steering.

(c) Incorporate a suitable seal between the microtunnel boring machine and the leading pipe.

(d) Provide protection to the electric and hydraulic motors and operating controls against water damage.

(e) Use bi-directional drive on the cutter-head wheel, and/or adjustable fins or other means, to control roll.

(f) Be capable of exerting a controllable pressure against the face, during both excavation and shutdown periods, to support the excavation face, prevent groundwater inflows, prevent running and flowing soils, and prevent loss of ground.

(g) Be capable of controlling the volume of excavated material removed at the excavation face and coordinating the machine advance rate to avoid over excavation.

(i) For Slurry Shield System: Include an automated spoil transportation slurry system that balances the groundwater and face pressures by the use of a slurry pressure balance system. System must be capable of adjustment required to maintain stability of the excavation face for the subsurface conditions to be encountered and must monitor and continuously balance the groundwater and face pressure to prevent loss of slurry or uncontrolled groundwater inflow.

(ii) For Earth Pressure-Balance System: Include an automated spoil transportation system that balances the groundwater and face pressures by the use of an earth pressure-balance system that controls the rate of passage of excavated material through the balanced screw auger or valves on the screw conveyer. System must be

capable of adjustment required to maintain stability of the excavation face for the subsurface conditions to be encountered and must monitor and continuously balance the groundwater and face pressure to prevent uncontrolled groundwater inflow.

(h) Be fully steerable both horizontally and vertically.

(i) Be capable of injecting lubricant between sleeve and strata to reduce friction between sleeve and strata.

(2) Guidance of the microtunnel boring machine must be through a remote console by means of active direction control, in or adjacent to the launching shaft. At a minimum, the thrust force, rate of advance, distance along heading, deviation from line, and deviation from grade must be monitored and displayed on the remote console.

(D) SAFETY

The Contractor must carry out the Contractor's operations in strict accordance with OSHA, NYC, and the Manufacturer's safety requirements.

The Contractor must provide adequate ventilation in the shafts at all times. Air quality in the shafts must be tested immediately prior to each change in shift. Air quality in the jacked pipe must be tested prior to personnel entry and periodically thereafter as required by law.

The Contractor must provide adequate lighting in the tunnel shafts and around equipment being utilized. Power and lighting circuits must be separated and thoroughly insulated.

(E) GEOTECHNICAL INSTRUMENTATION

The Contractor must install and monitor geotechnical instrumentation at the locations and in accordance with the requirements shown, specified, ordered or approved.

50.61.6 QUALIFICATIONS

The microtunneling/pipe-jacking Contractor or subcontractor performing the work required under this contract must be experienced in work of this nature and must have successfully completed a minimum of two (2) tunneling projects in the last five (5) years using pressurized face microtunneling/pipe-jacking equipment with a closed face tunnel shield and positive controlled face pressure. One of the successfully completed projects must have been in similar ground conditions (strata type and hydrostatic head), as to those anticipated on this contract. The Contractor must submit a description of such projects, which must include at a minimum, a listing of the locations, dates of projects, owners, pipe types and sizes, type of equipment utilized, ground conditions, drive lengths, maximum line, and grade deviations, and other information relevant to the issue of the successful completion of such projects.

The microtunneling/pipe-jacking project superintendent must have adequate experience in managing microtunneling/pipe-jacking projects similar to this contract.

The microtunneling/pipe-jacking machine operator(s) must have adequate experience in using the same type of equipment required for this project, namely, pressurized face microtunneling/pipe-jacking equipment with a closed face tunnel shield and positive, controllable tunnel face pressure.

Prior to the start of work the Contractor will be required to submit the name and resume of the microtunneling/pipe-jacking subcontractor for approval.

50.61.7 REPORTING REQUIREMENTS

The Contractor must maintain a Daily Log of all microtunneling/pipe-jacking activities. A copy of this log must be submitted to the Engineer on a daily basis. The log, at a minimum, must record the following in relationship to the advancement rate: (Advancement rate utilized for recording must be in one (1) foot intervals, unless otherwise directed by the Engineer.)

(1) Date and Time compared to the advancement rate.
(2) Total Jacking Pressures compared to the advancement rate, including all peak pressures.
(3) Cutter Head Torque compared to the advancement rate.
(4) Position of the Tunnel Boring Machine with respect to the design line and grade.
(5) Amounts, times and locations of lubrication.
(6) Unusual events or problems encountered.
(7) Upon completion of a bore (launching shaft to receiving shaft), the locations, pressures, and amounts of grout placed to fill all voids between the outside of the jacked sleeve and the soil/rock.

50.61.8 CLEANING

Prior to the insertion of the carrier pipe, the Contractor will be required to remove and properly dispose of all sediments and deposits from within the steel sleeve.

The Contractor must furnish all water and pumping equipment necessary for the cleaning operation. The sleeve must be clean and entirely free from projections that might interfere with the insertion of the carrier pipe through it.

50.61.9 INSPECTION AND TESTING

Immediately after the completion of the cleaning operation, the Engineer will conduct (unless waived in writing by the Engineer) a visual inspection of the steel sleeve for any defect or leakage so those repairs, if necessary, can be made. No carrier pipe must be installed until authorized by the Engineer.

The Contractor must provide the Engineer, without charge, all facilities and assistance necessary to perform this visual inspection of the steel sleeve and for obtaining any information the Engineer requires in order to access the progress and manner of the work performed.

The entire installation procedure must be rigorously inspected as herein specified, but inspection must not relieve the Contractor of responsibility to furnish material and perform work in accordance with the specifications. If at any time it is found that the pipe insertion procedure is not in accordance with these specifications, the pipe so installed will be subject to rejection.

After the sewer carrier pipe has been inserted into the steel sleeve and prior to grouting between the steel sleeve and the carrier pipe, the Contractor must test for leakage the sewer carrier pipe in accordance with **Section 40.11 - Leakage And Leakage Tests For Sewer Lines**.

Leakage or infiltration in excess of the specified amount must be located and stopped and all visible leaks must be stopped to the satisfaction of the Engineer, all at the Contractor's own expense.

Upon completion of all work, the Contractor must perform a television inspection and digital audio-visual recording of all sewers reconstructed in accordance with **Section 53.11** of the specifications. Payment for television inspection and digital audio-visual recording must be made under Item No. 53.11DR - TELEVISION INSPECTION AND DIGITAL AUDIO-VISUAL RECORDING OF SEWERS.

50.61.10 GROUTING

(A) GROUT FILL OUTSIDE JACKED SLEEVE

Upon completion of a jacked section (launching shaft to receiving shaft), the Contractor must immediately pressure grout from the interior of the steel sleeve. Pressure grout must be placed under pressure to fill all annular voids between the outside of the jacked sleeve and the soil/rock.

Systems of standard pipe, fittings, hose, and special grouting outlets embedded in the sleeve must be provided by the Contractor. Care must be taken to insure that parts of the system are maintained free from dirt. Cement grout must be forced under pressure into the grouting connections. Grouting must start at the lowest connections and must proceed until grout begins to flow from upper connections. Connections must then be made to those holes and the operation continued to completion. During the grouting process, each grout plug must be removed and the grout-mixing machine must be connected to the hole by means of a hose and nipple cut to the same thread as the screw plug.

The sleeve must have grout holes equipped with pipe half couplings. Three (3) grout holes spaced one hundred twenty (120) degrees on center must be installed on each section of pipe. The two (2) inch standard pipe half couplings welded into the holes in the sleeve must be provided with threaded cast iron plugs. Plugs must be no less than five-eighths (5/8) inch in diameter.

Apparatus for mixing and placing grout must be capable of mixing effectively and stirring the grout and then forcing it into the grout connections in a continuous uninterrupted flow. When grouting is completed the grout plugs in each section must be screwed into the grout holes for their full length and tightened to provide a watertight seal.

The Contractor must take all necessary precautions to prevent grout from escaping and setting on inner surface of steel sleeve. The Contractor must remove such grout and restore the surface to its original condition.

The Contractor must provide the Engineer all facilities necessary for the inspection of pressure grouting operation to ensure complete filling of the annular void. These facilities must include removing of grout

plugs as required for inspection behind the steel sleeve. Any voids found must be grouted at once as directed by the Engineer.

The Contractor must keep and furnish to the Engineer an accurate log of grouting operations, pressures, rates of pumping, amount of cement for each change in water/cement ratio, and such other data as are required by the Engineer. The log must be supplied by the Contractor to the Engineer or the Engineer's representative after each shift.

After completion of pressure grouting the sewer carrier pipe must be installed to the line and grade required within the steel sleeve.

(B) GROUT FILL AROUND CARRIER PIPE

After the carrier pipe is satisfactorily installed and passes inspection and testing, the carrier pipe must be secured to the steel sleeve at each end with a 12-inch thick concrete plug. Unless otherwise shown on the contract drawings, the Contractor must submit along with the required submittal in **Subsection 50.61.3** the design of these concrete plugs. The design of these concrete plugs must incorporate a method for securing the concrete plugs to the ends of the steel sleeve and carrier pipe so as to be capable of withstanding the grouting pressures without slippage or blow-out at the ends. The concrete plugs design must include an air relief port located at the highest (top) point of the plug.

After approval by the Engineer, the entire annular space between the inside of the steel sleeve and the outside of the sewer carrier pipe must be filled with Low Weight Cement Grout in one continuous uninterrupted operation in a manner to prevent occurrence of any voids between the steel sleeve and the carrier pipe.

The grout fill must be placed by pneumatic or pumping equipment under a pressure between 10-psi and 15-psi to ensure that the entire void space has been evenly and completely filled. The pressure must be continuously monitored and care must be taken to avoid pressures above 15-psi. Equipment and methods of placement of the grout fill will be subject to review by the Engineer.

The volume of the grout being placed must be monitored and recorded. A comparison between the theoretical volume and the actual volume of grout placed must be done and any discrepancies must be brought to the attention of the Engineer.

The Contractor must also fill the holes used to place the grout.

50.61.11 PROTECTIVE COATING

All concrete carrier pipes must be coated inside with two (2) coats of Koppers Bitumastic No. 300-M protective coating and with one (1) coat of a white Acrylic topcoat (Kop-Coat 600 Acrylic or Carbocrylic White S800) or approved equals.

Coating on the concrete carrier pipe must be applied prior to its placement in the Steel Sleeve. Prior to coating the concrete carrier pipe, the Contractor must be required to receive written approval from the Engineer that the surface to be coated is judged suitable to receive the protective coating as recommended by the coating manufacturer and/or the Engineer.

The Contractor is notified that if for any reason the coating manufacturer and/or Engineer conclude that the surfaces are not ready for coating, then immediately prior to applying the coating the surfaces must be cleaned and/or treated as directed. Surfaces must be brushed and thoroughly cleaned. Surfaces must then be permitted to dry thoroughly. All work must be performed to the complete satisfaction of the Engineer.

Prior to applying the protective coating all requirements and conditions of **DIVISION III - INSPECTION OF MATERIALS, SAMPLING AND METHOD OF TEST**, must be complied with.

Base and hardener must be mixed in accordance with the manufacturers recommendations and after final mixing must be applied in the presence of the Engineer within the time period stipulated by the manufacturer of the coating material. The Engineer must certify to the adequacy of the coating work (i.e., mixing application). The coating must be evenly applied in required number of coats by an airless spraying procedure approved by the Engineer.

Each protective coat must be at least ten (10) mils minimum dry film thickness. The total thickness for all pipes of the finished protective coating must be twenty (20) mils minimum dry film thickness.

The second protective coat must not be applied until the first protective coat is allowed to dry tack free. If a protective coat is permitted to cure more than seventy-two (72) hours, it must first be treated and/or conditioned as recommended by the coating material manufacturer before application of an additional coat will be permitted.

The Engineer prior to final acceptance of the work must certify all coating and thickness of coatings.

After the second coat has been approved by the Engineer, a white top coat, three (3) mils minimum dry film thickness, must be applied as recommended by the coating manufacturer and/or Engineer.

50.61.12 MEASUREMENT

The quantity of sewer in jacked steel sleeve to be measured for payment must be the number of linear feet of each size, kind, type, class, and wall thickness of sewer carrier pipe together with jacked steel sleeve incorporated in the work, complete, as shown, specified or required, measured horizontally along the center line of sewer. Measurement must be from inside face of launching shaft to inside face of receiving shaft.

50.61.13 PRICE TO COVER

The contract price for "SEWERS IN JACKED STEEL SLEEVES" must be the unit price bid per linear foot for each size, kind, class, and wall thickness of sewer carrier pipe together with jacked steel sleeve and must cover the cost of all labor, materials, plant, equipment, samples, tests, and insurance required and necessary to construct the sewers in jacked steel sleeves to the sizes and to the lines and grades shown, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**), additional subsurface investigations; geotechnical instrumentation, all sheeting and bracing, pumping, fluming, bridging, connections, maintaining flow in sewers; backfilling, launching and receiving shafts (including intermediate launching shafts), complete (including temporary excavation supports, groundwater control, thrust block, jacking frame, launch and exit seals, etc.), installation of steel sleeves, grouting required to fill voids between the outside of the jacked steel sleeve and the soil/rock, cleaning of steel sleeves, application of protective coating and top coating to interior surfaces of concrete carrier pipe, installation of sewer carrier pipe in steel sleeves, inspection and testing, grouting required to fill the voids between the inside of steel sleeves and the outside of sewer carrier pipe, preparation, submittal and approval of all required shop drawings and designs, obtaining of all necessary permits, and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the contract drawings, specifications, and standards, and as directed by the Engineer.

In addition, included in the price hereunder must be the cost of all labor and materials necessary to remove all specified and ordered existing sewers, manholes, structures, and appurtenances that may be in the launching and receiving shafts and in the line of the work and to do all the work incidental thereto, all in accordance with **Subsections 10.13 and 10.28** of the specifications and as directed by the Engineer.

Payment for Sewers In Jacked Steel Sleeves will be made under the Item Number as calculated below:

The Item Numbers for Sewers In Jacked Steel Sleeves have eleven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Sewers In Jacked Steel Sleeves:

50.61

(2) The sixth character must define the Type of Sewer Effluent:

S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer

(3) The seventh and eighth characters must define the Diameter of the Sewer Carrier Pipe. (The seventh and eighth characters representing the unit of inches for the Diameter of the Sewer Carrier Pipe.) See examples below:

10 - 10"
16 - 16"
30 - 30"

(4) The ninth character must define the Kind of Sewer Carrier Pipe:

V - Extra Strength Vitrified Clay Pipe (E.S.V.P.)
D - Ductile Iron Pipe (D.I.P) Class 56
R - Reinforced Concrete Pipe (R.C.P.) Class V

(5) The tenth and eleventh characters must define the Diameter of the Jacked Steel Sleeve Pipe. (The tenth and eleventh characters representing the unit of inches for the Diameter of the Jacked Steel Sleeve Pipe.) See examples below:

30 - 30”
66 - 66”

(6) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
50.61S10V30	10” E.S.V.P. SANITARY SEWER IN JACKED 30” STEEL SLEEVE	L.F.
50.61S12V30	12” E.S.V.P. SANITARY SEWER IN JACKED 30” STEEL SLEEVE	L.F.
50.61S15V30	15” E.S.V.P. SANITARY SEWER IN JACKED 30” STEEL SLEEVE	L.F.
50.61S18V36	18” E.S.V.P. SANITARY SEWER IN JACKED 36” STEEL SLEEVE	L.F.
50.61S10D30	10” D.I.P. CLASS 56 SANITARY SEWER IN JACKED 30” STEEL SLEEVE	L.F.
50.61S12D30	12” D.I.P. CLASS 56 SANITARY SEWER IN JACKED 30” STEEL SLEEVE	L.F.
50.61S16D30	16” D.I.P. CLASS 56 SANITARY SEWER IN JACKED 30” STEEL SLEEVE	L.F.
50.61S18D36	18” D.I.P. CLASS 56 SANITARY SEWER IN JACKED 36” STEEL SLEEVE	L.F.
50.61S24D42	24” D.I.P. CLASS 56 SANITARY SEWER IN JACKED 42” STEEL SLEEVE	L.F.
50.61S30D48	30” D.I.P. CLASS 56 SANITARY SEWER IN JACKED 48” STEEL SLEEVE	L.F.
50.61S36D54	36” D.I.P. CLASS 56 SANITARY SEWER IN JACKED 54” STEEL SLEEVE	L.F.
50.61S42D60	42” D.I.P. CLASS 56 SANITARY SEWER IN JACKED 60” STEEL SLEEVE	L.F.
50.61S48D66	48” D.I.P. CLASS 56 SANITARY SEWER IN JACKED 66” STEEL SLEEVE	L.F.
50.61S24R42	24” R.C.P. CLASS V SANITARY SEWER IN JACKED 42” STEEL SLEEVE	L.F.
50.61S30R48	30” R.C.P. CLASS V SANITARY SEWER IN JACKED 48” STEEL SLEEVE	L.F.
50.61S36R54	36” R.C.P. CLASS V SANITARY SEWER IN JACKED 54” STEEL SLEEVE	L.F.
50.61S42R60	42” R.C.P. CLASS V SANITARY SEWER IN JACKED 60” STEEL SLEEVE	L.F.
50.61S48R66	48” R.C.P. CLASS V SANITARY SEWER IN JACKED 66” STEEL SLEEVE	L.F.
50.61M10V30	10” E.S.V.P. STORM SEWER IN JACKED 30” STEEL SLEEVE	L.F.
50.61M12V30	12” E.S.V.P. STORM SEWER IN JACKED 30” STEEL SLEEVE	L.F.
50.61M15V30	15” E.S.V.P. STORM SEWER IN JACKED 30” STEEL SLEEVE	L.F.
50.61M18V36	18” E.S.V.P. STORM SEWER IN JACKED 36” STEEL SLEEVE	L.F.
50.61M10D30	10” D.I.P. CLASS 56 STORM SEWER IN JACKED 30” STEEL SLEEVE	L.F.
50.61M12D30	12” D.I.P. CLASS 56 STORM SEWER IN JACKED 30” STEEL SLEEVE	L.F.
50.61M16D30	16” D.I.P. CLASS 56 STORM SEWER IN JACKED 30” STEEL SLEEVE	L.F.
50.61M18D36	18” D.I.P. CLASS 56 STORM SEWER IN JACKED 36” STEEL SLEEVE	L.F.
50.61M24D42	24” D.I.P. CLASS 56 STORM SEWER IN JACKED 42” STEEL SLEEVE	L.F.
50.61M30D48	30” D.I.P. CLASS 56 STORM SEWER IN JACKED 48” STEEL SLEEVE	L.F.
50.61M36D54	36” D.I.P. CLASS 56 STORM SEWER IN JACKED 54” STEEL SLEEVE	L.F.
50.61M42D60	42” D.I.P. CLASS 56 STORM SEWER IN JACKED 60” STEEL SLEEVE	L.F.
50.61M48D66	48” D.I.P. CLASS 56 STORM SEWER IN JACKED 66” STEEL SLEEVE	L.F.
50.61M24R42	24” R.C.P. CLASS V STORM SEWER IN JACKED 42” STEEL SLEEVE	L.F.
50.61M30R48	30” R.C.P. CLASS V STORM SEWER IN JACKED 48” STEEL SLEEVE	L.F.
50.61M36R54	36” R.C.P. CLASS V STORM SEWER IN JACKED 54” STEEL SLEEVE	L.F.
50.61M42R60	42” R.C.P. CLASS V STORM SEWER IN JACKED 60” STEEL SLEEVE	L.F.
50.61M48R66	48” R.C.P. CLASS V STORM SEWER IN JACKED 66” STEEL SLEEVE	L.F.
50.61C10V30	10” E.S.V.P. COMBINED SEWER IN JACKED 30” STEEL SLEEVE	L.F.
50.61C12V30	12” E.S.V.P. COMBINED SEWER IN JACKED 30” STEEL SLEEVE	L.F.
50.61C15V30	15” E.S.V.P. COMBINED SEWER IN JACKED 30” STEEL SLEEVE	L.F.
50.61C18V36	18” E.S.V.P. COMBINED SEWER IN JACKED 36” STEEL SLEEVE	L.F.
50.61C10D30	10” D.I.P. CLASS 56 COMBINED SEWER IN JACKED 30” STEEL SLEEVE	L.F.
50.61C12D30	12” D.I.P. CLASS 56 COMBINED SEWER IN JACKED 30” STEEL SLEEVE	L.F.
50.61C16D30	16” D.I.P. CLASS 56 COMBINED SEWER IN JACKED 30” STEEL SLEEVE	L.F.
50.61C18D36	18” D.I.P. CLASS 56 COMBINED SEWER IN JACKED 36” STEEL SLEEVE	L.F.

Item No.	Description	Pay Unit
50.61C24D42	24” D.I.P. CLASS 56 COMBINED SEWER IN JACKED 42” STEEL SLEEVE	L.F.
50.61C30D48	30” D.I.P. CLASS 56 COMBINED SEWER IN JACKED 48” STEEL SLEEVE	L.F.
50.61C36D54	36” D.I.P. CLASS 56 COMBINED SEWER IN JACKED 54” STEEL SLEEVE	L.F.
50.61C42D60	42” D.I.P. CLASS 56 COMBINED SEWER IN JACKED 60” STEEL SLEEVE	L.F.
50.61C48D66	48” D.I.P. CLASS 56 COMBINED SEWER IN JACKED 66” STEEL SLEEVE	L.F.
50.61C24R42	24” R.C.P. CLASS V COMBINED SEWER IN JACKED 42” STEEL SLEEVE	L.F.
50.61C30R48	30” R.C.P. CLASS V COMBINED SEWER IN JACKED 48” STEEL SLEEVE	L.F.
50.61C36R54	36” R.C.P. CLASS V COMBINED SEWER IN JACKED 54” STEEL SLEEVE	L.F.
50.61C42R60	42” R.C.P. CLASS V COMBINED SEWER IN JACKED 60” STEEL SLEEVE	L.F.
50.61C48R66	48” R.C.P. CLASS V COMBINED SEWER IN JACKED 66” STEEL SLEEVE	L.F.

SECTION 50.62 – DIRECT JACKED PRECAST CONCRETE PIPE SEWERS

50.62.1 INTENT

This section describes construction of precast polymer concrete pipe sewers and/or precast reinforced concrete pipe sewers by direct jacking.

50.62.2 DESCRIPTION

(A) GENERAL

(1) The precast polymer concrete pipe sewers and/or precast reinforced concrete pipe sewers must be constructed to the sizes, kinds, classes, and wall thicknesses specified and in accordance with the details shown on the contract drawings. The construction of the sewers herein must be by means of the direct jacking of a precast polymer concrete pipe and\or precast reinforced concrete pipe with the use of microtunneling techniques.

Microtunneling is defined as the trenchless installation of the pipe by jacking the pipe behind a remotely controlled tunnel boring machine. The Microtunnel Boring Machine ("MTBM") must be capable of adequately and safely counter-balancing prevailing hydrostatic conditions and must be a slurry shield tunnel boring machine or an earth pressure-balanced shield tunnel boring machine or an approved equal.

(2) The Contractor will be permitted to submit for written approval by the Engineer an alternate method of direct jacking of a precast polymer concrete pipe and\or precast reinforced concrete pipe other than by microtunneling techniques specified in **Subsection 50.62.2(A)(1)**. Such alternate method must comply with all applicable specifications of this **Section 50.62**, the determination as to which specifications are applicable must be determined by the Engineer. If the alternate pipe jacking tunneling method is not capable of tunneling through rock and boulders of all sizes, and requires the manual excavation, removal, and disposal of rock and boulders at the tunnel face, then no separate or additional payment will be made for this manual rock and boulder excavation, removal, and disposal. If the alternate pipe jacking tunneling method is not capable of performing in saturated ground, and requires the installation of a dewatering system so as to work in "the dry", then no separate or additional payment will be made for this dewatering system installation, operation, and removal. The cost for all labor, materials, plant, equipment and insurance required and necessary to excavate, remove and dispose of all rock and boulders within the tunnel section, and to install, operate, and remove the dewatering system must be included in the prices bid per linear foot for the respective "DIRECT JACKED PRECAST CONCRETE PIPE SEWER" items.

(3) It is the Contractor's responsibility to choose the shaft excavation, and support methods, and the type of tunnel boring machine and its equipment and accessories to be used to complete the tunnel bore.

The Contractor must replace any equipment deemed necessary in order to complete the tunnel bore. This includes the rock or soil cutter head and any other required equipment. No additional or separate payment will be made for any equipment replacement that is required to complete the tunnel bore, with the exception of that allowed under **Section 70.53 - Allowance For Boulder Removal**.

(B) GEOTECHNICAL CONDITIONS

Geotechnical data provided by the City is for information purposes only. The Contractor must perform the Contractor's own geotechnical investigations to ensure that the type of tunnel boring machine (together with equipment and accessories) the Contractor chooses to use is capable of completing the tunnel bore and remove all materials (i.e. soil, boulders, rock, etc.) encountered.

The Contractor must thoroughly investigate the geotechnical conditions of the strata through which the tunnel boring is to be accomplished. After performing this thorough investigation the Contractor must prepare a construction report in accordance with **Section 76.11 - Construction Report** for the approval of the Engineer. (See **Subsection 50.62.3 - Submittals, paragraph (1)**).

50.62.3 SUBMITTALS

The Contractor must submit the following:

(1) Before commencing any operations associated with the construction of direct jacked precast concrete pipe sewers the Contractor must submit the construction report specified above. In addition to the requirements specified in **Section 76.11**, the construction report must contain all investigative geotechnical information and determinations as to tunnel boring feasibility and all means and methods

of construction that will be required to complete the tunnel bore. The Construction Report must also state the Contractor's assumptions regarding the subsurface conditions to be encountered during shaft and microtunnel construction.

(2) Details of tunneling machine the Contractor chooses to use together with required equipment and accessories. Include the following:

(a) Machine specifications (including but not limited to equipment, accessories, and means and methods of spoil removal) together with a letter from the microtunneling machine manufacturer demonstrating that the selected machine together with equipment, accessories, and means and methods of spoil removal is capable of progressing through the anticipated subsurface conditions, and capable of removing spoils effectively.

(b) For Slurry Shield System: Details of MTBM slurry system and soil separation methods including proposed slurry formulations and calculations of the system capacity to handle flows at all proposed distances and changes of elevations to and from the MTBM.

(c) For Earth Pressure-Balance System: Details of MTBM conveyance system and material transport methods including calculations of the system capacity to handle removal or flows at all proposed distances and changes of elevations to and from the MTBM.

(d) Jacking system details (jacks and jacking frames), method of operation, thrust capacity, and precast concrete pipe details. Describe method of control to prevent the maximum allowable jacking force from being exceeded.

(e) Description of lubrication mix equipment and procedure for lubricating the pipe during jacking operations, including estimated volume for the anticipated soils.

(f) Active Direction Control details and means of controlling line and grade.

(3) Before commencing any operations associated with the construction of direct jacked precast concrete pipe sewers, the Contractor must submit a detailed description of the proposed method of installation including locations and dimensions of launching/receiving shafts (including intermediate launching shafts), insertion procedures, and all shop drawings required for review and approval by the Engineer. These submittals must include procedural details to allow the Engineer to evaluate the procedure to be used. All pertinent dimensions, material properties, and design calculations must be shown.

(4) Theoretical jacking force calculations and pipe material calculations must be prepared and submitted. It is the sole responsibility of the Contractor to determine the maximum anticipated construction loads, including maximum jacking forces, Factor of Safety, and to ensure that the anticipated loads are implemented in the manufacturer's design of the pipe. These calculations must be submitted to the Engineer for review and approval, and must bear the signature and seal of a Licensed Professional Engineer, currently registered in the State of New York.

(5) Prepare and submit a proposed contingency plan for potential situations that may occur during tunneling operations. This submittal must at a minimum address the following scenarios:

(a) The MTBM hits an obstruction.

(b) Cuttings do not settle/separate with the equipment on site.

(c) The target laser is distorted by heat and/or humidity or has been knocked out of alignment. Describe which operational parameters will be observed/measured/recorded so that it can be determined if the above are occurring or have just occurred.

(d) The jacking pressures start to increase rapidly and there is reasonable concern for completing jacking operations to the receiving shaft.

(e) The MTBM "freezes" during jacking operations.

(6) Unless otherwise provided for in the contract documents, a proposed plan showing locations of required geotechnical instrumentation and any other Contractor proposed instrumentation. Include product information indicating the instrumentation sizes, material types, specifications, installation procedures, locations, and other pertinent data. The instrumentation installation specialist performing the installation of the geotechnical instrumentation must have adequate experience; proof of this experience must be included with this plan.

(7) Shaft Excavation and Support submittal, bearing the signature and seal of a Licensed Professional Engineer, currently registered in the State of New York, must include:

(a) Detailed narrative outlining the construction sequence.

(b) Engineering calculations, assumptions, and methodologies for the design of the shaft excavation support system. The Contractor must design excavation support systems and working slabs to withstand earth and hydrostatic pressures, bottom heave, equipment loads, applicable traffic and construction loads, and other surcharge loads to allow the safe construction of the tunnel and associated structures without excessive movement or settlement of the ground, and to prevent damage to adjacent structures, streets, and utilities. Use lateral earth pressures consistent with ground conditions, soil properties (type, composition, compaction, moisture content, etc.), water table, etc., described in the contract documents and in accordance with NYC, AISC and ACI code provisions, as applicable. Each component of the shaft excavation and support system must be designed to safely support the maximum combination of loads and other conditions that may occur during construction. These submittals must consider all beginning, intermediate, and final construction stages of shaft installation. The Contractor must also submit the Contractor's groundwater control system.

(c) Break-out and Break-in plans indicating type of support installed to transfer loads and maintain excavation support, groundwater control, and stability of the excavation when a MTBM exits or enters a shaft. Contractor must utilize shaft launch and exit seals to prevent inflow of groundwater, slurry, lubrication, and soil. Seals must be sized to accommodate microtunneling boring machine and jacking pipe, and must not impair the performance of the shaft excavation support system. Groundwater inflows at each seal must be less than five (5) gallons per minute, and total soil inflows at each seal must be less than two (2) cubic feet for the entire duration of the jacking operation. Seal design/installation must incorporate localized ground improvement as necessary to meet these criteria.

(d) Microtunneling machine thrust block design and details for the launching shaft. The thrust block must be perpendicular to the proposed pipe alignment. The thrust block must be designed to support the maximum jacking pressure developed by the main jacking system.

Note that review of the Contractor's Shaft Excavation and Support submittal by the Engineer does not relieve the Contractor and its design consultants of their responsibility to provide and maintain an adequate support system achieving the specified requirements.

(8) Excess Materials Disposal Plan: Excess materials disposal plan must include treatment (as applicable), transportation methods and routes, disposal location details for excess excavated materials (soil, rock, etc.), and disposal methods for groundwater generated during construction of tunnel and shafts. This plan must include estimated quantities for disposal of all excess excavated materials and groundwater.

(9) Shop drawings submittals showing all details of precast concrete pipe including steel reinforcement, joint dimensions for all pipe and fittings, etc. For Precast Polymer Concrete Pipe - submittal of design calculations demonstrating ASTM D6783 class and allowable axial jacking forces. For Precast Reinforced Concrete Pipe - submittal of design calculation demonstrating ASTM C76 class and allowable axial jacking forces. Submittals of Test Reports and Certificates Of Compliance for all precast concrete pipe.

(10) Shop drawings must be submitted in accordance with all applicable provisions of **Subsection 40.05.5 - Shop Drawings**, as required. Design criteria must be submitted in accordance with all applicable requirements of **Subsection 40.05.6 - Design Criteria**, as required.

(11) The Contractor must allow a minimum of four (4) weeks for review.

(12) All the above must be submitted as a complete package. All designs must bear the signature and seal of a Licensed Professional Engineer, currently registered in the State of New York.

(13) No work associated with the construction of direct jacked precast concrete pipe sewers must commence until the Contractor receives all required approved shop drawing from the Department of Design and Construction, Division of Infrastructure.

(14) Upon the completion of microtunneling/pipe-jacking activities the Contractor will be required to submit a report that will include copies of all Daily Logs along with a description of any unusual events or

problems encountered during microtunneling/pipe-jacking operation. In addition, all numerical data must be entered into Excel Format. A copy of the Excel file must be submitted along with this report.

50.62.4 MATERIALS

(A) PRECAST CONCRETE PIPE

(1) Precast Polymer Concrete Pipe: Precast polymer concrete pipe must comply with the requirements of **Section 21.08**. The minimum class of pipe must be Class V. Size of pipe must be as shown or specified.

(2) Precast Reinforced Concrete Pipe: Precast reinforced concrete pipe must comply with the requirements of **Section 21.05** and as amended herein. The minimum class and thickness of pipe must be Class IV, Wall C. Size of pipe must be as shown or specified. Precast reinforced concrete pipe must be protectively coated in accordance with **Subsection 50.62.11**.

(3) The jacked precast concrete pipe must be designed to withstand jacking thrust as well as external loads (including but not limited to skin friction, friction due to weight of pipe, face pressure due to strata type, and face pressure required to counteract slurry pressure). Jacking loads must be distributed over the minimum cross-sectional area of the pipe. A factor of safety of 2.5 must be used for jacking thrusts. Designs must consider bending and shear attributable to the eccentricity of the load on the jacking face. Hydrostatic tests will be required for precast concrete pipe.

(4) The outer walls of precast concrete pipe must be straight and the joints flush or slightly recessed in relation with the pipe outer diameter.

(5) Manufacture Of Precast Concrete Pipe:

(a) Precast Polymer Concrete Pipe: Precast polymer concrete pipe must be manufactured and supplied in accordance with **Section 21.08**.

(b) Precast Reinforced Concrete Pipe: Precast reinforced concrete pipe must at a minimum be manufactured and supplied as follows:

(1) Cement must be Type II, in accordance with ASTM C150.

(2) Steel reinforcement must consist of a minimum of two (2) cages of welded wire fabric conforming to ASTM A185.

(3) Pipe must be supplied in ten (10) foot lengths, except where shorter lengths are required for proper stationing.

(4) Concrete must have a minimum compressive strength of 6,000-psi at twenty-eight (28) hours, as determined from standard test cylinders, in accordance with ASTM C31.

(5) The concrete pipe must be cast vertically between inner and outer rigid steel forms. Mechanical vibrators must be used to compact the concrete and ensure smooth concrete surfaces.

(6) After casting, the pipe in its forms must be placed in a suitable enclosure and following a delay period of one (1) to four (4) hours, cured by the introduction of steam.

(c) All Precast Concrete Pipe: Each pipe must have three (3) factory installed threaded injection ports and check valves with stainless steel threaded plugs flush with the inside and outside faces of the pipe to facilitate the Contractors lubricating operation and to grout the pipe in place upon completion of each bore. The injection ports (connections) must be spaced one hundred twenty (120) degrees on center. Injection port fittings must comply with ASTM A53, standard weight Schedule 40, black.

(6) Quality Assurance And Testing Of Precast Concrete Pipe:

(a) The pipe manufacturer must have at their facility a fully equipped laboratory and staff to perform all testing on jacking pipe.

(b) Precast Polymer Concrete Pipe: Precast polymer concrete pipe must be tested in accordance with **Section 21.08**.

(c) Precast Reinforced Concrete Pipe: Precast reinforced concrete pipe must be tested in accordance with ASTM C76. The manufacturer must be required to perform the following additional tests and dimensional checks:

(1) Dimensional Inspection:

(i) The wall thickness in the joint and barrel must not vary by more than (+/-) three (3) percent of the nominal wall thickness.

(ii) The outside diameter of pipe must not vary from theoretical by more than +1/32, -1/16-inch per foot of inside diameter.

(iii) Pipe squareness must be checked by two means:

(1) For length of opposite sides (taping pipe 180-degrees apart), a tolerance of 1/4-inch is required for pipe 48-inches in diameter and less, and 3/8-inch for pipe 54-inches in diameter and greater.

(2) For end squareness (taping diagonals 180-degrees apart), a tolerance of 1/4-inch is required for pipe 48-inches in diameter and less, and 3/8-inch for pipe 54-inches in diameter and greater.

(iv) The normality of the joint face must have a maximum deviation of (+/-) 1-degree from perpendicular.

(2) Pipe (Concrete) Strength Confirmation: The compressive strength of each pipe must be determined by testing concrete cylinders from the same concrete as each jacking pipe. A minimum of four (4) test cylinders must be taken for each pipe and tested at intervals up to 28-days.

(3) Airholes and Gate Seams: The surfaces of each jacking pipe must be examined for airholes and gate offsets. The maximum allowable airhole must be 3/4-inch diameter and the maximum gate offset must be 1/8-inch. Airholes exceeding this criterion must be filled with neat cement and gate offsets greater than 1/8-inch must be ground smooth.

(7) Installation Of Precast Concrete Pipe: The following must be required:

(a) Just prior to lowering the precast concrete pipe into the trench, the joint surfaces must be wiped clean and lubricated with a manufacturer recommended lubricant.

(b) A pressure-distributing compression ring must be placed between the mating vertical joint surfaces to evenly distribute the jacking load. Precast concrete pipe must be installed in accordance with the manufacturer's recommendations and standard practices.

(c) Upon completing the joint, the position of the gasket must be checked with a feeler gage supplied by the manufacturer. If the gasket(s) is found not to be in the proper position, the joint must be remade and the gasket(s) replaced. Joint openings must not exceed the manufacturer's recommendations.

(B) JOINTS

(1) Precast Polymer Concrete Pipe - Joints must comply with the requirements of **Section 21.08**.

(2) Precast Reinforced Concrete Pipe:

(a) Joints for pipe **48-inches in diameter and less** must consist of a steel bell and concrete spigot. A solid rubber gasket must be compressed between the bell and spigot and an additional 1-inch square rubber gasket must be placed at the bell face. Surfaces of the bell ring that are exposed after manufacture must be protected with a corrosion resistant coating.

(b) Joints for pipe **54-inches in diameter and greater** must consist of a steel bell and steel spigot with a solid rubber gasket contained in the groove of the steel spigot.

(3) The pipe joints must be capable of (without the loss of seal or damage to the joints):

(a) Transferring jacking loads.

(b) Experiencing skin friction.

(c) Allowing angular rotation flexibility to permit routine steering of the bore head to maintain line and grade.

(d) Tolerating the installation pressures and the long term operating conditions and environment.

(4) Pipe joints must be protected by the installation of pressure-distributing compression rings (spacers) made of low modulus material (e.g. chipboard, knot-free soft wood, fiberboard, plywood). The pressure-distributing compression rings must be placed between pipe ends to reduce load concentrations on the pipes caused by unplane/unsquare ends, nonstraight sections, or angles between the axis' of adjacent pipes (due to steering). Pressure-Distributing Compression Rings should be as uniform as possible in compression resistance (modulus) so as not to be the cause of load concentrations.

(5) Precast concrete pipe joints must be submitted to the Engineer for approval.

(C) GROUT

Grout utilized to fill the voids between the outside of the jacked precast concrete pipe and the soil/rock must be Pressure Grout as described below:

Pressure Grout:

(a) Pressure grout must consist of neat Portland cement or it must be mixed in a proportion by volume of one (1) part Portland cement and one (1) part sand or it must be mixed by volume of one (1) part Portland cement to one and one-half (1-1/2) parts lime flour and one-fiftieth (1/50) part Interplast IV.

(b) All parts must be mixed with clean fresh water to the desired consistency. In no case must more than eight (8) gallons of water be mixed per bag of cement.

50.62.5 METHODS

(A) GENERAL

The Contractor must install launching and receiving shafts at the locations and in accordance with the requirements shown, specified, ordered, or approved. Excavation support system for each shaft must be as shown, specified, ordered, or approved. Shafts must be properly constructed and braced to withstand both external loads (soil, water, etc.) and internal jacking loads. The Contractor must furnish, install, and remove to the extent required; thrust blocks or whatever provisions may be required in driving the precast concrete pipe forward. A jacking frame with integrated pipe guides, steel rails, or beams embedded in concrete must be used in the launching shaft for placement and alignment of each piece of precast concrete pipe during installation procedures. Special care must be taken when setting the pipe guide rails to ensure correctness of the alignment, grade, and stability. Jacking operations must not commence until the concrete thrust block has attained the required strength.

The precast concrete pipe must be jacked into position by the use of jacks of sufficient capacity to push the pipe and microtunneling machine through the existing strata (soil and/or rock). Intermediate launching shafts must be provided as required. Upon completion of each jacked section (launching shaft to receiving shaft), the Contractor must immediately pressure grout from the interior of the precast concrete pipe in conformance with **Subsection 50.62.10**.

The excavated shafts must be dewatered wherever required due to groundwater conditions. Dewatering activities must not impair the performance of the microtunneling equipment or process. The Contractor must lower and maintain the groundwater level below the invert of the steel sleeve at all times during construction by dewatering means to prevent inflow of water or water and soil into the shafts. The Contractor must meet all applicable requirements for groundwater treatment and disposal.

(B) CONTROL OF LINE AND GRADE

(1) Lines and grades must conform to the requirements of **Subsection 10.09** and as amended herein. The Contractor must establish the baselines and benchmarks in accordance with this contract.

(2) The Contractor must submit to the Engineer copies of field notes used to establish all lines and grades. However, the Contractor remains fully responsible for the accuracy of the Contractor's

work. All survey work must be performed under the direction of a New York State Licensed Surveyor, and all submissions must be sealed and signed by the Licensed Surveyor.

(3) If there is any movement during construction, it is the Contractor's responsibility to detect and correct it as required. When the excavation is off line or grade, the Contractor must return to the design line and/or grade over the remaining portion of the drive at a rate of no more than one (1) inch per twenty-five (25) feet.

(4) The microtunnel excavation and run of jacked pipe must be controlled in such a manner that the deviation from grade is not more than one (1) inch nor from line more than three (3) inches. The Contractor must make note of all possible encumbrances and structures in the line of work that may restrict clearances.

(5) Record the exact position of the MTBM a minimum of once per shift to ensure the alignment is within the specified tolerances. Make the survey at the microtunnel boring machine to allow immediate correction of misalignment before allowable tolerances are exceeded. The tunnel guidance system may be used; however, select times to measure and record this information after the air temperatures have stabilized throughout the pipe to ensure accurate readings.

(C) EQUIPMENT

(1) The MTBM must be capable of controlling the volume of excavated material removed from the excavation face at all times. In addition, the MTBM must:

(a) Be capable of maintaining the excavation face under wet, dry, and adverse soil conditions and prevent loss of ground through the machine. The MTBM must provide satisfactory support of the excavation face at all times.

(b) Be articulated to allow steering.

(c) Incorporate a suitable seal between the microtunnel boring machine and the leading pipe.

(d) Provide protection to the electric and hydraulic motors and operating controls against water damage.

(e) Use bi-directional drive on the cutter-head wheel, and/or adjustable fins or other means, to control roll.

(f) Be capable of exerting a controllable pressure against the face, during both excavation and shutdown periods, to support the excavation face, prevent groundwater inflows, prevent running and flowing soils, and prevent loss of ground.

(g) Be capable of controlling the volume of excavated material removed at the excavation face and coordinating the machine advance rate to avoid over excavation.

(i) For Slurry Shield System: Include an automated spoil transportation slurry system that balances the groundwater and face pressures by the use of a slurry pressure balance system. System must be capable of adjustment required to maintain stability of the excavation face for the subsurface conditions to be encountered and must monitor and continuously balance the groundwater and face pressure to prevent loss of slurry or uncontrolled groundwater inflow.

(ii) For Earth Pressure-Balance System: Include an automated spoil transportation system that balances the groundwater and face pressures by the use of an earth pressure-balance system that controls the rate of passage of excavated material through the balanced screw auger or valves on the screw conveyer. System must be capable of adjustment required to maintain stability of the excavation face for the subsurface conditions to be encountered and must monitor and continuously balance the groundwater and face pressure to prevent uncontrolled groundwater inflow.

(h) Be fully steerable both horizontally and vertically.

(i) Be capable of injecting lubricant between precast concrete pipe and strata to reduce friction between precast concrete pipe and strata.

(2) Guidance of the microtunnel boring machine must be through a remote console by means of active direction control, in or adjacent to the launching shaft. At a minimum, the thrust force, rate

of advance, distance along heading, deviation from line, and deviation from grade must be monitored and displayed on the remote console.

(D) SAFETY

The Contractor must carry out the Contractor's operations in strict accordance with OSHA, NYC, and the Manufacturer's safety requirements.

The Contractor must provide adequate ventilation in the shafts at all times. Air quality in the shafts must be tested immediately prior to each change in shift. Air quality in the jacked pipe must be tested prior to personnel entry and periodically thereafter as required by law.

The Contractor must provide adequate lighting in the tunnel shafts and around equipment being utilized. Power and lighting circuits must be separated and thoroughly insulated.

(E) GEOTECHNICAL INSTRUMENTATION

The Contractor must install and monitor geotechnical instrumentation at the locations and in accordance with the requirements shown, specified, ordered, or approved.

50.62.6 QUALIFICATIONS

The microtunneling/pipe-jacking Contractor or subcontractor performing the work required under this contract must be experienced in work of this nature and must have successfully completed a minimum of two (2) tunneling projects in the last five (5) years using pressurized face microtunneling/pipe-jacking equipment with a closed face tunnel shield and positive controlled face pressure. One of the successfully completed projects must have been in similar ground conditions (strata type and hydrostatic head) as to those anticipated on this contract. The Contractor must submit a description of such projects, which must include at a minimum, a listing of the locations, dates of projects, owners, pipe types and sizes, type of equipment utilized, ground conditions, drive lengths, maximum line and grade deviations, and other information relevant to the issue of the successful completion of such projects.

The microtunneling/pipe-jacking project superintendent must have experience in managing microtunneling/pipe-jacking projects similar to this contract.

The microtunneling/pipe-jacking machine operator(s) must have experience in using the same type of equipment required for this project, namely, pressurized face microtunneling/pipe-jacking equipment with a closed face tunnel shield and positive, controllable tunnel face pressure.

Prior to the start of work, the Contractor will be required to submit the name and resume of the microtunneling/pipe-jacking subcontractor for approval.

50.62.7 REPORTING REQUIREMENTS

The Contractor must maintain a Daily Log of all microtunneling/pipe-jacking activities. A copy of this log must be submitted to the Engineer on a daily basis. The log, at a minimum, must record the following in relationship to the advancement rate: (Advancement rate utilized for recording must be in one (1) foot intervals, unless otherwise directed by the Engineer.)

(1) Date and Time compared to the advancement rate.
(2) Total Jacking Pressures compared to the advancement rate, including all peak pressures.
(3) Cutter Head Torque compared to the advancement rate.
(4) Position of the Tunnel Boring Machine with respect to the design line and grade.
(5) Amounts, times, and locations of lubrication.
(6) Unusual events or problems encountered.
(7) Upon completion of a bore (launching shaft to receiving shaft), the locations, pressures, and amounts of grout placed to fill all voids between the outside of the jacked precast concrete pipe and the soil/rock.

50.62.8 CLEANING

Upon completion of a bore (launching shaft to receiving shaft) and the grouting of all voids between the outside of the jacked precast concrete pipe and the soil/rock, the Contractor will be required to remove and properly dispose of all sediments and deposits from within the jacked precast concrete pipe.

The Contractor must furnish all water and pumping equipment necessary for the cleaning operation.

50.62.9 INSPECTION AND TESTING

Immediately after the completion of the cleaning operation, the Engineer will conduct (unless waived in writing by the Engineer) a visual inspection of the jacked precast concrete pipe for any defect or leakage so those repairs, if necessary, can be made.

The Contractor must provide the Engineer, without charge, all facilities and assistance necessary to perform this visual inspection of the jacked precast concrete pipe, and for obtaining any information the Engineer requires in order to access the progress and manner of the work performed.

The entire installation procedure must be rigorously inspected as herein specified, but inspection must not relieve the Contractor of responsibility to furnish material and perform work in accordance with the specifications. If at any time it is found that the pipe insertion procedure is not in accordance with these specifications, the pipe so installed will be subject to rejection.

After the Engineer's visual inspection or waiver of visual inspection, the Contractor must test for leakage in the jacked precast concrete pipe in accordance with **Section 40.11 - Leakage And Leakage Tests For Sewer Lines**.

Leakage or infiltration in excess of the specified amount must be located and stopped and all visible leaks must be stopped to the satisfaction of the Engineer, all at the Contractor's own expense.

Upon completion of all work, the Contractor must perform a television inspection and digital audio-visual recording of all sewers reconstructed in accordance with **Section 53.11** of the specifications. Payment for television inspection and digital audio-visual recording must be made under Item No. 53.11DR - TELEVISION INSPECTION AND DIGITAL AUDIO-VISUAL RECORDING OF SEWERS.

50.62.10 GROUTING

Upon completion of a jacked section (launching shaft to receiving shaft), the Contractor must immediately pressure grout from the interior of the jacked precast concrete pipe. Pressure grout must be placed under pressure to fill all annular voids between the outside of the jacked precast concrete pipe and the soil/rock.

Systems of standard pipe, fittings, hose and threaded injection ports, and check valves with stainless steel threaded plugs (factory installed) embedded in the precast concrete pipe walls must be provided by the Contractor. Care must be taken to ensure that parts of the system are maintained free from dirt. Cement grout must be forced under pressure into the threaded injection ports. Grouting must start at the lowest injection port, and must proceed until grout begins to flow from upper injection port. Connections must then be made to those injection ports and the operation continued to completion. During the grouting process, each stainless steel plug must be removed and the grout-mixing machine must be connected to the injection port by means of a hose and nipple cut to the same thread as the injection port.

The jacked precast concrete pipe must be supplied with embedded factory installed threaded injection ports and check valves with stainless steel threaded plugs flush with the inside and outside faces of the pipe so as to prevent infiltration of displaced earth during the jacking and grouting processes. Stainless steel threaded plugs when installed must be flush with the inside face of the pipe. Factory installed threaded injection ports and check valves with stainless steel threaded plugs must be of a diameter approved by the Engineer and compatible with the requirements of the Contractor's grouting operation. Three (3) injection ports spaced one hundred twenty (120) degrees on center must be installed on each section of pipe.

Apparatus for mixing and placing grout must be capable of mixing effectively and stirring the grout and then forcing it into the injection ports in a continuous uninterrupted flow. When grouting is completed the stainless steel threaded plugs in each section must be installed into the injection ports so as to provide a watertight seal.

The Contractor must take all necessary precautions to prevent grout from escaping and setting on inner surface of precast concrete pipe. The Contractor must remove such grout and restore the surface to its original condition.

The Contractor must provide the Engineer all facilities necessary for the inspection of pressure grouting operation to ensure complete filling of the annular void. These facilities must include removing of stainless steel plugs as required for inspection behind the jacked precast concrete pipe. Any voids found must be grouted at once as directed by the Engineer.

The Contractor must keep and furnish to the Engineer an accurate log of grouting operations, pressures, rates of pumping, amount of cement for each change in water/cement ratio, and such other data as are

required by the Engineer. The log must be supplied by the Contractor to the Engineer or the Engineer's representative after each shift.

50.62.11 PROTECTIVE COATING FOR PRECAST REINFORCED CONCRETE PIPE

All jacked precast reinforced concrete pipe must be coated inside with two (2) coats of Koppers Bitumastic No. 300-M protective coating and with one (1) coat of a white Acrylic topcoat (Kop-Coat 600 Acrylic or Carbocrylic White S800) or approved equals.

Coating on the jacked precast reinforced concrete pipe must be applied prior to its placement. Prior to coating the jacked precast reinforced concrete pipe, the Contractor must be required to receive written approval from the Engineer that the surface to be coated is judged suitable to receive the protective coating as recommended by the coating manufacturer and/or the Engineer.

The Contractor is notified that if for any reason the coating manufacturer and/or Engineer conclude that the surfaces are not ready for coating, then immediately prior to applying, the coating the surfaces must be cleaned and/or treated as directed. Surfaces must be brushed and thoroughly cleaned. Surfaces must then be permitted to dry thoroughly. All work must be performed to the complete satisfaction of the Engineer.

Prior to applying the protective coating, all requirements and conditions of **DIVISION III - INSPECTION OF MATERIAL, SAMPLING AND METHODS OF TEST** must be complied with.

Base and hardener must be mixed in accordance with the manufacturers' recommendations and after final mixing must be applied in the presence of the Engineer within the time period stipulated by the manufacturer of the coating material. The Engineer must certify to the adequacy of the coating work (i.e., mixing application). The coating must be evenly applied in required number of coats by an airless spraying procedure approved by the Engineer.

Each protective coat must be at least ten (10) mils minimum dry film thickness. The total thickness for all pipes of the finished protective coating must be twenty (20) mils minimum dry film thickness.

The second protective coat must not be applied until the first protective coat is allowed to dry tack free. If a protective coat is permitted to cure more than seventy-two (72) hours, it must first be treated and/or conditioned as recommended by the coating material manufacturer before application of an additional coat will be permitted.

The Engineer prior to final acceptance of the work must certify all coating and thickness of coatings.

After the second coat has been approved by the Engineer, a white top coat, three (3) mils minimum dry film thickness, must be applied as recommended by the coating manufacturer and/or Engineer.

50.62.12 MEASUREMENT

The quantity of direct jacked precast concrete pipe sewers to be measured for payment must be the number of linear feet of each size, kind, type, class, and wall thickness of direct jacked precast concrete pipe sewer incorporated in the work, complete, as shown, specified or required, measured horizontally along the center lines of sewers. Measurement must be from inside face of launching shaft to inside face of receiving shaft.

50.62.13 PRICE TO COVER

The contract price for "DIRECT JACKED PRECAST CONCRETE PIPE SEWERS" must be the unit price bid per linear foot for each size, kind, type, class, and wall thickness of direct jacked precast concrete pipe sewer and must cover the cost of all labor, materials, plant, equipment, samples, tests, and insurance required and necessary to construct the direct jacked precast concrete pipe sewers of the sizes and to the lines and grades shown, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**), additional subsurface investigations; geotechnical instrumentation, all sheeting and bracing, pumping, fluming, bridging, connections, maintaining flow in sewers, backfilling, launching and receiving shafts (including intermediate launching shafts), complete (including temporary excavation supports, groundwater control, thrust block, jacking frame, launch and exit seals, etc.), installation of precast concrete pipe sewers by direct jacking, grouting required to fill voids between the outside of the jacked precast concrete pipe sewer and the soil/rock, cleaning of jacked precast concrete pipe sewer, application of protective coating and top coating to interior surfaces of precast concrete pipe; inspection and testing; preparation, submittal and approval of all required shop drawings and designs, obtaining of all necessary permits, and furnishing and installing all other items necessary to

complete this work and do all work incidental thereto, all in accordance with the contract drawings, specifications and standards and as directed by the Engineer.

In addition, included in the price hereunder must be the cost of all labor and materials necessary to remove all specified and ordered existing sewers, manholes, structures, and appurtenances that may be in the launching and receiving shafts and in the line of the work and to do all the work incidental thereto, all in accordance with **Subsections 10.13 and 10.28** of the specifications and as directed by the Engineer.

Payment for Direct Jacked Precast Concrete Pipe Sewers will be made under the Item Number as calculated below:

The Item Numbers for Direct Jacked Precast Concrete Pipe Sewers have ten characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Direct Jacked Precast Concrete Pipe Sewers:

50.62

(2) The sixth character must define the Type of Sewer Effluent:

S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer

(3) The seventh and eighth characters must define the Diameter of the Precast Concrete Pipe Sewer to be Direct Jacked. (The seventh and eighth characters representing the unit of inches for the Diameter of the Precast Concrete Pipe Sewer to be Direct Jacked.) See examples below:

24 - 24”
78 - 78”

(4) The ninth character must define the Kind of Precast Concrete Pipe Sewer to be Direct Jacked:

R - Reinforced Concrete Pipe (R.C.P.)
P - Polymer Concrete Pipe (P.C.P.)

(5) The tenth character must define the Class of Precast Concrete Pipe Sewer to be Direct Jacked:

4 - Class IV
5 - Class V

(6) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
50.62S24R4	DIRECT JACKED 24” R.C.P. CLASS IV SANITARY SEWER	L.F.
50.62S30R4	DIRECT JACKED 30” R.C.P. CLASS IV SANITARY SEWER	L.F.
50.62S36R4	DIRECT JACKED 36” R.C.P. CLASS IV SANITARY SEWER	L.F.
50.62S42R4	DIRECT JACKED 42” R.C.P. CLASS IV SANITARY SEWER	L.F.
50.62S48R4	DIRECT JACKED 48” R.C.P. CLASS IV SANITARY SEWER	L.F.
50.62S24R5	DIRECT JACKED 24” R.C.P. CLASS V SANITARY SEWER	L.F.
50.62S30R5	DIRECT JACKED 30” R.C.P. CLASS V SANITARY SEWER	L.F.
50.62S36R5	DIRECT JACKED 36” R.C.P. CLASS V SANITARY SEWER	L.F.
50.62S42R5	DIRECT JACKED 42” R.C.P. CLASS V SANITARY SEWER	L.F.
50.62S48R5	DIRECT JACKED 48” R.C.P. CLASS V SANITARY SEWER	L.F.
50.62S24P5	DIRECT JACKED 24” P.C.P. CLASS V SANITARY SEWER	L.F.
50.62S30P5	DIRECT JACKED 30” P.C.P. CLASS V SANITARY SEWER	L.F.
50.62S36P5	DIRECT JACKED 36” P.C.P. CLASS V SANITARY SEWER	L.F.
50.62S42P5	DIRECT JACKED 42” P.C.P. CLASS V SANITARY SEWER	L.F.
50.62S48P5	DIRECT JACKED 48” P.C.P. CLASS V SANITARY SEWER	L.F.
50.62M24R4	DIRECT JACKED 24” R.C.P. CLASS IV STORM SEWER	L.F.
50.62M30R4	DIRECT JACKED 30” R.C.P. CLASS IV STORM SEWER	L.F.
50.62M36R4	DIRECT JACKED 36” R.C.P. CLASS IV STORM SEWER	L.F.
50.62M42R4	DIRECT JACKED 42” R.C.P. CLASS IV STORM SEWER	L.F.
50.62M48R4	DIRECT JACKED 48” R.C.P. CLASS IV STORM SEWER	L.F.
50.62M54R4	DIRECT JACKED 54” R.C.P. CLASS IV STORM SEWER	L.F.

Item No.	Description	Pay Unit
50.62M60R4	DIRECT JACKED 60” R.C.P. CLASS IV STORM SEWER	L.F.
50.62M66R4	DIRECT JACKED 66” R.C.P. CLASS IV STORM SEWER	L.F.
50.62M72R4	DIRECT JACKED 72” R.C.P. CLASS IV STORM SEWER	L.F.
50.62M78R4	DIRECT JACKED 78” R.C.P. CLASS IV STORM SEWER	L.F.
50.62M84R4	DIRECT JACKED 84” R.C.P. CLASS IV STORM SEWER	L.F.
50.62M90R4	DIRECT JACKED 90” R.C.P. CLASS IV STORM SEWER	L.F.
50.62M96R4	DIRECT JACKED 96” R.C.P. CLASS IV STORM SEWER	L.F.
50.62M24R5	DIRECT JACKED 24” R.C.P. CLASS V STORM SEWER	L.F.
50.62M30R5	DIRECT JACKED 30” R.C.P. CLASS V STORM SEWER	L.F.
50.62M36R5	DIRECT JACKED 36” R.C.P. CLASS V STORM SEWER	L.F.
50.62M42R5	DIRECT JACKED 42” R.C.P. CLASS V STORM SEWER	L.F.
50.62M48R5	DIRECT JACKED 48” R.C.P. CLASS V STORM SEWER	L.F.
50.62M54R5	DIRECT JACKED 54” R.C.P. CLASS V STORM SEWER	L.F.
50.62M60R5	DIRECT JACKED 60” R.C.P. CLASS V STORM SEWER	L.F.
50.62M66R5	DIRECT JACKED 66” R.C.P. CLASS V STORM SEWER	L.F.
50.62M72R5	DIRECT JACKED 72” R.C.P. CLASS V STORM SEWER	L.F.
50.62M78R5	DIRECT JACKED 78” R.C.P. CLASS V STORM SEWER	L.F.
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50.62C24R4	DIRECT JACKED 24” R.C.P. CLASS IV COMBINED SEWER	L.F.
50.62C30R4	DIRECT JACKED 30” R.C.P. CLASS IV COMBINED SEWER	L.F.
50.62C36R4	DIRECT JACKED 36” R.C.P. CLASS IV COMBINED SEWER	L.F.
50.62C42R4	DIRECT JACKED 42” R.C.P. CLASS IV COMBINED SEWER	L.F.
50.62C48R4	DIRECT JACKED 48” R.C.P. CLASS IV COMBINED SEWER	L.F.
50.62C54R4	DIRECT JACKED 54” R.C.P. CLASS IV COMBINED SEWER	L.F.
50.62C60R4	DIRECT JACKED 60” R.C.P. CLASS IV COMBINED SEWER	L.F.
50.62C66R4	DIRECT JACKED 66” R.C.P. CLASS IV COMBINED SEWER	L.F.
50.62C72R4	DIRECT JACKED 72” R.C.P. CLASS IV COMBINED SEWER	L.F.
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50.62C24R5	DIRECT JACKED 24” R.C.P. CLASS V COMBINED SEWER	L.F.
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50.62C48R5	DIRECT JACKED 48” R.C.P. CLASS V COMBINED SEWER	L.F.
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50.62C84R5	DIRECT JACKED 84” R.C.P. CLASS V COMBINED SEWER	L.F.
50.62C90R5	DIRECT JACKED 90” R.C.P. CLASS V COMBINED SEWER	L.F.
50.62C96R5	DIRECT JACKED 96” R.C.P. CLASS V COMBINED SEWER	L.F.

Item No.	Description	Pay Unit
50.62C24P5	DIRECT JACKED 24” P.C.P. CLASS V COMBINED SEWER	L.F.
50.62C30P5	DIRECT JACKED 30” P.C.P. CLASS V COMBINED SEWER	L.F.
50.62C36P5	DIRECT JACKED 36” P.C.P. CLASS V COMBINED SEWER	L.F.
50.62C42P5	DIRECT JACKED 42” P.C.P. CLASS V COMBINED SEWER	L.F.
50.62C48P5	DIRECT JACKED 48” P.C.P. CLASS V COMBINED SEWER	L.F.
50.62C54P5	DIRECT JACKED 54” P.C.P. CLASS V COMBINED SEWER	L.F.
50.62C60P5	DIRECT JACKED 60” P.C.P. CLASS V COMBINED SEWER	L.F.
50.62C66P5	DIRECT JACKED 66” P.C.P. CLASS V COMBINED SEWER	L.F.
50.62C72P5	DIRECT JACKED 72” P.C.P. CLASS V COMBINED SEWER	L.F.
50.62C78P5	DIRECT JACKED 78” P.C.P. CLASS V COMBINED SEWER	L.F.
50.62C84P5	DIRECT JACKED 84” P.C.P. CLASS V COMBINED SEWER	L.F.
50.62C90P5	DIRECT JACKED 90” P.C.P. CLASS V COMBINED SEWER	L.F.
50.62C96P5	DIRECT JACKED 96” P.C.P. CLASS V COMBINED SEWER	L.F.

SECTION 50.71 – CURED-IN-PLACE (CIPP) LINING METHOD

50.71.1 INTENT

It is the intent of this section to provide for the reconstruction of existing sewers by the installation of a resin-impregnated flexible tube that is inflated within the existing conduit to form a hard, impermeable, corrosion resistant pipe within a pipe. When cured, the cured-in-place-pipe (CIPP) will be formed to the original conduit.

50.71.2 REQUIREMENTS

(A) DESCRIPTION OF WORK

Unless otherwise specified in the contract, the Contractor must use a Department of Environmental Protection (DEP) approved cured-in-place-pipe lining method on all existing sewers shown, specified, or ordered to be reconstructed under this contract by use of an approved lining method. All such work must comply with the terms of this specification and with the manufacturer's standards set forth for the lining method(s) selected by the Contractor.

Under this method the Contractor must reconstruct existing sewers by the insertion of either a flexible polyester felt or glass fiber lining tube that has been saturated with either a thermosetting or photosetting resin. The liner must be inserted into the existing sewer either by direct inversion (ASTM F1216) using a head of water or air, or by pulling the tube into place by winching and then inflating it by inversion of a calibration hose (ASTM F1743). The thermosetting resin must then be cured by either circulating hot water through the tube or by circulating hot air (a mixture of steam and air), or by circulating steam to cure the resin into a hard impermeable pipe. The photo-initiated resin must be exposed to an ultraviolet light source to cure the resin into a hard impermeable pipe.

The Contractor must make all investigations of the existing sewers to be reconstructed and determine and select the most effective approved lining method(s) appropriate for installation in the existing sewers to be reconstructed. The Contractor is responsible for the successful completion of all work required herein; failure of the Contractor's selected lining method(s) to be satisfactorily installed in the existing sewers must not relieve the Contractor of the Contractor's responsibility to provide satisfactorily reconstructed sewers.

Any cost associated with the removal of the unsatisfactorily installed liner and the subsequent, satisfactory reinstallation of an approved liner must be borne solely by the Contractor, and the Contractor must not make any claim against the City for this additional required work.

Once installed, the liner must extend from manhole to manhole in a continuous tight-fitting watertight pipe-within-a-pipe, and be chemically resistant to sewage gases and materials. During the warranty period any defects that might affect the integrity or strength of the liner must be immediately repaired or replaced by the Contractor, at the Contractor's expense, pursuant to the manufacturer's recommendations, and to the satisfaction of the Engineer.

(B) REFERENCE SPECIFICATIONS AND STANDARDS

The American Society for Testing and Materials Standard Specifications ASTM C581, D638, D790, D2990, D5813, F1216, F1743, and F2019, and the manufacturer's standards are hereby made a part of this specification.

(C) LINER SIZE AND LENGTH

The liner must be fabricated to a size that when installed will neatly fit the internal circumference of the sewer to be lined. The liner thickness must be designed to adequately resist all external pressures and conditions (e.g. deflection, ring bending, buckling and minimum stiffness). The length of the liner must be that deemed necessary to effectively span the distance and carry out the insertion and seal of the liner at the inlet and outlet manholes. The Contractor must verify the lengths in the field before cutting the liner to length. Prior to the start of work the Contractor will be required to submit design calculations for wall thickness to the Engineer. When UV-cured liners are used, the Contractor must also submit the manufacturer's product specific data regarding the glass fiber tube, the resin and initiator cocktail system and the necessary manufacturer installation reference material detailing the type of light source and the speed in which it will be advanced to insure proper curing.

Allowance for circumferential and longitudinal stretching of the liner during installation must be made as per the manufacturer's standards for the approved method of lining chosen. The finished wall thickness of liner must not be less than six (6) millimeters in thickness.

(D) DESIGN PARAMETERS - The following design parameters must be used in the design of pipe liners in addition to the manufacturer's standards:

(1)	Ovality of Existing Pipe	2% Minimum
(2)	Existing Pipe Condition	Fully Deteriorated
(3)	Modulus of Soil Reaction	700-psi Minimum
(4)	Factor of Safety Against Buckling	2 Minimum
(5)	Allowable Deflection	5% Maximum
(6)	Ratio of Pipe to Soil Strength	10% Minimum
(7)	Live Load	AASHTO HS20-44 Loading under Roadways AASHTO E-80 Loading under Railroads
(8)	Soil Unit Weight	120-pcf Minimum (If no Boring Data is available in vicinity.)
(9)	Creep Reduction Factor	50% Maximum

(E) LINER MATERIAL - The Contractor must furnish, prior to use of the lining materials, satisfactory written guarantee of the Contractor's compliance with the liner manufacturer's standards for all materials (polyester felt tubing, including the polyurethane covered felt and the thermosetting resin or glass fiber tubing soaked in photosetting resin) and techniques being used in the method.

Prior to the start of work the Contractor will be required to submit to the Engineer the types of resins and the resultant cure schedules for each length and size of sewer to be lined. The finished liner must incorporate thermosetting materials that will withstand the corrosive effects of the normal existing effluents.

(F) SAFETY - The Contractor must carry out the Contractor's operations in strict accordance with all OSHA and manufacturer's safety requirements. Emphasis must be placed upon safety requirements for entering confined spaces and working with hot water, steam, or resins that may cause fumes.

The Contractor must erect such signs and other devices as are necessary for the safety of the work site and must secure the site and conform all work to the safety requirements of all pertinent regulatory agencies.

(G) AIR QUALITY - The Contractor is advised that all liner installation work must be carried out in full compliance with all City, State, and Federal laws, rules, and regulations regarding Air Quality and Safety.

The contractor must take all necessary precautions to minimize the release of styrene or other VOC emissions and mitigate odors generated during set and the CIPP lining process. The Contractor must also take all necessary precautions to prevent such odors from entering structures, businesses or other types of establishments, through service connections or other plumbing fixtures.

(H) FLOW BYPASSING - Prior to the start of work the Contractor will be required to submit a fluming/bypass-pumping detail in accordance with **Subsection 10.13 - (3) Existing Flow**. The Contractor must provide for the diversion of flow of existing sewers at existing upstream manholes (if available) and pump the flow into an existing downstream manhole. The pumps and bypass lines must be of adequate capacity and size to handle the flow. The proposed bypassing system must be submitted to the Engineer for approval and no work must commence until such approval is granted.

(I) TELEVISION INSPECTION PRIOR TO INSTALLATION - All bidders are advised that a digital audio-visual inspection was made of the sewers to be reconstructed and that this recording (the "DEP recording") is available for review prior to bid opening. All prospective bidders are urged to view this recording in order to assess the suitability of the lining methods for use on this project. The City of New York does not guarantee the successful use of any particular method on this project and the Contractor must utilize the Contractor's judgment as to the effective use of the method(s) the Contractor selects.

The Contractor will also be required to perform another television inspection and digital audio-visual recording of the sewer a maximum of seven (7) days prior to the setting up of the liner insertion equipment at the site. This inspection will be performed, utilizing a radial eye camera, to determine the latest condition of the sewer and to accurately identify the location of active service connections. Should the results of this television inspection show a condition different than that shown on the DEP recording, the Contractor must immediately notify the Engineer.

For each section to be lined, the Contractor must certify in writing that the DEP approved method the Contractor intends to use is suitable.

(J) CLEANING - The Contractor must furnish all labor, materials and equipment and must do all work necessary to remove and dispose of all debris, sediment, silt, refuse, timber, roots, and materials of all kinds which can be removed by conventional non-excavation type pipe cleaning equipment located in the existing sewers and manholes. The Contractor must immediately notify the Engineer if such debris, etc., cannot be removed by conventional non-excavation type pipe cleaning equipment.

Protruding service connections must be removed and paid for consistent with **Section 52.51**.

(K) SERVICE CONNECTIONS - The Contractor must be required to determine which service connections are active and must be responsible for controlling (or maintaining) the flow for each active service connection along the line of the sewer to be rehabilitated. Where necessary, the flow from an active service connection must be bypassed to a manhole downstream of the proposed work by means of pumping from the trap located in the basement of the affected building. However, should such bypassing be judged unfeasible by the Engineer, the Contractor must excavate to the service connection outside the building area (sidewalk or roadway as determined by the Engineer) and bypass the connection from this point. The pump and bypass line for each service connection must be of adequate capacity and size to handle the flow.

Prior to the commencement of any work, the Contractor must make all necessary investigations and prepare a plan for the controlling (or maintaining) of the flow and, where necessary, for the bypassing of active service connections. This plan must be submitted to the Engineer for approval and no work must commence until such approval is granted.

(L) EQUIPMENT SPECIFICATION - The Contractor must provide suitable temperature and pressure gauges in accordance with the manufacturer's standards and specifications. High-pressure steam hoses and fittings have to be rated in accordance with the steam generator used. Thermocouples are to be marked for each fluid to be conveyed: RED-steam; BLUE-water; GREEN-air. The pulling winch must be equipped with a tension gauge (Type-Martin Decker or Approved Equal) - smooth running and variable speed. The cutting device must be a Gulectron type or approved equal remote monitored device when used inside the lined pipe.

The Contractor must prepare and inspect all necessary tools and any spare parts that are required for equipment that suffer frequent breakdowns, and must ensure that said tools and spare parts are available at the site. Supporting equipment, such as pumps and generators, must be provided at the site in the event there is a fluid surge and pumping is required on an emergency basis. The Contractor must also prepare and make operable all necessary communication equipment for the Contractor’s field crew.

(M) INSTALLATION OF LINER - Prior to the installation of liner, the Contractor must fully comply with **Subsections 50.71.2(C) through 50.71.2(L)**, inclusively, and with any additional requirements set forth in the specific provisions applicable to the respective lining methods. The Contractor cannot proceed with the installation of liner until the Engineer, in writing, certifies such compliance and directs the Contractor to proceed with the lining installation. The approved liner must be installed pursuant to the specific provisions set forth for the selected lining method. If any problem occurs during the installation operation the Contractor must investigate with a television camera from the remote manhole.

(N) PRELIMINARY TELEVISION INSPECTION OF INSTALLED LINER - After the liner is sufficiently cool (below one hundred degrees Fahrenheit (100°F)) and before opening the service connections, a preliminary television inspection and digital audio-visual recording of the newly installed liner must be performed to determine if the liner is properly installed.

(O) SERVICE CONNECTIONS - After the liner has been installed, the Contractor must re-open all existing active service connections and those inactive connections ordered by the Engineer. These service connections must be re-opened and paid for consistent with **Section 52.61**.

(P) FINAL TELEVISION INSPECTION AFTER INSTALLATION - A final television inspection and digital audio-visual recording of the newly lined sewer including the restored service connections must be performed immediately after work is completed. Should the results of this final inspection reveal any defects, as determined by the Engineer, the Contractor will be required to repair or replace these defects as ordered by the Engineer at the sole expense of the Contractor.

Payment for this final television inspection will be made under Item No. 53.11DR - TELEVISION INSPECTION AND DIGITAL AUDIO-VISUAL RECORDING OF SEWERS.

(Q) WORK SCHEDULE - The Contractor must be permitted to occupy the lane immediately above the sewer location and the parking lane immediately adjacent to the site of work unless otherwise specified. No further roadway or traffic restrictions will be permitted.

50.71.3 INSTALLATION

(1) PREPARING AND INSERTING THE LINER - The Contractor must designate a location where the uncured resin in the original containers and the un-impregnated liner will be impregnated prior to installation. The Contractor must allow the Engineer and/or the Engineer's representative to inspect the materials and chemical impregnation "wet out" procedure. A resin and catalyst system compatible with the requirement of this method must be used. The quantities of the liquid thermosetting materials inserted into the lining tube must be as per manufacturer's standards so as to fully saturate the liner material and provide the lining thickness specified. The contractor must protect, store and handle materials during transportation and delivery, while stored on-site and during installation following Manufacturer's recommendations. Liners impregnated with thermo-initiated resins must be stored within the proper temperature range and liners impregnated with photo-initiated resins must not be exposed to UV-light sources, to insure no premature curing occurs.

Prior to installation of liner, the downstream sewer manhole adjacent to the sewer section to be lined must be plugged.

The chemical impregnated liner material must be inserted into the sewer line being reconstructed through the existing manhole by either the direct inversion method or by the pull-in-place method, as recommended by the manufacturer. The head used to extend the liner tube must be sufficient enough to fully extend the tube both circumferentially and longitudinally. The head used will fall within the manufacturer's guidelines to insure that a proper finished thickness is achieved and that the liner fit snug to the existing pipe wall producing dimples at service connections and flared ends at the entrance and exit manholes.

Winch cable must be equipped with a tension gauge to measure tension during pull through.

Inflation of liners and heat source method used must be accomplished in accordance with manufacturer's standards and specifications.

Curing temperatures and pressures must be monitored so as not to overstress the liner and cause damage or failure of the liner prior to cure.

The use of a lubricant is recommended and such lubricant must be compatible with liner and resin.

The Contractor will be required to monitor and remove styrene to acceptable levels during the inflation and curing processes. An activated carbon filtration system must be employed to remove styrene from both the process air flow and condensed steam, prior to release into the air or an adjacent or downstream sanitary or combined sewer manhole.

(2) CURING OF LINER - After inflation or inversion is completed, the Contractor must supply a suitable heat source. The equipment must be capable of delivering steam or hot water to the far end of the liner to uniformly raise the temperature in the entire liner above the temperature required to initiate and effect curing of the resin system. The temperature must be determined by the resin/catalyst system employed. The heat source must be fitted with suitable monitors to gauge the temperature and pressure of the incoming and outgoing heat exchanger circulating heating medium. Thermocouples must be placed between the liner and the invert at each manhole so as to determine and record the temperature of the liner and time of exotherm. Initial cure must be deemed to be completed when inspection of the exposed portions of the liner show it to be hard and sound; and when temperature reading(s) at the interface of the liner with the host pipe indicate sufficient heating has occurred. The cure period must be of a duration recommended by the resin manufacturer; modified for the site specific conditions at the time curing is affected. During this cure time, the temperature inside the liner will be continuously maintained in the range required.

Once the cure is complete, the Contractor must cool the hardened liner to a temperature below one hundred degrees Fahrenheit (100ºF) before relieving the internal pressure. Cool down must be accomplished as recommended by the manufacturer. Care must be taken in the release of the internal pressure so that a vacuum will not develop that could damage the newly installed liner.

For UV-light CIPP systems, the intensity and duration of exposure to the photo-initiator's required UV-light wavelength must be as per the manufacturer's recommendations for the proposed size and thickness of tube, to insure that the liner has been cured completely. The UV-light source must be fitted with multiple temperature sensors to insure that reaction temperatures stay within the Manufacturer's acceptable range

and do not blister the interior liner. All lamps must be monitored to ensure that they are on and functioning properly. In the event that a lamp fails or the reaction temperatures fall below the Manufacturer's acceptable range during CIPP installation, the Contractor must reduce the speed of the light source (increasing the exposure duration) by the Manufacturer's specified amount. The Manufacturer's recommended cooling phase must be observed after the last lamp of the light source has been turned off.

The finished lining must be continuous over the entire length and be free from visual defects such as foreign inclusions, dry spots, pinholes and delamination. The lining must be impervious and free of any leakage from the pipe to the surrounding ground or from the ground to the inside of the lined pipe.

If due to broken or misaligned pipe at the access manhole, the lining fails to make a tight seal, the Contractor must apply a seal of a resin mixture compatible with the liner.

After the curing has been completed, any residual water and condensation that adheres to the inner wall of the liner must be removed. This residual water must be collected and pumped from the channel of the downstream manhole and circulated through a separate carbon filtration unit before discharge into a downstream sanitary or combined sewer manhole. In the case of lining a storm sewer section, the collected filtered residual water and process water must not be discharged into the downstream manhole or stream, but discharged into a nearby sanitary manhole.

50.71.4 MEASUREMENT

The quantity to be measured for payment must be the length of reconstructed sewer, accepted by the Engineer, measured horizontally along the centerline of the sewer from inside face of manhole to inside face of manhole.

50.71.5 PRICE TO COVER

The contract price for "RECONSTRUCTION OF EXISTING SEWERS, USING D.E.P. APPROVED CIPP LINING METHOD" must be the unit price bid per linear foot for each size sewer reconstructed by a cured-in-place-pipe DEP approved lining method and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required or necessary to reconstruct the sewers of the sizes shown including the cleaning of the existing sewers using conventional non-excavation type pipe cleaning equipment; television inspection prior to installation; diversion of flow of existing sewers; controlling (or maintaining) the flow for all active service connections; necessary bypassing and pumping of the existing active service connections; repair of active service connections; all necessary excavation, backfilling and compaction; complete installation of the liner; preliminary television inspection of installed liner; temporary and permanent restoration of all disturbed sidewalk and pavement areas (unless items for temporary and permanent restoration are otherwise provided in the Bid Schedule); cleaning up; and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans and specifications and as directed by the Engineer.

50.71.6 SEPARATE PAYMENT

Payment for this final television inspection will be made under Item No. 53.11DR - TELEVISION INSPECTION AND DIGITAL AUDIO-VISUAL RECORDING OF SEWERS.

Payment for Reconstruction Of Existing Sewers Using D.E.P. Approved Cured-In-Place-Pipe (CIPP) Lining Method will be made under the Item Number as calculated below:

The Item Numbers for Reconstruction Of Existing Sewers Using D.E.P. Approved Cured-In-Place-Pipe (CIPP) Lining Method have eleven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Reconstruction Of Existing Sewers Using D.E.P. Approved Cured-In-Place-Pipe (CIPP) Lining Method:

50.71

(2) The sixth character must define the Type of Sewer Effluent:

S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer
I - Interceptor Sewer

(3) The seventh and eighth characters must define either the Diameter of the Sewer for Existing Circular Sewers or the Width of the Sewer for Existing Horizontal Elliptical Sewers, Vertical Elliptical Sewers and Egg-Shaped Sewers. (The seventh and eighth characters representing the unit of inches for either the Diameter of the Sewer for Existing Circular Sewers or the Width of the Sewer for Existing Horizontal Elliptical Sewers, Vertical Elliptical Sewers and Egg-Shaped Sewers.) See examples below:

10 - 10”
30 - 30”

(4) The ninth character must define the Shape of the Existing Sewer:

D - Circular (Diameter)
H - Horizontal Elliptical
V - Vertical Elliptical
E - Egg-Shaped
R - Rectangular

(5) The tenth and eleventh characters must define either Circular or the Height of the Sewer for Existing Horizontal Elliptical Sewers, Vertical Elliptical Sewers and Egg-Shaped Sewers. (The tenth and eleventh characters representing either Circular or the unit of inches for the Height of the Sewer for Existing Horizontal Elliptical Sewers, Vertical Elliptical Sewers and Egg-Shaped Sewers.) See examples below:

00 - Circular
19 - 19”
32 - 32”

(6) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
50.71S10D00	RECONSTRUCTION OF EXISTING 10” DIAMETER CIRCULAR SANITARY SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71S12D00	RECONSTRUCTION OF EXISTING 12” DIAMETER CIRCULAR SANITARY SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71S18D00	RECONSTRUCTION OF EXISTING 18” DIAMETER CIRCULAR SANITARY SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71S24D24	RECONSTRUCTION OF EXISTING 24” DIAMETER CIRCULAR SANITARY SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71S23H14	RECONSTRUCTION OF EXISTING 23”W X 14”H HORIZONTAL ELLIPTICAL SANITARY SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71S30H19	RECONSTRUCTION OF EXISTING 30”W X 19”H HORIZONTAL ELLIPTICAL SANITARY SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71S14V23	RECONSTRUCTION OF EXISTING 14”W X 23”H VERTICAL ELLIPTICAL SANITARY SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71S19V30	RECONSTRUCTION OF EXISTING 19”W X 30”H VERTICAL ELLIPTICAL SANITARY SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71S20E29	RECONSTRUCTION OF EXISTING 20”W X 29”H EGG-SHAPED SANITARY SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71S24E42	RECONSTRUCTION OF EXISTING 24”W X 42”H EGG-SHAPED SANITARY SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71S25E37	RECONSTRUCTION OF EXISTING 25”W X 37”H EGG-SHAPED SANITARY SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71S29E40	RECONSTRUCTION OF EXISTING 29”W X 40”H EGG-SHAPED SANITARY SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71M15D00	RECONSTRUCTION OF EXISTING 15” DIAMETER CIRCULAR STORM SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71M18D00	RECONSTRUCTION OF EXISTING 18” DIAMETER CIRCULAR STORM SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.

Item No.	Description	Pay Unit
50.71M30D00	RECONSTRUCTION OF EXISTING 30” DIAMETER CIRCULAR STORM SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71M42D00	RECONSTRUCTION OF EXISTING 42” DIAMETER CIRCULAR STORM SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71M38H24	RECONSTRUCTION OF EXISTING 38”W X 24”H HORIZONTAL ELLIPTICAL STORM SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71M53H34	RECONSTRUCTION OF EXISTING 53”W X 34”H HORIZONTAL ELLIPTICAL STORM SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71M24V38	RECONSTRUCTION OF EXISTING 24”W X 38”H VERTICAL ELLIPTICAL STORM SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71M32V48	RECONSTRUCTION OF EXISTING 32”W X 48”H VERTICAL ELLIPTICAL STORM SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71M34V53	RECONSTRUCTION OF EXISTING 34”W X 53”H VERTICAL ELLIPTICAL STORM SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71M30E45	RECONSTRUCTION OF EXISTING 30”W X 45”H EGG-SHAPED STORM SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71M33E48	RECONSTRUCTION OF EXISTING 33”W X 48”H EGG-SHAPED STORM SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71M35E52	RECONSTRUCTION OF EXISTING 35”W X 52”H EGG-SHAPED STORM SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71M40E53	RECONSTRUCTION OF EXISTING 40”W X 53”H EGG-SHAPED STORM SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71M24R36	RECONSTRUCTION OF EXISTING 24”W X 36”H RECTANGULAR STORM SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71M32R48	RECONSTRUCTION OF EXISTING 32”W X 48”H RECTANGULAR STORM SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71C16D00	RECONSTRUCTION OF EXISTING 16” DIAMETER CIRCULAR COMBINED SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71C24D00	RECONSTRUCTION OF EXISTING 24” DIAMETER CIRCULAR COMBINED SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71C36D00	RECONSTRUCTION OF EXISTING 36” DIAMETER CIRCULAR COMBINED SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71C48D00	RECONSTRUCTION OF EXISTING 48” DIAMETER CIRCULAR COMBINED SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71C45H29	RECONSTRUCTION OF EXISTING 45”W X 29”H HORIZONTAL ELLIPTICAL COMBINED SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71C60H38	RECONSTRUCTION OF EXISTING 60”W X 38”H HORIZONTAL ELLIPTICAL COMBINED SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71C29V45	RECONSTRUCTION OF EXISTING 29”W X 45”H VERTICAL ELLIPTICAL COMBINED SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71C34V53	RECONSTRUCTION OF EXISTING 34”W X 53”H VERTICAL ELLIPTICAL COMBINED SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71C38V60	RECONSTRUCTION OF EXISTING 38”W X 60”H VERTICAL ELLIPTICAL COMBINED SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71C32E44	RECONSTRUCTION OF EXISTING 32”W X 44”H EGG-SHAPED COMBINED SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71C34E46	RECONSTRUCTION OF EXISTING 34”W X 46”H EGG-SHAPED COMBINED SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71C38E50	RECONSTRUCTION OF EXISTING 38”W X 50”H EGG-SHAPED COMBINED SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71C41E60	RECONSTRUCTION OF EXISTING 41”W X 60”H EGG-SHAPED COMBINED SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71C42E56	RECONSTRUCTION OF EXISTING 42”W X 56”H EGG-SHAPED COMBINED SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71C30R42	RECONSTRUCTION OF EXISTING 30”W X 42”H RECTANGULAR COMBINED SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71C36R48	RECONSTRUCTION OF EXISTING 36”W X 48”H RECTANGULAR COMBINED SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.

Item No.	Description	Pay Unit
50.71I36D00	RECONSTRUCTION OF EXISTING 36” DIAMETER CIRCULAR INTERCEPTOR SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71I48D00	RECONSTRUCTION OF EXISTING 48” DIAMETER CIRCULAR INTERCEPTOR SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.
50.71I36R48	RECONSTRUCTION OF EXISTING 36”W X 48”H RECTANGULAR INTERCEPTOR SEWER, USING D.E.P. APPROVED CIPP LINING METHOD	L.F.

SECTION 50.72 – RECONSTRUCTION OF EXISTING SEWERS USING SHOTCRETE METHOD

50.72.1 INTENT

It is the intent of this section to provide for the reconstruction of existing sewers by the use of pneumatically placed concrete otherwise known as shotcrete. When cured, the shotcrete will be formed to the original conduit.

50.72.2 DESCRIPTION OF WORK

The reconstruction of existing sewers using shotcrete method must be performed in strict accordance with **Subsections 50.72.3 through 50.72.7**, inclusively.

50.72.3 FLOW BYPASSING AND SEWER CLEANING

Prior to the start of work the Contractor will be required to submit a fluming/bypass-pumping detail in accordance with **Subsection 10.13 - (3) Existing Flow**. The Contractor must provide for the diversion of flow of existing sewers at existing upstream manholes (if available) and pump the flow into an existing downstream manhole. The pumps and bypass lines must be of adequate capacity and size to handle the flow. The proposed bypassing system must be submitted to the Engineer for approval and no work must commence until such approval is granted. Bypass for man entry must require dual plugs, back up pumps and an escape plan if failure of bypass occurs.

Prior to performing the work of repairing and reconstructing (shotcreting) the existing sewers and sewer portions through the manholes, the Contractor must thoroughly clean the existing sewers and sewer portions through the manholes in accordance with **Section 54.11**.

50.72.4 SEWER REPAIR

Upon completion of the cleaning of the existing sewers and sewer portions through the manholes to be reconstructed (shotcreted) the Contractor must inform the Engineer of such and must perform no further work until such time that the Engineer inspects and notifies the Contractor, in writing, that the sewers and sewer portions through the manholes have been cleaned to the satisfaction of the Engineer. At the time of this inspection the Engineer must inform the Contractor of all areas that require sewer repair. If it is determined by the Engineer that the sewer has been damaged and/or that injection grouting is required to fill surrounding voids and/or stop infiltration/exfiltration of the existing sewer to be reconstructed (shotcreted), the Contractor must perform the sewer repair work in accordance with **Section 54.21 - Portland Cement (Type V) - Injection Grouting** and **Section 54.31 - Shotcrete For Repair Work**.

50.72.5 MATERIALS

(A) Cement must be either Type V Portland Cement meeting the requirements of ASTM C150 or blended cement containing 8% microsilica that meets the requirements of NYS Department of Transportation Standard Specification 701-03, Type IP (8).

(B) Sand must conform to the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**. The term "dry" as applied to sand, designates a normal moisture content of from three (3) percent to six (6) percent.

(C) Water must be fresh, clean and free from oils, acids, alkali or organic matter.

(D) Reinforcement must consist of 2x2-12-gauge or 3x3-10-gauge galvanized welded wire mesh. The wire mesh must conform to the Standard Specifications of the American Society for Testing Materials for "Cold Drawn Steel Wire for Concrete Reinforcement", Serial Designation A82 and "Welded Steel Wire Fabric for Concrete Reinforcement", Serial Designation A185. Welded wire mesh must have a minimum yield strength of thirty-five thousand (35,000) pounds per square inch.

50.72.6 ADMIXTURES

Admixtures may be used in the shotcrete mix to enhance certain properties. However, no admixtures may be used without the prior approval of the Engineer. Laboratory test results or Manufacturer's data must be submitted by the Contractor to the Engineer proving that the admixture will not detract from the specified twenty-eight (28) day compressive strength. The admixture must also be compatible with the existing sewer, wire mesh and cement used in the newly applied shotcrete.

All admixtures considered for inclusion in the shotcrete mix must comply with the State of New York, Department of Transportation, Standard Specifications, Section 711-08 "Admixtures". The name of the

admixture must be found on the "Approval List" issued by the NYS DOT Materials Bureau. The brand name of the approved admixture must be plainly marked on the admixture container.

50.72.7 RECONSTRUCTION OF EXISTING SEWERS AND MANHOLES (SHOTCRETE PROCESS)

(A) DESCRIPTION - The Contractor will be responsible for the reconstruction of existing sewers and sewer portions through the manholes via the use of pneumatically placed concrete otherwise known as shotcrete. The Contractor has the option of using either the Dry-Mix Shotcrete Process or the Wet-Mix Shotcrete Process.

The Dry-Mix Shotcrete Process is a process in which the dry cement-aggregate mixture is thoroughly mixed and fed into a special mechanical feeder or gun called the delivery equipment, then the mixture is introduced into the delivery hose by a metering device such as a feed wheel, rotor or feed bowl or by air pressure (orifice feed) and conveyed by compressed air to a nozzle, at the nozzle water is injected under pressure through a water ring and intimately mixed with the other ingredients and the resulting mixture is jetted from the nozzle at high velocity onto the surface to be shotcreted.

The Wet-Mix Shotcrete Process is a process in which all ingredients including mixing water are thoroughly mixed and introduced into the chamber of the delivery equipment, then the mixture is metered into the delivery hose and moved by displacement or conveyed by compressed air to a nozzle, at the nozzle an accelerator is usually added and additional air is injected through an air ring to increase velocity and improve the gunning pattern, and then jetted from the nozzle at high velocity onto the surface to be shotcreted.

The delivery system consists of the nozzle, water ring or air ring, and any necessary valves connected to the delivery hose.

(B) PROPORTIONING

(1) DRY-MIX SHOTCRETE PROCESS - Dry-Mix Shotcrete must be mixed in the proportion of one (1) bag of Portland Cement to three (3) cubic feet of sand, volumetrically batch measured by means of batch boxes or a proportioning plant approved by the Engineer. Wheelbarrows or shovels will not be permitted for measuring. The same source of sand must be used throughout the contract. The dry shotcrete mixture must not be altered unless otherwise directed by the Engineer.

Dry-Mix Shotcrete must be thoroughly mixed in a dry state either by hand or in a mechanical mixer before placing in the hopper of the cement gun or other apparatus.

Water must not be added to the mix after mixing or before using the cement gun. Sufficient water must be added at the nozzle to achieve a four thousand (4,000) pound per square inch, twenty-eight (28) day compressive strength.

Dry shotcrete mixture that has gone for a period of forty-five (45) minutes or longer from the time of mixing without being incorporated into the work must be discarded. Remixing or tempering is not be permitted.

(2) WET-MIX SHOTCRETE PROCESS - Wet-Mix Shotcrete must be mixed in the proportion of one (1) bag of Portland Cement to three (3) cubic feet of sand, volumetrically batch measured by means of batch boxes or a proportioning plant approved by the Engineer. Sufficient water must be added to the mix to achieve a four thousand (4,000) pound per square inch, twenty-eight (28) day compressive strength. Wheelbarrows or shovels will not be permitted for measuring. The same source of sand must be used throughout the contract. The wet shotcrete mixture must not be altered unless otherwise directed by the Engineer.

Wet-Mix Shotcrete must be thoroughly mixed by a mechanical mixer to the desired consistency and in accordance with ACI 506R-90 before placing in the hopper of the cement gun or other apparatus.

Wet shotcrete mixture that has gone for a period of forty-five (45) minutes or longer from the time of mixing without being incorporated into the work must be discarded. Remixing or tempering must not be permitted.

(C) EQUIPMENT - Batching and mixing equipment must be capable of thoroughly mixing the materials in sufficient quantity to maintain placing continuity. The pneumatic mixing and delivering equipment must be of sufficient capacity.

For Dry-Mix Process the lower chamber must deliver material to the delivery hose continuously during the upper chamber recharging period.

Gaskets in the equipment must be kept in good condition in order to avoid reduced pressure and consequent reduced velocity of material during the charging periods. The interior of the drums, feed gearing, and valves must be cleaned at regular intervals (at least once every shift).

For rough or heavy work, nozzle pressures of fifty (50) to sixty (60) pounds must be maintained.

For high lifts or long hose lengths pressures of seventy (70) to seventy-five (75) pounds must be maintained in order to insure against clogging.

Any standard type of air compressor will be satisfactory, provided it is of sufficient capacity to maintain, without interruption, the pressures and volume of air necessary for the longest hose delivery. Air compressor capacity determinations must include allowances for the air consumed in blowing rebound, cleaning reinforcement and other incidental uses. Compressor equipment must be of such capacity as to insure air pressures, at the special mixer, nozzle, etc., capable of producing the required velocities.

Water pressure must be maintained at a minimum of fifteen (15) pounds greater than the highest air pressure required for placing. Both air and water pressures must be uniformly steady (nonpulsating).

Velocities of three hundred seventy-five (375) to five hundred (500) feet per second must be maintained using a three-quarter (3/4) inch or a one (1) inch nozzle.

Velocities of four hundred twenty-five (425) to five hundred fifty (550) feet per second must be maintained using a one and one-half (1-1/2) inch nozzle.

Velocities other than specified must be allowed only if approved in writing by the Engineer.

Nozzles for Dry-Mix Process must be of the "Pre-Mixing" type, with a perforated water feed ring inside the nozzle to direct an even distribution of water through the material at the place of application.

Nozzles for Wet-Mix Process must be the type with a perforated air injection ring inside the nozzle to increase exit velocity and provide a spray pattern.

(D) QUALIFICATIONS OF THE SHOTCRETING CONTRACTOR - Prior to starting any shotcreting work, the Contractor must submit, for the Engineer's review and approval, the resumes, with references, of the Shotcreting Contractor. The Shotcrete Contractor must have satisfactorily completed a minimum of three (3) similar or larger shotcreting projects elsewhere within the last three (3) year period prior to the date of the opening of the bid.

(E) QUALIFICATIONS AND DUTIES OF WORKING PERSONNEL

(1) ONSITE PROJECT MANAGEMENT PERSONNEL must each have had adequate experience as a Project Manager and adequate experience on similar work. If the onsite project management personnel are removed from the project, the Shotcreting Contractor must replace those personnel immediately with adequately experienced personnel.

(2) FOREMEN must each have had adequate experience as a Nozzleman and adequate experience on similar work.

(3) NOZZLEMEN must be qualified workmen, each having had adequate experience in similar work. It is the Nozzleman's responsibility to:

(a) Place the material with the proper amount of water at the nozzle in order to insure complete hydration. Place the material so as to prevent excessive rebound. Normal rebound must range from twenty (20) percent to thirty-five (35) percent of the sand depending on the type of work.

(b) Direct the Reboundman where to clear away rebound for the subsequent placement of shotcrete and/or to cut out slugs, sand spots and sand slough pockets. Such defects must be replaced after the surrounding shotcrete has taken its initial set. (Immediate replacement is not desirable because additional sloughs may result in the surrounding area.)

(c) Hold the nozzle at the proper distance, (minimum of three (3) feet except in confined locations), and at the proper angle to secure maximum compaction with minimum loss of material. This angle should be as near perpendicular to the surface as the type of work permits.

(d) Direct the crew when to start and stop feeding material, and to stop the work when the material is not being delivered uniformly to the nozzle.

(e) Determine and insure that the air pressure at the gun is uniform and is maintaining proper material velocity at the nozzle, and that the water pressure is a minimum of fifteen (15) pounds greater than the highest air pressure required for placing.

(f) Apply the shotcrete to finish lines in a neat workmanlike manner.

(4) GUNMEN must have adequate experience to operate the special pneumatic mixer, direct the work of mixer crews, maintain proper pressure on the pneumatic gun to insure the necessary nozzle velocities, and insure that the material is uniformly fed to the nozzle.

(F) SAFETY AND TEMPORARY LIGHTING

(1) SAFE ENVIRONMENT - The Contractor must carry out the Contractor's operations in strict accordance with all OSHA and manufacturer's safety requirements. Emphasis must be placed upon safety requirements for entering confined spaces.

The Contractor must erect such signs and other devices as are necessary for the safety of the work site and must secure the site and conform all work to the safety requirements of all pertinent regulatory agencies.

The Contractor is advised that all shotcrete work must be carried out in full compliance with all City, State, and Federal laws, rules, and regulations regarding Air Quality and Safety.

(2) TEMPORARY LIGHTING WORK INCLUDED - The Contractor must furnish all labor, materials, and equipment and do all work necessary to install, maintain, and eventually remove all temporary lighting.

(a) Temporary lighting must consist of electric wire stringers attached to the crown of the sewer being worked on. The stringer must not present a hazard to those workers inside the sewer. Lighting pigtails must be attached to the stringer every twenty-five (25) linear feet. Bulb wattage must be sufficient to adequately light the section of sewer being worked on. Bulbs must be replaced in kind as needed.

(b) The Contractor must maintain the temporary lighting until such time as the Engineer inspects and approves the newly shotcreted crown and upper walls of that particular run of sewer. Temporary lighting may be removed as soon as the Engineer approves and accepts the newly shotcreted sewer section.

(3) COST - All costs associated with providing safe environment and temporary lighting must be deemed to have been included in the unit price bid per linear foot of Sewer Reconstruction.

(G) CONNECTIONS TO HYDRANTS - The Contractor must strictly comply with the New York State Department of Health's Public Water Supply Guide on "CROSS-CONNECTION CONTROL". In order to insure strict compliance with the State Guide, all connections to Hydrants must be provided with an approved and certified "REDUCED PRESSURE ZONE BACKFLOW PREVENTER" in accordance with the Department's Standards and as directed by the Engineer. The cost for all labor, materials and equipment required to complete this work must be deemed included in the prices bid for all items of this contract.

(H) MEANS AND METHODS - Upon completion of the cleaning and repair of the existing sewers and sewer portions through the manholes to be reconstructed (shotcreted) the Contractor must inform the Engineer of such and must perform no further work until such time that the Engineer inspects and notifies the Contractor, in writing, that the sewers and sewer portions through the manholes have been repaired and cleaned to the satisfaction of the Engineer and that the Contractor may proceed with the installation of the wire mesh. After such notification the Contractor must attach 2x2-12-gauge or 3x3-10-gauge galvanized welded wire mesh to the sewer. The wire mesh must be properly fastened to the surface of the sewer by galvanized anchors. Mesh must be rigidly secured to the anchors with 16-gauge steel tie wires so as to prevent the mesh's movement or deflection. Mesh must be placed approximately one and one-half (1-1/2) to two (2) inches from the surface of the sewer. When sheets of mesh intersect, they must be lapped a minimum of six (6) inches and the lap must be securely tied together. The mesh must be cut properly and carefully bent to closely follow the contours of the area to be shotcreted. Galvanized anchors must be spaced as needed to properly hold the mesh in place. The galvanized anchors must be expansion anchor type bolts with a hook on the exposed end, or an approved equal. An expanding sleeve must be on the embedded end and positively locked in a predrilled hole.

Four (4) small plastic depth gauges must be attached as a ring around the inner surface of the sewer, one (1) at the crown, one (1) at the invert, and one (1) at each spring line. The gauge must show a depth of three (3) inches. The gauge rings must be placed five (5) linear feet apart parallel to the center line of the sewer. The preset three (3) inch gauge guides must be positioned just below the proposed finish coat of shotcrete. The gauges will be left in place within the shotcrete.

Immediately prior to applying shotcrete to the sewer, all surfaces and wire mesh must receive a final thorough cleaning by water blasting to remove anything which could interfere with the bond between the shotcrete and the surface of the sewer or the wire mesh. Upon completion of the installation of the wire mesh, placement of the plastic depth gauges, and the final cleaning of the existing sewers and sewer portions through the manholes to be reconstructed (shotcreted) the Contractor must inform the Engineer of such and must perform no further work until such time that the Engineer inspects and notifies the Contractor, in writing, that the work of installing the wire mesh, placing the plastic depth gauges and final cleaning of the sewers and manholes has been performed to the satisfaction of the Engineer and that the Contractor may proceed with the shotcreting process. After such notification three (3) inches of shotcrete must then be placed over the surface. (The tolerance for placement of three (3) inches of shotcrete must be plus or minus one-quarter (1/4) inch.) The shotcreted area must be given a final clean broom finish.

The Contractor must furnish all labor, materials, and equipment and must do all work necessary to place the wire mesh and shotcrete over the entire surface area of the interior of the existing sewer, including the invert, walls and crown, in accordance with the plans and specifications, and as directed by the Engineer. Reconstruction (Shotcreting) of the existing sewer must include shotcreting and wire mesh through the manholes over the entire section of the interior of the manholes up to a line of elevation equivalent to the inner top of the largest sewer.

(I) SEQUENCE OF SHOTCRETE APPLICATION - Wire mesh must be installed around the entire inner face of the sewer. The sewer must then be cleaned by water blasting. Shotcrete must be applied to the invert and lower walls from spring line to spring line to the full design thickness in a one (1) layer application if possible. However, a maximum two (2) layer application will be permitted, providing that the time interval between the successive layer is sufficient to allow for initial set to develop (harden slightly or stiffen), and that the first layer of shotcrete is placed to a sufficient depth so as to completely cover the wire mesh. Prior to application of the second layer all loose, uneven or excess material, glaze, laitance and rebound must be removed from the base coat by brooming, scraping, screeding or other approved methods. Also any surface deposits that take a final set must be removed by sandblasting and the surface cleaned with an air-water blast. The surface of the base coat must be thoroughly examined for hollow areas resulting from rebound pockets or lack of bond. Hollows, sags or other defects must be cut out. The surface of the base coat to be shot must be left open, rough and highly textured to improve bond, and must be damp. Curing compounds or other bond breaking materials must not be applied to the surface of the base coat. When the shotcreting of the invert and lower walls is complete, the surface must be finished in an approved manner, and then sufficient time must be given to allow the invert and lower walls to cure. At this point in time, the Contractor may request that the Engineer perform a walk through inspection of the invert in the dry. If the Engineer approves and accepts the shotcreted invert, a gentle flow of nonturbulent sewage flow will be permitted over the cured and accepted invert. In no event may the top surface of flow be higher than twelve (12) inches below the spring line. If the invert and lower walls are not approved and accepted by the Engineer, flow will not be permitted on the invert until such time as the Contractor performs remedial work, which in turn has been approved and accepted by the Engineer.

Upon acceptance of the invert the Contractor must apply shotcrete to the crown and upper walls from spring line to spring line in a maximum two (2) layer application. The first layer of shotcrete must be placed to a sufficient depth so as to completely cover the wire mesh. The second layer of shotcrete may be placed at a later time after the first layer has substantially hardened. Prior to the application of the second layer all loose, uneven or excess material, glaze, laitance and rebound must be removed from the base coat by brooming, scraping, screeding or other approved methods. Also the surface of the base coat must be thoroughly examined for hollow areas resulting from rebound pockets or lack of bond. Hollows, sags or other defects must be cut out. The surface of the base coat to be shot must be left open, rough and highly textured to improve bond, and must be damp. Prior to the application of the second layer the surface of the base coat must be cleaned with an air-water blast. Curing compounds or other bond breaking material must not be applied to the surface of the base coat. When the shotcreting of the crown and upper walls is complete the surface must be finished in an approved manner and then sufficient time must be given to allow the crown and upper walls to cure. The Engineer must then perform a walk through inspection of the crown and upper walls. If the crown and upper walls are not approved and accepted by the Engineer, the Contractor will perform remedial work. The remedial work must be approved and accepted by the Engineer.

Temporary lighting must be maintained until the crown and upper wall shotcrete work is accepted by the Engineer.

(J) APPLICATION - Shotcrete must not be placed on a frozen surface nor during freezing weather at the site of application. Shotcrete must not be placed when it is anticipated that the temperature during the following twenty-four (24) hours will drop below forty (40) degrees Fahrenheit at the site of application.

Sequence of application must be from the bottom to the top. The Contractor will be permitted to apply the shotcrete from the top to the bottom provided the Contractor can demonstrate that the rebound is properly removed. Shooting must be from an angle as near perpendicular to the surface as practicable, with the nozzle held approximately three (3) feet from the work (except in confined locations). If the flow of material at the nozzle is not uniform, and slugs, sand spots, or sand sloughs result, the nozzleman must direct the nozzle away from the work until the faulty conditions are corrected. Such defects must be replaced as the work progresses in accordance with the specifications and as directed by the Engineer.

Construction joints or day's work joints must be sloped off to a thin clean, regular edge, preferably at a forty-five (45) degree slope. Before placing the adjoining work, the sloped portion and adjacent shotcrete must be thoroughly cleaned as necessary and then moistened and scoured with an air jet.

(K) SUSPENSION - Shotcreting must be suspended if:

(1) High wind separates the cement from the sand at the nozzle.

(2) Temperature approaches freezing temperature at the site of application (temperature falls below forty (40) degrees Fahrenheit) and the shotcrete cannot be protected.

(3) Rain (other than a very light sprinkle) would washout the shotcrete.

(L) SURFACE FINISH - The nozzleman must bring the shotcrete to an even plane and to well-formed corners by working up to the guides, using somewhat lower placing velocity than normal.

After the body coat has been placed, the surface must be trued with a thin edge screed to remove high areas and expose low areas. Low areas must be properly filled with shotcrete to insure a true surface. The entire surface must be broom finished after the surface of the shotcrete has been trued.

(M) CURING - All shotcrete must be cured in accordance with ACI 506R-90 and as specified and as directed by the Engineer.

The freshly shotcreted invert must not be disturbed until it has attained an initial set, as determined by the Engineer. All fluming and/or bypass pumping must be maintained during the curing process.

(N) TESTING - TEST CORES

Determination of the strength of the shotcrete will be based on the average strength of test cores made in the manner hereinafter described. A minimum of one (1) set of three (3) test cores will be required at the start of the project for the first three hundred (300) linear feet of sewer shotcreted with a minimum of one (1) additional set made for every additional three hundred (300) linear feet of sewer shotcreted. During the progress of the reconstruction, the Engineer will have test cores made to determine whether the shotcrete being produced complies with the contract requirements. Test cores will be made and stored in accordance with ASTM C42, except as otherwise modified by the Engineer. Each test will consist of three (3) cores; one (1) to be tested at seven (7) days, the other two (2) at twenty-eight (28) days.

Test cores must be made at the point of shotcrete deposit and must be representative of the batch from which they are taken. The Contractor under the Engineer’s supervision must provide the necessary labor and facilities required to make, store and care for the test cores. They must be safeguarded against injury and protected from the elements.

The Engineer will be responsible for the preparation, documentation and labeling of the test cores and for notifying the Contractor, at least twenty-four (24) hours in advance, when a shipment of test cores is ready for delivery, so that cores can be tested for the standard twenty-eight (28) day and/or seven (7) day tests. Test cores must be transported to the testing laboratory when directed by the Engineer.

The Contractor must arrange to protect all cores from damage during loading, transport to, and unloading at a Department of Design and Construction designated testing laboratory, and must obtain a receipt for delivered test cores, which must be submitted to the Engineer.

The Total Minimum Number of Test Core Sets to be taken by the Engineer must be determined as follows:

(a) A minimum of One (1) Test core set must be taken at the start of the project for the first Three Hundred (300) Linear Feet of Sewer Section Shotcreted;

(b) Then a minimum of One (1) Test core set must be taken for every additional Three Hundred (300) Linear Feet of Sewer Section Shotcreted.

Should the average strength of the seven (7) day test cores fail to meet the seven (7) day strength requirements for the specified shotcrete, the Engineer may direct the Contractor to change the mix. All tests will be made by the Department of Design and Construction designated testing laboratory. The Contractor may, if the Contractor so desires, take test cores corresponding to those taken for the Department of Design and Construction designated testing laboratory. However, determination of payment will be based solely on the test cores taken for the Department of Design and Construction designated testing laboratory. The sampling must be based on the quantities indicated hereinafter.

Shotcrete must have a minimum compressive strength of four thousand (4,000) pounds per square inch at the end of twenty-eight (28) days. The Contractor must be considered to have met the requirements of the specifications for shotcrete placed in the section of sewer, when the average strength of all twenty-eight (28) day test cores taken for that section of sewer is equal to or better than the four thousand (4,000) pound per square inch requirement.

The strength of shotcrete placed in each section of sewer will be recorded as the average strength of all twenty-eight (28) day test cores taken for that section of sewer, determined in accordance with the following conditions: Test cores exhibiting strengths in excess of one hundred fifteen (115) percent of the specified minimum strength will be considered to have only a strength of one hundred fifteen (115) percent of the specified minimum strength in determining the average strength of the shotcrete. The cores exhibiting strengths below the specified minimum strength will be considered as having the exhibited strength in determining the average strength of the shotcrete.

(O) TELEVISION INSPECTION AND RECORDING - Upon completion of all work the Contractor must perform a television inspection and digital audio-visual recording of all sewers reconstructed in accordance with **Section 53.11** of the specifications. Payment for television inspection and digital audio-visual recording must be made under Item No. 53.11DR - TELEVISION INSPECTION AND DIGITAL AUDIO-VISUAL RECORDING OF SEWERS.

50.72.8 MEASUREMENT

The quantity of sewers reconstructed by shotcreting process to be measured for payment must be the number of linear feet of existing sewer reconstructed to the satisfaction of the Engineer, as shown, specified or required, measured horizontally along the centerline of the existing sewer through the manholes.

50.72.9 PRICE TO COVER

The contract price for “RECONSTRUCTION OF EXISTING SEWERS USING SHOTCRETE METHOD” must be the unit price bid per linear foot for each size and type of existing sewer and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required or necessary to reconstruct the existing sewer as specified herein, including the taking, storing and protecting of test cores; fluming and/or diversion of the flow in the existing sewer; cleaning up; and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans and specifications and as directed by the Engineer.

50.72.10 DETERMINATION OF PAYMENT

When the average strength of the test cores equals or exceeds four thousand (4,000) pounds per square inch, the appropriate shotcrete incorporated in the existing sewer will be paid for at the contract price bid.

When the average strength of the test cores is less than four thousand (4,000) pounds per square inch, the appropriate shotcrete incorporated in the existing sewer will be paid for at a price which will have the same proportion to a price of five hundred ($500.00) dollars per cubic yard for such shotcrete that the deficient strength bears to four thousand (4,000) pounds per square inch. Such difference in cost must be deducted from the contract price bid. When the average strength of the test cores is three thousand two hundred (3,200) pounds per square inch or less, the Contractor may be required, at the order of the Engineer, to remove the defective shotcrete or portions thereof and replace it with shotcrete in full compliance with the specifications at no extra cost to the City.

In the event the Contractor should take exception to the results as determined by test cores taken for the Department of Design and Construction designated testing laboratory, the Contractor may, at the

Contractor's own cost, elect to take core borings of the completed shotcrete work at places to be designated by the Engineer. Such core borings will be tested by the Department of Design and Construction designated testing laboratory. The Contractor, at the Contractor's own expense, may elect to take corresponding core borings adjacent to the Department's core borings and employ a recognized testing laboratory to make comprehensive tests. All such tests must be done in the presence of a representative of the Department of Design and Construction designated testing laboratory. The core borings must be delivered to the laboratories by the Contractor immediately so that compressive tests can be performed as close to the twenty-eight (28) day compressive test requirement as is possible. The result of the test of each Contractor's corresponding core boring will be averaged with that of the adjacent Department's core boring, and the resulting averages will be used to determine the average strength of the shotcrete in lieu of the comparable test core results. Determination of payment based on the average strength of core borings will be made according to the method specified herein.

Core borings having strengths exceeding one hundred twenty-five (125) percent of the specified minimum strength will be considered to have a strength of only one hundred twenty-five (125) percent of the specified minimum strength in determining the average strength of the shotcrete. Core borings exhibiting strengths below the specified minimum strength will be considered as having the exhibited strength in determining the average strength of the shotcrete.

Where cores have been removed within the limits of this contract, the Contractor must refill core openings with a proper patch of non-shrink cement mortar at no cost to the City.

Payment for Reconstruction Of Existing Sewers Using Shotcrete Method will be made under the Item Number as calculated below:

The Item Numbers for Reconstruction Of Existing Sewers Using Shotcrete Method have sixteen characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Reconstruction Of Existing Sewers Using Shotcrete Method:

50.72

(2) The sixth character must define the Type of Sewer Effluent:

S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer
I - Interceptor Sewer

(3) The seventh, eighth, ninth and tenth characters must define either the Diameter of the Sewer for Existing Circular Sewers or the Width of the Sewer for Existing Sewers of Other Shapes (e.g. Rectangular, Arched, Elliptical, and Egg). (The seventh and eighth characters representing the unit of feet and the ninth and tenth characters representing the unit of inches for either the Diameter of the Sewer for Existing Circular Sewers or the Width of the Sewer for Existing Sewers of Other Shapes.) See examples below:

0600 - 6'-0'
0903 - 9'-3"
1008 - 10'-8"
1311 - 13'11"

(4) The eleventh character must define the Shape of the Existing Sewer:

D - Circular (Diameter)
R - Rectangular (Single Barrel)
B - Double Barrel Rectangular
T - Triple Barrel Rectangular
A - Arch-Shaped
H - Horizontal Elliptical
V - Vertical Elliptical
E - Egg-Shaped

(5) The twelfth character must define the Kind of Existing Sewer:

B - Brick
C - Concrete

(6) The thirteenth, fourteenth, fifteenth and sixteenth characters must define either Circular and Arch-Shaped or the Height of the Sewer for Existing Sewers of Other Shapes (e.g. Rectangular, Elliptical, and Egg). (The thirteenth and fourteenth characters representing the unit of feet and the fifteenth and sixteenth characters representing the unit of inches for the Height of the Sewer for Existing Sewers of Other Shapes.) See examples below:

0000 - Circular and Arch-Shaped
0600 - 6'-0'
0903 - 9'-3"
1008 - 10'-8"
1311 - 13'11"

(7) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
50.72S0406DB0000	RECONSTRUCTION OF EXISTING 4'-6" DIAMETER CIRCULAR BRICK SANITARY SEWER USING SHOTCRETE METHOD	L.F.
50.72S0406DC0000	RECONSTRUCTION OF EXISTING 4'-6" DIAMETER CIRCULAR CONCRETE SANITARY SEWER USING SHOTCRETE METHOD	L.F.
50.72S0403RC0400	RECONSTRUCTION OF EXISTING 4'-3"W X 4'-0"H RECTANGULAR CONCRETE SANITARY SEWER USING SHOTCRETE METHOD	L.F.
50.72S0700AB0000	RECONSTRUCTION OF EXISTING 7'-0"W ARCH-SHAPED BRICK SANITARY SEWER USING SHOTCRETE METHOD	L.F.
50.72S0400VB0604	RECONSTRUCTION OF EXISTING 4'-0"W X 6'-4"H VERTICAL ELLIPTICAL BRICK SANITARY SEWER USING SHOTCRETE METHOD	L.F.
50.72S0307VC0508	RECONSTRUCTION OF EXISTING 3'-7"W X 5'-8"H VERTICAL ELLIPTICAL CONCRETE SANITARY SEWER USING SHOTCRETE METHOD	L.F.
50.72S0304EB0500	RECONSTRUCTION OF EXISTING 3'-4"W X 5'-0"H EGG-SHAPED BRICK SANITARY SEWER USING SHOTCRETE METHOD	L.F.
50.72S0309EC0500	RECONSTRUCTION OF EXISTING 3'-9"W X 5'-0"H EGG-SHAPED CONCRETE SANITARY SEWER USING SHOTCRETE METHOD	L.F.
50.72M0500DB0000	RECONSTRUCTION OF EXISTING 5'-0" DIAMETER CIRCULAR BRICK STORM SEWER USING SHOTCRETE METHOD	L.F.
50.72M0500DC0000	RECONSTRUCTION OF EXISTING 5'-0" DIAMETER CIRCULAR CONCRETE STORM SEWER USING SHOTCRETE METHOD	L.F.
50.72M0500RC0403	RECONSTRUCTION OF EXISTING 5'-0"W X 4'-3"H RECTANGULAR CONCRETE STORM SEWER USING SHOTCRETE METHOD	L.F.
50.72M0900AB0000	RECONSTRUCTION OF EXISTING 9'-0"W ARCH-SHAPED BRICK STORM SEWER USING SHOTCRETE METHOD	L.F.
50.72M0709AB0000	RECONSTRUCTION OF EXISTING 7'-9"W ARCH-SHAPED BRICK STORM SEWER USING SHOTCRETE METHOD	L.F.
50.72M0405VB0611	RECONSTRUCTION OF EXISTING 4'-5"W X 6'-11"H VERTICAL ELLIPTICAL BRICK STORM SEWER USING SHOTCRETE METHOD	L.F.
50.72M0410VC0707	RECONSTRUCTION OF EXISTING 4'-10"W X 7'-7"H VERTICAL ELLIPTICAL CONCRETE STORM SEWER USING SHOTCRETE METHOD	L.F.
50.72M0405VC0611	RECONSTRUCTION OF EXISTING 4'-5"W X 6'-11"H VERTICAL ELLIPTICAL CONCRETE STORM SEWER USING SHOTCRETE METHOD	L.F.
50.72M0400VC0604	RECONSTRUCTION OF EXISTING 4'-0"W X 6'-4"H VERTICAL ELLIPTICAL CONCRETE STORM SEWER USING SHOTCRETE METHOD	L.F.
50.72M0311EB0510	RECONSTRUCTION OF EXISTING 3'-11"W X 5'-10"H EGG-SHAPED BRICK STORM SEWER USING SHOTCRETE METHOD	L.F.

50.72M0404EC0505	RECONSTRUCTION OF EXISTING 4’-4”W X 5’-5”H EGG-SHAPED CONCRETE STORM SEWER USING SHOTCRETE METHOD	L.F.
50.72M0402EC0502	RECONSTRUCTION OF EXISTING 4’-2”W X 5’-2”H EGG-SHAPED CONCRETE STORM SEWER USING SHOTCRETE METHOD	L.F.
50.72C0600DB0000	RECONSTRUCTION OF EXISTING 6’-0” DIAMETER CIRCULAR BRICK COMBINED SEWER USING SHOTCRETE METHOD	L.F.
50.72C0506DB0000	RECONSTRUCTION OF EXISTING 5’-6” DIAMETER CIRCULAR BRICK COMBINED SEWER USING SHOTCRETE METHOD	L.F.
50.72C0600DC0000	RECONSTRUCTION OF EXISTING 6’-0” DIAMETER CIRCULAR CONCRETE COMBINED SEWER USING SHOTCRETE METHOD	L.F.
50.72C0506DC0000	RECONSTRUCTION OF EXISTING 5’-6” DIAMETER CIRCULAR CONCRETE COMBINED SEWER USING SHOTCRETE METHOD	L.F.
50.72C1006RC0603	RECONSTRUCTION OF EXISTING 10’-6”W X 6’-3”H RECTANGULAR CONCRETE COMBINED SEWER USING SHOTCRETE METHOD	L.F.
50.72C0706RC0500	RECONSTRUCTION OF EXISTING 7’-6”W X 5’-0”H RECTANGULAR CONCRETE COMBINED SEWER USING SHOTCRETE METHOD	L.F.
50.72C1100AB0000	RECONSTRUCTION OF EXISTING 11’-0”W ARCH-SHAPED BRICK COMBINED SEWER USING SHOTCRETE METHOD	L.F.
50.72C1000AB0000	RECONSTRUCTION OF EXISTING 10’-0”W ARCH-SHAPED BRICK COMBINED SEWER USING SHOTCRETE METHOD	L.F.
50.72C0906AB0000	RECONSTRUCTION OF EXISTING 9’-6”W ARCH-SHAPED BRICK COMBINED SEWER USING SHOTCRETE METHOD	L.F.
50.72C0503VB0802	RECONSTRUCTION OF EXISTING 5’-3”W X 8’-2”H VERTICAL ELLIPTICAL BRICK COMBINED SEWER USING SHOTCRETE METHOD	L.F.
50.72C0410VB0707	RECONSTRUCTION OF EXISTING 4’-10”W X 7’-7”H VERTICAL ELLIPTICAL BRICK COMBINED SEWER USING SHOTCRETE METHOD	L.F.
50.72C0605VC1001	RECONSTRUCTION OF EXISTING 6’-5”W X 10’-1”H VERTICAL ELLIPTICAL CONCRETE COMBINED SEWER USING SHOTCRETE METHOD	L.F.
50.72C0600VC0905	RECONSTRUCTION OF EXISTING 6’-0”W X 9’-5”H VERTICAL ELLIPTICAL CONCRETE COMBINED SEWER USING SHOTCRETE METHOD	L.F.
50.72C0508VC0810	RECONSTRUCTION OF EXISTING 5’-8”W X 8’-10”H VERTICAL ELLIPTICAL CONCRETE COMBINED SEWER USING SHOTCRETE METHOD	L.F.
50.72C0503VC0802	RECONSTRUCTION OF EXISTING 5’-3”W X 8’-2”H VERTICAL ELLIPTICAL CONCRETE COMBINED SEWER USING SHOTCRETE METHOD	L.F.
50.72C0402EB0602	RECONSTRUCTION OF EXISTING 4’-2”W X 6’-2”H EGG-SHAPED BRICK COMBINED SEWER USING SHOTCRETE METHOD	L.F.
50.72C0410EC0605	RECONSTRUCTION OF EXISTING 4’-10”W X 6’-5”H EGG-SHAPED CONCRETE COMBINED SEWER USING SHOTCRETE METHOD	L.F.
50.72C0408EC0600	RECONSTRUCTION OF EXISTING 4’-8”W X 6’-0”H EGG-SHAPED CONCRETE COMBINED SEWER USING SHOTCRETE METHOD	L.F.
50.72C0406EC0508	RECONSTRUCTION OF EXISTING 4’-6”W X 5’-8”H EGG-SHAPED CONCRETE COMBINED SEWER USING SHOTCRETE METHOD	L.F.
50.72I0500DC0000	RECONSTRUCTION OF EXISTING 5’-0” DIAMETER CIRCULAR CONCRETE INTERCEPTOR SEWER USING SHOTCRETE METHOD	L.F.
50.72I0506RC0400	RECONSTRUCTION OF EXISTING 5’-6”W X 4’-0”H RECTANGULAR CONCRETE INTERCEPTOR SEWER USING SHOTCRETE METHOD	L.F.
50.72I0500BC0500	RECONSTRUCTION OF EXISTING 5’-0”W X 5’-0”H DOUBLE BARREL RECTANGULAR CONCRETE INTERCEPTOR SEWER USING SHOTCRETE METHOD	L.F.
50.72I0606TC0500	RECONSTRUCTION OF EXISTING 6’-6”W X 5’-0”H TRIPLE BARREL RECTANGULAR CONCRETE INTERCEPTOR SEWER USING SHOTCRETE METHOD	L.F.

SECTION 50.73 – RECONSTRUCTION OF EXISTING SEWERS USING CEMENT LINING METHOD

50.73.1 INTENT

This section describes the reconstruction of existing ductile iron or cast iron sewers using a cement lining method.

50.73.2 MATERIALS

Cement must be Type V High Sulfate-Resistant Portland Cement conforming to the requirements of ASTM C150 and to **General Specification 11 - Concrete, as modified in Section 23.01**. Each bag of cement must be deemed to be one (1) cubic foot.

Sand must be silica-type conforming to the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**. The term "dry" as applied to sand, designates normal moisture content of from three (3) percent to six (6) percent.

Water must be fresh, clean and free from oils, acids, alkali or organic matter.

50.73.3 REQUIREMENTS

Cement-mortar mixture for cement lining must consist of one (1) part Silica-type Sand and one (1) part Type V High Sulfate-Resistant Portland Cement.

The design of the cement-mortar mixture is to be corrosion proof and the thickness must be consistent with ANSI/AWWA C104/A21.4, for Double Thickness.

Cement lining for ductile iron or cast iron pipe must be in accordance with ANSI/AWWA C104/A21.4.

Cement-mortar for lining must not be retamped and must not be used after it has been mixed for more than one (1) hour.

Lining must not be performed in freezing weather.

Surface crazing and cracks in the newly placed cement lining must not exceed that specified in AWWA C104.

Prior to the start of work the Contractor will be required to submit a fluming/bypass-pumping detail in accordance with **Subsection 10.13 - (3) Existing Flow**. The Contractor must provide for the diversion of flow of existing sewers at existing upstream manholes (if available) and pump the flow into an existing downstream manhole. The pumps and bypass lines must be of adequate capacity and size to handle the flow. The proposed bypassing system must be submitted to the Engineer for approval and no work must commence until such approval is granted.

The Contractor must be required to determine which service connections are active and must be responsible for controlling (or maintaining) the flow for each active service connection along the line of the sewer to be rehabilitated. Where necessary, the flow from an active service connection must be bypassed to a manhole downstream of the proposed work by means of pumping from the trap located in the basement of the affected building. However, should such bypassing be judged unfeasible by the Engineer, the Contractor must excavate to the service connection outside the building area (sidewalk or roadway as determined by the Engineer) and bypass the connection from this point. The pump and bypass line for each service connection must be of adequate capacity and size to handle the flow.

Prior to the commencement of any work, the Contractor must make all necessary investigations and prepare a plan for the controlling (or maintaining) of the flow and, where necessary, for the bypassing of active service connections. This plan must be submitted to the Engineer for approval and no work must commence until such approval is granted.

The Contractor must continue to divert the flow of the existing sewer and control (or maintain) the flow for active service connections during the installation of and curing of the cement lining and during the final television inspection and digital audio-visual recording.

The Contractor must carry out the Contractor’s operations in strict accordance with all OSHA and manufacturer's safety requirements. Emphasis must be placed upon safety requirements for entering confined spaces.

The Contractor must erect such signs and other devices as are necessary for the safety of the work site and must secure the site and conform all work to the safety requirements of all pertinent regulatory agencies.

The Contractor is advised that all lining work must be carried out in full compliance with all City, State, and Federal laws, rules, and regulations regarding Air Quality and Safety.

50.73.4 SEWER CLEANING

Prior to performing the work of cement lining the existing ductile iron or cast iron sewers, the Contractor must thoroughly clean the existing sewers in accordance with **Section 54.13**.

50.73.5 CONSTRUCTION METHODS

After the pipe is clean and dry, cement-mortar must be applied to the walls of the pipe by the rotating head of an electric or air powered machine and the cement-mortar must be finished with a rotating trowel or a conical drag trowel positioned just behind the dispensing head consistent with the diameter of the pipe. As the machine moves through the pipe, it must leave a smooth, troweled (nonstructural) finish. The mortar must be mixed on site in a mixing van or concrete batch plant located near the access manhole. The mortar must then be transported from the mixing plant to the high-speed centrifugal sprayer through high-pressure hoses or must be mechanically delivered. In pipes 24-inches and less in diameter, the sprayer and trowel must be dragged through the pipe by a winch system controlled outside of the excavation. For pipes greater than 24-inches in diameter, a manned, machine driven liner must deliver and finish the mortar. Once the mortar has been applied the thickness of the liner must be checked for adequacy in the presence of the Engineer.

The application of the cement-mortar and the speed of the trowel must remain consistent throughout the entire run so as to ensure the thickness of the lining is uniform. The lining-machine operator must regulate the mortar application. Grinding of the lining will not be permitted.

After the cement liner has been accepted, the pipe must be capped at both ends to allow for proper curing of the mortar. Water can be introduced into the pipe without pressure to allow curing twenty-four (24) hours after installation of the cement lining.

Services connections along the cement-lined section must be clear of any mortar. Clogged service connections must be cleared about one (1) hour after the cement lining is completed using compressed air to blow open the service line at the connection to the sewer.

After completion of installation and curing of the liner, the Contractor must perform a final television inspection and digital audio-visual recording of the rehabilitated pipe in accordance with the **Section 53.11** of the specifications.

50.73.6 MEASUREMENT

The quantity of ductile iron or cast iron sewer cement lined to be measured for payment must be the number of linear feet of each size in-place existing ductile iron or cast iron sewer actually cement lined, complete and to the satisfaction of the Engineer, measured along the centerline of the ductile iron or cast iron sewer.

50.73.7 PRICE TO COVER

The contract price for “RECONSTRUCTION OF EXISTING SEWERS USING CEMENT LINING METHOD” must be the unit price bid per linear foot for each size and type of existing sewer reconstructed using cement lining method and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required or necessary for the cement lining of the in-place existing ductile iron or cast iron sewer including the diversion of flow of existing sewer; controlling (or maintaining) the flow for all active service connections; necessary bypassing and pumping of the existing active service connections; repair of active service connections; all necessary excavation, backfilling and compaction; temporary and permanent restoration of all disturbed sidewalk and pavement areas (unless items for temporary and permanent restoration are otherwise provided in the Bid Schedule); cleaning up; and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans and specifications and as directed by the Engineer.

50.73.8 SEPARATE PAYMENT

The Contractor is notified that separate payment will be made for the final television inspections and digital audio-visual recordings ordered by the Engineer as specified herein under Item No. 53.11DR - TELEVISION INSPECTION AND DIGITAL AUDIO-VISUAL RECORDING OF SEWERS.

Payment for Reconstruction Of Existing Sewers Using Cement Lining Method will be made under the Item Number as calculated below:

The Item Numbers for Reconstruction Of Existing Sewers Using Cement Lining Method have ten characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Reconstruction Of Existing Sewers Using Cement Lining Method:

50.73

(2) The sixth character must define the Type of Sewer Effluent:

S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer

(3) The seventh and eighth characters must define the Kind of Existing Sewer to be Cement Lined:

CL - Cast Iron Pipe (C.I.P.) to be Lined
DL - Ductile Iron Pipe (D.I.P.) to be Lined

(4) The ninth and tenth characters must define the Diameter of the Existing Sewer to be Cement Lined. (The ninth and tenth characters representing the unit of inches for the Diameter of the Existing Sewer to be Cement Lined.) See examples below:

12 - 12'
36 - 36"

(5) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	**Description**	**Pay Unit**
50.73SCL12	RECONSTRUCTION OF EXISTING 12" C.I.P SANITARY SEWER, USING CEMENT LINING METHOD	L.F.
50.73SCL16	RECONSTRUCTION OF EXISTING 16" C.I.P SANITARY SEWER, USING CEMENT LINING METHOD	L.F.
50.73SDL12	RECONSTRUCTION OF EXISTING 12" D.I.P SANITARY SEWER, USING CEMENT LINING METHOD	L.F.
50.73SDL18	RECONSTRUCTION OF EXISTING 18" D.I.P SANITARY SEWER, USING CEMENT LINING METHOD	L.F.
50.73MCL16	RECONSTRUCTION OF EXISTING 16" C.I.P STORM SEWER, USING CEMENT LINING METHOD	L.F.
50.73MCL24	RECONSTRUCTION OF EXISTING 24" C.I.P STORM SEWER, USING CEMENT LINING METHOD	L.F.
50.73MDL18	RECONSTRUCTION OF EXISTING 18" D.I.P STORM SEWER, USING CEMENT LINING METHOD	L.F.
50.73MDL24	RECONSTRUCTION OF EXISTING 24" D.I.P STORM SEWER, USING CEMENT LINING METHOD	L.F.
50.73CCL18	RECONSTRUCTION OF EXISTING 18" C.I.P COMBINED SEWER, USING CEMENT LINING METHOD	L.F.
50.73CCL36	RECONSTRUCTION OF EXISTING 36" C.I.P COMBINED SEWER, USING CEMENT LINING METHOD	L.F.
50.73CDL18	RECONSTRUCTION OF EXISTING 18" D.I.P COMBINED SEWER, USING CEMENT LINING METHOD	L.F.
50.73CDL24	RECONSTRUCTION OF EXISTING 24" D.I.P COMBINED SEWER, USING CEMENT LINING METHOD	L.F.

SECTION 51.11 – CHAMBERS

51.11.1 DESCRIPTION

Chambers must be constructed of the sizes and shapes shown complete with frames and covers.

51.11.2 MATERIALS

(A) Concrete must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(B) Brick and brick masonry must comply with the requirements of **Section 23.02**.

(C) Frames and covers must be cast iron, unless otherwise shown on the contract plans, complying with the requirements of **Section 22.01**, Type 1. Malleable iron or cast steel covers, when required, must comply with the requirements of **Section 22.01 and Section 22.04**.

(D) Steps must be cast iron and must comply with the requirements of **Section 22.01**, Type 1, or must be copolymer polypropylene plastic manhole steps with one-half (1/2) inch Grade 60 steel reinforcement and must comply with the Sewer Design Standards.

(E) Cement mortar must comply with the requirements of **Section 23.03**.

(F) Reinforcement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(G) Structural steel must comply with the requirements of **Section 23.05**.

(H) Cast iron pipe must comply with the requirements of **Section 21.03**.

(I) Vitrified clay pipe must comply with the requirements of **Section 21.02**.

(J) Ductile iron pipe must comply with the requirements of **Section 21.06**.

(K) Bluestone must be tough, sound, durable, fine graded sandstone or quartzite, free from injurious seams and other imperfections and saw cut to the required dimensions. It must be set in a full bed of fresh mortar in compliance with the requirements of **Section 23.03**.

(L) Granite slabs must comply with the requirements of **Section 23.07**.

(M) Aluminum floor gratings must comply with the requirements of **Section 22.05**.

(N) Tide gates must comply with the requirements of **Section 51.61.2.(H)**.

(O) Stop Logs must comply with the requirements of **Section 51.61.2.(K)**.

51.11.3 CONSTRUCTION METHODS

(A) GENERAL - Chambers must be constructed of the sizes and dimensions, and at the locations and to the elevations as shown on the plans or as ordered by the Engineer.

(B) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

(C) INVERTS - Inverts of chambers must be formed between transverse templates and screeded. Where the radii of inverts are too small to permit screeding between templates, the inverts must be shaped by means of interior forms. The concrete for inverts must be deposited continuously for their entire cross section and length. Inverts must be carefully protected from all injury during the progress of the work. The inverts of chambers must be troweled smooth.

(D) SIDE WALLS - Concrete in the side walls of chambers must be deposited continuously to the height and to the thickness approved and for their entire length.

(E) ROOF - Concrete in the roofs of chambers must be deposited continuously for the full depths, and for the entire widths and lengths of the roofs. The outer surfaces of roofs must be finished true and smooth.

(F) STEPS AND LADDERS - The Contractor must furnish and install in the chambers, steps and ladders of the size, shape and spacing shown on the plans and on the Sewer Design Standards.

(G) SETTING FRAMES AND COVERS - The brick masonry or concrete for the chambers must be built to within such distance of the final grade as shown, specified or ordered. Frames and covers must be as

shown on the Sewer Design Standards. The frames must be set on the masonry or concrete in a full bed of stiff fresh cement mortar.

(H) REINFORCEMENT AND STRUCTURAL STEEL - The steel reinforcement must be of the dimensions and shapes shown, and installed in the manner specified in **General Specification 11 - Concrete, as modified in Section 23.01**. Structural steel must be of the shapes and sizes shown, and installed as directed.

(I) PRECAST CHAMBERS - Chambers must not be precast unless permission to do so is specified in the contract documents. Precast chambers when permitted in the contract documents must comply with the requirements of **Subsections 51.21.4 and 51.31.4**.

(J) REMOVAL OF FORMS - Forms must be removed in accordance with **General Specification 11 - Concrete, as modified in Section 23.01**.

(K) BULKHEADS - Approved construction joint bulkheads with provisions for keying and doweling for future sewers must be provided, where shown or required.

(L) CONNECTIONS - All connections to chambers of existing, new or future sewers and catch basin connections must be constructed as shown on the plans or as directed. All connections for future sewers must be closed with bulkheads of brick masonry eight (8) inches thick, unless otherwise shown on the plans or specified.

(M) WATERSTOPS - Waterstops must be provided between each successive pour in accordance with **Section 25.04**. Details must be submitted for waterstops as part of the shop drawings.

51.11.4 MEASUREMENT

The quantities of chambers to be measured for payment must be the number of chambers of each size and type, incorporated in the work, complete, as shown, specified or required.

51.11.5 PRICE TO COVER

The contract price for “CHAMBERS” must be the unit price bid per each size and type chamber and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to construct the chambers of the sizes and dimensions and at the locations and to the elevations shown, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); reinforcement and structural steel; all sheeting and bracing; pumping; fluming; bridging; breaking down and filling in of abandoned sewer appurtenances; connections; maintaining flow in sewers; backfilling; cleaning up; and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans and specifications, and as directed by the Engineer. Included in the price hereunder must be the cost for all labor and materials required to install granite slabs or bluestone, manhole frames and covers, manhole steps and all other hardware in accordance with the plans, specifications and standards, or as directed by the Engineer.

The contract price hereunder must also include the cost of all labor and materials required to connect at the chamber all existing and new sewers and basin connections; and all required structural steel, reinforcement and bulkheads for future sewer connections, as shown on the plans or as directed by the Engineer.

In addition, the cost of all labor and materials necessary to remove all specified or ordered existing sewers, manholes, structures and appurtenances that may be in the line of the work and do all work incidental thereto, all in accordance with **Subsections 10.13 and 10.28** of the specifications and as directed by the Engineer, must be included in the price.

Payment for Chambers will be made under the Item Number as calculated below:

The Item Numbers for Chambers have nine characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Chambers:

51.11

(2) The sixth character must define the Kind of Chamber:

C – Chamber
G – Tide Gate Chamber

J - Junction Chamber
O - Overflow Chamber
T - Transition Chamber
E - Equalizer Chamber
S - Siphon Chamber
V - Diversion Chamber
P - Standard Precast Manhole
D - Standard Precast Drop-Pipe Manhole (Type I)
R - Standard Precast Drop-Pipe Manhole (Type II)

(3) The seventh, eighth and ninth characters must define either the Number of the Chamber or the Diameter (in feet) of the Standard Precast Manhole and Standard Precast Drop-Pipe Manhole. See examples below:

000 - No Number
002 - No. 2
011 - No. 11
28A - No. 28A
004 - 4'-0" Diameter
010 - 10'-0" Diameter

(4) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
51.11C000	CHAMBER	EACH
51.11C001	CHAMBER NO. 1	EACH
51.11C002	CHAMBER NO. 2	EACH
51.11C003	CHAMBER NO. 3	EACH
51.11C010	CHAMBER NO. 10	EACH
51.11C011	CHAMBER NO. 11	EACH
51.11C23A	CHAMBER NO. 23A	EACH
51.11G000	TIDE GATE CHAMBER	EACH
51.11J000	JUNCTION CHAMBER	EACH
51.11J001	JUNCTION CHAMBER NO. 1	EACH
51.11J002	JUNCTION CHAMBER NO. 2	EACH
51.11O000	OVERFLOW CHAMBER	EACH
51.11O001	OVERFLOW CHAMBER NO. 1	EACH
51.11O002	OVERFLOW CHAMBER NO. 2	EACH
51.11T000	TRANSITION CHAMBER	EACH
51.11T001	TRANSITION CHAMBER NO. 1	EACH
51.11T002	TRANSITION CHAMBER NO. 2	EACH
51.11E000	EQUALIZER CHAMBER	EACH
51.11E001	EQUALIZER CHAMBER NO. 1	EACH
51.11E002	EQUALIZER CHAMBER NO. 2	EACH
51.11S000	SIPHON CHAMBER	EACH
51.11S001	SIPHON CHAMBER NO. 1	EACH
51.11S002	SIPHON CHAMBER NO. 2	EACH
51.11V000	DIVERSION CHAMBER	EACH
51.11V001	DIVERSION CHAMBER NO. 1	EACH
51.11V002	DIVERSION CHAMBER NO. 2	EACH
51.11P004	STANDARD 4'-0" DIAMETER PRECAST MANHOLE	EACH
51.11P005	STANDARD 5'-0" DIAMETER PRECAST MANHOLE	EACH
51.11P006	STANDARD 6'-0" DIAMETER PRECAST MANHOLE	EACH
51.11P007	STANDARD 7'-0" DIAMETER PRECAST MANHOLE	EACH
51.11P008	STANDARD 8'-0" DIAMETER PRECAST MANHOLE	EACH
51.11P010	STANDARD 10'-0" DIAMETER PRECAST MANHOLE	EACH
51.11D006	STANDARD 6'-0" DIAMETER PRECAST DROP-PIPE MANHOLE TYPE I	EACH
51.11R007	STANDARD 7'-0" DIAMETER PRECAST DROP-PIPE MANHOLE TYPE II	EACH
51.11R008	STANDARD 8'-0" DIAMETER PRECAST DROP-PIPE MANHOLE TYPE II	EACH
51.11R010	STANDARD 10'-0" DIAMETER PRECAST DROP-PIPE MANHOLE TYPE II	EACH

SECTION 51.21 – MANHOLES

51.21.1 DESCRIPTION

Manholes must be constructed of the sizes and shapes shown and of the types specified complete with frames and covers.

51.21.2 MATERIALS

(A) Concrete must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(B) Brick and brick masonry must comply with the requirements of **Section 23.02**.

(C) Frames and covers must be of cast iron, unless otherwise shown on the contract plans, complying with the requirements of **Section 22.01**, Type 1. Malleable iron or cast steel covers, when required, must comply with the requirements of **Section 22.01 and Section 22.04**.

(D) Steps must be cast iron and must comply with the requirements of **Section 22.01**, Type 1, or must be copolymer polypropylene plastic manhole steps with one-half (1/2) inch Grade 60 steel reinforcement and must comply with the Sewer Design Standards.

(E) Cement mortar must comply with the requirements of **Section 23.03**.

(F) Reinforcement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(G) Structural steel must comply with the requirements of **Section 23.05**.

(H) Cast iron pipe must comply with the requirements of **Section 21.03**.

(I) Vitrified clay pipe must comply with the requirements of **Section 21.02**.

(J) Ductile iron pipe must comply with the requirements of **Section 21.06**.

(K) Bluestone must be tough, sound, durable, fine graded sandstone or quartzite, free from injurious seams and other imperfections and saw cut to the required dimensions. It must be set in a full bed of fresh mortar in compliance with the requirements of **Section 23.03**.

(L) Granite slabs must comply with the requirements of **Section 23.07**.

(M) Aluminum floor gratings must comply with the requirements of **Section 22.05**.

51.21.3 CONSTRUCTION METHODS

(A) GENERAL - Manholes must be constructed of the sizes and dimensions, and of the types, and at the locations and to the elevations shown on the plans or as directed by the Engineer, and as shown on the Sewer Design Standards.

(B) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** must apply to the work to be done hereunder.

(C) CONCRETE MANHOLES - Concrete manholes must be built of the sizes and dimensions, and of the types, shown on the plans or as directed by the Engineer, and as shown on the Sewer Design Standards. The following must apply:

(1) Inverts of manholes must be formed between transverse templates and must be screeded. Where the radii of inverts are too small to permit screeding between templates, the inverts must be shaped by means of interior forms. The concrete for inverts must be deposited continuously for their entire cross section and length of manhole. Inverts must be carefully protected from all injury during the progress of the work. The inverts of manholes must be troweled smooth.

(2) Concrete in sidewalls of manholes must be deposited continuously to the height and to the thickness approved and for their entire length.

(3) Concrete in roofs of manholes must be deposited continuously for the full depths, and for the entire widths and lengths of the roofs. The outer surfaces of roofs must be finished true and smooth.

(D) STEPS AND LADDERS - The Contractor must furnish and install in the manholes, steps and ladders of the size, shape and spacing shown on the plans and on the Sewer Design Standards. Steps and ladders

or other step or ladder hardware must be placed integrally with the concrete or must be installed by drilling a core hole and either installing a thermoplastic insert or expansion anchor to except hardware, or setting hardware into nonshrink fresh grout or an approved nonshrink compound.

(E) SETTING FRAMES AND COVERS - The brick masonry or concrete for the manholes must be built to within such distance of the final grade as shown, specified or ordered. Frames and covers must be as shown on the Sewer Design Standards. The frames must be set on the masonry or concrete in a full bed of stiff fresh cement mortar.

(F) REMOVAL OF FORMS - Forms must be removed in accordance with **General Specification 11 - Concrete, as modified in Section 23.01**.

(G) REINFORCEMENT AND STRUCTURAL STEEL - The steel reinforcement must be of the dimensions and shapes shown, and installed in the manner specified in **General Specification 11 - Concrete, as modified in Section 23.01**. Structural steel must be of the shapes and sizes shown, and installed as directed.

(H) BULKHEADS - Approved construction joint bulkheads with provisions for keying and doweling for future sewers must be provided, where shown or required.

(I) CONNECTIONS - All connections to manholes of existing, new or future sewers and catch basin connections must be constructed as shown on the plans or as directed. All connections for future sewers must be closed with bulkheads of brick masonry eight (8) inches thick, unless otherwise shown on the plans or specified.

(J) WATERSTOPS - Waterstops must be provided between each successive pour in accordance with **Section 25.04**.

51.21.4 PRECAST REINFORCED CONCRETE MANHOLES

(A) DESCRIPTION - The Contractor is advised that in lieu of poured-in-place manholes the substitution of Precast Reinforced Concrete Manholes that comply with the Sewer Design Standards will be permitted for manholes Types A-1, A-2, B-1, B-2, C-1, C-2, D-1 and D-2, on sewers up to and including eighty-four (84) inches in diameter. All requirements of **Section 51.21** must apply unless otherwise amended herein.

(B) MATERIALS

(1) Concrete must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**, except that the concrete must have a concrete design mix for five thousand (5,000) pounds per square inch (minimum twenty-eight (28) day compressive strength of four thousand (4,000) pounds per square inch). The maximum allowable chloride content in the concrete must not exceed one-tenth (1/10) of one percent by weight of cement. The maximum water/cement ratio must not exceed forty-seven (47) percent by weight.

(2) Portland Cement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**, and must be Type II unless otherwise specified. Coarse and Fine Aggregate for concrete must be well graded in accordance with **Subsection 2.6.1.1 of General Specification 11 - Concrete, as modified in Section 23.01**. Size of Coarse Aggregate must be three-quarter (3/4) inch unless smaller size aggregate is required due to nature of work.

(3) Reinforcement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(4) Welded Steel Wire Fabric must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01** and must have a minimum specified yield strength of sixty-five thousand (65,000) pounds per square inch.

(5) High range water reducing admixtures meeting the requirements of ASTM C494 Type F and having been previously approved by the New York State Department of Transportation may be used.

(C) DETAILS - The minimum dimensions, minimum reinforcement and minimum requirements utilized for the construction of precast reinforced concrete manholes must conform to the Sewer Design Standards that are deemed a part of this contract.

(D) JOINTS AND GASKETS - Each section of precast reinforced concrete manhole must be provided with lap and spigot joints that will permit water tight and permanent joints. The minimum lap must be that shown

on the standard details. Gaskets must be provided at all joints and must be either 7/8" x 7/8" or 1" diameter Self Sealing Butyl Gasket (quality equal to Federal Specification No. SS-S-00210) or "0" Ring Gaskets with the size as specified on the standards drawings. "0" Ring Gaskets must be in conformance with **Subsection 21.05.5** of the specifications.

(E) TESTING - Concrete utilized in the construction of precast reinforced concrete manholes must be tested in conformance with **General Specification 11 - Concrete, as modified in Section 23.01**, with the exception that the concrete, steel reinforcement, fabrication and manufacture must be tested and certified as to compliance by an independent Testing Laboratory licensed in the State of New York and approved by the Department of Design and Construction.

Hydrostatic Tests, identical to those performed for Reinforced Concrete Pipe, and as defined in these specifications must be performed and must be satisfactorily completed prior to acceptance.

Testing must also conform to all applicable sections of **DIVISION III - INSPECTION OF MATERIALS, SAMPLING, AND METHODS OF TEST** of these specifications.

In addition all manufacture of sections must be witnessed by an approved licensed independent Testing Laboratory and Certified as to Compliance with the standard drawings and specifications.

The cost of all testing as described above must be included in the price bid per manhole.

(F) OPENINGS FOR LATERAL CONNECTIONS - All sewer pipe openings must conform to the sizes, dimensions and requirements specified on the Sewer Design Standards for Precast Manholes. All sewer pipe openings must be provided with two (2) number four (4) reinforcement bar hoops around each opening and each opening must be provided for at the time of manufacture.

Openings installed in the field will only be permitted for twelve (12) inch diameter basin chutes. The maximum-cored opening for basin chutes must be sixteen (16) inches. The Engineer must approve coring machines and coring methods.

Pipe openings will not be permitted through joints. The distance from the top or bottom of any section to the opening must be a minimum of three (3) inches plus the joint depth for cast pipe openings and a minimum of twelve (12) inches plus the joint depth for cored openings for basin connections.

(G) SUBMISSIONS BY THE CONTRACTOR - Prior to delivery of precast manholes the Contractor will be required to submit three (3) copies of the manufacturer's Drill Sheets to the Engineer for review. These sheets must note all pipe entries, final grades, etc. The Engineer's review of such submissions must in no way absolve the Contractor from full responsibility as to the correctness of each precast manhole with regard to details, contract plans, standards and specifications.

(H) MANUFACTURE - Precast manholes must be built in conformance with the standard drawings and must be cast in steel forms.

Devices used to position reinforcement must be made of, or coated with, material so that corrosion of the device will not occur. Sufficient devices must be provided to position the reinforcement for required concrete cover.

Concrete must be thoroughly consolidated by internal or external vibration or a combination of both.

(I) CURING - All precast sections must be subjected to curing by one of the following methods:

(1) STEAM CURING - Sections may be placed in a curing chamber, free from outside drafts, and cured in a moist atmosphere maintained at a temperature between one hundred (100) degrees Fahrenheit and one hundred sixty (160) degrees Fahrenheit, by the injection of steam for a period of not less than twelve (12) hours or, when necessary, for such additional time as may be needed to enable the pipe to meet the strength requirements. Steam curing must not commence until at least two (2) hours have elapsed since completion of placement of concrete in the forms. When a curing chamber is not available, sections may be placed in an enclosure of canvas and subjected to steam around the entire section at the temperature and for the time specified above. The enclosure must be so erected as to allow full circulation of steam around the entire section. The interior surface of the curing room or canvas jackets and the surfaces of the section must be entirely moist at all times.

(2) WATER SPRAY CURING - Under the conditions of enclosure described in the above paragraph on "Steam Curing", sections may be cured by subjecting them to a continuous fine spray of water in an enclosure maintained at a temperature of not less than seventy (70) degrees Fahrenheit for

a period of not less than seventy-two (72) hours or such additional time as may be necessary to meet the strength requirements.

(3) SATURATED COVER CURING - The sides and top of each section must be covered with heavy burlap or other suitable material saturated with water before applying and kept saturated at a temperature of not less than seventy (70) degrees Fahrenheit for seventy-two (72) hours or such additional time as may be necessary to meet the strength requirements.

Precast Sections must not be subject to freezing temperatures until the required twenty-eight (28) day compressive strength is achieved.

(J) INSTALLATION - All precast manholes must be installed in accordance with the standards and specifications for Precast Manholes and as directed by the Engineer.

(K) MARKINGS - The manufacturer must mark each individual piece with permanent markings on the inside of each section. The following minimum information must be listed:

(1) Date of Manufacture
(2) Manufacturer's Logo
(3) Individual Piece Identification
(4) ASTM Designation

(L) DELIVERY OF SECTIONS - No sections must be delivered to the job site until they have attained the specified twenty-eight (28) day compressive strength as evidenced by cylinder testing. In addition, five (5) copies of all test results, steel supplier certifications, independent Testing Laboratory certifications, and fabrication and manufacture certifications must be submitted to the Engineer prior to delivery or at the time of delivery.

51.21.5 MEASUREMENT

The quantities of manholes to be measured for payment must be the number of manholes of each size and type, incorporated in the work, complete, as shown, specified or required.

51.21.6 PRICE TO COVER

The contract price for “MANHOLES” must be the unit price bid per each size and type manhole and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to construct the manholes of the sizes and dimensions, and of the types and at the locations and to the elevations shown, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); reinforcement and structural steel; all sheeting and bracing; pumping; fluming; bridging; breaking down and filling in of abandoned sewer appurtenances; connections; maintaining flow in sewers; backfilling; cleaning up; and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans, specifications and standards, and as directed by the Engineer. Included in the price hereunder must be the cost for all labor and materials required to install granite slabs or bluestone, manhole frames and covers, manhole steps and all other hardware in accordance with the plans, specifications and standards, or as directed by the Engineer.

The contract price hereunder must also include the cost of all labor and materials required to connect at the manhole all sewers and basin connections and all required structural steel, reinforcement and bulkheads for future sewer connections, as shown on the plans or as directed by the Engineer.

In addition, included in the price hereunder must be the cost of all labor and materials necessary to remove all specified or ordered existing sewers, manholes, structures and appurtenances, that may be in the line of the work and do all work incidental thereto, all in accordance with **Subsections 10.13 and 10.28** of the specifications and as directed by the Engineer.

Where precast reinforced concrete manholes are used in lieu of poured-in-place manholes, the cost for furnishing, delivery and installation of the precast reinforced concrete manholes, complete with invert shelf; manhole frames and covers; manhole steps; additional excavation and sheeting associated with the widening and deepening of a trench due to increased width of precast manholes and due to the placement of a stone ballast leveling pad; stone ballast; connections; and all work incidental thereto all in accordance with the plans, specifications and standards, must be deemed included in the contract price bid for "MANHOLES". No additional or separate payments will be made for any work associated with the installation of precast reinforced concrete manholes.

Payment for Manholes will be made under the Item Number as calculated below:

The Item Numbers for Manholes have thirteen characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Manholes:

51.21

(2) The sixth character must define the Kind of Manhole:

S - Standard Manhole or Standard Shallow Manhole
A - Access Manhole
C - Cleanout Manhole
L - Special Manhole
D - Special Deep Manhole
W - Special Shallow Manhole

(3) The seventh, eighth and ninth characters must define either the Type of Manhole for Standard Manholes or Standard Shallow Manholes or the Number of the Manhole for Access, Cleanout, Special, Special Deep or Special Shallow Manholes. See examples below:

0A1 - Type A-1
0C2 - Type C-2
000 - No Number/No Type
003 - No. 3
012 - No. 12
23A - No.23A

(4) The tenth, eleventh and twelfth characters must define either the Diameter of the Circular Pipe Sewer or the Width of the Horizontal Elliptical Pipe Sewer the Manholes are on. (The tenth, eleventh and twelfth characters representing the unit of inches for either the Diameter of the Circular Pipe Sewer or the Width of the Horizontal Elliptical Pipe Sewer the Manholes are on.) See examples below:

000 - Inclusive Of All Diameter Sewers That Are Allowed On Sewer Design Standards For Manholes (Types A-1, A-2, A-3, B-1 and B-2), Or Of All Size Sewers That Are On Access, Cleanout, Special, Special Deep and Special Shallow Manholes
036 - 36”
121 - 121”

(5) The thirteenth character must define the Kind of Sewers the Manholes are on. See examples below:

V - Various Kinds (As shown or specified.)
C - Reinforced Concrete
R - Reinforced Concrete Pipe (R.C.P.)
D - Ductile Iron Pipe (D.I.P.)
H - Horizontal Elliptical Reinforced Concrete Pipe (H.E.R.C.P.)
E - Existing (Various Kinds)

(6) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	**Description**	**Pay Unit**
51.21S0A1000V	STANDARD MANHOLE TYPE A-1	EACH
51.21S0A1000E	STANDARD MANHOLE TYPE A-1 ON EXISTING SEWER	EACH
51.21S0A2000V	STANDARD MANHOLE TYPE A-2	EACH
51.21S0A3000V	STANDARD SHALLOW MANHOLE TYPE A-3	EACH
51.21S0B1000V	STANDARD MANHOLE TYPE B-1	EACH
51.21S0B2000V	STANDARD MANHOLE TYPE B-2	EACH
51.21S0C1036R	STANDARD MANHOLE TYPE C-1 ON 36” R.C.P. SEWER	EACH
51.21S0C1036D	STANDARD MANHOLE TYPE C-1 ON 36” D.I.P. SEWER	EACH

Item No.	Description	Pay Unit
51.21S0C1036E	STANDARD MANHOLE TYPE C-1 ON EXISTING 36” SEWER	EACH
51.21S0C1042R	STANDARD MANHOLE TYPE C-1 ON 42” R.C.P. SEWER	EACH
51.21S0C1042D	STANDARD MANHOLE TYPE C-1 ON 42” D.I.P. SEWER	EACH
51.21S0C1042E	STANDARD MANHOLE TYPE C-1 ON EXISTING 42” SEWER	EACH
51.21S0C1048R	STANDARD MANHOLE TYPE C-1 ON 48” R.C.P. SEWER	EACH
51.21S0C1048D	STANDARD MANHOLE TYPE C-1 ON 48” D.I.P. SEWER	EACH
51.21S0C1048E	STANDARD MANHOLE TYPE C-1 ON EXISTING 48” SEWER	EACH
51.21S0C1054R	STANDARD MANHOLE TYPE C-1 ON 54” R.C.P. SEWER	EACH
51.21S0C1060R	STANDARD MANHOLE TYPE C-1 ON 60” R.C.P. SEWER	EACH
51.21S0C2036R	STANDARD MANHOLE TYPE C-2 ON 36” R.C.P. SEWER	EACH
51.21S0C2036D	STANDARD MANHOLE TYPE C-2 ON 36” D.I.P. SEWER	EACH
51.21S0C2042R	STANDARD MANHOLE TYPE C-2 ON 42” R.C.P. SEWER	EACH
51.21S0C2042D	STANDARD MANHOLE TYPE C-2 ON 42” D.I.P. SEWER	EACH
51.21S0C2048R	STANDARD MANHOLE TYPE C-2 ON 48” R.C.P. SEWER	EACH
51.21S0C2048D	STANDARD MANHOLE TYPE C-2 ON 48” D.I.P. SEWER	EACH
51.21S0C2054R	STANDARD MANHOLE TYPE C-2 ON 54” R.C.P. SEWER	EACH
51.21S0C2060R	STANDARD MANHOLE TYPE C-2 ON 60” R.C.P. SEWER	EACH
51.21S0D1066R	STANDARD MANHOLE TYPE D-1 ON 66” R.C.P. SEWER	EACH
51.21S0D1072R	STANDARD MANHOLE TYPE D-1 ON 72” R.C.P. SEWER	EACH
51.21S0D1078R	STANDARD MANHOLE TYPE D-1 ON 78” R.C.P. SEWER	EACH
51.21S0D1084R	STANDARD MANHOLE TYPE D-1 ON 84” R.C.P. SEWER	EACH
51.21S0D1090R	STANDARD MANHOLE TYPE D-1 ON 90” R.C.P. SEWER	EACH
51.21S0D1096R	STANDARD MANHOLE TYPE D-1 ON 96” R.C.P. SEWER	EACH
51.21S0D2066R	STANDARD MANHOLE TYPE D-2 ON 66” R.C.P. SEWER	EACH
51.21S0D2072R	STANDARD MANHOLE TYPE D-2 ON 72” R.C.P. SEWER	EACH
51.21S0D2078R	STANDARD MANHOLE TYPE D-2 ON 78” R.C.P. SEWER	EACH
51.21S0D2084R	STANDARD MANHOLE TYPE D-2 ON 84” R.C.P. SEWER	EACH
51.21S0D2090R	STANDARD MANHOLE TYPE D-2 ON 90” R.C.P. SEWER	EACH
51.21S0D2096R	STANDARD MANHOLE TYPE D-2 ON 96” R.C.P. SEWER	EACH
51.21S0E1023H	STANDARD MANHOLE TYPE E-1 ON 23”W X 14”H H.E.R.C.P. SEWER	EACH
51.21S0E1030H	STANDARD MANHOLE TYPE E-1 ON 30”W X 19”H H.E.R.C.P. SEWER	EACH
51.21S0E1038H	STANDARD MANHOLE TYPE E-1 ON 38”W X 24”H H.E.R.C.P. SEWER	EACH
51.21S0E1045H	STANDARD MANHOLE TYPE E-1 ON 45”W X 29”H H.E.R.C.P. SEWER	EACH
51.21S0E1053H	STANDARD MANHOLE TYPE E-1 ON 53”W X 34”H H.E.R.C.P. SEWER	EACH
51.21S0E1060H	STANDARD MANHOLE TYPE E-1 ON 60”W X 38”H H.E.R.C.P. SEWER	EACH
51.21S0E2068H	STANDARD MANHOLE TYPE E-2 ON 68”W X 43”H H.E.R.C.P. SEWER	EACH
51.21S0E2076H	STANDARD MANHOLE TYPE E-2 ON 76”W X 48”H H.E.R.C.P. SEWER	EACH
51.21S0E2083H	STANDARD MANHOLE TYPE E-2 ON 83”W X 53”H H.E.R.C.P. SEWER	EACH
51.21S0E2091H	STANDARD MANHOLE TYPE E-2 ON 91”W X 58”H H.E.R.C.P. SEWER	EACH
51.21S0E2098H	STANDARD MANHOLE TYPE E-2 ON 98”W X 63”H H.E.R.C.P. SEWER	EACH
51.21S0E2106H	STANDARD MANHOLE TYPE E-2 ON 106”W X 68”H H.E.R.C.P. SEWER	EACH
51.21S0E2113H	STANDARD MANHOLE TYPE E-2 ON 113”W X 72”H H.E.R.C.P. SEWER	EACH
51.21S0E2121H	STANDARD MANHOLE TYPE E-2 ON 121”W X 77”H H.E.R.C.P. SEWER	EACH
51.21A000000C	ACCESS MANHOLE	EACH
51.21A000000E	ACCESS MANHOLE ON EXISTING SEWER	EACH
51.21A001000C	ACCESS MANHOLE NO. 1	EACH
51.21A002000C	ACCESS MANHOLE NO. 2	EACH
51.21C000000C	CLEANOUT MANHOLE	EACH
51.21C000000E	CLEANOUT MANHOLE ON EXISTING SEWER	EACH
51.21C001000C	CLEANOUT MANHOLE NO. 1	EACH
51.21C002000C	CLEANOUT MANHOLE NO. 2	EACH
51.21L000000V	SPECIAL MANHOLE	EACH
51.21L000000E	SPECIAL MANHOLE ON EXISTING SEWER	EACH
51.21L001000V	SPECIAL MANHOLE NO. 1	EACH
51.21L002000V	SPECIAL MANHOLE NO. 2	EACH
51.21L012000V	SPECIAL MANHOLE NO. 12	EACH
51.21L23A000V	SPECIAL MANHOLE NO. 23A	EACH
51.21D000000V	SPECIAL DEEP MANHOLE	EACH

Item No.	Description	Pay Unit
51.21D000000E	SPECIAL DEEP MANHOLE ON EXISTING SEWER	EACH
51.21D001000V	SPECIAL DEEP MANHOLE NO. 1	EACH
51.21D002000V	SPECIAL DEEP MANHOLE NO. 2	EACH
51.21W000000V	SPECIAL SHALLOW MANHOLE	EACH
51.21W000000E	SPECIAL SHALLOW MANHOLE ON EXISTING SEWER	EACH
51.21W001000V	SPECIAL SHALLOW MANHOLE NO. 1	EACH
51.21W002000V	SPECIAL SHALLOW MANHOLE NO. 2	EACH

SECTION 51.22 – RECONSTRUCTION OF EXISTING MANHOLES

51.22.1 INTENT

This section describes the reconstruction of existing manholes on existing sewers, lined sewers and shotcreted sewers.

51.22.2 WORK INCLUDED

Where existing sewer manholes are shown on the plans, specified in the contract documents, or ordered by the Engineer to be reconstructed, the Contractor must furnish all labor, materials, equipment, etc., necessary and required to reconstruct such manholes as specified herein and as ordered.

51.22.3 CONSTRUCTION METHODS

(A) ON EXISTING SEWERS

From the invert of the manhole to the bottom of the casting; all loose and missing brick, masonry or concrete must be repaired and/or removed as directed by the Engineer; all debris, excess mortar, etc. must be removed so that the faces of the manhole walls and the invert are left smooth and clean; and all surfaces must be cleaned by water blasting or other approved method. If any step is damaged or unsafe, as determined by the Engineer, all steps in the manhole chimney must be removed and must not be replaced. Finally, the whole area must be purged or flashed by placing a one-half (1/2) inch minimum finishing coat of mortar with a float finish. The invert dish finish coat must be tapered at all ends so as to provide a smooth transition to existing sewers.

(B) ON EXISTING LINED SEWERS

From the invert of the manhole to the bottom of the casting; all loose and missing brick, masonry or concrete must be repaired and/or removed as directed by the Engineer; all debris, excess mortar, etc. must be removed so that the faces of the manhole walls and the invert are left smooth and clean; and all wall and invert surfaces must be cleaned by water blasting or other approved method. If any step is damaged or unsafe, as determined by the Engineer, all steps in the manhole chimney must be removed and must not be replaced. Finally, the whole area must be purged or flashed by placing a one-half (1/2) inch minimum finishing coat of mortar with a float finish. The invert dish must receive a proportionately thicker finish coat so as to provide a smooth transition from existing sewer to the inside surface of liner.

(C) ON EXISTING SHOTCRETED SEWERS

From the inner top of the largest sewer to the bottom of the casting; all loose and missing brick, masonry or concrete must be repaired and/or removed as directed by the Engineer; all debris, excess mortar, etc. must be removed so that the faces of the manhole walls are left smooth and clean; and all wall surfaces must be cleaned by water blasting or other approved method. If any step is damaged or unsafe, as determined by the Engineer, all steps in the manhole chimney must be removed and must not be replaced. Finally, the whole area must be purged or flashed by placing a one-half (1/2) inch minimum finishing coat of mortar with a float finish..

(D) STANDARD FOR RECONSTRUCTION OF EXISTING MANHOLE

The Contractor's attention is directed to the STANDARD FOR RECONSTRUCTION OF EXISTING MANHOLE AND REPLACEMENT OF EXISTING MANHOLE FRAME AND COVER.

51.22.4 MEASUREMENT

The quantity to be measured for payment must be the number of manholes (regardless of the size of sewers the manholes are on) completely reconstructed as shown, specified, or ordered, and which are accepted by the Engineer.

51.22.5 PRICE TO COVER

(A) ON EXISTING SEWERS

The contract price for Item No. 51.22RM - RECONSTRUCTION OF EXISTING MANHOLE ON EXISTING SEWER must be the unit price bid per each existing manhole reconstructed on an existing sewer (regardless of the size of sewer the manhole is on) and must cover the cost of all labor, materials, plant and equipment required or necessary to perform all the work specified herein, including the cost for chipping of debris, excess mortar, etc., from the manhole walls and invert by the

use of pneumatic or conventional hand held hammers or chisels, cleaning invert of extraneous mortar, chips and debris and the doing of all work incidental thereto, all in accordance with the plans and specifications and as directed by the Engineer.

(B) ON EXISTING LINED SEWERS

The contract price for Item No. 51.22RL - RECONSTRUCTION OF EXISTING MANHOLE ON EXISTING LINED SEWER must be the unit price bid per each existing manhole reconstructed on an existing lined sewer (regardless of the size of sewer the manhole is on) and must cover the cost of all labor, materials, plant and equipment required or necessary to perform all the work specified herein, including the cost for chipping of debris, excess mortar, etc., from the manhole walls and invert by the use of pneumatic or conventional hand held hammers or chisels, cleaning invert of extraneous mortar, chips and debris and the doing of all work incidental thereto, all in accordance with the plans and specifications and as directed by the Engineer.

(C) ON EXISTING SHOTCRETED SEWERS

The contract price for Item No. 51.22RS - RECONSTRUCTION OF EXISTING MANHOLE ON EXISTING SHOTCRETED SEWER must be the unit price bid per each existing manhole reconstructed on an existing shotcreted sewer (regardless of the size of sewer the manhole is on) and must cover the cost of all labor, materials, plant and equipment required or necessary to perform all the work specified herein, including the cost for chipping of debris, excess mortar, etc., from the manhole walls by the use of pneumatic or conventional hand held hammers or chisels, cleaning invert of extraneous mortar, chips and debris and the doing of all work incidental thereto, all in accordance with the plans and specifications and as directed by the Engineer.

Payment for Reconstruction Of Existing Manholes will be made under the Item Number as calculated below:

The Item Numbers for Reconstruction Of Existing Manholes have seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Reconstruction Of Existing Manholes:

51.22

(2) The sixth and seventh characters must define the Kind of Sewer manhole reconstruction is to be on:

RM - Existing Sewer
REL - Existing Lined Sewer
RS - Existing Shotcreted Sewer

(3) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	**Description**	**Pay Unit**
51.22RM	RECONSTRUCTION OF EXISTING MANHOLE ON EXISTING SEWER	EACH
51.22RL	RECONSTRUCTION OF EXISTING MANHOLE ON EXISTING LINED SEWER	EACH
51.22RS	RECONSTRUCTION OF EXISTING MANHOLE ON EXISTING SHOTCRETED SEWER	EACH

SECTION 51.23 – REPLACEMENT OF EXISTING MANHOLE FRAME AND COVER

51.23.1 INTENT

This section describes the replacement of existing manhole frames and covers.

51.23.2 WORK INCLUDED

Where existing manhole frames and covers are shown on the plans, specified in the contract documents, or ordered by the Engineer to be replaced, the Contractor must furnish all labor, materials, equipment, etc., necessary and required to remove such manhole frames and covers (which are twenty-four (24) inches in diameter or otherwise damaged, defective or nonstandard) and replace them with new standard twenty-seven (27) inch cast iron manhole frames and covers.

51.23.3 CONSTRUCTION METHODS

The Contractor is responsible for breaking out and removing all manhole frames and covers at the locations shown, specified, or ordered by the Engineer. Upon removal, a new standard twenty-seven (27) inch diameter cast iron manhole frame and cover must be installed. All courses of brick damaged or removed during removal of existing castings must be replaced. The new casting must be properly set on a bed of mortar. Finally, the area of pavement damaged due to removal of castings must be repaired.

The Contractor's attention is directed to the STANDARD FOR RECONSTRUCTION OF EXISTING MANHOLE AND REPLACEMENT OF EXISTING MANHOLE FRAME AND COVER.

All castings must become the property of and be disposed of by the Contractor.

51.23.4 MEASUREMENT

The quantity to be measured for payment must be the number of sets of manhole frames and covers completely incorporated into the work as shown, specified or ordered.

51.23.5 PRICE TO COVER

The contract price for Item No. 51.23RF - REPLACEMENT OF EXISTING MANHOLE FRAME AND COVER must be the unit price bid per each set of manhole frame and cover replaced and must cover the cost of all labor, materials, plant and equipment required or necessary to perform all work, including the removal and permanent restoration of surrounding pavements, excavation and backfilling required, cleanup, and the doing of all work incidental thereto, all in accordance with the plans and specifications and as directed by the Engineer.

Payment for Replacement Of Existing Manhole Frame And Cover will be made under the Item Number as calculated below:

The Item Number for Replacement Of Existing Manhole Frame And Cover has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Replacement Of Existing Manhole Frame And Cover:

51.23

(2) The sixth and seventh characters must define Replacement Of Existing Manhole Frame And Cover:

RF - Replacement Of Existing Manhole Frame And Cover

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
51.23RF	REPLACEMENT OF EXISTING MANHOLE FRAME AND COVER	EACH

SECTION 51.31 – DROP PIPE MANHOLES

51.31.1 DESCRIPTION

Drop-Pipe Manholes must be constructed of the sizes and shapes shown and of the types specified complete with frames and covers.

51.31.2 MATERIALS

(A) Concrete must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(B) Brick and brick masonry must comply with the requirements of **Section 23.02**.

(C) Frames and covers must be of cast iron, unless otherwise shown on the contract plans, complying with the requirements of **Section 22.01**, Type 1. Malleable iron or cast steel covers, when required, must comply with the requirements of **Section 22.01 and Section 22.04**.

(D) Steps must be cast iron and must comply with the requirements of **Section 22.01**, Type 1, or must be copolymer polypropylene plastic manhole steps with one-half (1/2) inch Grade 60 steel reinforcement and must comply with the Sewer Design Standards.

(E) Cement mortar must comply with the requirements of **Section 23.03**.

(F) Reinforcement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(G) Structural steel must comply with the requirements of **Section 23.05**.

(H) Cast iron pipe must comply with the requirements of **Section 21.03**.

(I) Vitrified clay pipe must comply with the requirements of **Section 21.02**.

(J) Ductile iron pipe must comply with the requirements of **Section 21.06**.

(K) Bluestone must be tough, sound, durable, fine graded sandstone or quartzite, free from injurious seams and other imperfections and saw cut to the required dimensions. It must be set in a full bed of fresh mortar in compliance with the requirements of **Section 23.03**.

(L) Granite slabs must comply with the requirements of **Section 23.07**.

(M) Aluminum floor gratings must comply with the requirements of **Section 22.05**.

51.31.3 CONSTRUCTION METHODS

(A) GENERAL - Drop-Pipe Manholes must be constructed of the sizes and dimensions, and of the types, and at the locations and to the elevations shown on the plans or as directed by the Engineer, and as shown on the Sewer Design Standards.

(B) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

(C) CONCRETE DROP-PIPE MANHOLES - Concrete drop-pipe manholes must be built of the sizes and dimensions, and of the types, shown on the plans or as directed by the Engineer, and as shown on the Sewer Design Standards. The following must apply:

(1) Inverts of drop-pipe manholes must be formed between transverse templates and must be screeded. Where the radii of inverts are too small to permit screeding between templates, the inverts must be shaped by means of interior forms. The concrete for inverts must be deposited continuously for their entire cross section and length of drop-pipe manhole. Inverts must be carefully protected from all injury during the progress of the work. The inverts of drop-pipe manholes must be troweled smooth.

(2) Concrete in side walls of drop-pipe manholes must be deposited continuously to the height and to the thickness approved and for their entire length.

(3) Concrete encasement for drop pipe must be deposited continuously to the height and to the cross section approved. Concrete encasement for drop pipe must be anchored to the side wall(s) as shown or specified, freestanding encasement for drop pipe is not permitted. The use of bolt-on straps or bands to secure the drop pipe to the side wall(s) will not be permitted.

(4) Concrete in roofs of drop-pipe manholes must be deposited continuously for the full depths, and for the entire widths and lengths of the roofs. The outer surfaces of roofs must be finished true and smooth.

(D) STEPS AND LADDERS - The Contractor must furnish and install in the drop-pipe manholes, steps and ladders of the size, shape and spacing shown on the plans and on the Sewer Design Standards. Steps and ladders or other step or ladder hardware must be placed integrally with the concrete or must be installed by drilling a core hole and either installing a thermoplastic insert or expansion anchor to except hardware, or setting hardware into nonshrink fresh grout or an approved nonshrink compound.

(E) SETTING FRAMES AND COVERS - The brick masonry or concrete for the drop-pipe manholes must be built to within such distance of the final grade as shown, specified or ordered. Frames and covers must be as shown on the Sewer Design Standards. The frames must be set on the masonry or concrete in a full bed of stiff fresh cement mortar.

(F) REMOVAL OF FORMS - Forms must be removed in accordance with **General Specification 11 - Concrete, as modified in Section 23.01**.

(G) REINFORCEMENT AND STRUCTURAL STEEL - The steel reinforcement must be of the dimensions and shapes shown, and installed in the manner specified in **General Specification 11 - Concrete, as modified in Section 23.01**. Structural steel must be of the shapes and sizes shown, and installed as directed.

(H) BULKHEADS - Approved construction joint bulkheads with provisions for keying and doweling for future sewers must be provided, where shown or required.

(I) CONNECTIONS - All connections to drop-pipe manholes of existing, new or future sewers and catch basin connections must be constructed as shown on the plans or as directed. All connections for future sewers must be closed with bulkheads of brick masonry eight (8) inches thick, unless otherwise shown on the plans or specified.

51.31.4 PRECAST REINFORCED CONCRETE DROP-PIPE MANHOLES

(A) DESCRIPTION - The Contractor is advised that in lieu of poured-in-place drop-pipe manholes the substitution of Precast Reinforced Concrete Drop-Pipe Manholes that comply with the Sewer Design Standards will be permitted for drop-pipe manholes Type I and Type II. All requirements of **Section 51.31** must apply unless otherwise amended herein.

(B) MATERIALS

(1) Concrete must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**, except that the concrete must have a concrete design mix for five thousand (5,000) pounds per square inch (minimum twenty-eight (28) day compressive strength of four thousand (4,000) pounds per square inch). The maximum allowable chloride content in the concrete must not exceed one-tenth (1/10) of one percent by weight of cement. The maximum water/cement ratio must not exceed forty-seven (47) percent by weight.

(2) Portland Cement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**, and must be Type II unless otherwise specified. Coarse and Fine Aggregate for concrete must be well graded in accordance with **Subsection 2.6.1.1 of General Specification 11 - Concrete, as modified in Section 23.01**. Size of Coarse Aggregate must be three-quarter (3/4) inch unless smaller size aggregate is required due to nature of work.

(3) Reinforcement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(4) Welded Steel Wire Fabric must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01** and must have a minimum specified yield strength of sixty-five thousand (65,000) pounds per square inch.

(5) High range water reducing admixtures meeting the requirements of ASTM C494 Type F and having been previously approved by the New York State Department of Transportation may be used.

(C) DETAILS - The minimum dimensions, minimum reinforcement and minimum requirements utilized for the construction of precast reinforced concrete drop-pipe manholes must conform to the Sewer Design Standards that are deemed a part of this contract.

(D) JOINTS AND GASKETS - Each section of precast reinforced concrete drop-pipe manhole must be provided with lap and spigot joints that will permit water tight and permanent joints. The minimum lap must be that shown on the Standard Details. Gaskets must be provided at all joints and must be either 7/8" x 7/8" or 1" diameter Self Sealing Butyl Gasket (quality equal to Federal Specification No. SS-S-00210) or "0" Ring Gaskets with the size as specified on the standards drawings. "0" Ring Gaskets must be in conformance with **Subsection 21.05.5** of the specifications.

(E) TESTING - Concrete utilized in the construction of precast reinforced concrete drop-pipe manholes must be tested in conformance with **General Specification 11 - Concrete, as modified in Section 23.01**, with the exception that the concrete, steel reinforcement, fabrication and manufacture must be tested and certified as to compliance by an independent Testing Laboratory licensed in the State of New York and approved by the Department of Design and Construction.

Hydrostatic Tests, identical to those performed for Reinforced Concrete Pipe, and as defined in these specifications must be performed and must be satisfactorily completed prior to acceptance.

Testing must also conform to all applicable sections of **DIVISION III - INSPECTION OF MATERIALS, SAMPLING, AND METHODS OF TEST** of these specifications.

In addition, all manufacture of sections must be witnessed by an approved licensed independent Testing Laboratory and Certified as to Compliance with the standard drawings and specifications.

The cost of all testing as described above must be deemed included in the price bid per drop-pipe manhole.

(F) OPENINGS FOR LATERAL CONNECTIONS - All sewer pipe openings must conform to the sizes, dimensions and requirements specified on the Sewer Design Standards for Precast Drop-Pipe Manholes. All sewer pipe openings must be provided with two (2) number four (4) reinforcement bar hoops around each opening and each opening must be provided for at the time of manufacture.

Openings installed in the field will only be permitted for twelve (12) inch diameter basin chutes. The maximum-cored opening for basin chutes must be sixteen (16) inches. The Engineer must approve coring machines and coring methods.

Pipe openings will not be permitted through joints. The distance from the top or bottom of any section to the opening must be a minimum of three (3) inches plus the joint depth for cast pipe openings and a minimum of twelve (12) inches plus the joint depth for cored openings for basin connections.

(G) SUBMISSIONS BY THE CONTRACTOR - Prior to delivery of precast drop-pipe manholes the Contractor will be required to submit three (3) copies of the manufacturer's Drill Sheets to the Engineer for review. These sheets must note all pipe entries, final grades, etc. The Engineer's review of such submissions must in no way absolve the Contractor from full responsibility as to the correctness of each precast drop-pipe manhole with regard to details, contract plans, standards and specifications.

(H) MANUFACTURE - Precast drop-pipe manholes must be built in conformance with the standard drawings and must be cast in steel forms.

Devices used to position reinforcement must be made of, or coated with, material so that corrosion of the device will not occur. Sufficient devices must be provided to position the reinforcement for required concrete cover.

Concrete must be thoroughly consolidated by internal or external vibration or a combination of both.

(I) CURING - All precast sections must be subjected to curing by one of the following methods:

(1) STEAM CURING - Sections may be placed in a curing chamber, free from outside drafts, and cured in a moist atmosphere maintained at a temperature between one hundred (100) degrees Fahrenheit and one hundred sixty (160) degrees Fahrenheit, by the injection of steam for a period of not less than twelve (12) hours or, when necessary, for such additional time as may be needed to enable the pipe to meet the strength requirements. Steam curing must not commence until at least two (2) hours have elapsed since completion of placement of concrete in the forms. When a curing chamber is not available, sections may be placed in an enclosure of canvas and subjected to steam around the entire section at the temperature and for the time specified above. The enclosure must be so erected as to allow full circulation of steam around the entire section. The interior surface of the curing room or canvas jackets and the surfaces of the section must be entirely moist at all times.

(2) WATER SPRAY CURING - Under the conditions of enclosure described in the above paragraph on "Steam Curing", sections may be cured by subjecting them to a continuous fine spray of water in an enclosure maintained at a temperature of not less than seventy (70) degrees Fahrenheit for a period of not less than seventy-two (72) hours or such additional time as may be necessary to meet the strength requirements.

(3) SATURATED COVER CURING - The sides and top of each section must be covered with heavy burlap or other suitable material saturated with water before applying and kept saturated at a temperature of not less than seventy (70) degrees Fahrenheit for seventy-two (72) hours or such additional time as may be necessary to meet the strength requirements.

Precast Sections must not be subjected to freezing temperatures until the required twenty-eight (28) day compressive strength is achieved.

(J) INSTALLATION - All precast drop-pipe manholes must be installed in accordance with the standards and specifications for Precast Drop-Pipe Manholes and as directed by the Engineer.

(K) MARKINGS - The manufacturer must mark each individual piece with permanent markings on the inside of each section. The following minimum information must be listed:

(1) Date of Manufacture
(2) Manufacturer's Logo
(3) Individual Piece Identification
(4) ASTM Designation

(L) DELIVERY OF SECTIONS - Sections must not be delivered to the job site until they have attained the specified twenty-eight (28) day compressive strength as evidenced by cylinder testing. In addition, five (5) copies of all test results, steel supplier certifications, independent Testing Laboratory certifications, and fabrication and manufacture certifications must be submitted to the Engineer prior to delivery or at the time of delivery.

51.31.5 MEASUREMENT

The quantities of drop-pipe manholes to be measured for payment must be the number of drop-pipe manholes of each size and type, incorporated in the work, complete, as shown, specified or required.

51.31.6 PRICE TO COVER

The contract price for “DROP-PIPE MANHOLES” must be the unit price bid per each size and type drop-pipe manhole and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to construct the drop-pipe manholes of the sizes and dimensions, and of the types and at the locations and to the elevations shown, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); reinforcement and structural steel; all sheeting and bracing; pumping; fluming; bridging; breaking down and filling in of abandoned sewer appurtenances; connections; maintaining flow in sewers; backfilling; cleaning up; and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans, specifications and standards, and as directed by the Engineer. Included in the price hereunder must be the cost for all labor and materials required to install granite slabs or bluestone, manhole frames and covers, manhole steps, drop pipe and all other hardware in accordance with the plans, specifications and standards, or as directed by the Engineer.

The contract price hereunder must also include the cost of all labor and materials required to connect at the drop-pipe manhole all sewers and basin connections and all required structural steel, reinforcement and bulkheads for future sewer connections, as shown on the plans or as directed by the Engineer.

In addition, the price hereunder must include the cost of all labor and materials necessary to remove all specified or ordered existing sewers, manholes, structures and appurtenances, that may be in the line of the work and do all work incidental thereto, all in accordance with **Subsections 10.13 and 10.28** of the specifications and as directed by the Engineer.

Where precast reinforced concrete drop-pipe manholes are used in lieu of poured-in-place drop-pipe manholes, the cost for furnishing, delivery and installation of the precast reinforced concrete drop-pipe manholes, complete with invert shelf; granite slabs; drop pipe; reinforced concrete drop pipe encasement; threaded dowels and thermoplastic inserts; manhole frames and covers; manhole steps; additional excavation and sheeting associated with the widening and deepening of a trench due to increased width of precast drop-pipe manholes and due to the placement of a stone ballast leveling pad; stone ballast;

connections; and all work incidental thereto all in accordance with the plans, specifications and standards, must be included in the contract price bid for "DROP-PIPE MANHOLES". No additional or separate payments will be made for any work associated with the installation of precast reinforced concrete drop-pipe manholes.

Payment for Drop-Pipe Manholes will be made under the Item Number as calculated below:

The Item Numbers for Drop-Pipe Manholes have twelve characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Drop-Pipe Manholes:

51.31

(2) The sixth character must define the Kind of Manhole:

S - Standard Drop-Pipe Manhole
L - Special Drop-Pipe Manhole
D - Special Deep Drop-Pipe Manhole

(3) The seventh, eighth and ninth characters must define either the Type of Standard Drop-Pipe Manhole or the Number of the Drop-Pipe Manhole for Special Drop-Pipe or Special Deep Drop-Pipe Manholes. See examples below:

001 - Type I
002 - Type II
000 - No Number/No Type
003 - No. 3
012 - No. 12
23A - No. 23A

(4) The tenth and eleventh characters must define the Diameter of the Circular Pipe Sewer the Drop-Pipe Manholes are on. (The tenth and eleventh characters representing the unit of inches for the Diameter of the Circular Pipe Sewer the Drop-Pipe Manholes are on.) See examples below:

00 - Inclusive Of All Diameter Sewers That Are Allowed On Sewer Design Standards For Drop-Pipe Manhole (Type I), Or Of All Size Sewers That Are On Special Drop-Pipe and Special Deep Drop-Pipe Manholes
36 - 36”

(5) The twelfth character must define the Kind of Sewers the Manholes are on. See examples below:

V - Various Kinds (As shown or specified.)
R - Reinforced Concrete Pipe (R.C.P.)
S - Extra-Strength Vitrified Pipe (E.S.V.P.)
D - Ductile Iron Pipe (D.I.P.)
E - Existing (Various Kinds)

(6) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
51.31S00100V	STANDARD DROP-PIPE MANHOLE TYPE I	EACH
51.31S00100E	STANDARD DROP-PIPE MANHOLE TYPE I ON EXISTING SEWER	EACH
51.31S00210S	STANDARD DROP-PIPE MANHOLE TYPE II ON 10” E.S.V.P. SEWER	EACH
51.31S00210D	STANDARD DROP-PIPE MANHOLE TYPE II ON 10” D.I.P. SEWER	EACH
51.31S00210E	STANDARD DROP-PIPE MANHOLE TYPE II ON EXISTING 10” SEWER	EACH
51.31S00212S	STANDARD DROP-PIPE MANHOLE TYPE II ON 12” E.S.V.P. SEWER	EACH
51.31S00212D	STANDARD DROP-PIPE MANHOLE TYPE II ON 12” D.I.P. SEWER	EACH
51.31S00212E	STANDARD DROP-PIPE MANHOLE TYPE II ON EXISTING 12” SEWER	EACH
51.31S00215S	STANDARD DROP-PIPE MANHOLE TYPE II ON 15” E.S.V.P. SEWER	EACH
51.31S00218S	STANDARD DROP-PIPE MANHOLE TYPE II ON 18” E.S.V.P. SEWER	EACH
51.31S00224R	STANDARD DROP-PIPE MANHOLE TYPE II ON 24” R.C.P. SEWER	EACH
51.31S00224D	STANDARD DROP-PIPE MANHOLE TYPE II ON 24” D.I.P. SEWER	EACH

Item No.	Description	Pay Unit
51.31S00224E	STANDARD DROP-PIPE MANHOLE TYPE II ON EXISTING 24” SEWER	EACH
51.31S00230R	STANDARD DROP-PIPE MANHOLE TYPE II ON 30” R.C.P. SEWER	EACH
51.31S00236R	STANDARD DROP-PIPE MANHOLE TYPE II ON 36” R.C.P. SEWER	EACH
51.31S00242R	STANDARD DROP-PIPE MANHOLE TYPE II ON 42” R.C.P. SEWER	EACH
51.31S00248R	STANDARD DROP-PIPE MANHOLE TYPE II ON 48” R.C.P. SEWER	EACH
51.31S00254R	STANDARD DROP-PIPE MANHOLE TYPE II ON 54” R.C.P. SEWER	EACH
51.31S00260R	STANDARD DROP-PIPE MANHOLE TYPE II ON 60” R.C.P. SEWER	EACH
51.31L00000V	SPECIAL DROP-PIPE MANHOLE	EACH
51.31L00000E	SPECIAL DROP-PIPE MANHOLE ON EXISTING SEWER	EACH
51.31L00100V	SPECIAL DROP-PIPE MANHOLE NO. 1	EACH
51.31L00200V	SPECIAL DROP-PIPE MANHOLE NO. 2	EACH
51.31L01200V	SPECIAL DROP-PIPE MANHOLE NO. 12	EACH
51.31L23A00V	SPECIAL DROP-PIPE MANHOLE NO. 23A	EACH
51.31D00000V	SPECIAL DEEP DROP-PIPE MANHOLE	EACH
51.31D00000E	SPECIAL DEEP DROP-PIPE MANHOLE ON EXISTING SEWER	EACH
51.31D00100V	SPECIAL DEEP DROP-PIPE MANHOLE NO. 1	EACH
51.31D00200V	SPECIAL DEEP DROP-PIPE MANHOLE NO. 2	EACH

SECTION 51.41 – CATCH BASINS

51.41.1 DESCRIPTION

Catch basins must be constructed of the sizes and shapes shown and of the types specified complete with frames, gratings, covers, hoods, hooks and all other hardware as shown or required.

51.41.2 MATERIALS

(A) Concrete must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(B) Brick and brick masonry must comply with the requirements of **Section 23.02**.

(C) Frames and hoods must be of cast iron complying with the requirements of **Section 22.01**, Type 1, unless otherwise shown on the plans.

(D) Gratings and covers must be of cast iron, unless otherwise shown on the contract plans, complying with the requirements of **Section 22.01**, Type 1. Malleable iron or cast steel gratings and covers, when required, must comply with the requirements of **Section 22.01 and Section 22.04**.

(E) Hooks must be of stainless steel one-half (1/2) inch square bar stock, and must be 18-8 stainless steel Type 303, complying with the requirements of ASTM A582. All other approved hangers together with fasteners must be 18-8 stainless steel Type 303, complying with the requirements of ASTM A582.

(F) Cement mortar must comply with the requirements of **Section 23.03**.

(G) Reinforcement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

51.41.3 CONSTRUCTION METHODS

(A) GENERAL - The Contractor is notified that all catch basins installed under the contract must be Type 1 Catch Basins, unless otherwise specified in the contract documents or directed by the Engineer.

Catch Basins must be constructed of the sizes and dimensions and of the types, and at the locations and to the elevations shown on the plans or as directed by the Engineer, and as shown on the Sewer Design Standards.

Catch Basins must be installed in accordance with final grade. The brick masonry or concrete for catch basins must be built to within such distance of the final grade as shown, specified or ordered.

(B) GENERAL CONSTRUCTION PROVISIONS

(1) The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

(2) Frames, gratings, covers, hoods, hooks and all other hardware must be in accordance with the Sewer Design Standards. The frames must be set on the masonry or concrete in a full bed of stiff fresh cement mortar.

(3) The Contractor is notified that at all locations, specified in the contract documents or directed by the Engineer, requiring the installation of Catch Basins and for which there is no new sidewalk restoration called for under the contract, the following minimum work must be required to be performed in the sidewalk area. The Contractor must saw cut the existing sidewalk and curb at a distance of one (1) foot around the perimeter of the catch basin, excavate, place expansion joints all around and then install a concrete curb and a four (4) inch thick concrete sidewalk within the removed sidewalk area (See Standards for Catch Basins). The cost for all labor and material required and necessary to construct this slab of concrete, including the saw cutting and removal of sidewalk and curb, placing of expansion joints, and reconstruction of curb and sidewalk, must be included in the prices bid for the respective catch basin items. No separate or additional payment will be made for this work.

(C) CATCH BASIN CONSTRUCTION

(1) Catch basins must be built of the sizes and dimensions, and of the types, shown on the plans or as directed by the Engineer, and as shown on the Sewer Design Standards. The following applies:

(a) The concrete for bases of catch basins must be deposited continuously for their entire area together with keys. Bases must be carefully protected from all injury during the progress of the work. The bases of catch basins must be true and smooth.

(b) Concrete in sidewalls of catch basins must be deposited continuously to the height and to the thickness approved and for their entire length.

(c) Concrete in roofs of catch basins must be deposited continuously for the full depths, and for the entire widths and lengths of the roofs. The outer surfaces of roofs must be finished true and smooth.

(d) Chutes for Type 3 catch basins must be poured in one piece. The concrete must be deposited continuously for the entire dimensions of the chutes.

(2) The locations of the catch basins shown on the plans are approximate only. The Contractor must, with the approval of the Engineer, establish the catch basin locations taking into consideration the following:

(a) Drainage of the area to the catch basin Location.

(b) Damage to trees or their root system.

(3) No catch basin must be installed in a location where a pedestrian ramp or driveway depressed curb exists. The minimum distance between a catch basin frame and grating and the end of a depressed curb apron must be one (1) foot.

(4) All corner catch basins are to be located fully behind the property line of the intersecting street unless otherwise ordered, in writing, by the Engineer.

(5) INSTALLING OF HOOKS OR OTHER HANGER HARDWARE FOR HOODS - The Contractor must furnish and install in the catch basins, hooks and hoods of the size and shape shown on the Sewer Design Standards. Hooks or other hanger hardware must be placed integrally with the concrete or must be installed by drilling a core hole and either installing a thermoplastic insert or expansion anchor to except hardware, or setting hardware into nonshrink fresh grout or an approved nonshrink compound.

(6) SETTING FRAMES, GRATES AND COVERS - The brick masonry or concrete for the catch basins must be built to within such distance of the final grade as shown, specified or ordered. Frames, grates and covers must be as shown on the Sewer Design Standards. The frames must be set on the masonry or concrete in a full bed of stiff fresh cement mortar.

(7) REMOVAL OF FORMS - Forms must be removed in accordance with **General Specification 11 - Concrete, as modified in Section 23.01**.

(8) REINFORCEMENT - The steel reinforcement must be of the dimensions and shapes shown, and installed in the manner specified in **General Specification 11 - Concrete, as modified in Section 23.01**.

(9) CONNECTIONS - All connections to catch basins must be constructed as shown on the plans or as directed. All connections for future catch basin connections must be closed with bulkheads of brick masonry eight (8) inches thick, unless otherwise shown on the plans or specified.

Catch basin connection pipe or catch basin connection pipe openings will not be permitted through the corner of catch basins. The distance from the edge of a pipe or an opening to the inside face of the adjoining wall must be a minimum of three (3) inches.

(D) CATCH BASIN CONSTRUCTION WHERE NO CURB EXISTS

(1) Where there are no existing curbs, the Contractor must survey the area and where possible, locate the proposed catch basins on the future curb line and use a three (3) inch thick asphalt apron to direct the surface flow to the new catch basin. A swale must be created for a minimum of three (3) feet around the catch basin.

(2) All work for catch basin construction where no curb exists must be done in accordance with the Sewer Design Standards.

(3) Where no curbs exist, catch basins must be staked out (lines and grades) by a L.S. or a P.E., and signed and sealed layout sheets must be submitted to the Engineer prior to excavation. The Contractor must install the catch basins in accordance with the submitted layout sheets.

(E) ABANDONING EXISTING CATCH BASINS - Existing catch basins which are shown or ordered to be abandoned, or are made unnecessary by the construction of new catch basins, must be abandoned in accordance with **Subsection 10.13(4)**. The curb, sidewalk and pavement affected by the catch basin abandonment must be permanently restored to match the existing condition.

The Contractor must restore the area with new sidewalk, curb and roadway in a manner that will provide positive drainage to the new catch basins and eliminate the ponding that may otherwise occur in the area of the abandoned catch basins. Existing catch basin connections must be bulkheaded. The cost of all labor, materials and equipment required and necessary to abandon existing catch basins in accordance with **Subsection 10.13(4)**, including bulkheading of catch basin connections and restoration of sidewalks and curbs must be deemed included in the prices bid for all items of work. No separate or additional payment will be made for the abandoning of existing catch basins unless specific items are provided for in the Bid Schedule.

51.41.4 PRECAST REINFORCED CONCRETE CATCH BASINS

(A) DESCRIPTION - The Contractor is advised that in lieu of poured-in-place catch basins the substitution of Precast Reinforced Concrete Catch Basins that comply with the Sewer Design Standards will be permitted for catch basins Types 1, 2 and 3, and for Double Catch Basins. All requirements of **Section 51.41** applies unless otherwise amended herein.

(B) MATERIALS

(1) Concrete must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(2) Portland Cement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**, and must be Type II unless otherwise specified. Coarse and Fine Aggregate for concrete must be well graded in accordance with **Subsection 2.6.1.1 of General Specification 11 - Concrete, as modified in Section 23.01**. Size of Coarse Aggregate must be three-quarter (3/4) inch unless smaller size aggregate is required due to nature of work.

(3) Reinforcement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(4) Welded Steel Wire Fabric must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01** and must have a minimum specified yield strength of sixty-five thousand (65,000) pounds per square inch.

(5) High range water reducing admixtures meeting the requirements of ASTM C494 Type F and having been previously approved by the New York State Department of Transportation may be used.

(C) DETAILS - The minimum dimensions, minimum reinforcement and minimum requirements utilized for the construction of precast reinforced concrete catch basins must conform to the Sewer Design Standards that are deemed a part of this contract.

(D) Precast reinforced concrete catch basins must be manufactured in one (1) piece, as shown.

(E) TESTING - Concrete utilized in the construction of precast reinforced concrete catch basins must be tested in conformance with **General Specification 11 - Concrete, as modified in Section 23.01**, with the exception that the concrete, steel reinforcement, fabrication and manufacture must be tested and certified as to compliance by an independent Testing Laboratory licensed in the State of New York and approved by the Department of Design and Construction.

Testing must also conform to all applicable sections of **DIVISION III - INSPECTION OF MATERIALS, SAMPLING, AND METHODS OF TEST** of these specifications.

In addition all manufacture of catch basins must be witnessed by an approved licensed independent Testing Laboratory and Certified as to Compliance with the standard drawings and with these specifications.

The cost of all testing as described above must be deemed included in the price bid per catch basin.

(F) OPENINGS FOR LATERAL CONNECTIONS - All catch basin connection pipe openings must conform to the sizes, dimensions and requirements specified on the Sewer Design Standards for Precast Catch Basins. All catch basin connection pipe openings must be provided for at the time of manufacture.

(G) SUBMISSIONS BY THE CONTRACTOR - Prior to delivery of precast catch basins the Contractor will be required to submit three (3) copies of the manufacturer's Drill Sheets to the Engineer for review. These sheets must note all pipe entries, final grades, etc. The Engineer's review of such submissions must in no way absolve the Contractor from full responsibility as to the correctness of each precast catch basin with regard to details, contract plans, standards and specifications.

(H) MANUFACTURE - Precast catch basins must be built in conformance with the standard drawings and must be cast in steel forms.

Devices used to position reinforcement must be made of, or coated with, material so that corrosion of the device will not occur. Sufficient devices must be provided to position the reinforcement for required concrete cover.

Concrete must be thoroughly consolidated by internal or external vibration or a combination of both.

(I) CURING - All precast catch basins must be subjected to curing by one of the following methods:

(1) STEAM CURING - Catch basins may be placed in a curing chamber, free from outside drafts, and cured in a moist atmosphere maintained at a temperature between one hundred (100) degrees Fahrenheit and one hundred sixty (160) degrees Fahrenheit, by the injection of steam for a period of not less than twelve (12) hours or, when necessary, for such additional time as may be needed to enable the pipe to meet the strength requirements. Steam curing must not commence until at least two (2) hours have elapsed since completion of placement of concrete in the forms. When a curing chamber is not available, catch basins may be placed in an enclosure of canvas and subjected to steam around the entire catch basin at the temperature and for the time specified above. The enclosure must be so erected as to allow full circulation of steam around the entire catch basin. The interior surface of the curing room or canvas jackets and the surfaces of the catch basin must be entirely moist at all times.

(2) WATER SPRAY CURING - Under the conditions of enclosure described in the above paragraph on "Steam Curing", catch basins may be cured by subjecting them to a continuous fine spray of water in an enclosure maintained at a temperature of not less than seventy (70) degrees Fahrenheit for a period of not less than seventy-two (72) hours or such additional time as may be necessary to meet the strength requirements.

(3) SATURATED COVER CURING - The sides and top of each catch basin must be covered with heavy burlap or other suitable material saturated with water before applying and kept saturated at a temperature of not less than seventy (70) degrees Fahrenheit for seventy-two (72) hours or such additional time as may be necessary to meet the strength requirements.

Precast catch basins must not be subjected to freezing temperatures until the required twenty-eight (28) day compressive strength is achieved.

(J) INSTALLATION - All precast catch basins must be installed in accordance with the standards and specifications for Precast Catch Basins and as directed by the Engineer.

Where directed by the Engineer, a two (2) inch thick select granular fill cushion must be provided in order to assure uniform bedding at subgrade. The cost of the above work must be included in the prices bid for the catch basins.

(K) MARKINGS - The manufacturer must mark each catch basin with permanent markings on the inside of each catch basin. The following minimum information must be listed:

(1) Date of Manufacture
(2) Manufacturer's Logo
(3) Individual Piece Identification
(4) ASTM Designation

(L) DELIVERY OF CATCH BASINS – Catch basins must not be delivered to the job site until they have attained the specified twenty-eight (28) day compressive strength as evidenced by cylinder testing. In addition, five (5) copies of all test results, steel supplier certifications, independent Testing Laboratory

certifications, and fabrication and manufacture certifications must be submitted to the Engineer prior to delivery or at the time of delivery.

51.41.5 MEASUREMENT

The quantities of catch basins to be measured for payment must be the number of catch basins of each size and type, incorporated in the work, complete, as shown, specified or required.

51.41.6 PRICE TO COVER

The contract price for “CATCH BASINS” must be the unit price bid per each size and type catch basin and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to construct the catch basins of the sizes and dimensions, and of the types and at the locations and to the elevations shown, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); reinforcement; all sheeting and bracing; pumping; fluming; bridging; breaking down and filling in of abandoned sewer appurtenances; connections; backfilling; cleaning up; and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans, specifications and standards, and as directed by the Engineer. Included in the price hereunder must be the cost for all labor and materials required to install frames, gratings, covers, hoods, hooks and all other hardware; in accordance with the plans, specifications and standards, and as directed by the Engineer.

The cost of installing curbs and three (3) inch thick asphalt aprons in accordance with **Subsection 51.41.3(D)** where no curbs exist as shown on the plans or as ordered by the Engineer, must be included in the contract price bid for "CATCH BASINS".

In addition, included in the price hereunder must be the cost of all labor and materials necessary to remove all specified or ordered existing sewers, manholes, structures, catch basins and appurtenances, that may be in the line of the work and do all work incidental thereto, all in accordance with **Subsections 10.13 and 10.28** of the specifications and as directed by the Engineer.

Where precast reinforced concrete catch basins are used in lieu of poured-in-place catch basins, the cost for furnishing, delivery and installation of the precast reinforced concrete catch basins, complete with chutes for Type 3 catch basins; reinforcement; frames; gratings; covers; hoods; hooks and other hardware; additional excavation and sheeting, as required; select granular fill; hand excavation; connections; and all work incidental thereto all in accordance with the plans, specifications and standards, must be included in the contract price bid for "CATCH BASINS". No additional or separate payments will be made for any work associated with the installation of precast reinforced concrete catch basins.

Payment for Catch Basins will be made under the Item Number as calculated below:

The Item Numbers for Catch Basins have nine characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Catch Basins:

51.41

(2) The sixth character must define the Kind of Catch Basin:

S - Standard Catch Basin
D - Standard Double Catch Basin
P - Special Catch Basin
W - Shallow Catch Basin

(3) The seventh, eighth and ninth characters must define either the Type of Catch Basin for Standard Catch Basins or the Number of the Catch Basin for Special Catch Basins or Shallow Catch Basins. See examples below:

002 - Type 2
000 - No Number/No Type
003 - No. 3
012 - No. 12
18A - No. 18A

(4) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
51.41S001	STANDARD CATCH BASIN, TYPE 1	EACH
51.41S002	STANDARD CATCH BASIN, TYPE 2	EACH
51.41S003	STANDARD CATCH BASIN, TYPE 3	EACH
51.41D001	STANDARD DOUBLE CATCH BASIN, TYPE 1	EACH
51.41D002	STANDARD DOUBLE CATCH BASIN, TYPE 2	EACH
51.41P000	SPECIAL CATCH BASIN	EACH
51.41P001	SPECIAL CATCH BASIN NO. 1	EACH
51.41P002	SPECIAL CATCH BASIN NO. 2	EACH
51.41P012	SPECIAL CATCH BASIN NO. 12	EACH
51.41P18A	SPECIAL CATCH BASIN NO. 18A	EACH
51.41W000	SHALLOW CATCH BASIN	EACH
51.41W001	SHALLOW CATCH BASIN NO. 1	EACH
51.41W002	SHALLOW CATCH BASIN NO. 2	EACH

SECTION 51.42 – INCREMENTAL COST OF (STANDARD TYPE 3 OR OTHER KIND AND NUMBER) CATCH BASIN IN LIEU OF (STANDARD TYPE 1 OR STANDARD TYPE 2 OR OTHER KIND AND NUMBER) CATCH BASIN

51.42.1 DESCRIPTION

Where the substitution of a new (Standard Type 3 or other Kind and Number) catch basin is ordered by the Engineer to replace a new (Standard Type 1 or Standard Type 2 or other Kind and Number) catch basin that was originally shown or specified to be constructed, payment for this substitution must be made as specified herein.

The Contractor must include only the incremental cost of all labor, materials, plant, equipment and incidentals necessary to furnish and install a new (Standard Type 3 or other Kind and Number) catch basin in place of a new (Standard Type 1 or Standard Type 2 or other Kind and Number) catch basin in the respective "INCREMENTAL COST OF (STANDARD TYPE 3 OR OTHER KIND AND NUMBER) CATCH BASIN IN LIEU OF (STANDARD TYPE 1 OR STANDARD TYPE 2 OR OTHER KIND AND NUMBER) CATCH BASIN" item.

51.42.2 MATERIALS AND CONSTRUCTION METHODS

Materials and construction methods for catch basins must comply with all requirements of **Section 51.41**.

51.42.3 PAYMENT

Payment for each new (Standard Type 3 or other Kind and Number) catch basin directed to be installed by the Engineer in place of a new (Standard Type 1 or Standard Type 2 or other Kind and Number) catch basin must be made under the unit price bid for either "STANDARD CATCH BASIN, TYPE 1" or "STANDARD CATCH BASIN, TYPE 2" or "Other Kind And Number Catch Basin" item, plus the unit price bid for the respective "INCREMENTAL COST OF (STANDARD TYPE 3 OR OTHER KIND AND NUMBER) CATCH BASIN IN LIEU OF (STANDARD TYPE 1 OR STANDARD TYPE 2 OR OTHER KIND AND NUMBER) CATCH BASIN" item.

Payment for Incremental Cost Of (Standard Type 3 Or Other Kind And Number) Catch Basin In Lieu Of (Standard Type 1 Or Standard Type 2 Or Other Kind And Number) Catch Basin will be made under the Item Number as calculated below:

The Item Numbers for Incremental Cost Of (Standard Type 3 Or Other Kind And Number) Catch Basin In Lieu Of (Standard Type 1 Or Standard Type 2 Or Other Kind And Number) Catch Basin have nine characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Incremental Cost Of (Standard Type 3 Or Other Kind And Number) Catch Basin In Lieu Of (Standard Type 1 Or Standard Type 2 Or Other Kind And Number) Catch Basin:

51.42

(2) The sixth and seventh characters must define the (Standard Type Or Other Kind And Number) Catch Basin to be replaced with a (Standard Type 3 Or Other Kind And Number) Catch Basin:

S1 - Standard Catch Basin Type 1
S2 - Standard Catch Basin Type 2
P1 - Special Catch Basin No. 1
W1 - Shallow Catch Basin No. 1

(3) The eighth and ninth characters must define the (Standard Type 3 Or Other Kind And Number) Catch Basin replacement:

SO - Standard Catch Basin Type 3 With Curb Piece
SX - Standard Catch Basin Type 3 Without Curb Piece
P2 - Special Catch Basin No. 2
W2 - Shallow Catch Basin No. 2

(4) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
51.42S1SO	INCREMENTAL COST OF STANDARD CATCH BASIN TYPE 3 WITH CURB PIECE IN LIEU OF STANDARD CATCH BASIN TYPE 1	EACH
51.42S2SO	INCREMENTAL COST OF STANDARD CATCH BASIN TYPE 3 WITH CURB PIECE IN LIEU OF STANDARD CATCH BASIN TYPE 2	EACH
51.42S1SX	INCREMENTAL COST OF STANDARD CATCH BASIN TYPE 3 WITHOUT CURB PIECE IN LIEU OF STANDARD CATCH BASIN TYPE 1	EACH
51.42S2SX	INCREMENTAL COST OF STANDARD CATCH BASIN TYPE 3 WITHOUT CURB PIECE IN LIEU OF STANDARD CATCH BASIN TYPE 2	EACH
51.42P1P2	INCREMENTAL COST OF SPECIAL CATCH BASIN NO. 2 IN LIEU OF SPECIAL CATCH BASIN NO. 1	EACH
51.42W1W2	INCREMENTAL COST OF SHALLOW CATCH BASIN NO. 2 IN LIEU OF SHALLOW CATCH BASIN NO. 1	EACH

SECTION 51.51 – PRECAST SEEPAGE BASINS

51.51.1 DESCRIPTION

Precast reinforced concrete seepage basins must be constructed of the sizes shown on the plans, complete with frames and covers, and all in accordance with the specifications and standards.

51.51.2 MATERIALS

(A) Concrete must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**, except that the concrete must have a concrete design mix for five thousand (5,000) pounds per square inch (minimum twenty-eight (28) day compressive strength of four thousand (4,000) pounds per square inch). The maximum allowable chloride content in the concrete must not exceed one-tenth (1/10) of one percent by weight of cement. The maximum water/cement ratio must not exceed forty-seven (47) percent by weight.

(B) Portland Cement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**, and must be Type II unless otherwise specified. Coarse and Fine Aggregate for concrete must be well graded in accordance with **Subsection 2.6.1.1 of General Specification 11 - Concrete, as modified in Section 23.01**. Size of Coarse Aggregate must be three-quarter (3/4) inch unless smaller size aggregate is required due to nature of work.

(C) Brick and brick masonry must comply with the requirements of **Section 23.02**.

(D) Frames and covers must be of cast iron, unless otherwise shown on the contract plans, complying with the requirements of **Section 22.01**, Type 1. Malleable iron or cast steel covers, when required, must comply with the requirements of **Section 22.01 and Section 22.04**.

(E) Cement mortar must comply with the requirements of **Section 23.03**.

(F) Reinforcement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(G) Welded Steel Wire Fabric must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01** and must have a minimum specified yield strength of sixty-five thousand (65,000) pounds per square inch.

(H) High range water reducing admixtures meeting the requirements of ASTM C494 Type F and having been previously approved by the New York State Department of Transportation may be used.

(I) Ground stabilization filter fabric must comply with the requirements of **Section 25.03**.

51.51.3 CONSTRUCTION METHODS

(A) GENERAL - Precast reinforced concrete seepage basins must be constructed of the sizes and dimensions, and at the locations and to the elevations shown on the plans or as directed by the Engineer, and as shown on the Sewer Design Standards. The location of all seepage basins must be such that the opening in the top slab together with the frame and cover must be totally in the roadway area or totally in the sidewalk area.

Unless otherwise specified, the total depth of a seepage basin from the final grade to the seepage pit excavation subgrade must be approximately seventeen (17) feet as specified on the Sewer Design Standards.

(B) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** must apply to the work to be done hereunder.

(C) SETTING FRAMES AND COVERS - The brick masonry for the seepage basin must be built to within such distance of the final grade as shown, specified or ordered. Frames and covers must be as shown on the Sewer Design Standards. The frames must be set on the masonry in a full bed of stiff fresh cement mortar.

(D) REINFORCEMENT - The steel reinforcement must be of the dimensions and shapes shown, and installed in the manner specified in **General Specification 11 - Concrete, as modified in Section 23.01**.

(E) CONNECTIONS - All connections to seepage basins must be constructed as shown on the plans or as directed.

(F) DETAILS - The minimum dimensions, minimum reinforcement and minimum requirements utilized for the construction of precast reinforced concrete seepage basins must conform to the Sewer Design Standards that are deemed a part of this contract.

(G) JOINTS - Each section of precast reinforced concrete seepage basin (i.e. slabs, rings, footings) must be fitted together and placed on a one-half (1/2) inch thick full bed of stiff fresh cement mortar. The rings when fitted together must be matched so as to form a smooth and uniform inner wall.

(H) TESTING - Concrete utilized in the construction of precast reinforced concrete seepage basins must be tested in conformance with **General Specification 11 - Concrete, as modified in Section 23.01**, with the exception that the concrete, steel reinforcement, fabrication and manufacture must be tested and certified as to compliance by an independent Testing Laboratory licensed in the State of New York and approved by the Department of Design and Construction.

Testing must also conform to all applicable sections of **DIVISION III - INSPECTION OF MATERIALS, SAMPLING, AND METHODS OF TEST** of these specifications.

In addition, all manufacture of sections must be witnessed by an approved licensed independent Testing Laboratory and Certified as to Compliance with the standard drawings and specifications.

The cost of all testing as described above must be included in the price bid per precast reinforced concrete seepage basin.

(I) OPENINGS FOR LATERAL CONNECTIONS - All catch basin connection pipe openings in the solid ring must conform to the sizes, dimensions and requirements specified on the Sewer Design Standards for Precast Seepage Basins. Cast pipe openings and cored opening will be placed in solid ring only. No cast pipe opening or cored opening will be allowed in drainage ring and no basin connection must be made into a drainage ring. The Engineer must approve coring machines and coring methods.

(J) SUBMISSIONS BY THE CONTRACTOR - Prior to delivery of precast reinforced concrete seepage basins the Contractor will be required to submit three (3) copies of the manufacturer's Drill Sheets to the Engineer for review. These sheets must note all pipe entries, final grades, etc. The Engineer's review of such submissions must in no way absolve the Contractor from full responsibility as to the correctness of each precast seepage basin with regard to details, contract plans, standards and specifications.

(K) MANUFACTURE - Precast reinforced concrete seepage basins must be built in conformance with the standard drawings and must be cast in steel forms.

Devices used to position reinforcement must be made of, or coated with, material so that corrosion of the device will not occur. Sufficient devices must be provided to position the reinforcement for required concrete cover.

Concrete must be thoroughly consolidated by internal or external vibration or a combination of both.

(L) CURING - All precast sections must be subjected to curing by one of the following methods:

(1) STEAM CURING - Sections may be placed in a curing chamber, free from outside drafts, and cured in a moist atmosphere maintained at a temperature between one hundred (100) degrees Fahrenheit and one hundred sixty (160) degrees Fahrenheit, by the injection of steam for a period of not less than twelve (12) hours or, when necessary, for such additional time as may be needed to enable the pipe to meet the strength requirements. Steam curing must not commence until at least two (2) hours have elapsed since completion of placement of concrete in the forms. When a curing chamber is not available, sections may be placed in an enclosure of canvas and subjected to steam around the entire section at the temperature and for the time specified above. The enclosure must be so erected as to allow full circulation of steam around the entire section. The interior surface of the curing room or canvas jackets and the surfaces of the section must be entirely moist at all times.

(2) WATER SPRAY CURING - Under the conditions of enclosure described in the above paragraph on "Steam Curing", sections may be cured by subjecting them to a continuous fine spray of water in an enclosure maintained at a temperature of not less than seventy (70) degrees Fahrenheit for a period of not less than seventy-two (72) hours or such additional time as may be necessary to meet the strength requirements.

(3) SATURATED COVER CURING - The sides and top of each section must be covered with heavy burlap or other suitable material saturated with water before applying and kept saturated at a

temperature of not less than seventy (70) degrees Fahrenheit for seventy-two (72) hours or such additional time as may be necessary to meet the strength requirements.

Precast Sections must not be subjected to freezing temperatures until the required twenty-eight (28) day compressive strength is achieved.

(M) INSTALLATION - All precast seepage basins must be installed in accordance with the standards and specifications for Precast Seepage Basins and as directed by the Engineer.

(N) MARKINGS - The manufacturer must mark each individual piece with permanent markings on the inside of each section. The following minimum information must be listed:

(1) Date of Manufacture
(2) Manufacturer's Logo
(3) Individual Piece Identification
(4) ASTM Designation

(O) DELIVERY OF SECTIONS – Sections must not be delivered to the job site until they have attained the specified twenty-eight (28) day compressive strength as evidenced by cylinder testing. In addition, five (5) copies of all test results, steel supplier certifications, independent Testing Laboratory certifications, and fabrication and manufacture certifications must be submitted to the Engineer prior to delivery or at the time of delivery.

51.51.4 MEASUREMENT

The quantities of precast seepage basins to be measured for payment must be the number of precast seepage basins of each size, incorporated in the work, complete, as shown, specified or required.

51.51.5 PRICE TO COVER

The contract price for “PRECAST SEEPAGE BASINS” must be the unit price bid for each size precast seepage basin and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to construct the precast seepage basins of the sizes and dimensions, and at the locations and to the elevations shown, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); reinforcement; all sheeting and bracing; pumping; fluming; bridging; breaking down and filling in of abandoned sewer appurtenances; connections; backfilling; cleaning up; and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans, specifications and standards, and as directed by the Engineer. Included in the price hereunder must be the cost for all labor and materials required to furnish, deliver and install the precast sections (i.e. solid rings, drainage rings, slabs, footings), frames and covers and all other hardware in accordance with the plans, specifications and standards, or as directed by the Engineer.

The contract price hereunder must also include the cost of all labor and materials required furnish, deliver and install all stone ballast and ground stabilization filter fabric, as shown on the standards or as directed by the Engineer.

In addition, included in the price hereunder must be the cost of all labor and materials necessary to remove all specified or ordered existing sewers, manholes, structures and appurtenances, that may be in the line of the work and do all work incidental thereto, all in accordance with **Subsections 10.13 and 10.28** of the specifications and as directed by the Engineer.

Payment for Precast Seepage Basins will be made under the Item Number as calculated below:

The Item Numbers for Precast Seepage Basins have eight characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Precast Seepage Basins:

51.51

(2) The sixth character must define Standard Precast Seepage Basins:

S – Standard

(3) The seventh and eighth characters must define the Diameter of Standard Precast Seepage Basins. See examples below:

04 - 4’-0”
12 - 12’-0”

(4) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
51.51S04	STANDARD 4’-0” DIAMETER PRECAST SEEPAGE BASIN	EACH
51.51S08	STANDARD 8’-0” DIAMETER PRECAST SEEPAGE BASIN	EACH
51.51S10	STANDARD 10’-0” DIAMETER PRECAST SEEPAGE BASIN	EACH
51.51S12	STANDARD 12’-0” DIAMETER PRECAST SEEPAGE BASIN	EACH

SECTION 51.61 – OUTFALL STRUCTURES

51.61.1 DESCRIPTION

The outfall structures will be constructed to the lines and grades and within the limits of payment in accordance with the Contract Drawings, the specifications, and directions of the Engineer.

51.61.2 MATERIALS

(A) Concrete used for outfall structure (including headwalls, reinforced concrete sewer outfalls, cradles and encasements, chambers, manholes, and catch basins) must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**, the concrete must contain entrained air of six percent (6%) and a corrosion inhibitor. The corrosion inhibitor must consist of a calcium nitrite solution, containing 30 ±2% calcium nitrite solids by weight and having a specific gravity of 1.27 ±0.02. The corrosion inhibitor when used in the manufacturing process must not produce a significant amount of chloride ions in the final product (less than 1,000-ppm). The pH must be greater than 8. The admixture must not contain chemicals that produce a condition injurious to the quality and durability of the concrete or reinforcing steel. Calcium nitrite, to be used as an accelerator, may be used as per manufacturer's direction, in conjunction with compatible retarding admixtures to control setting time and workability of the concrete, consult the manufacturer of the product.

The corrosion inhibitor must be added to the mix immediately after air entraining and retarding admixtures have been introduced into the batch.

Acceptance of calcium nitrite based corrosion inhibitor must be based upon it being listed in the most current New York State Department of Transportation's "Approved List Of Calcium Nitrite Based Corrosion Inhibitors".

(B) Reinforcement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(C) Structural steel must comply with the requirements of **Section 23.05**.

(D) The cement used for outfall structure (including headwalls and reinforced concrete sewer outfalls) must be Type-V cement. (This must not include cement for concrete cradles and encasements, chambers, manholes, catch basins, and precast reinforced concrete pipes for sewers, such cement must be Type-II).

In lieu of Type-V cement, the Contractor will be permitted to utilize Type-II cement with the addition of seven and one-half percent (7-1/2%) Micro Silica Fume. Types of additives utilized must have been previously approved by New York State Department of Transportation.

(E) Reinforced concrete sewers, precast reinforced concrete pipe sewers, vitrified pipe sewers, and ductile iron pipe sewers must comply with the requirements of **Sections 50.11, 50.21, 50.31, and 50.41**, respectively, except as otherwise amended in the plans and specifications.

(F) Chambers, manholes, drop-pipe manholes, catch basins, and catch basin connections must comply with the requirements of **Sections 51.11, 51.21, 51.31, 51.41, and 52.11**, respectively, except as otherwise amended in the plans and specifications.

(G) Boulders must be clean natural stones. Recycled material will not be permitted. The shape of stones must be such so as to provide a consistent pattern that provides for a minimum of voids between all adjacent stones. Stones must be seven hundred (700) pounds in nominal weight. (The absolute minimum weight of stone that will be accepted must be five hundred (500) pounds.)

(H) Tide gates must be stainless steel low-flow flap gates as manufactured by H. Fontaine Ltd., or approved equivalent. Tide gates must consist of: Stainless steel for flaps and frames, and thimbles when required must be in accordance with ASTM A240 Type 316L; Bolts, studs, nuts, and anchor bolts must be in accordance with ASTM A276 Type 316, and ASTM F593 and F594 GR2 for Type 316; Hinges must consist of stainless steel pin and have Ultra-High Molecular Weight Polyethylene (UHMWPE) bushings in accordance with ASTM D4020; and, Seals must be made of Ethylene Propylene Diene Terpolymers (EPDM) in accordance with ASTM D2000.

(I) Steel Sheet Piling must comply with the requirements of ASTM A690, and with the applicable sections of **Section 24.01** as determined solely by the Engineer..

(J) Composite Sheet Piling must be manufactured entirely from a glass fiber reinforced polymer composite that meets or exceeds the characteristics listed in this specification. All sheet piling must be

wholly and completely manufactured in an ISO certified production facility, and must conform dimensionally to ASTM D3917; and conform to ASTM D4385, Level I for all criteria except for the following, which must conform to Level II:

(a) Die Parting Line
(b) Exposed Underlayer
(c) Fiber Prominence
(d) Grooving
(e) Inclusion
(f) Internal Shrinkage Cracks
(g) Saw Burn
(h) Stop Marks

(K) Stop Logs

Stop Logs must be an engineered system that includes stop log planks, guides, and a lifting device.

(1) Materials.

(i) Aluminum Stop Log Planks

- Stop log planks must be 6061-T6 aluminum with a mill finish. Planks must be fabricated from plate or extruded material.
- Lip seals must be extruded ASTM D2000 Grade 2BC 515 neoprene with a seating surface at least 1" in width.
- Guides, anchor bolts, and all miscellaneous hardware must be ASTM A276 T316 stainless steel.
- Lifting device must be ASTM A276 T304 stainless steel.

(ii) Timber Stop Log Planks

- Stop log planks must be treated Southern Yellow Pine, Douglas Fir, or approved equal, as shown on the Contract Drawings. Grade and dressing must be as shown on the Contract Drawings. Timber must be graded per ASTM D245.
- Stop log planks must be treated with Micronized Copper Azole (MCA) pressure treatment for use category UC5A per AWPA P61 and ICC-ES AC326.
- The MCA treated lumber must be tested in accordance with AWPA E5 and must have an Evaluation Service Report issued by the ICC-ES.
- Timber must have end tags that certify conformance with APWA standards, and identify the timber's producer, preservative, retention, and AWPA use category.
- Guides, anchor bolts, and all miscellaneous hardware must be ASTM A276 T316 stainless steel.
- Lifting device must be ASTM A276 T304 stainless steel.

(2) Performance Requirements.

For aluminum planks, the stop log system must be designed for and meet the following requirements:

- Planks must not deflect more than 1/360 of the plank's span under the design head shown on the Contract Drawings.
- Planks must be furnished with a continuous lip type seal mounted on the bottom of the plank and up both sides of the plank; seals on the guides will not be accepted. The vertical face of the seal must be in contact with the seating surface of the guide to provide for a proper seal at the corners. The shape of the seal must provide a seating surface having a minimum width of 1 inch.
- The system and seals must be designed for flow in either direction.
- The system must be designed and guaranteed for a maximum leakage of 0.5 gallons per minute per linear foot of seal length. Any stop log planks that do not fit or bind, or do not meet leakage requirements must be repaired and retested all at no additional cost to the City.
- End caps will not be allowed on the planks; planks must have sufficient weight to be submerged under their own weight.
- Each plank must be furnished with two lifting lugs. The lifting lugs must be designed to allow for removal of the plank under the full design load.

- Plank length must be as shown on the contract drawings. Plank height must be selected based on overall plank weight; the tallest standard plank that will weigh two hundred (200) pounds or less must be provided.

For timber planks, the stop system must be designed for and meet the following requirements:

- The stop log planks must have a bending stress of not less than 1800 psi.
- The stop log planks must be designed for the head shown on the Contract Drawings or specified in the Contract Documents.
- The Contractor must demonstrate that the in-place stop log planks assembly is watertight. Any stop log planks that bind, do not fit or do not meet watertightness requirements must be repaired and retested all at no additional cost to the City.
- Each plank must be furnished with two lifting lugs. The lifting lugs must be designed to allow for removal of the plank under the full design load.

(3) Construction Details.

Stop log planks greater than eleven (11) feet in length or six (6) inches in width must be aluminum. Otherwise, stop log planks must be timber planks.

Planks and lifting device must be indelibly marked (engraved, stenciled, welded tags, etc.) with the following information:

- Planks: Contract Number, Plank Size, and Outfall Address / Specific Location.
- Lifting device for stop log planks: Contract Number, device Safe Working Load (SWL), and Outfall Address / Specific Location.

Planks must be test fit for installation and removal in the field in the presence of and to the satisfaction of the Engineer. The completely assembled planks must be field tested for leakage in the presence of and to the satisfaction of the Engineer.

Any timber planks that are not watertight or aluminum planks that leak more than the design rate, do not fit, or bind must be repaired and retested at no additional cost to the City. After the successful fit and leak tests, the planks and lifting device must be delivered to a designated NYCDEP yard and unloaded for storage at no additional cost to the City.

The lifting device for stop log planks must be equipped with a suitable eye for portable crane operation. The lifting device must be designed to use the guide rails to maintain orientation with the planks and must have a remote release capable of securing and releasing the stop logs.

(4) Submittals.

The Contractor must submit the following for approval by the Engineer:

- Working and shop drawings
- Detailed dimensional drawings, including length tolerances
- Assembly and installation drawings, which must show all component weights
- Manufacturer’s shop leak test report
- Certified material test reports

51.61.3 CONSTRUCTION METHOD

(A) GENERAL - The outfall structures must be constructed “in the dry”. The Contractor’s means and methods of construction for the outfall structure must be submitted, prior to the start of work, to the Engineer for written approval.

The Contractor must be required to submit plans, details, and other substantiating data as necessary to establish the adequacy of the Contractor's proposed means and methods of construction. These documents must be prepared under the direction of and be signed and sealed by a Professional Engineer licensed to practice in the State of New York.

(B) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

(C) The concrete for the footings, cradles, encasements, inverts, etc. must be deposited continuously for the entire cross section and for such longitudinal distances as approved.

(D) The concrete for the walls, headwalls, etc. must be deposited continuously to the height, to the thickness and for such longitudinal distances as approved.

(E) Boulder Protection Placement - Boulders are placed to prevent scour and erosion at sewer outfalls. The Contractor must remove all debris and clean and prepare the tidal flat/existing ground, and must excavate the existing surface to the depth required in order to install the boulder protection where shown, specified, or as ordered. Boulder aprons and protections must be placed in compliance with all permits and as shown, specified, or ordered. The layer of boulders must be placed in order to obtain a minimum of voids between stones. Dropping of boulders into place will not be permitted.

(F) Steel Sheet Piling and Composite Sheet Piling must be tested and installed in accordance with the manufacturer's recommendations, as directed by the Engineer, and with the applicable sections of **Section 70.11 - Piles** as determined solely by the Engineer.

51.61.4 PRICE TO COVER

The contract price for "OUTFALLS" must be the unit price bid per each outfall structure and must cover the cost of all labor, materials, plant, equipment, samples, tests, and insurance required or necessary to construct the outfall structure "in the dry" to the lines, grades, sizes, dimensions and within the limits of payment shown on contract drawings, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**), all sheeting and bracing, temporary steel or composite sheet piling, reinforcement and structural steel, pumping; fluming; bridging, breaking down and filling in of abandoned sewer appurtenances, connections, maintaining flow in sewers, backfilling, fill for grade, preparation of shop drawings and all other required means and methods of construction reports and drawings, obtaining of necessary permits and special construction requirement for constructing "in the dry", cleaning up, and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans and specifications and as directed by the Engineer.

Also, included in the bid price for the outfall structure must be the cost of all labor, materials and equipment necessary and required, within the limits of payment shown on the contract drawings, to construct permanent steel or composite sheet piling bulkheads, sewers with encasements and foundations; chambers, manholes and catch basins with foundations, headwalls and foundations, retaining walls, tide gates, bar screens (trash racks), permanent fencing, boulders for aprons and protections; all dredging required for placement of stone ballast, riprap, slope pavement aprons, boulder aprons, boulder protections, etc., to remove all specified or ordered existing sewers, manholes, bulkheads, debris and appurtenances that may be in the line of the work in accordance with **Subsections 10.13 and 10.28** of the specifications, and all other work shown, specified or ordered. No separate payment will be made for the above work.

Unless otherwise specified, payment for the outfalls, and items specified in **Subsection 51.61.5** below must be complete and must complement each other, whatever item(s) the Contractor may consider not covered under one must be deemed covered under one of the others. No separate or additional payment will be made for any such considered item(s).

51.61.5 SEPARATE PAYMENT

The Contractor is notified that payment for the cost of furnishing, delivering, and placing of Timber Piles, Structural Steel H-Piles, Concrete Filled Steel Pipe Piles, Continuous Flight Auger Piles, Mini-Piles, Stone Ballast; Riprap, Slope Pavements, and Grouted Stone Pavements within outfall limits must be made under the unit price bid for the respective bid items.

Payment for the cost of furnishing and placing concrete and steel reinforcing bars required to construct Concrete Caps atop Steel or Composite Sheet Piling Bulkheads must be made under Item No. 73.21AC - ADDITIONAL CONCRETE, and Item No. 73.51AS - ADDITIONAL STEEL REINFORCING BARS.

Payment for Outfall Structures will be made under the Item Number as calculated below:

The Item Numbers for Outfall Structures have eight characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Outfall Structures:

51.61

(2) The sixth character must define Outfall Structure:

F - Outfall Structure

(3) The seventh, eighth and ninth characters must define the Number of the Outfall Structure. See examples below:

000 - No Number
002 - No. 2
011 - No. 11
16A - No. 16A

(4) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	**Description**	**Pay Unit**
51.61F000	OUTFALL	EACH
51.61F001	OUTFALL NO. 1	EACH
51.61F002	OUTFALL NO. 2	EACH
51.61F011	OUTFALL NO. 11	EACH
51.61F16A	OUTFALL NO. 16A	EACH

SECTION 51.71 – MODIFICATION OF EXISTING STRUCTURES

51.71.1 DESCRIPTION

Existing chambers, siphon chambers, manholes, drop-pipe manholes, catch basins, outfalls and other kinds of existing structures must be modified in accordance with the contract drawings within the limits and to the sizes, shapes and dimensions and to the elevations shown, complete.

51.71.2 MATERIALS

(A) Concrete must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**. Concrete used in existing outfall structures must comply with **Subsection 51.61.2(A)**.

(B) Brick and brick masonry must comply with the requirements of **Section 23.02**.

(C) Frames, covers, gratings and hoods must be of cast iron, unless otherwise shown on the contract plans, complying with the requirements of **Section 22.01**, Type 1. Malleable iron or cast steel covers and gratings, when required, must comply with the requirements of **Section 22.01 and Section 22.04**.

(D) Steps must be cast iron and must comply with the requirements of **Section 22.01**, Type 1, or must be copolymer polypropylene plastic manhole steps with one-half (1/2) inch Grade 60 steel reinforcement and must comply with the Sewer Design Standards.

(E) Hooks must be of stainless steel one-half (1/2) inch square bar stock, and must be 18-8 stainless steel Type 303, complying with the requirements of ASTM A582. All other approved hangers together with fasteners must be 18-8 stainless steel Type 303, complying with the requirements of ASTM A582.

(F) Cement mortar must comply with the requirements of **Section 23.03**. Cement used in existing outfall structures must comply with **Subsection 51.61.2(D)**.

(G) Reinforcement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(H) Structural steel must comply with the requirements of **Section 23.05**.

(I) Cast iron pipe must comply with the requirements of **Section 21.03**.

(J) Vitrified clay pipe must comply with the requirements of **Section 21.02**.

(K) Ductile iron pipe must comply with the requirements of **Section 21.06**.

(L) Bluestone must be tough, sound, durable, fine graded sandstone or quartzite, free from injurious seams and other imperfections and saw cut to the required dimensions. It must be set in a full bed of fresh mortar in compliance with the requirements of **Section 23.03**.

(M) Granite slabs must comply with the requirements of **Section 23.07**.

(N) Aluminum floor gratings must comply with the requirements of **Section 22.05**.

(O) Timber and lumber must comply with the requirements of **Section 23.06**. Timber columns for supports must have a minimum (Extreme Fiber in Bending) F_b = 1,700-psi and a minimum (Compression Parallel to Grain) F_c = 1,400-psi.

(P) All materials to be used in existing outfall structures must comply with the materials specified in **Subsection 51.61.2 - Materials**.

51.71.3 CONSTRUCTION METHODS

(A) GENERAL - The existing chambers, siphon chambers, manholes, drop-pipe manholes, catch basins, outfalls and other kinds of existing structures must be modified in accordance with the sizes, shapes and dimensions, and to the elevations as shown on the plans or as ordered by the Engineer. All work must be performed “in the dry”.

The Contractor’s means and methods of construction for the modification of existing structure must be submitted, prior to the start of work, to the Engineer for written approval.

The Contractor must be required to submit plans, details and other substantiating data as necessary to establish the adequacy of the Contractor's proposed means and methods of construction. These documents must be prepared under the direction of and be signed and sealed by a Professional Engineer licensed to practice in the State of New York.

(B) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

(C) DEMOLITION WORK ON EXISTING STRUCTURES - Portion(s) of the existing structure that are specified to be demolished must be removed within the limits shown, specified or ordered. Removal of portion(s) of structure beyond the limits shown, specified or ordered must not be permitted unless approved in writing by the Engineer.

The Contractor must temporarily support the existing structure with adequate shoring and bracing prior to demolition of any portion of the existing structure so as to prevent collapse to portions of the structure required to remain and to provide for safe working conditions. Prior to placing temporary shoring and bracing the Contractor must submit to the Engineer for approval drawings together with computations signed and sealed by a New York State Licensed Professional Engineer detailing the method of temporary shoring and bracing the Contractor will utilize. The Contractor must also include on these drawings and computations recommendations for removal of earth and other loads so as to relieve all stresses that will cause overburden to the areas of the structure that are to be demolished and rebuilt. All supports must be placed close to the area(s) to be demolished and must be secure and evenly spaced. (These drawing and computation requirements can be waived by written approval of the Engineer.)

All existing reinforcing bars must be incorporated into the new modified portion of the structure(s) and must be cut to lengths as directed in the field by the Engineer to meet minimum lap requirements and to maintain continuity of the structure. Dowelling must be provided as shown, specified or ordered.

(D) INVERTS - Inverts of chambers, manholes, etc. must be formed between transverse templates and must be screeded. Where the radii of inverts are too small to permit screeding between templates, the inverts must be shaped by means of interior forms. The concrete for inverts must be deposited continuously for their entire cross section and length. Inverts must be carefully protected from all injury during the progress of the work. The inverts must be troweled smooth.

(E) SIDE WALLS - Concrete in the side walls of chambers, manholes, etc. must be deposited continuously to the height and to the thickness approved and for their entire length.

(F) ROOF - Concrete in the roof of chambers, manholes, etc. must be deposited continuously for the full depths, and for the entire widths and lengths of the roofs. The outer surfaces of roofs must be finished true and smooth.

(G) STEPS AND LADDERS - The Contractor must furnish and install in the chambers, manholes, etc. steps and ladders of the size, shape and spacing shown on the plans and on the Sewer Design Standards.

(H) SETTING FRAMES AND COVERS - The brick masonry or concrete for the chambers, manholes, etc. must be built to within such distance of the final grade as shown, specified or ordered. Frames and covers must be as shown on the Sewer Design Standards. The frames must be set on the masonry or concrete in a full bed of stiff fresh cement mortar.

(I) REINFORCEMENT AND STRUCTURAL STEEL - The steel reinforcement must be of the dimensions and shapes shown, and installed in the manner specified in **General Specification 11 - Concrete, as modified in Section 23.01**. Structural steel must be of the shapes and sizes shown, and installed as directed.

(J) REMOVAL OF FORMS - Forms must be removed in accordance with **General Specification 11 - Concrete, as modified in Section 23.01**.

(K) BULKHEADS - Approved construction joint bulkheads with provisions for keying and doweling for future sewers must be provided, where shown or required.

(L) CONNECTIONS - All connections to chambers, manholes, etc. of existing, new or future sewers and catch basin connections must be constructed as shown on the plans or as directed. All connections for future sewers must be closed with bulkheads of brick masonry eight (8) inches thick, unless otherwise shown on the plans or specified.

(M) WATERSTOPS - Waterstops must be provided between each successive pour in accordance with **Section 25.04**. Details must be submitted for waterstops as part of the shop drawings.

(N) FOOTINGS, CRADLES, ENCASEMENTS, ETC - The concrete for the footings, cradles, encasements, etc. must be deposited continuously for the entire cross section and for such longitudinal distances as approved.

(O) WALLS, HEADWALLS, ETC. - The concrete for the walls, headwalls, etc. must be deposited continuously to the height, to the thickness and for such longitudinal distances as approved.

(P) BOULDER PROTECTION PLACEMENT - Boulders are placed to prevent scour and erosion at sewer outfalls. The Contractor must remove all debris and clean and prepare the tidal flat/existing ground, and must excavate the existing surface to the depth required in order to install the boulder protection where shown, specified or as ordered. Boulder aprons and protections must be placed in compliance with all permits and as shown, specified or ordered. The layer of boulders must be placed in order to obtain a minimum of voids between stones. Dropping of boulders into place will not be permitted.

(Q) STEEL SHEET PILING AND COMPOSITE SHEET PILING - Steel Sheet Piling and Composite Sheet Piling must be tested and installed in accordance with the manufacturer's recommendations, as directed by the Engineer, and with the applicable sections of **Section 70.11 - Piles** as determined solely by the Engineer.

51.71.4 PRICE TO COVER

The contract price for "MODIFICATION OF EXISTING STRUCTURES" must be the unit price bid per each modification of existing structure and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to modify the existing structure within the limits and of the sizes, dimensions and to the elevations shown, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); temporary shoring and bracing; temporary steel or composite sheet piling; demolition of existing structure within limits shown, specified or ordered; additional excavation required to relieve overburden; reinforcement and structural steel; all sheeting and bracing; pumping; fluming; bridging; breaking down and filling in of abandoned sewer appurtenances; connections; maintaining flow in sewers; backfilling; fill for grade; preparation of all shop drawings; obtaining of necessary permits and special construction requirements for constructing "in the dry"; cleaning up; and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans and specifications, and as directed by the Engineer. Included in the price hereunder must be the cost for all labor and materials required to install granite slabs, manhole frames and covers, manhole steps; catch basin frames and gratings and all other hardware in accordance with the plans, specifications and standards, or as directed by the Engineer.

The contract price hereunder must also include the cost of all labor and materials required to connect at the chambers, manholes, etc. all existing and new sewers and basin connections; and all required structural steel, reinforcement and bulkheads for future sewer connections, as shown on the plans or as directed by the Engineer.

In addition, included in the price hereunder must be the cost of all labor and materials necessary to remove all specified or ordered existing sewers, manholes, bulkheads, structures, debris and appurtenances that may be in the line of the work and do all work incidental thereto, all in accordance with **Subsections 10.13 and 10.28** of the specifications and as directed by the Engineer.

Also, included in the bid price for the modification of existing outfall structure must be the cost of all labor, materials and equipment necessary and required, within the limits of payment shown on the contract drawings, to construct permanent steel or composite sheet piling bulkheads; sewers with encasements and foundations; chambers, manholes and catch basins with foundations; headwalls and foundations; retaining walls; tide gates; bar screens (trash racks); permanent fencing; boulders for aprons and protections; all dredging required for placement of stone ballast, riprap, slope pavement aprons, boulder aprons, boulder protections, etc. No separate payment will be made for the above work.

51.71.5 SEPARATE PAYMENT

The Contractor is notified that payment for the cost of furnishing, delivering and placing of Timber Piles; Structural Steel H-Piles; Concrete Filled Steel Pipe Piles; Continuous Flight Auger Piles; Mini-Piles; Stone Ballast; Riprap; Slope Pavements; and Grouted Stone Pavements within modification of existing outfall limits must be made under the unit price bid for the respective bid items.

Payment for the cost of furnishing and placing concrete and steel reinforcing bars required to construct Concrete Pile Caps atop Steel or Composite Sheet Piling Bulkheads must be made under Item No. 73.21AC - ADDITIONAL CONCRETE, and Item No. 73.51AS - ADDITIONAL STEEL REINFORCING BARS.

Payment for Modification Of Existing Structures will be made under the Item Number as calculated below:

The Item Numbers for Modification Of Existing Structures have eleven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Modification Of Existing Structures:

51.71

(2) The sixth character must define the Kind of Existing Structure being modified:

C - Chamber
M - Manhole
D - Drop-Pipe Manhole
S - Siphon Chamber
T - Interceptor Sewer Manhole
L - Culvert Chamber
B - Catch Basin
N - Double Catch Basin
F - Outfall

(3) The seventh and eighth characters must define the Type of Structure to which the Existing Structure will be modified to (if applicable). See examples below:

00 - No Type
01 - Type 1 or Type I
C2 - Type C-2
0M - Manhole
W3 - Type 3 With Curb Piece
X3 - Type 3 Without Curb Piece
W0 - No Type With Curb Piece
X0 - No Type Without Curb Piece

(4) The ninth, tenth and eleventh characters must define either the Type of Existing Structure to be modified or the Number of the Existing Structure to be modified. See examples below:

000 - No Number/No Type
003 - No. 3
012 - No. 12
28A - No. 28A
001 - Type 1 or Type I
002 - Type 2 or Type II
0B2 - Type B-2
0W3 - Type 3 With Curb Piece
0X3 - Type 3 Without Curb Piece
0W0 - No Type With Curb Piece
0X0 - No Type Without Curb Piece

(5) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
51.71C00000	MODIFICATION OF EXISTING CHAMBER	EACH
51.71C00001	MODIFICATION OF EXISTING CHAMBER NO.1	EACH
51.71C00002	MODIFICATION OF EXISTING CHAMBER NO.2	EACH
51.71M00000	MODIFICATION OF EXISTING MANHOLE	EACH
51.71M00001	MODIFICATION OF EXISTING MANHOLE NO. 1	EACH
51.71M00002	MODIFICATION OF EXISTING MANHOLE NO. 2	EACH
51.71M0033A	MODIFICATION OF EXISTING MANHOLE NO. 33A	EACH
51.71M000B1	MODIFICATION OF EXISTING MANHOLE TYPE B-1	EACH
51.71D00000	MODIFICATION OF EXISTING DROP-PIPE MANHOLE	EACH
51.71D00001	MODIFICATION OF EXISTING DROP-PIPE MANHOLE NO. 1	EACH
51.71D00028	MODIFICATION OF EXISTING DROP-PIPE MANHOLE NO. 28	EACH
51.71S00000	MODIFICATION OF EXISTING SIPHON CHAMBER	EACH
51.71T00000	MODIFICATION OF EXISTING INTERCEPTOR SEWER MANHOLE	EACH
51.71L00000	MODIFICATION OF EXISTING CULVERT CHAMBER	EACH

Item No.	Description	Pay Unit
51.71F00000	MODIFICATION OF EXISTING OUTFALL	EACH
51.71F00001	MODIFICATION OF EXISTING OUTFALL NO. 1	EACH
51.71F00002	MODIFICATION OF EXISTING OUTFALL NO. 2	EACH
51.71B00000	MODIFICATION OF EXISTING CATCH BASIN	EACH
51.71B00001	MODIFICATION OF EXISTING TYPE 1 CATCH BASIN	EACH
51.71B00002	MODIFICATION OF EXISTING TYPE 2 CATCH BASIN	EACH
51.71B02001	MODIFICATION OF EXISTING TYPE 1 CATCH BASIN TO TYPE 2	EACH
51.71B01002	MODIFICATION OF EXISTING TYPE 2 CATCH BASIN TO TYPE 1	EACH
51.71BW30X3	MODIFICATION OF EXISTING TYPE 3 CATCH BASIN WITHOUT CURB PIECE TO TYPE 3 WITH CURB PIECE	EACH
51.71BX30W3	MODIFICATION OF EXISTING TYPE 3 CATCH BASIN WITH CURB PIECE TO TYPE 3 WITHOUT CURB PIECE	EACH
51.71B0M000	MODIFICATION OF EXISTING CATCH BASIN TO MANHOLE	EACH
51.71NW00X0	MODIFICATION OF EXISTING DOUBLE CATCH BASIN WITHOUT CURB PIECE TO DOUBLE CATCH BASIN WITH CURB PIECE	EACH

SECTION 52.11 – CATCH BASIN CONNECTIONS

52.11.1 DESCRIPTION

Catch basins connections must be constructed of the sizes, classes and kinds shown, specified or required.

Unless otherwise shown, specified or ordered catch basin connections must be twelve (12) inch diameter ductile iron basin connection on a stone bedding or encasement.

52.11.2 MATERIALS

(A) Vitrified clay pipe must comply with the requirements of **Section 21.02**. Kind, class and size of pipe must be as shown or specified. Joints must comply with the requirements of **Subsection 50.31.3(C)**.

(B) Ductile iron pipe must comply with the requirements of **Section 21.06** and must be Class 56 unless otherwise specified. Joints must comply with the requirements of **Subsection 21.06.5**. Unless otherwise specified or directed all joints for ductile iron basin connections must be "push-on" joint type. All fittings required must be ductile iron or gray iron rated for two hundred fifty (250) pounds per square inch in accordance with ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11.

(C) Cement mortar must comply with the requirements of **Section 23.03**.

(D) Cement grout must comply with the requirements of **Section 23.04**.

(E) Gasket and mortar joint must comply with the requirements of **Section 21.07**, Type 1, and as specified in **Subsection 50.31.3(C)**.

(F) Premoulded bituminous compound joint must comply with the requirements of **Section 21.07**, Type 2, and as specified in **Subsection 50.31.3(C)**.

(G) Elastomeric pipe joint must comply with the requirements of **Section 21.07**, Type 3, and as specified in **Subsection 50.31.3(C)**.

(H) Ring rubber gasket and grooved spigot joint must comply with the requirements of **Section 21.07**, Type 4, and as specified in **Subsection 50.31.3(C)**.

(I) Concrete for cradle and encasement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(J) Crushed stone must comply with the requirements of **Section 40.12**.

(K) Ground stabilization filter fabric must comply with the requirements of **Section 25.03**.

52.11.3 CONSTRUCTION METHODS

(A) GENERAL - Catch basin connections must be constructed of the sizes, classes and kinds, and to the lines and grades shown on the plans, specified or as ordered by the Engineer. The Engineer may direct that the inverts of basin connections be lowered or raised, so as to meet conditions encountered at the time of construction. The cost of this work must be deemed included in the contract price bid for basin connections.

Catch basin connection pipe or catch basin connection pipe openings will not be permitted through the corner of catch basins. The distance from the edge of a pipe or an opening to the inside face of the adjoining wall must be a minimum of three (3) inches.

The location and angle of basin connections may be varied to suit field conditions. Basin connections must be installed with a minimum drop of six (6) inches from the basin to the sewer.

(B) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

(C) LAYING - The pipe must be laid with the male ends toward the outlet. The pipes must be fitted together and matched so that when laid in the work they will form a sewer with a smooth and uniform invert.

During the progress of the work the exposed ends of pipe sewers must be provided with approved temporary covers fitted to the pipe so as to exclude earth and other materials.

The ends of the pipe that enter masonry walls must be cut to fit the inner face of the masonry. Unless otherwise directed, such cutting must be done before the pipes are built in.

Unless otherwise directed the trench for each catch basin connection must be fully excavated for its entire length before any pipes are laid therein.

(D) JOINTS

(1) Joints must be made in accordance with the requirements of the specifications as stated hereinabove for the specific kind of pipe used.

(2) Inspection - Unless otherwise directed by the Engineer, the finished joint must be left exposed for inspection and approval by the Engineer. A suitable ladder affording easy access for such inspection must be provided.

(E) BEDDING

(1) Ductile iron pipe basin connections must be laid on a six (6) inch thick compacted layer of crushed stone. The six (6) inch thick layer of crushed stone must be placed on the subgrade of the trench for its full width. The subgrade must be prepared to the proper grade so that the ductile iron pipe may be placed on the crushed stone base accurately to line and grade in agreement with the plans, specifications and standards, and as directed by the Engineer. Crushed stone must also be placed around the pipe to a depth of one-half (1/2) the outer diameter of the pipe and for the full width of the trench. The rest of the trench must be backfilled and compacted as specified in the specifications and as directed by the Engineer. The Contractor must note that in accordance with the Sewer Design Standards a ground stabilization filter fabric must be placed all around at the interface of the stone base and sheeting and/or soil.

Where the cover, from final grade to the outer top of pipe, is less than three (3) feet, the ductile iron pipe basin connections must be fully encased in crushed stone or concrete, as directed by the Engineer.

The cost for the crushed stone bedding or encasement, ground stabilization filter fabric and all labor, equipment and expenses necessary and required to place the crushed stone and ground stabilization filter fabric must be included in the price bid for contract Item No. 52.11D12 - 12" DUCTILE IRON PIPE BASIN CONNECTION. No separate or additional payment will be made under this item or any other item of the contract for this material and work. The additional concrete required for the concrete encasement of ductile iron pipe basin connections must be paid for at the contract price bid for Item No. 73.21AC - ADDITIONAL CONCRETE.

(2) Where vitrified pipe basin connections are specifically shown, specified or required, vitrified pipe basin connections must be laid in continuous concrete cradles. Where the cover, from final grade to the outer top of pipe, is less than four (4) feet, the vitrified pipe basin connections must be fully encased in concrete. The additional concrete required for the encasement of vitrified pipe basin connections must be paid for at the contract price bid for Item No. 73.21AC - ADDITIONAL CONCRETE.

Concrete cradles for pipe must be cast in one (1) pour and must be of the dimensions shown, specified or directed.

Concrete sills of approved shapes and dimensions must be used for the temporary support of pipes that are to be permanently supported on concrete cradles. Such sills must be completely embedded in the concrete cradle. Working drawings of these sills must be submitted to the Engineer for approval before pipe laying begins.

Forms must be removed in accordance with **General Specification 11 - Concrete, as modified in Section 23.01**.

(F) DAMAGED PIPE - Pipe damaged from handling or any cause whatsoever, whether in or out of the trench, must be replaced and removed from the site of the work by and at the sole expense of the Contractor.

(G) CONNECTIONS TO STRUCTURES - Where openings are not provided in manholes and chambers for connection of twelve (12) inch catch basin connections, the Contractor must core openings in the walls of the manholes and chambers for catch basin connections as directed by the Engineer. The maximum diameter of the cored opening for catch basin connections must be sixteen (16) inches. The use of pneumatic percussion hammers will not be permitted in order to provide an opening for catch basin connections.

(H) FIELD CUTTING - Ductile iron pipe must be cut only by means of abrasive saws, hack saws, wheel type cutters, milling type cutters or as approved by the Engineer. The use of "squeeze" type pipe cutters and cutting torches will not be permitted. The outside of the cut end must be beveled about one-quarter (1/4) inch at an angle of about thirty (30) degrees all around the pipe, with a coarse file or a portable grinder.

Vitrified pipe must be cut only by means of wheel type cutters, milling type cutters or as approved by the Engineer.

The use of diamond points and dog chisels will not be permitted.

52.11.4 MEASUREMENT

The quantities of catch basin connections to be measured for payment must be the number of linear feet of each size, kind and class of catch basin connection pipe incorporated in the work, complete, as shown, specified or required, measured along the center lines of catch basin connection pipes where laid.

Payment will be made from inside face of catch basin to inside face of manhole, chamber or catch basin, unless otherwise shown or specified in the contract documents. When circular precast manholes are incorporated into the work, the inside face of the manhole must be the vertical plane at which the catch basin connection's outside diameter transverse to the horizontal center line of the catch basin connection intersects the inside wall of the circular precast manhole.

52.11.5 PRICE TO COVER

The contract price for “CATCH BASIN CONNECTIONS” (e.g. Item No. 52.11D12 - 12” DUCTILE IRON PIPE BASIN CONNECTION, or Item No. 52.11V12 - 12” EXTRA STRENGTH VITRIFIED PIPE BASIN CONNECTION) must be the unit price bid per linear foot for each size, kind and class of catch basin connection pipe and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to construct the catch basin connections of the sizes and to the lines and grades shown or as directed, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); concrete cradles; crushed stone bedding and encasements; all sheeting and bracing; pumping; fluming; bridging; breaking down and filling in of abandoned sewer appurtenances; cored openings for connections to structures; connections; backfilling; cleaning up; and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans, specifications and standards and as directed by the Engineer.

In addition, included in the price hereunder must be the cost of all labor and materials necessary to remove all specified or ordered existing sewers, manholes, catch basins, structures and appurtenances that may be in the line of the work and do all work incidental thereto, all in accordance with **Subsections 10.13 and 10.28** of the specifications and as directed by the Engineer.

Payment for Catch Basin Connections will be made under the Item Number as calculated below:

The Item Numbers for Catch Basin Connections have eight characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Catch Basin Connections:

52.11

(2) The sixth character must define the Kind Of Catch Basin Connection:

D - Ductile Iron Pipe (D.I.P.) Class 56 On Stone Bedding
V - Extra Strength Vitrified Clay Pipe (E.S.V.P.) On Concrete Cradle

(3) The seventh and eighth characters must define the Diameter of the Catch Basin Connection Pipe. (The seventh and eighth characters representing the unit of inches for the Diameter of the Catch Basin Connection Pipe.) See examples below:

12 - 12”

(4) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
52.11D12	12” DUCTILE IRON PIPE BASIN CONNECTION	L.F.
52.11V12	12” EXTRA STRENGTH VITRIFIED PIPE BASIN CONNECTION	L.F.

SECTION 52.21 – RISERS FOR HOUSE CONNECTIONS

52.21.1 DESCRIPTION

Risers for house connections must be constructed of the sizes, classes and kinds shown, specified or required.

Riser pipe and fittings on precast reinforced concrete pipe sewers and on vitrified pipe sewers must be extra strength full diameter vitrified clay and must be installed in accordance with the Sewer Design Standards for risers on precast reinforced concrete pipe sewers and vitrified pipe sewers. Riser pipe on ductile iron pipe sewers and cast iron pipe sewers must be ductile iron and all fittings must be ductile iron or gray iron and must be installed in accordance with the Sewer Design Standards for ductile iron pipe alternate.

52.21.2 MATERIALS

(A) Vitrified pipe must comply with the requirements of **Section 21.02**. Kind, class and size of pipe must be as shown or specified. Joints must comply with the requirements of **Subsection 50.31.3(C)**.

(B) Ductile iron pipe must comply with the requirements of **Section 21.06** and must be Class 56 unless otherwise specified. Joints must comply with the requirements of **Subsection 21.06.5**. Unless otherwise specified or directed all joints for ductile iron riser pipe must be mechanical joint type as per Sewer Design Standards. All fittings required must be ductile iron or gray iron rated for two hundred fifty (250) pounds per square inch in accordance with ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11.

(C) Cement mortar must comply with the requirements of **Section 23.03**.

(D) Cement grout must comply with the requirements of **Section 23.04**.

(E) Gasket and mortar joint must comply with the requirements of **Section 21.07**, Type 1, and as specified in **Subsection 50.31.3(C)**.

(F) Premoulded bituminous compound joint must comply with the requirements of **Section 21.07**, Type 2, and as specified in **Subsection 50.31.3(C)**.

(G) Elastomeric pipe joint must comply with the requirements of **Section 21.07**, Type 3, and as specified in **Subsection 50.31.3(C)**.

(H) Ring rubber gasket and grooved spigot joint must comply with the requirements of **Section 21.07**, Type 4, and as specified in **Subsection 50.31.3(C)**.

(I) Concrete for cradle and encasement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(J) Reinforcement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

52.21.3 CONSTRUCTION METHODS

(A) GENERAL - Risers for house connections must be constructed of the sizes, classes and kinds shown, specified or ordered, and from the spurs or pipe openings to such a height as ordered. Location of spurs and risers and height of risers are not shown on the plans. Need for and location of spurs and risers, and height of risers will be determined by the Engineer at the time of construction. The Contractor must provide pipe Wye or Double-Wye branches for risers as required by the field conditions and as directed by the Engineer.

If the locations of risers and the heights of risers are shown on the plans they, must be understood to be approximate and for information only. The final locations and height of risers must be as determined by the Engineer at the time of construction.

(B) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work done hereunder.

(C) PLACING - The riser pipe must be placed with the male ends toward the outlet. The pipes must be fitted together and matched so that when placed in the work they will form a drain with a smooth and uniform interior. They must be installed and be supported and surrounded by reinforced concrete in accordance with the Sewer Design Standards and as directed by the Engineer. Unconnected dead ends of risers must be closed with approved tile or precast concrete plugs or with hand tightening (wing nut type) expandable

plugs provide a watertight seal. The threads are to be greased prior to tightening to ensure a proper seal without stripping.

Forms must be removed in accordance with **General Specification 11 - Concrete, as modified in Section 23.01**.

(D) JOINTS

(1) Joints must be made in accordance with the requirements of the specifications as stated hereinabove for the specific kind of pipe used.

(2) Inspection - Unless otherwise directed by the Engineer, the finished joint must be left exposed for inspection and approval by the Engineer. A suitable ladder affording easy access for such inspection must be provided.

(E) DAMAGED PIPE - Pipe damaged from handling or any cause whatsoever, whether in or out of the trench, must be replaced and removed from the site of the work by and at the sole expense of the Contractor.

52.21.4 MEASUREMENT

The quantities of risers for house connections to be measured for payment must be the number of vertical feet of each size, kind and class of riser pipe incorporated in the work, complete, as shown, specified or required, measured along the center lines of the riser pipes from the inner top of the pipe sewer to the maximum height of riser pipe as installed.

52.21.5 PRICE TO COVER

The contract price for “RISERS FOR HOUSE CONNECTIONS” (e.g. Item No. 52.21D08 - 8” DUCTILE IRON PIPE RISER FOR HOUSE CONNECTION, or Item No. 52.21V08 - 8” E.S.V.P. RISER FOR HOUSE CONNECTION) must be the unit price bid per vertical foot for each size, kind and class of riser pipe and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to construct the risers of the sizes and to the heights as directed by the Engineer, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); concrete encasements; steel reinforcement bars; Wye and Tee spurs; pipe; fittings; Wye and Double-Wye branches; plugs; all sheeting and bracing; pumping; fluming; connections; backfilling; and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans, specifications and standards and as directed by the Engineer.

Included in the price hereunder is the cost of all the labor and materials required and necessary to reconnect complete the house connection drains where required at the time of construction, and do all the work incidental thereto, all in accordance with the specifications and standards and as directed by the Engineer.

Payment for Risers For House Connections will be made under the Item Number as calculated below:

The Item Numbers for Risers For House Connections have eight characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Risers For House Connections:

52.21

(2) The sixth character must define the Kind Of Riser For House Connection:

D - Ductile Iron Pipe (D.I.P.) Encased In Concrete
V - Extra Strength Vitrified Clay Pipe (E.S.V.P.) Encased In Concrete

(3) The seventh and eighth characters must define the Diameter of the Riser Pipe For House Connection. (The seventh and eighth characters representing the unit of inches for the Diameter of the Riser Pipe For House Connection.) See examples below:

08 - 8”
10 - 10”

(4) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
52.21V08	8” E.S.V.P. RISER FOR HOUSE CONNECTION	V.F.
52.21V10	10” E.S.V.P. RISER FOR HOUSE CONNECTION	V.F.
52.21D08	8” DUCTILE IRON PIPE RISER FOR HOUSE CONNECTION	V.F.
52.21D10	10” DUCTILE IRON PIPE RISER FOR HOUSE CONNECTION	V.F.

SECTION 52.31 – SPURS FOR HOUSE CONNECTIONS

52.31.1 DESCRIPTION

Spurs for house connections must be constructed of the sizes, classes, and kinds shown, specified, or required.

52.31.2 MATERIALS

(A) Vitrified pipe must comply with the requirements of **Section 21.02**. Kind, class, and size of pipe must be as shown or specified. Joints must comply with the requirements of **Subsection 50.31.3(C)**.

(B) Ductile iron pipe must comply with the requirements of **Section 21.06** and must be Class 56 unless otherwise specified. Joints must comply with the requirements of **Subsection 21.06.5**. Unless otherwise specified or directed, all joints for ductile iron spur pipe must be mechanical joint type. All fittings required must be ductile iron or gray iron rated for two hundred fifty (250) pounds per square inch in accordance with ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11.

Where spurs are required on ductile iron pipe sewers less than sixteen (16) inches in diameter, Wyes must be utilized.

Where spurs are required on ductile iron pipe sewers sixteen (16) inches and greater in diameter, the use of Tees and/or saddles will be permitted. All saddles must be approved by the Department of Design and Construction.

(C) Cast iron pipe must comply with the requirements of **Section 21.03**. Kind, class, and size of pipe must be as shown or specified. Joints must comply with the requirements of **Subsection 21.06.5** as defined for ductile iron pipe. Unless otherwise specified or directed, all joints for cast iron spur pipe must be mechanical joint type. All fittings required must be ductile iron or gray iron rated for two hundred fifty (250) pounds per square inch in accordance with ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11.

(D) Cement mortar must comply with the requirements of **Section 23.03**.

(E) Cement grout must comply with the requirements of **Section 23.04**.

(F) Gasket and mortar joint must comply with the requirements of **Section 21.07**, Type 1, and as specified in **Subsection 50.31.3(C)**.

(G) Premoulded bituminous compound joint must comply with the requirements of **Section 21.07**, Type 2, and as specified in **Subsection 50.31.3(C)**.

(H) Elastomeric pipe joint must comply with the requirements of **Section 21.07**, Type 3, and as specified in **Subsection 50.31.3(C)**.

(I) Ring rubber gasket and grooved spigot joint must comply with the requirements of **Section 21.07**, Type 4, and as specified in **Subsection 50.31.3(C)**.

(J) Concrete for cradle and encasement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

52.31.3 CONSTRUCTION METHODS

(A) GENERAL - Spurs for house connections must be constructed of the sizes, classes, and kinds shown, specified, or ordered. Locations of spurs are not shown on the plans. The Engineer will determine the need for and location of spurs at the time of construction. The Contractor must provide pipe Wye or Tee branches for spurs as required by the field conditions and as directed by the Engineer.

If the location of spurs are shown on the plans, they must be understood to be approximate and for information only. The final locations of spurs must be as determined by the Engineer at the time of construction.

(B) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

(C) INSTALLATION -

(i) In precast reinforced concrete pipe sewers, spur pipe must be bell and spigot with the spigot end molded or cut to fit flush in the socketed opening provided in the precast reinforced concrete pipe sewer so

that the inner surface of the sewer must be smooth with no protruding spur pipe. The spur pipe spigot end must be of sufficient length to reach the exterior of the sewer.

(ii) Vitrified pipe sewers must have spurs of the sizes shown, specified, or ordered molded thereon to form the required Wye or Tee branch spur pipe sewer. Cast iron pipe sewers and ductile iron pipe sewers must have spurs of the sizes shown, specified, or ordered molded thereon to form the required Wye or Tee branch spur pipe sewer and all joints must be mechanical joint type. Such spur pipe sewer must be furnished and laid in pipe sewers where directed by the Engineer.

(iii)The Contractor must be permitted, with the approval of the Engineer, to use on sixteen (16) inch in diameter and larger ductile iron pipe sewer as a substitute for ductile iron pipe Wye and Tee branch premolded spur pipe sewer an approved seal tight type saddle similar to Geneco Sealtite Type "C", Model "CO" Sewer Pipe Saddle.

(iv) Unconnected dead ends of spurs must be closed with approved tile or precast concrete plugs or with hand tightening (wing nut type) expandable plugs to provide a watertight seal. The threads are to be greased prior to tightening to ensure a proper seal without stripping.

(D) DAMAGED SPUR PIPE - Wye or Tee branch spur pipe damaged from handling or any cause whatsoever, whether in or out of the trench, must be replaced and removed from the site of the work by and at the sole expense of the Contractor.

(E) CONCRETE ENCASEMENT - When E.S.V.P. sewers are laid on a concrete cradle or fully encased, the molded spur thereon must be fully encased in concrete for a minimum distance of six (6) inches on all sides of the pipe sewer and sewer spur.

(F) Ductile iron pipe Wye or Tee branch spur pipe sewer must conform to the Sewer Design Standards for ductile iron pipe alternate.

52.31.4 MEASUREMENT

The quantities of spurs for house connections to be measured for payment must be the number of each size, kind, and class spur pipe incorporated in the work, complete, as shown, specified or required.

52.31.5 PRICE TO COVER

The contract price for “SPURS FOR HOUSE CONNECTIONS” (e.g. Item No. 52.31D06S18 - 6” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 18” D.I.P. SANITARY SEWER, or Item No. 52.31V06S18 - 6” E.S.V.P. SPUR FOR HOUSE CONNECTION ON 18” E.S.V.P. SANITARY SEWER) must be the unit price bid per each size, kind, and class of spur and must cover the cost of all labor, materials, plant, equipment, and insurance required and necessary to furnish and install the spurs as directed by the Engineer, including concrete encasement, fittings, plugs; connections, and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans, specifications, and standards, and as directed by the Engineer.

Spur on a pipe sewer must be included for payment hereunder but the cost of the pipe sewer is included in the appropriate pipe sewer item.

Payment for Spurs For House Connections will be made under the Item Number as calculated below:

The Item Numbers for Spurs For House Connections have eleven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Spurs For House Connections:

52.31

(2) The sixth character must define the Kind Of Spur For House Connection:

D - Ductile Iron Pipe (D.I.P.)
V - Extra Strength Vitrified Clay Pipe (E.S.V.P.)

(3) The seventh and eighth characters must define the Diameter of the Spur For House Connection. (The seventh and eighth characters representing the unit of inches for the Diameter of the Spur For House Connection.) See examples below:

06 - 6”
10 - 10”

(4) The ninth character must define the Type of Sewer Effluent:

S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer
P - All Type Of Sewer Effluent

(5) The tenth and eleventh characters must define the Diameter of the Pipe the Spur For House Connection is on. (The tenth and eleventh characters representing the unit of inches for the Diameter of the Pipe the Spur For House Connection is on.) See examples below:

08 - 8”
12 - 12”
30 - 30”
00 - All Pipe Diameter

(6) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
52.31V06S10	6” E.S.V.P. SPUR FOR HOUSE CONNECTION ON 10” E.S.V.P. SANITARY SEWER	EACH
52.31V06S15	6” E.S.V.P. SPUR FOR HOUSE CONNECTION ON 15” E.S.V.P. SANITARY SEWER	EACH
52.31V08S10	8” E.S.V.P. SPUR FOR HOUSE CONNECTION ON 10” E.S.V.P. SANITARY SEWER	EACH
52.31V08S12	8” E.S.V.P. SPUR FOR HOUSE CONNECTION ON 12” E.S.V.P. SANITARY SEWER	EACH
52.31V08S18	8” E.S.V.P. SPUR FOR HOUSE CONNECTION ON 18” E.S.V.P. SANITARY SEWER	EACH
52.31V10S10	10” E.S.V.P. SPUR FOR HOUSE CONNECTION ON 10” E.S.V.P. SANITARY SEWER	EACH
52.31V10S15	10” E.S.V.P. SPUR FOR HOUSE CONNECTION ON 15” E.S.V.P. SANITARY SEWER	EACH
52.31D06S10	6” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 10” D.I.P. SANITARY SEWER	EACH
52.31D06S16	6” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 16” D.I.P. SANITARY SEWER	EACH
52.31D06S24	6” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 24” D.I.P. SANITARY SEWER	EACH
52.31D06S36	6” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 36” D.I.P. SANITARY SEWER	EACH
52.31D06S48	6” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 48” D.I.P. SANITARY SEWER	EACH
52.31D08S10	8” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 10” D.I.P. SANITARY SEWER	EACH
52.31D08S12	8” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 12” D.I.P. SANITARY SEWER	EACH
52.31D08S18	8” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 18” D.I.P. SANITARY SEWER	EACH
52.31D08S30	8” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 30” D.I.P. SANITARY SEWER	EACH
52.31D08S42	8” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 42” D.I.P. SANITARY SEWER	EACH
52.31D10S10	10” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 10” D.I.P. SANITARY SEWER	EACH
52.31D10S16	10” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 16” D.I.P. SANITARY SEWER	EACH
52.31D10S24	10” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 24” D.I.P. SANITARY SEWER	EACH

Item No.	Description	Pay Unit
52.31D10S36	10” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 36” D.I.P. SANITARY SEWER	EACH
52.31D10S48	10” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 48” D.I.P. SANITARY SEWER	EACH
52.31V06M12	6” E.S.V.P. SPUR FOR HOUSE CONNECTION ON 12” E.S.V.P. STORM SEWER	EACH
52.31V06M18	6” E.S.V.P. SPUR FOR HOUSE CONNECTION ON 18” E.S.V.P. STORM SEWER	EACH
52.31V08M12	8” E.S.V.P. SPUR FOR HOUSE CONNECTION ON 12” E.S.V.P. STORM SEWER	EACH
52.31V08M15	8” E.S.V.P. SPUR FOR HOUSE CONNECTION ON 15” E.S.V.P. STORM SEWER	EACH
52.31V10M12	10” E.S.V.P. SPUR FOR HOUSE CONNECTION ON 12” E.S.V.P. STORM SEWER	EACH
52.31V10M18	10” E.S.V.P. SPUR FOR HOUSE CONNECTION ON 18” E.S.V.P. STORM SEWER	EACH
52.31D06M12	6” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 12” D.I.P. STORM SEWER	EACH
52.31D06M18	6” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 18” D.I.P. STORM SEWER	EACH
52.31D06M30	6” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 30” D.I.P. STORM SEWER	EACH
52.31D06M42	6” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 42” D.I.P. STORM SEWER	EACH
52.31D08M12	8” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 12” D.I.P. STORM SEWER	EACH
52.31D08M16	8” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 16” D.I.P. STORM SEWER	EACH
52.31D08M24	8” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 24” D.I.P. STORM SEWER	EACH
52.31D08M36	8” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 36” D.I.P. STORM SEWER	EACH
52.31D08M48	8” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 48” D.I.P. STORM SEWER	EACH
52.31D10M12	10” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 12” D.I.P. STORM SEWER	EACH
52.31D10M18	10” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 18” D.I.P. STORM SEWER	EACH
52.31D10M30	10” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 30” D.I.P. STORM SEWER	EACH
52.31D10M42	10” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 42” D.I.P. STORM SEWER	EACH
52.31V06C15	6” E.S.V.P. SPUR FOR HOUSE CONNECTION ON 15” E.S.V.P. COMBINED SEWER	EACH
52.31V06C18	6” E.S.V.P. SPUR FOR HOUSE CONNECTION ON 18” E.S.V.P. COMBINED SEWER	EACH
52.31V08C15	8” E.S.V.P. SPUR FOR HOUSE CONNECTION ON 15” E.S.V.P. COMBINED SEWER	EACH
52.31V08C18	8” E.S.V.P. SPUR FOR HOUSE CONNECTION ON 18” E.S.V.P. COMBINED SEWER	EACH
52.31V10C15	10” E.S.V.P. SPUR FOR HOUSE CONNECTION ON 15” E.S.V.P. COMBINED SEWER	EACH
52.31V10C18	10” E.S.V.P. SPUR FOR HOUSE CONNECTION ON 18” E.S.V.P. COMBINED SEWER	EACH
52.31D06C16	6” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 16” D.I.P. COMBINED SEWER	EACH
52.31D06C24	6” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 24” D.I.P. COMBINED SEWER	EACH

Item No.	Description	Pay Unit
52.31D06C36	6” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 36” D.I.P. COMBINED SEWER	EACH
52.31D06C48	6” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 48” D.I.P. COMBINED SEWER	EACH
52.31D08C16	8” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 16” D.I.P. COMBINED SEWER	EACH
52.31D08C18	8” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 18” D.I.P. COMBINED SEWER	EACH
52.31D08C30	8” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 30” D.I.P. COMBINED SEWER	EACH
52.31D08C42	8” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 42” D.I.P. COMBINED SEWER	EACH
52.31D10C16	10” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 16” D.I.P. COMBINED SEWER	EACH
52.31D10C24	10” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 24” D.I.P. COMBINED SEWER	EACH
52.31D10C36	10” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 36” D.I.P. COMBINED SEWER	EACH
52.31D10C48	10” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 48” D.I.P. COMBINED SEWER	EACH
52.31V06P00	6” E.S.V.P. SPUR FOR HOUSE CONNECTION ON E.S.V.P. SEWER	EACH
52.31V08P00	8” E.S.V.P. SPUR FOR HOUSE CONNECTION ON E.S.V.P. SEWER	EACH
52.31D06P00	6” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON D.I.P. SEWER	EACH
52.31D08P00	8” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON D.I.P. SEWER	EACH

SECTION 52.41 – HOUSE CONNECTION DRAINS

52.41.1 DESCRIPTION

Whenever new house connection drains are proposed, the Contractor must be able to use and/or substitute ductile iron or cast iron soil pipe for new house connection drains. New house connection drains must be constructed of the sizes shown, specified or required.

Existing house connection drains and other service pipes damaged or removed on account of the construction work must be reconstructed and reconnected of the same sizes, classes and kinds. The minimum size of reconnection must be six (6) inches.

52.41.2 MATERIALS

(A) Vitrified pipe must comply with the requirements of **Section 21.02**. Kind, class and size of pipe must be as shown or specified. Joints must comply with the requirements of **Subsection 50.31.3(C)**.

(B) Ductile iron pipe must comply with the requirements of **Section 21.06** and must be Class 56 unless otherwise specified. Joints must comply with the requirements of **Subsection 21.06.5**. Unless otherwise specified or directed all joints for ductile iron pipe house connection drain must be "push-on" joint type. All fittings required must be ductile iron or gray iron rated for two hundred fifty (250) pounds per square inch in accordance with ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11.

(C) Cast iron soil pipe must comply with the requirements of **Section 21.04**. Joints must comply with the requirements of **Subsection 21.04.3**. Unless otherwise specified or directed all joints for cast iron soil pipe house connection drain must be "push-on" joint type.

(D) Cement mortar must comply with the requirements of **Section 23.03**.

(E) Cement grout must comply with the requirements of **Section 23.04**.

(F) Gasket and mortar joint must comply with the requirements of **Section 21.07**, Type 1, and as specified in **Subsection 50.31.3(C)**.

(G) Premoulded bituminous compound joint must comply with the requirements of **Section 21.07**, Type 2, and as specified in **Subsection 50.31.3(C)**.

(H) Elastomeric pipe joint must comply with the requirements of **Section 21.07**, Type 3, and as specified in **Subsection 50.31.3(C)**.

(I) Ring rubber gasket and grooved spigot joint must comply with the requirements of **Section 21.07**, Type 4, and as specified in **Subsection 50.31.3(C)**.

(J) Concrete for cradle and encasement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(K) Crushed stone must comply with the requirements of **Section 40.12**.

(L) Ground stabilization filter fabric must comply with the requirements of **Section 25.03**.

52.41.3 CONSTRUCTION METHODS

(A) PRECONSTRUCTION SURVEY - Whenever a new sewer is to be constructed or the proposed sewer is to be placed in a new location or at a higher elevation than the existing sewer (existing sewer to be abandoned), the Contractor must, prior to the start of construction, determine by survey, test pits, television inspection, or any other means necessary, for each and every house within the limits of the new sewer construction, the locations and elevations of the house traps (for new connections), the location and elevations of the house connections (for reconnections), and the location of the existing sewer to which they are connected (for reconnections). Based on the Contractor's finding, the Contractor must inform the Engineer, in writing, of any anticipated difficulties the Contractor might encounter in order to provide new connections to the proposed sewer, or in order to reconnect existing house connections to the proposed sewer.

If the Contractor is required to enter upon private property to gain access to private buildings, in order to perform work under this section, the Contractor must obtain all consents necessary. One (1) counterpart of each such consent, duly signed and acknowledged by the owners, executors or administrators for owners and for owners agents, lessees and any other persons who must have a vested or contingent interest in

the building, or notice of refusal if consent is not obtained, must be filed with the Engineer at least two (2) days before the commencement of examination.

(B) GENERAL - The Contractor must install; for all buildings and properties which are not presently being serviced by existing sanitary sewers, combined sewers or temporary drains within the project limits; new house connection drains of the sizes shown, specified or required, as directed by the Engineer. New house connection drains must be laid with a uniform minimum gradient of not less than one-quarter (1/4) inch per foot, and unless otherwise possible the depth from the top of curb grade to the inner bottom of the drain must be a minimum of eight (8) feet at the curb line. The new house connection drains must be constructed from the spur on the main line sewer to a point between two (2) to five (5) feet beyond the curb line as directed by the Engineer. A plugged hub must be left at the end of the pipe for the plumber's future connection. In no case must the new house connection drain be extended into private property.

All buildings and properties which are presently being serviced by existing sanitary sewers, combined sewers or temporary drains within the project limits, and whose existing house connection drains have been damaged or removed due to the construction work, must have their house connection drains reconstructed of the same sizes, classes and kinds of pipe, and must be reconnected to the new sewer unless otherwise indicated on the plans or in the specifications, or ordered in writing by the Engineer.

(C) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

(D) LAYING - The pipe must be laid with the male ends toward the outlet. The pipes must be fitted together and matched so that when laid in the work they will form a drain with a smooth and uniform invert.

During the progress of the work the exposed ends of pipe drains must be provided with approved temporary covers fitted to the pipe so as to exclude earth and other materials.

Unless otherwise directed the trench for each house connection must be fully excavated for its entire length before any pipes are laid therein.

The unconnected hub end must be plugged with a hand tightening (wing nut type) expandable plug to provide a watertight seal. The threads are to be greased prior to tightening to ensure a proper seal without stripping.

Where required, the connection to the main line sewer spur or riser is to be made using a donut type Fernco adapter, or approved equal (compatible according to the pipe manufacturer).

On ductile iron pipe sewers or risers, or where required, a flexible D.I.P to E.S.V.P or C.I.S.P coupling must be used to connect house connection drains. The coupling must be Fernco, or approved equal.

(E) BEDDING

(1) Cast iron soil pipe and ductile iron pipe used for new house connection drain must be laid on a six (6) inch thick compacted layer of crushed stone. The six (6) inch thick layer of crushed stone must be placed on the subgrade of the trench for its full width. The subgrade must be prepared to the proper grade so that the pipe may be placed on the crushed stone base accurately to line and grade in agreement with the plans, specifications and standards, and as directed by the Engineer. Crushed stone must also be placed around the pipe to a depth of one-half (1/2) the outer diameter of the pipe and for the full width of the trench. The rest of the trench must be backfilled and compacted as specified in the specifications and as directed by the Engineer. The Contractor must note that in accordance with the Sewer Design Standards for ductile iron pipe alternate, a ground stabilization filter fabric must be placed all around at the interface of the stone base and sheeting and/or soil.

    Where the cover, from final grade to the outer top of pipe, is less than three (3) feet, the pipe house connection drains must be fully encased in concrete, as directed by the Engineer.

    The cost for the crushed stone bedding or encasement, ground stabilization filter fabric and all labor, equipment and expenses necessary and required to place the crushed stone and ground stabilization filter fabric must be deemed included in the prices bid for the contract items for house connection drains. No separate or additional payment will be made under this item or any other item of the contract for this material and work. The additional concrete required for the concrete encasement of pipe house connection drains must be paid for at the contract price bid for Item No. 73.21AC - ADDITIONAL CONCRETE.

(2) Where vitrified pipe, cast iron soil pipe or ductile iron pipe is used to reconstruct and reconnect exist house connection drains that were damaged or removed due to the construction work, they must be laid in continuous concrete cradles that overlaps the existing house connection drain by a minimum of one (1) foot at each interface of new pipe to old pipe. Where the cover, from final grade to the outer top of pipe, is less than three (3) feet, the reconstructed house connection drain must be fully encased in concrete. The cost for the concrete cradle and all labor, equipment and expenses necessary and required to place the concrete cradle must be included in the price bid for the contract item(s) for "HOUSE CONNECTION DRAIN ON CONCRETE CRADLE (RECONNECTION)". The additional concrete required for the concrete encasement of the house connection drains must be paid for at the contract price bid for Item No. 73.21AC - ADDITIONAL CONCRETE.

Concrete cradles for pipe must be cast in one (1) pour and must be of the dimensions shown, specified or directed.

Concrete sills of approved shapes and dimensions must be used for the temporary support of pipes that are to be permanently supported on concrete cradles. Such sills must be completely embedded in the concrete cradle. Working drawings of these sills must be submitted to the Engineer for approval before pipe laying begins. The use of wood or other material shims will be required as directed by the Engineer.

Forms must be removed in accordance with **General Specification 11 - Concrete, as modified in Section 23.01**.

(F) LEAKAGE TESTING - The sewer main and new house connection drains must be tested for leakage in accordance with **Section 40.11**.

(G) DAMAGED PIPE - Pipe damaged from handling or any cause whatsoever, whether in or out of the trench, must be replaced and removed from the site of the work by and at the sole expense of the Contractor.

(H) EXISTING DRAINS RESTORED OR EXTENDED - Where existing house connection drains connected to existing sewers are in physical interference with the work under this contract, the same must be relaid and reconnected to the existing sewers as directed by the Engineer. The cost of this work must be paid for at the contract price bid for the reconnection item, unless otherwise specified in the contract documents. Where no house connection item exists the work must be paid for in accordance with **Articles 25 and 26** of the Contract.

Where necessary, drains and house connections affected by this work must be extended and connected as directed.

(I) FIELD CUTTING - Ductile iron pipe and cast iron soil pipe must be cut only by means of abrasive saws, hack saws, wheel type cutters, milling type cutters or as approved by the Engineer. The use of "squeeze" type pipe cutters and cutting torches will not be permitted. The outside of the cut end must be beveled about one-quarter (1/4) inch at an angle of about thirty (30) degrees all around the pipe, with a coarse file or a portable grinder.

Vitrified pipe must be cut only by means of wheel type cutters, milling type cutters or as approved by the Engineer.

The ends of existing house connection drains must be cut by approved means so as to provide a smooth transverse cut surface for the joining of old pipe to new pipe.

The use of diamond points and dog chisels will not be permitted.

(J) LOWERING OF PROPOSED SEWER - Subject to prior approval of the Department of Design and Construction, should the proposed sewer be required to be lowered, from those elevations shown on the contract drawings in order to reconnect the existing house connections, additional payment will be made to the Contractor under the item(s) labeled "ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS". House connections that will have to be extended for proper reconnections will be paid for at the price bid for the respective reconnection item.

52.41.4 MEASUREMENT

The quantities of house connection drains to be measured for payment must be the number of linear feet of each size, kind and class of house connection drain pipe incorporated in the work, complete, as shown,

specified or required, measured from the spurs or risers of the sewer along the center lines of house connection drain pipes where laid.

52.41.5 PRICE TO COVER

The contract price for “NEW HOUSE CONNECTION DRAINS” (e. g. Item No. 52.41D06N - NEW 6” D.I.P. HOUSE CONNECTION DRAIN ON STONE BEDDING, or Item No. 52.41C06N - NEW 6” C.I.S.P. HOUSE CONNECTION DRAIN ON STONE BEDDING, or Item No. 52.41V06N - NEW 6” E.S.V.P. HOUSE CONNECTION DRAIN ON CONCRETE CRADLE) must be the unit price bid per linear foot for each size, kind and class of house connection drain pipe and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to construct the house connection drains of the sizes and to the lines and grades specified and as directed, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); preconstruction survey including test pits; concrete cradles; crushed stone bedding and encasements; ground stabilization filter fabric; plugs; couplings; adapters; fittings; all sheeting and bracing; pumping; fluming; bridging; connections; backfilling; cleaning up; temporary and final restoration of sidewalks, driveways and curbs (unless items for temporary and final restoration of sidewalks, driveways and curbs are otherwise provided in the Bid Schedule); and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans, specifications and standards and as directed by the Engineer. Whenever the Contractor uses or substitutes another kind of pipe for the house connection drain pipe proposed (e.g. ductile iron pipe for cast iron soil pipe) the cost of all labor and material necessary to construct the house connection drain of this other kind of pipe must be included in the price bid for the proposed house connection drain pipe.

The contract price for “RECONNECTION OF HOUSE CONNECTION DRAINS” (e.g. Item No. 52.41D06R - 6” D.I.P. HOUSE CONNECTION DRAIN ON CONCRETE CRADLE (RECONNECTION), or Item No. 52.41C06R - 6” C.I.S.P. HOUSE CONNECTION DRAIN ON CONCRETE CRADLE (RECONNECTION), or Item No. 52.41V06R - 6” E.S.V.P. HOUSE CONNECTION DRAIN ON CONCRETE CRADLE (RECONNECTION)) must be the unit price bid per linear foot for each size, kind and class of house connection drain pipe and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to construct the house connection drains of the sizes and to the lines and grades specified and as directed, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); preconstruction survey including test pits; concrete cradles; plugs; couplings; adapters; fittings; all sheeting and bracing; pumping; fluming; bridging; connections; backfilling; cleaning up; temporary and final restoration of sidewalks, driveways and curbs (unless items for temporary and final restoration of sidewalks, driveways and curbs are otherwise provided in the Bid Schedule); and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans, specifications and standards and as directed by the Engineer.

In addition, included in the prices hereunder must be the cost of all labor and materials necessary to remove all specified or ordered existing sewers, drains, manholes, catch basins, structures and appurtenances, that may be in the line of the work and do all work incidental thereto, all in accordance with **Subsections 10.13 and 10.28** of the specifications and as directed by the Engineer.

Payment for House Connection Drains will be made under the Item Number as calculated below:

The Item Numbers for House Connection Drains have nine characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define House Connection Drains:

52.41

(2) The sixth character must define the Kind Of House Connection Drain:

D - Ductile Iron Pipe (D.I.P.)
V - Extra Strength Vitrified Clay Pipe (E.S.V.P.)
C - Cast Iron Soil Pipe (C.I.S.P.)

(3) The seventh and eighth characters must define the Diameter of the Pipe for House Connection Drain. (The seventh and eighth characters representing the unit of inches for the Diameter of the Pipe for House Connection Drain.) See examples below:

06 - 6”

10 - 10”

(4) The ninth character must define the Type of House Connection:

R - Reconnection of Existing House Connection
N - New House Connection (Not To Exceed Item)

(5) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
52.41V06R	6” E.S.V.P. HOUSE CONNECTION DRAIN ON CONCRETE CRADLE (RECONNECTION)	L.F.
52.41V08R	8” E.S.V.P. HOUSE CONNECTION DRAIN ON CONCRETE CRADLE (RECONNECTION)	L.F.
52.41V10R	10” E.S.V.P. HOUSE CONNECTION DRAIN ON CONCRETE CRADLE (RECONNECTION)	L.F.
52.41C06R	6” C.I.S.P. HOUSE CONNECTION DRAIN ON CONCRETE CRADLE (RECONNECTION)	L.F.
52.41C08R	8” C.I.S.P. HOUSE CONNECTION DRAIN ON CONCRETE CRADLE (RECONNECTION)	L.F.
52.41C10R	10” C.I.S.P. HOUSE CONNECTION DRAIN ON CONCRETE CRADLE (RECONNECTION)	L.F.
52.41D06R	6” D.I.P. HOUSE CONNECTION DRAIN ON CONCRETE CRADLE (RECONNECTION)	L.F.
52.41D08R	8” D.I.P. HOUSE CONNECTION DRAIN ON CONCRETE CRADLE (RECONNECTION)	L.F.
52.41D10R	10” D.I.P. HOUSE CONNECTION DRAIN ON CONCRETE CRADLE (RECONNECTION)	L.F.
52.41V06N	NEW 6” E.S.V.P. HOUSE CONNECTION DRAIN ON CONCRETE CRADLE (NOT TO EXCEED $XX.XX/L.F.)	L.F.
52.41V08N	NEW 8” E.S.V.P. HOUSE CONNECTION DRAIN ON CONCRETE CRADLE (NOT TO EXCEED $XX.XX/L.F.)	L.F.
52.41V10N	NEW 10” E.S.V.P. HOUSE CONNECTION DRAIN ON CONCRETE CRADLE (NOT TO EXCEED $XX.XX/L.F.)	L.F.
52.41C06N	NEW 6” C.I.S.P. HOUSE CONNECTION DRAIN ON STONE BEDDING (NOT TO EXCEED $XX.XX/L.F.)	L.F.
52.41C08N	NEW 8” C.I.S.P. HOUSE CONNECTION DRAIN ON STONE BEDDING (NOT TO EXCEED $XX.XX/L.F.)	L.F.
52.41C10N	NEW 10” C.I.S.P. HOUSE CONNECTION DRAIN ON STONE BEDDING (NOT TO EXCEED $XX.XX/L.F.)	L.F.
52.41D06N	NEW 6” D.I.P. HOUSE CONNECTION DRAIN ON STONE BEDDING (NOT TO EXCEED $XX.XX/L.F.)	L.F.
52.41D08N	NEW 8” D.I.P. HOUSE CONNECTION DRAIN ON STONE BEDDING (NOT TO EXCEED $XX.XX/L.F.)	L.F.
52.41D10N	NEW 10” D.I.P. HOUSE CONNECTION DRAIN ON STONE BEDDING (NOT TO EXCEED $XX.XX/L.F.)	L.F.

SECTION 52.51 – REMOVAL OF PROTRUDING SERVICE CONNECTIONS

52.51.1 DESCRIPTION

Under this section the Contractor will be required to remove or trim protruding service connections.

52.51.2 METHOD

Upon completion of televising the existing sewer and prior to lining the Contractor must notify the Engineer of all protruding service connections that will affect the Contractor's selected lining method. Upon written approval from the Engineer the Contractor must remove or trim the protrusion. This must be accomplished from the interior of the sewer by means of a television camera directed cutting device.

52.51.3 MEASUREMENT

The quantity to be measured for payment must be the number of protrusions actually removed or trimmed (regardless of the materials and sizes) as directed and approved by the Engineer.

52.51.4 PRICE TO COVER

The contract price for Item No. 52.51RP - REMOVAL OF PROTRUDING SERVICE CONNECTIONS must be the unit price bid per each protruding service connection removed or trimmed and must cover the cost of all labor, material, plant and equipment required or necessary to remove or trim the protruding service connections regardless of the service connection material (e.g. clay, cast iron, ductile iron, etc.) and size all in accordance with the plans and specifications and as directed by the Engineer.

Payment for Removal Of Protruding Service Connections will be made under the Item Number as calculated below:

The Item Number for Removal Of Protruding Service Connections has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Removal Of Protruding Service Connections:

52.51

(2) The sixth and seventh characters must define Removal Of Protruding Service Connections:

RP - Removal Of Protruding Service Connections

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
52.51RP	REMOVAL OF PROTRUDING SERVICE CONNECTIONS	EACH

SECTION 52.61 – RE-OPENING OF SERVICE CONNECTIONS

52.61.1 DESCRIPTION

Under this section the Contractor will be required to re-open all existing active service connections and those inactive connections ordered by the Engineer.

52.61.2 METHOD

After the liner has been installed and cured the Contractor must re-open all existing active service connections and those inactive connections ordered by the Engineer. The re-opening of connections must be done without excavation and from the interior of the newly installed liner by the use of a remote controlled cutting device. All connections that are to be re-opened must be satisfactorily opened to the approximate size and shape of the original opening and must be smooth and flush wherever there is a potential for debris buildup.

52.61.3 MEASUREMENT

The quantity to be measured for payment must be the number of active service connections or inactive connections (regardless of the sizes) actually opened as required and directed by the Engineer.

52.61.4 PRICE TO COVER

The contract price for Item No. 52.61RC - RE-OPENING OF SERVICE CONNECTIONS must be the unit price bid per each active service connection or inactive connection re-opened and must cover the cost of all labor, material, plant and equipment required or necessary to re-open the active service connection or inactive connection regardless of the size all in accordance with the plans and specifications and as directed by the Engineer.

Payment for Re-Opening Of Service Connections will be made under the Item Number as calculated below:

The Item Number for Re-Opening Of Service Connections has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Re-Opening Of Service Connections:

52.61

(2) The sixth and seventh characters must define Re-Opening Of Service Connections:

RC - Re-Opening Of Service Connections

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
52.61RC	RE-OPENING OF SERVICE CONNECTIONS	EACH

SECTION 53.11 – TELEVISION INSPECTION AND DIGITAL AUDIO-VISUAL RECORDING OF SEWERS

53.11.1 DESCRIPTION

Prior to the final inspection of the work completed under this contract, the Contractor must make a closed circuit television inspection and digital audio-visual recording of all sewers constructed under this contract which are fifty-four (54) inches or smaller in their least inside dimension.

53.11.2 ENGINEER'S APPROVALS

(A) The Contractor must execute all the provisions of this section in a manner approved by the Engineer.

(B) All labor, experienced supervision, skilled technicians, mobile television studios, electronic equipment, television cameras, materials, and equipment necessary and required to perform the work of this section must be provided in strict accordance with the most current Industry Standards and are subject to final approval by the Engineer.

53.11.3 NOTICE

The Contractor must give the Engineer five (5) days notice of the Contractor's intention to begin the work included under this section.

53.11.4 DEFINITIONS

(1) Digital Inspection - Operation necessary to complete a true-color audio-visual inspection of all sewers constructed under this contract. The Contractor must furnish all labor, materials, equipment, tools, and other incidental services for digitally formatted inspection.

(2) MPEG - MPEG (pronounced M-peg), which stands for Moving Pictures Expert Group, is the nickname given to a family of International Standards used for coding audio-visual information in a digital compressed format. For purposes of this specification, MPEG must be defined as an ISO-MPEG Level 1 standard (MPEG-1) digital audio-visual coding having a resolution of 352-pixels (x) by 240-pixels (y) and an interlaced frame rate of thirty (30) frames per second. All MPEG codings must be named using .mpg as the file extension.

(3) CD-ROM - Compact Disk-Read Only Memory. For the purposes of this specification, CD-ROM must be defined as a CD-R written or "burned" in accordance with the ISO-9660 Level 2 specifications.

(4) PACP (Pipe Assessment and Certification Program) - A standard developed by NASSCO for the inspection of sewer lines.

53.11.5 SUPERVISION AND TECHNICIAN

(1) An experienced supervisor who has adequate experience in the field of pipeline inspection must coordinate the entire inspection operation stated under this section and as approved by the Engineer.

(2) The skilled technician required herein must have adequate experience in the field of pipeline inspection and must perform all work as directed by the Engineer.

53.11.6 EQUIPMENT

(1) The Contractor must furnish the digital scanning studio, audio-visual digital encoding equipment/software, and other necessary equipment, materials, labor, technicians, as required to perform the inspections. The Contractor at the Contractor's own cost and expense must provide the electricity for all operations.

(2) The digital scanning equipment must be capable of inspecting a minimum of one thousand two hundred fifty (1,250) linear feet of sewer line. The inspection equipment must be capable of clearly scanning the interior of a 6-inch-diameter sewer and all larger size sewers up to and including fifty-four (54) inches in their least inside dimension.

(3) The scanning equipment must be transported in a stable condition through the sewer line under inspection. Throughout the inspection the scanning equipment must be positioned with the unit directed along the longitudinal axis of the sewer. When the scanning equipment is towed by winch and bond through the sewer line, all winches must be stable with either locking or ratcheting drums. All winches must be inherently stable under loaded conditions. The bonds must be steel or of an equally non-elastic material to ensure the smooth and steady progress of the equipment. The bonds must be oriented in such a manner

as to enable unhindered extension or retraction through the sewer conduit. All efforts must be made to prevent damage to the sewer conduit during the inspection. In the case where the Contractor, for any reason, causes damage the cost of repair or remedy must be borne by the Contractor.

(4) Prior to inspection, water must be introduced to the upstream manhole to aid in identifying sags in the sewer.

(5) The digital scanning studio must be large enough to accommodate four (4) persons comfortably seated for the purpose of viewing the digital monitors while the inspection is in progress. The studio must be insulated against noise and extremes in temperature, and must be provided with means of controlling external and internal sources of light in a manner capable of ensuring that the monitor screen display is in accordance with the requirements of these specifications. The Engineer or the Engineer's representative must have access to view the digital monitor at all times. The digital monitor, central control panel, and control must be located in the mobile studio. The studio must be mounted on a mobile vehicle (truck), which allows safe and orderly movement of the inspection equipment throughout the work site.

(6) The equipment used for the sewer line inspection must be specifically designed and constructed for pipeline inspection. The unit must be waterproof and must be operative in any conditions that may be encountered in the inspection environment. The Contractor must provide pan and tilt functions to facilitate the inspection of service laterals and sewer line defects (open joints, cracks, infiltration, etc.). The scanning equipment must be capable of a three hundred sixty degrees (360º) rotational scan and the tilt arc must not be less than two hundred twenty-five degrees (225º) unless otherwise approved by the Engineer. The adjustment of focus and iris must provide a minimum focal range of three (3) inches in front of the scanning unit's lens. The distance along the sewer in focus from the initial point of observation must be a minimum of twice the vertical height of the sewer. The illumination system must be adjustable and such that it will allow an even distribution of the light around the sewer perimeter without the loss of contrast, flare out of picture, or shadowing. The view must be transmitted to a monitor of not less than fourteen (14) inches in size. The equipment must be capable of receiving and transmitting a picture of not less than four hundred sixty (460) lines of horizontal resolution. The travel speed of the inspection unit (through the sewer) must be uniform and must not exceed the maximum speed of thirty (30) feet per minute or as ordered by the Engineer.

(7) The Contractor must test the equipment to verify the picture quality. The Equipment manufacturer's recommendation must be used to clearly differentiate between the following colors: white, yellow, cyan, green, magenta, red, blue, and black.

(8) The digital inspection equipment must be of such quality as to enable the following to be achieved:

(a) Color: With the monitor adjusted for correct saturation, the six colors plus black and white must be clearly resolved with the primary and complementary colors in order of decreasing luminance.

(b) Linearity: The background grid must show squares of equal size, without convergence/divergence over the whole of picture. The center circle must appear round and have the correct height/width relationship (±5%).

(c) Resolution: The live picture must be displayed on a digital monitor capable of providing a clear, stable image free of electrical interference with a minimum horizontal resolution not less than four hundred sixty (460) lines.

(d) Color Consistency: To ensure that the unit will provide similar results when used with its own illumination source, the lighting must be fixed in intensity prior to commencing the inspection. In order to ensure color consistency no variation in illumination must take place during the inspection.

(e) The inspection monitor display must incorporate an automatically updated record in feet and tenths of a foot of the distance along the line from the cable calibration point to the lens of the camera. The relative positions of the two points should also be noted. The Contactor must use a suitable metering device that enables the cable length to be accurately measured; this must be accurate to ±1% or six (6) inches, whichever is greater. The Contractor must demonstrate that the tolerance is being achieved by wheel measurement between manholes on the surface. This accurate measurement must be included in the post inspection report.

53.11.7 EXECUTION

(1) Digitally Formatted Inspections: The Contractor must inspect sewer pipelines with pan and tilt imagery as specified so as to record all relevant construction features and defects of the pipeline as permanent record. Inspection of pipelines must be carried out in a format approved by the Engineer. A skilled technician who must be located at the control panel in the mobile television studio must control the operation of the equipment.

(2) The unit must be positioned to reduce the risk of picture distortion. In circular sewers, the lens must be positioned centrally at the spring-line (i.e. in prime position) within the sewer. In non-circular sewers, unit orientation must be at mid-height, unless otherwise approved by the Engineer, and centered horizontally. In all instances the lens must be directed along the longitudinal axis of the sewer when in prime position. A positioning tolerance of ±10% of the vertical sewer dimension must be allowed when the camera is in prime position.

53.11.8 INSPECTION REQUIREMENTS

(1) Any operator responsible for data collection and defect coding must hold a current PACP Certification. Such certification must be submitted to the Engineer prior to start of any work.

(2) When the digital scanner is being inserted into the manhole, the video file will be paused and will be restarted when the operator is ready to commence the pipe inspection.

(3) The inspection must commence from starting point to termination point as specified herein and as directed by the Engineer.

(4) The operator must use PACP codes that are approved by the Engineer.

(5) During the course of the inspection, the Engineer may indicate the specific views appearing on the monitor that are to be photographed. The size of the photographs must not be less than 3” x 4”. The cost of the photographs, ordered taken by the Engineer, must be included in the contract price for Item No. 53.11DR - TELEVISION INSPECTION AND DIGITAL AUDIO-VISUAL RECORDING OF SEWERS. The photographs taken during the inspection must be mounted within the post inspection report and keyed to their exact location on the route sheet.

53.11.9 DIGITAL AUDIO-VISUAL RECORDING (D.A.V.R)

(1) Visual Recording: Continuous digital recordings of the inspection view as it appears on the monitor must be stored. It is intended that a digital recording will be made of the complete pipe inspection. The recording must also be used as a permanent record of the inspection. The recording must be MPEG1 and must comply with ISO/IEC 11172 MPEG 1 Specifications. The digital encoding must include both sound and visual information that can be reproduced with an image equal to the quality of the original picture on the monitor. Compression rate must be 1.5-Mb/s. The replay of the compressed video information, when reviewed on Windows Media Player Version 6.4 or higher, must be free of electrical interference and must produce a clear stable image. The audio portion of the composite digital coding must be sufficiently free of electrical interference and background noise to produce an oral report that is clear and completely and easily discernible. The operator must pause the digital recording at any time that there is a delay in the inspection, the pause must in no way affect, freeze, or interrupt the replay of the video and must not close the video file during the inspection. The operator must store a single video file for each inspection. The data must be time coded using the elapsed time from the video file. The elapsed time specifications must comply with PACP requirements. The naming of the video file must be automatic and must match the inspection file name.

(2) The audio portion of the inspection report must include the location or identification of the section, manhole-to-manhole direction of travel, and the distance traveled on the specific run encountered. The digital scanning equipment must be continuously connected to the monitoring equipment. The digital scanning unit and monitoring equipment must have the built-in capability to allow the Engineer to instantly review both the audio and visual quality of the recordings at all times during the inspection.

(3) Separate MPEG files must be created for each sewer line segment. MPEG files and the data inspection files must be written to CD-ROM media for delivery to the Engineer. Multiple MPEGs may exist on each CD-ROM. Each CD-ROM must be labeled, at a minimum, with the following information: Project ID. No., Location(s), Date Began and Date Completed.

(4) MPEG files must be named according to the following file specification:

[UPSTREAM MANHOLE NUMBER A - DOWNSTREAM MANHOLE NUMBER B] .mpg (e.g. for recording from upstream Manhole No. 6 to downstream Manhole No. 7 file must be labeled [MH NO 6 - MH NO 7] .mpg)

(5) DVD R's (DVD+R or DVD+RW) may be substituted for CD-ROMs when applicable.

(6) The Contractor is hereby required to have the television inspection equipment set up in such a fashion so as to have two (2) Digital Audio-Visual Recordings (D.A.V.R.) recording simultaneously at the project site (one computer with double disk burning capabilities). The City's Engineer or a duly designated representative will be so situated so as to be able to see the entire digital audio-visual recording as it is taking place.

The two (2) D.A.V.R. will be so designated and marked "D.A.V.R.A" and "D.A.V.R.B".

D.A.V.R.A must be included in the post inspection report that is to be given to the Engineer and D.A.V.R.B will be kept by the Contractor.

The recordings from both D.A.V.Rs must have the following information on it:

(a) Project ID. No.
(b) Location
(c) Date Began
(d) Date Completed

53.11.10 POST INSPECTION REPORT

(1) Post Inspection Report: After completion of all required television inspections and digital audio-visual recordings of sewers constructed under this contract, the supervisor must furnish to both the Engineer and the Contractor a complete bound report for their permanent records.

The report must include the logging of all sections of sewers inspected, all audio-visual digital recordings, collected data and specific details as to service connections, water infiltration from the joints, and other points of interest noted during the inspection. The report must become the property of the Department of Design and Construction and must be delivered to the Engineer not more than ten (10) business days after the completion of all required television inspections and digital audio-visual recordings of sewers constructed under this contract. The experienced supervisor, Contractor, and the Engineer present at the time of the inspections must sign the report.

One (1) copy of the report must be furnished to the Department of Design and Construction. The report must also include but not be limited to:

(a) Route sheet (including but not limited to street names, north arrow, location of manholes and numbering of manholes). Note: The route sheet will be provided by the Engineer and must become part of the report;

(b) Permanent visual record including CD-ROM's of the sewers televised (keyed to their exact location on the route sheet);

(c) Photographs (keyed to their exact location on the route sheet);

(d) Text and/or summary.

(2) Data must be delivered in electronic format in accordance with PACP data structure developed by NASSCO.

(3) Digital Data Display: At the start of each sewer length being inspected, the length of pipeline from zero up to the cable calibration point must be recorded and reported in order to obtain a full record of the sewer length. The length entered on the data display must allow for the distance from the start of the survey to the cable calibration point (preset position) such that the footage at the start of the survey is zero.

(4) Inspection Record: At the start of each manhole length, a data generator must electronically generate and clearly display on the viewing monitor and digital recording, a record of data in alphanumeric form containing the information required.

(5) Once the inspection of the pipeline is under way, specific data must be continuously displayed on the viewing monitor and the MPEG1 file. The size and position of the data display must be such as not to interfere with the main subject of the picture yet must always be easily readable when the recording is

replayed. It must be possible to move the data on the video screen to ensure continual ability to read the data on the screen. At minimum, the following data must be displayed:

(a) Automatic update of the scanning unit's position shown in feet,

(b) Upstream manhole and downstream manhole reference numbers,

(c) Observations and Defects entered by the Technician during the inspection. (i.e., Service connections, water infiltration from joints, etc.)

(6) Each sewer length, i.e. the length of sewer between two consecutive manholes, must be entered on a separate data file. Where a Contractor elects to "pass through" a manhole during an inspection the Contractor must start a new data file at the manhole "pass through" and must re-set the distance to zero.

53.11.11 MEASUREMENT

The quantity of television inspection and digital audio-visual recording to be measured for payment must be the number of linear feet of sewer actually inspected by television inspection and digital audio-visual recording under this contract in accordance with this **Section 53.11** and as directed by the Engineer.

53.11.12 PRICE TO COVER

The contract price for Item No. 53.11DR - TELEVISION INSPECTION AND DIGITAL AUDIO-VISUAL RECORDING OF SEWERS must be the unit price bid per linear foot of sewer inspected by television inspection and digital audio-visual recording under this section and must cover the cost of all labor, supervision and technicians, mobile television studios, equipment, power, materials, and insurance required and necessary to perform the closed circuit television inspection, digital audio-visual recording, taking of photographs ordered by the Engineer, preparing the reports detailing the results of the inspection, and do all the work incidental thereto, all in accordance with the plans and specifications, and as directed by the Engineer.

Payment for Television Inspection And Digital Audio-Visual Recording Of Sewers will be made under the Item Number as calculated below:

The Item Number for Television Inspection And Digital Audio-Visual Recording Of Sewers has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Television Inspection And Digital Audio-Visual Recording Of Sewers:

53.11

(2) The sixth and seventh characters must define Television Inspection And Digital Audio-Visual Recording Of Sewers:

DR - Television Inspection And Digital Audio-Visual Recording Of Sewers

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
53.11DR	TELEVISION INSPECTION AND DIGITAL AUDIO-VISUAL RECORDING OF SEWERS	L.F.

SECTION 54.11 – SEWER CLEANING

54.11.1 INTENT

This section describes the cleaning of the following existing sewers:

(a) Sewers that are to be reconstructed by pneumatically placed concrete.

(b) Sewers that are shown, specified, or ordered cleaned, within the contract limits, for which no reconstruction or rehabilitation work is to be performed.

54.11.2 WORK INCLUDED

1. The Contractor must furnish all labor, materials, and equipment and must do all work necessary to remove and dispose of all loose debris, grease, oil, and silt from the invert, walls, and crown of all existing sewers and sewer portions through the manholes which are shown on the plans or specified in the contract documents to be cleaned, repaired, and/or reconstructed. The Contractor must also do all work necessary to clean all exposed steel of rust, masonry, etc.
2. Prior to the start of work, the Contractor will be required to submit a fluming/bypass-pumping detail in accordance with **Subsection 10.13 - (3) Existing Flow**. This fluming/bypass-pumping diagram must detail the Contractor's method to prevent debris, silt, and grease from migrating downstream during the cleaning operation. The Contractor must be required to clean the downstream sewer if the debris, grease, oil, and silt from the cleaning are not captured and removed at no additional cost to the City.
3. After all debris (of any kind), grease, and fines have been physically removed from the sewers and sewer portions through the manholes, the sewer surfaces, and sewer portion through the manhole surfaces must receive a thorough cleaning by high-pressure water blasting or other approved method, to remove any silt, grease, oil, or any other substance which could interfere with the bond of the newly placed concrete with the surfaces of the sewers and sewer portions through the manholes.
4. Unless otherwise approved, the water-blast pump must have a minimum capacity of 5,000-psi pressure. The Contractor must refer to SSPC-SP13/NACE 6 “Surface Preparation Of Concrete” for detailed guidelines. The surface preparation requirement is to expose aggregate to sound concrete and obtain a uniform surface texture of CSP 4-6 ICRI Guideline 03732.
5. For areas where exposed rebar is present, abrasive blasting or power wire brushing is required to thoroughly remove rust and scale from the rebar. Any loose concrete around or behind the rebar must be removed. Chipping concrete away from behind the rebar may be required to ensure the rebar is rust free prior to application of the resurfacing material.

54.11.3 DISPOSAL

All material removed from the sewers and sewer portions through the manholes under this contract will become the property of the Contractor and must be properly disposed of away from the site, at the Contractor’s expense.

In the event that the cleaning of sewers and sewer portions through the manholes is subcontracted, it is Contractor’s responsibility to ensure that the subcontractor properly disposes of the material removed away from the site.

54.11.4 MEASUREMENT

The quantity of sewer cleaning to be measured for payment must be the number of linear feet of existing sewers (regardless of the sizes) actually cleaned of loose debris, grease, oil, and silt to the satisfaction of the Engineer, measured along the centerline of the sewer through the manholes.

54.11.5 PRICE TO COVER

The contract price for Item No. 54.11SC - SEWER CLEANING must be the unit price bid per linear foot and must cover the cost of all labor, materials, and equipment required or necessary for the cleaning of and proper removal and disposal of all loose debris, grease, oil, laitance and silt in the existing sewers and sewer portions through the manholes regardless of the size, including fluming, dewatering and/or diversion of the flow in the existing sewers, abrasive water blasting, power wire brushing and furnishing and installing all other items necessary to complete this work, together with all work incidental thereto, all in accordance with the plans and specifications and as directed by the Engineer.

54.11.6 ADDITIONAL PAYMENT

For the purposes of payment, loose debris must be defined as solids not larger than twelve (12) inches in their greatest dimension that can be removed from the invert area of existing sewers and sewer portions through the manholes without chipping to facilitate removal. Loose debris must also be defined as loose concrete around or behind rebar that require removal. Chipping must mean removal by pneumatic or conventional hand held hammers and chisels. Silt must be defined as all sedimentary material.

Should the Contractor be required to remove and dispose of any debris not falling within the guidelines specified herein, then payment for the cost of all labor, material, equipment, etc. must be made in accordance with **Articles 25 and 26** of the Contract.

Payment for Sewer Cleaning will be made under the Item Number as calculated below:

The Item Number for Sewer Cleaning has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Sewer Cleaning:

54.11

(2) The sixth and seventh characters must define Sewer Cleaning:

SC - Sewer Cleaning

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
54.11SC	SEWER CLEANING	L.F.

SECTION 54.12 – CLEANING OF DRAINAGE STRUCTURES

54.12.1 INTENT

(A) When Item No. 54.12CS - CLEANING OF DRAINAGE STRUCTURES is specifically provided for in the Bid Schedule of the contract the Contractor must perform the work as specified in this **Section 54.12**.

(B) When there is no specific item provided for in the Bid Schedule for cleaning of drainage structures the Contractor must clean the existing catch basins and connections in accordance with **Subsection 10.13(2)**. The cost of this required cleaning of existing catch basins and connections must be deemed included in the prices bid for all items of work. No separate or additional payment will be made for this work.

54.12.2 DESCRIPTION

Under this section, the Contractor must clean the existing drainage structures (basins, drains, connecting pipes, etc.) designated, and remove all debris, rubbish, silt, etc. from site, and do all incidental work, all in accordance with the plans, specifications and as directed by the Engineer.

The Contractor must be required to perform the following work as specifically designated on the contract drawings or as directed by the Engineer:

(1) Clean all existing drainage structures to be removed prior to their removal.

(2) Clean all existing drainage structures to be left in place within the project limits.

54.12.3 METHOD

All cleaning methods must receive the approval of the Engineer, and final inspection must be made prior to approval for payment.

Payment under this item will be made on a one-time basis for each designated drainage structure satisfactorily cleaned prior to construction.

Also during the progress of the work, and until the completion and acceptance thereof, all drainage structures, both new and existing, must be kept thoroughly serviceable throughout the progress of work, and left serviceable at the completion of the contract at no direct payment, in accordance with the requirements of **Section 74.21 - Maintenance Of Site**.

54.12.4 DISPOSAL

All material removed from the existing drainage structures under this contract will become the property of the Contractor and must be properly disposed of away from the site, at the Contractor's expense.

In the event that the cleaning of existing drainage structures is subcontracted, it is the Contractor's responsibility to ensure that the subcontractor properly disposes of the material removed away from the site.

54.12.5 MEASUREMENT

The quantity to be measured for payment is the number of cubic yards of debris removed from the drainage structures.

54.12.6 PRICE TO COVER

The contract price for Item No. 54.12CS - CLEANING OF DRAINAGE STRUCTURES is the unit price bid per cubic yard of debris removed from the drainage structure and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to clean the basins, drains, inlets and connecting pipes designated, to the satisfaction of the Engineer, and do all work incidental thereto, all in accordance with the plans, specifications and as directed by the Engineer.

Payment for Cleaning Of Drainage Structures will be made under the Item Number as calculated below:

The Item Number for Cleaning Of Drainage Structures has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Cleaning Of Drainage Structures:

54.12

(2) The sixth and seventh characters must define Cleaning Of Drainage Structures:

CS - Cleaning Of Drainage Structures

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
54.12CS	CLEANING OF DRAINAGE STRUCTURES	C.Y.

SECTION 54.13 – CLEANING OF EXISTING DUCTILE IRON OR CAST IRON SEWERS

54.13.1 INTENT

This section describes cleaning of existing ductile iron or cast iron sewers.

54.13.2 WORK INCLUDED

The Contractor must furnish all labor, materials and equipment and must do all work necessary to remove and dispose of all tuberculation, loose rust, scale, loose and deteriorating portions of the pipe, debris, grease, oil and silt from the internal circumference of the existing ductile iron or cast iron sewers which are shown on the plans or specified in the contract documents to be cleaned.

Prior to the start of work the Contractor will be required to submit to the Engineer for approval a fluming/bypass-pumping detail in accordance with **Subsection 10.13 - (3) Existing Flow** and a detailed description of the proposed extraction method of all materials from the existing ductile iron or cast iron sewer during the primary cleaning operation. This fluming/bypass-pumping diagram and detailed description of material extraction must detail the Contractor's method to prevent tuberculation, loose rust, scale, loose and deteriorating portions of the pipe, debris, grease, oil and silt from migrating downstream during the cleaning operation. The Contractor must provide for the diversion of flow of existing sewers at existing upstream manholes (if available) and pump the flow into an existing downstream manhole. The pumps and bypass lines must be of adequate capacity and size to handle the flow. The Contractor must be required to clean the downstream sewer to the satisfaction of the Engineer if the tuberculation, loose rust, scale, loose and deteriorating portions of the pipe, debris, grease, oil and silt from the cleaning are not captured and removed.

Prior to the start of work the Contractor must determine which service connections are active and make all necessary investigations and prepare a plan for the controlling (or maintaining) of the flow and, where necessary, for the bypassing of active service connections. This plan must be submitted to the Engineer for approval and no work cannot commence until such approval is granted. The Contractor must be responsible for controlling (or maintaining) the flow for each active service connection along the line of the sewer to be rehabilitated. Where necessary, the flow from an active service connection must be bypassed to a manhole downstream of the proposed work by means of pumping from the trap located in the basement of the affected building. However, should such bypassing be judged unfeasible by the Engineer, the Contractor must excavate to the service connection outside the building area (sidewalk or roadway as determined by the Engineer) and bypass the connection from this point. The pump and bypass line for each service connection must be of adequate capacity and size to handle the flow. All excavations for bypassing service connections must be backfilled, compacted and pavement restored as directed by the Engineer. All service connections damaged must be repaired in accordance with the specifications and as directed by the Engineer.

After all debris (of any kind), grease, and fines have been physically removed, the ductile iron or cast iron sewer surfaces must receive a thorough final cleaning. This method of final cleaning of the existing ductile iron or cast iron sewers and the method of removal of any cleaning debris must also be submitted to the Engineer for approval prior to the start of work.

After completion of the cleaning and subsequent to cement lining of the existing ductile iron or cast iron pipe, the Contractor must television inspect and digital audio-visual record the existing ductile iron or cast iron pipe for inspection and approval by the Engineer that the pipe is sufficiently cleaned and adequately prepared for cement lining of the pipe. If it is determined by the Engineer that further cleaning(s) are required the Contractor must reclean the pipe as ordered and perform additional television inspection(s) and digital audio-visual recording(s) of the pipe.

54.13.3 CONSTRUCTION METHODS

The Drag Cleaning Method must be used for the primary cleaning of existing ductile iron or cast iron sewers on this project. The Contractor must supply all labor, materials and equipment required to clean the existing ductile iron or cast iron sewers in accordance with the requirements of this specification and as directed by the Engineer. The drag cleaning method must consist of pulling a mechanical cleaner assembly of steel scraper blades and tight-fitting rubber squeegees through the pipe sections (between manholes). This must be accomplished by both ends of the mechanical cleaner being fastened to steel cables which are attached to power winches at either end of the pipe section to be cleaned. The mechanical cleaner assembly must be winched first in one direction and then in the other direction as many times as required to properly clean the pipe and to expose the bare metal of the pipe.

The end sections of the pipe being cleaned must be protected to prevent gouging of the pipe by the pulling steel cables.

After the ductile iron or cast iron sewer is thoroughly drag cleaned to the satisfaction of the Engineer, the ductile iron or cast iron sewer surfaces must receive a thorough final cleaning by a method approved by the Engineer.

The Contractor is responsible for the proper disposal of all debris collected from the pipe and must comply with all requirements of this contract.

54.13.4 DISPOSAL

All material removed from the existing ductile iron or cast iron sewers under this contract will become the property of the Contractor and must be properly disposed of away from the site, at the Contractor's expense.

In the event that the cleaning of existing ductile iron or cast iron sewers is subcontracted, it is the Contractor's responsibility to ensure that the subcontractor properly disposes of the material removed away from the site.

54.13.5 MEASUREMENT

The quantity of ductile iron or cast iron sewer cleaning to be measured for payment is the number of linear feet of each size in-place existing ductile iron or cast iron sewer actually cleaned, complete and to the satisfaction of the Engineer, measured along the centerline of the ductile iron or cast iron sewer.

54.13.6 PRICE TO COVER

The contract price for "CLEANING OF EXISTING DUCTILE IRON OR CAST IRON SEWERS" is the unit price bid per linear foot for each size and type of existing sewer cleaned and must cover the cost of all labor, materials and equipment required or necessary for the cleaning of and proper removal and disposal of all tuberculation, loose rust, scale, loose and deteriorating portions of the existing pipe, debris, grease, oil and silt from the entire internal circumference of the in-place existing ductile iron or cast iron sewer, perform television inspection and digital audio-visual recording specified herein, diversion of flow of existing sewer, controlling (or maintaining) the flow for all active service connections, necessary bypassing and pumping of the existing active service connections, all necessary excavation, backfilling and compaction, temporary and permanent restoration of all disturbed sidewalk and pavement areas (unless items for temporary and permanent restoration are otherwise provided in the Bid Schedule), repair of service connections and do all work incidental thereto, all in accordance with the plans and specifications and as directed by the Engineer.

In addition, included in the unit prices bid hereunder must be the cost for all labor, materials and equipment required to provide all submittals required, and separate and collect solid and suspended cleaning debris and dispose of water if hydraulic cleaning is used as a method of final cleaning.

54.13.7 NO ADDITIONAL OR SEPARATE PAYMENT

The Contractor is notified that no additional or separate payment will be made for any recleanings and additional television inspections and digital audio-visual recordings ordered by the Engineer as specified herein. Payment for cleaning of existing ductile iron or cast iron sewers must be made once for the linear foot of pipe cleaned.

54.13.8 ADDITIONAL PAYMENT

For the purposes of payment, loose debris is defined as solids that can be removed from the existing ductile iron or cast iron sewer without chipping to facilitate removal. Chipping means removal by pneumatic or conventional hand-held hammers and chisels. The Engineer must be informed, in writing, as to the extent and location of any material that cannot be removed.

Should the Contractor be required to remove and dispose of any debris not falling within the guidelines specified above, then payment for the cost of all labor, material, equipment, etc. must be made in accordance with **Articles 25 and 26** of the Contract.

Payment for Cleaning Of Existing Ductile Iron Or Cast Iron Sewers will be made under the Item Number as calculated below:

The Item Numbers for Cleaning Of Existing Ductile Iron Or Cast Iron Sewers have ten characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Cleaning Of Existing Ductile Iron Or Cast Iron Sewers:

54.13

(2) The sixth character must define the Type of Sewer Effluent:

S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer

(3) The seventh and eighth characters must define the Kind of Existing Sewer to be Cleaned:

CC - Cast Iron Pipe (C.I.P.) to be Cleaned
DC - Ductile Iron Pipe (D.I.P.) to be Cleaned

(4) The ninth and tenth characters must define the Diameter of the Existing Sewer to be Cleaned. (The ninth and tenth characters representing the unit of inches for the Diameter of the Existing Sewer to be Cleaned.) See examples below:

12 – 12”
24 – 24”

(5) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	**Description**	**Pay Unit**
54.13SCC10	CLEANING OF EXISTING 10” C.I.P. SANITARY SEWER	L.F.
54.13SCC12	CLEANING OF EXISTING 12” C.I.P. SANITARY SEWER	L.F.
54.13MCC12	CLEANING OF EXISTING 12” C.I.P. STORM SEWER	L.F.
54.13MCC18	CLEANING OF EXISTING 18” C.I.P. STORM SEWER	L.F.
54.13CCC12	CLEANING OF EXISTING 12” C.I.P. COMBINED SEWER	L.F.
54.13CCC16	CLEANING OF EXISTING 16” C.I.P. COMBINED SEWER	L.F.
54.13CCC24	CLEANING OF EXISTING 24” C.I.P. COMBINED SEWER	L.F.
54.13SDC10	CLEANING OF EXISTING 10” D.I.P. SANITARY SEWER	L.F.
54.13SDC12	CLEANING OF EXISTING 12” D.I.P. SANITARY SEWER	L.F.
54.13MDC12	CLEANING OF EXISTING 12” D.I.P. STORM SEWER	L.F.
54.13MDC18	CLEANING OF EXISTING 18” D.I.P. STORM SEWER	L.F.
54.13CDC16	CLEANING OF EXISTING 16” D.I.P. COMBINED SEWER	L.F.
54.13CDC24	CLEANING OF EXISTING 24” D.I.P. COMBINED SEWER	L.F.

SECTION 54.21 – PORTLAND CEMENT (TYPE V) INJECTION GROUTING

54.21.1 INTENT

This section describes injection grouting that is required to fill surrounding voids and/or stop infiltration/exfiltration of the existing sewer to be reconstructed.

54.21.2 MATERIALS

Injection Grout must be neat Portland Cement. Water used in the mix must be clean fresh water and in no case must the water-cement ratio exceed eight (8) gallons of water per bag of cement. Portland Cement must be Type V.

54.21.3 CONSTRUCTION METHOD

(A) Injection grout holes must be located in the sewer as necessary to insure injection grout penetration. In general, injection grout holes must not have spacings exceeding eight (8) feet on centers for the entire length of the affected sewer, unless otherwise directed by the Engineer.

(B) Grout must be injected through the injection grout holes to insure filling of the voids. Adjacent injection grout holes must serve as vent holes.

(C) Injection grouting pressure must be the minimum pressure required to overcome the hydrostatic pressure beneath the sewer.

(D) Injection grouting must commence at the upstream end of the sewer.

(E) Depending upon the conditions encountered in the existing sewer, injection grouting must be performed prior to or after the repair of any damaged areas as directed by the Engineer.

54.21.4 MEASUREMENT

The quantity of injection grout used for injection grouting will be measured on the basis of the actual number of bags of Portland Cement (Type V) mixed and placed in the work to the satisfaction of the Engineer, in conformity with the contract documents. Portland Cement used for injection grout which remains in the grout hose, mixing pan, grout machine, or for waste grout which re-enters the interior of the sewer as the result of improper sealing, or as a result of improper work on the part of the Contractor, must be deducted from the measurement.

54.21.5 PRICE TO COVER

The contract price for Item No. 54.21PC - PORTLAND CEMENT (TYPE V) - INJECTION GROUTING must be the unit price bid per bag used for injection grouting under and around the sewer and must cover the cost of all labor, materials and equipment required or necessary for the proper placement of the injection grout around the existing sewer, including fluming and/or diversion of the flow in the existing sewer and furnishing and installing all other items necessary to complete this work, together with all work incidental thereto, all in accordance with the plans and specifications and as directed by the Engineer.

Payment for Portland Cement (Type V) - Injection Grouting will be made under the Item Number as calculated below:

The Item Number for Portland Cement (Type V) - Injection Grouting has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Portland Cement (Type V) - Injection Grouting:

54.21

(2) The sixth and seventh characters must define Portland Cement (Type V) - Injection Grouting:

PC - Portland Cement (Type V) - Injection Grouting

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
54.21PC	PORTLAND CEMENT (TYPE V) - INJECTION GROUTING	BAGS

SECTION 54.31 – SHOTCRETE FOR REPAIR WORK

54.31.1 INTENT

This section describes shotcrete for repair work that is required to repair the existing sewer to its original structural lines.

54.31.2 MATERIALS

(A) Shotcrete for Repair must be a mixture of one (1) part cement (Type V) to three parts sand with a sufficient amount of water to provide a suitable mix.

(B) Reinforcement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01** and **Section 73.51**.

54.31.3 CONSTRUCTION METHOD

(A) DAMAGED INVERT - If the existing invert is found to be damaged and lower than its original designed elevation, as determined by the Engineer, the Contractor must restore the invert up to the spring line by placing Number Four (4) Steel Reinforcing Bars at twelve (12) inches spacing in both directions throughout the depressed and damaged area and then apply sufficient quantities of shotcrete to restore the sewer section to its original structural lines. There must be a minimum clearance of three-quarter (3/4) inch between steel reinforcement and the surface of the shotcrete.

(B) CRACKS IN WALLS AND MISSING BRICK, MASONRY OR CONCRETE

(1) The following repair procedure is to be used only when in the opinion of the Engineer the structural integrity of the sewer has not been compromised.

Isolated cracks up to five (5) linear feet long and up to one-half (1/2) inch wide and gaps created by three (3) or less missing bricks or created by missing masonry or concrete less than one (1) square foot in area, are to be considered nonthreatening and must not be singled out for special repair. Where cracks and gaps exceed the above listed parameters, the Contractor must mechanically rake out loose or crumbling material from the opening, flush the gap with water from a pressure hose, place Number Three (3) Steel Reinforcing Bars at six (6) inches spacing in both directions throughout the area of the gap, properly anchoring the steel reinforcement bars to the existing sewer, and force sufficient quantities of shotcrete into the opening so as to completely fill the gap in order to restore the surface of the sewer to its original structural lines. There must be a minimum clearance of three-quarter (3/4) inch between steel reinforcement and the surface of the shotcrete.

(2) The following repair procedure is to be used only when, in the opinion of the Engineer, the structural integrity of the sewer has been compromised because of cracks and gaps to the extent that the sewer is considered unsafe.

The Contractor must cease work in that unsafe section of the sewer. The Contractor must then submit for the Engineer's review and approval, the Contractor’s recommendation (including an estimate of costs) for repairing the damage so as to make the sewer safe as well as operable. The Contractor must not perform any remedial work prior to receiving written notification of the Engineer's approval. This "make safe" work must be considered as extra work, and must be paid for in accordance with **Articles 25 and 26** of the Contract.

(C) All house connection piping spigots intruding more than three (3) inches into the sewer to be shotcreted must be trimmed back so that the ends of their spigots will line up with the proposed inside face of the shotcreted sewer.

54.31.4 MEASUREMENT

(A) The quantity of shotcrete for repair work will be measured on the basis of the actual number of cubic feet of shotcrete used to repair the damages to the invert, fill cracks in the walls, and fill gaps created by missing brick, masonry or concrete) placed in the work to the satisfaction of the Engineer, in conformity with the contract documents.

(B) The quantity of steel used for repair work will be measured on the basis of the actual number of pounds of additional steel reinforcement bars placed in the work to the satisfaction of the Engineer, in conformity with the contract documents.

54.31.5 PRICE TO COVER

(A) The contract price for Item No. 54.31SR - SHOTCRETE FOR REPAIR WORK must be the unit price bid per cubic foot and must cover the cost of all labor, materials and equipment required or necessary to repair the existing sewer as specified herein, including fluming and/or diversion of the flow in the existing sewer and furnishing and installing all other items necessary to complete this work, together with all work incidental thereto, all in accordance with the plans and specifications and as directed by the Engineer. Note that shotcrete work performed for sewer repair is not the equivalent of shotcrete work performed for sewer reconstruction.

(B) Payment for the cost of all labor, material and equipment required or necessary to properly place in the existing sewer steel reinforcing bars used for repair work must be made under Item No. 73.51AS - ADDITIONAL STEEL REINFORCING BARS.

Payment for Shotcrete For Repair Work will be made under the Item Number as calculated below:

The Item Number for Shotcrete For Repair Work has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Shotcrete For Repair Work:

54.31

(2) The sixth and seventh characters must define Shotcrete For Repair Work:

SR - Shotcrete For Repair Work

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
54.31SR	SHOTCRETE FOR REPAIR WORK	C.F.

SECTION 55.11 – ABANDONING BASINS AND INLETS

55.11.1 INTENT

(A) When Item No. 55.11AB - ABANDONING BASINS AND INLETS is specifically provided for in the Bid Schedule of the contract the Contractor must perform the work as specified in this **Section 55.11**.

(B) When there is no specific item provided for in the Bid Schedule for abandoning existing basins and inlets the Contractor must abandon the existing basins and inlets in accordance with **Subsection 10.13(4)**. The cost of this required abandoning of basins and inlets must be included in the prices bid for all items of work. No separate or additional payment will be made for this work.

55.11.2 DESCRIPTION

Under this section, the Contractor must abandon existing basins and inlets shown, specified or ordered.

Abandoning basins and inlets must include removal of castings; demolishing walls to the required depth, bulkheading pipes, breaking up bottom slabs, filling and compacting openings, and performing all work as directed by the Engineer:

55.11.3 MATERIALS

(A) Brick and brick masonry must comply with the requirements of **Section 23.02**.

(B) Cement mortar must comply with the requirements of **Section 23.03**.

(C) Fill material must comply with the requirements of **Subsection 40.06.2**.

55.11.4 METHOD

The Contractor must perform (at a minimum) the following work in order to properly abandon existing basins and inlets:

(A) Existing frames, grates, covers and other castings must be removed.

(B) Existing basins and inlets must be broken down to a depth four (4) feet below final grade.

(C) Pipe connection openings to existing basins and inlets must be bulkheaded with brick masonry.

(D) The bottom slabs of existing basins and inlets must be broken up in such a manner as to prevent water from being trapped.

(E) The entire openings of existing basins and inlets must be filled in and compacted in accordance with **Subsection 40.06.3** and as directed by the Engineer.

(F) All castings and debris removed as a result of the above demolition work must become the property of the Contractor and must be properly disposed of away from the site, at the Contractor's expense. Such castings and debris must not be permitted for use as fill in the abandoned basin and inlet openings.

55.11.5 MEASUREMENT

The quantity of abandoned existing basins and inlets to be measured for payment must be the number of each existing basin and inlet abandoned in place.

55.11.6 PRICE TO COVER

The contract price for Item No. 55.11AB - ABANDONING BASINS AND INLETS must be the unit price bid per each existing basin and inlet abandoned and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to abandon existing basins and inlets shown, specified or ordered, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); demolition work; excavation and disposal of all castings and demolition debris; bulkheading of existing pipes; filling in and compacting of openings of basins and inlets; cleaning up; and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans and specifications and as directed by the Engineer.

Payment for Abandoning Basins And Inlets will be made under the Item Number as calculated below:

The Item Number for Abandoning Basins And Inlets has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Abandoning Basins And Inlets:

55.11

(2) The sixth and seventh characters must define Abandoning Basins And Inlets:

AB - Abandoning Basins And Inlets

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
55.11AB	ABANDONING BASINS AND INLETS	EACH

(NO TEXT ON THIS PAGE)

CITY OF NEW YORK

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF WATER AND SEWER OPERATIONS

DIVISION VI – CLASSIFIED SECTIONS OF WATER MAIN WORK

SECTIONS 60.11 TO 66.11

(NO TEXT ON THIS PAGE)

SECTION 60.11 – FURNISHING AND DELIVERING DUCTILE IRON PIPE

60.11.1 DESCRIPTION

This section describes furnishing and delivering of ductile iron water main pipe, of the sizes, kinds, and classes shown, specified or ordered.

60.11.2 MATERIALS

Ductile iron pipe must be in accordance with **Section 20.01 - Specifications For Ductile Iron Pipe And Accessories**.

60.11.3 CONSTRUCTION

Prior to ordering ductile iron pipe, the Contractor must submit to the Engineer a vendor list for approval. Within five (5) consecutive calendar days after receiving vendor approval, the Contractor must submit evidence to the Department of Design and Construction of having ordered the material from an acceptable foundry.

All ductile iron pipes must be manufactured at least ten (10) consecutive calendar days before delivery to the site to allow for proper inspection and recording of the accepted pipe.

After the completion of manufacturing and inspection of the ductile iron pipe to be furnished by the Contractor (but prior to the shipment thereof), the Contractor must furnish a detailed schedule of the ductile iron pipe that constitutes the content of each shipment. This schedule must be delivered to the Engineer. The schedule must give in numerical order the description and number of each and every article constituting the shipment. The Contractor must not make shipments until the schedule has been checked and approved, in writing, by the Engineer.

The Engineer must approve storage of ductile iron pipe and appurtenances within the project limits. On-site storage is limited to ductile iron pipe and appurtenances projected for use within seven (7) calendar days, as per the Contractor's approved schedule. The Engineer reserves the right to limit the storage of on-site materials to three (3) calendar days in business or congested areas.

All ductile iron pipe and all other castings, valves, hydrants, and materials of construction must be supported upon wooden blocks of sufficient size to prevent injury to the pavement.

The Contractor must be responsible for all materials, including ductile iron pipe, until they are finally accepted and incorporated in the work.

During any suspension of the work, all materials delivered upon but not placed in the work must be neatly piled so as not to obstruct public travel or must be removed from the work site at the direction of the Engineer; pipes and other castings, valves, and hydrants, if directed, must be temporarily stored at a site designated by the Contractor and approved in writing by the Engineer.

Unless so removed by the Contractor, within ten (10) calendar days of written notice from the Engineer, the Engineer may have the materials moved at the expense of the Contractor.

60.11.4 MEASUREMENT

The quantity of ductile iron pipe to be measured for payment must be the number of linear feet actually furnished and delivered and incorporated into the work, complete, as shown, specified, or required and as measured along the center line axis of the pipe when installed.

For pipe sizes with I.D., smaller than 16”, the unit price used for payment of work done on pipes of a size not covered by the Bid Schedule will be obtained by taking the unit price of the nearest larger size contained in the Bid Schedule.

60.11.5 PRICE TO COVER

Payment for the "FURNISHING AND DELIVERING DUCTILE IRON PIPE” must be the unit price bid per linear foot for each size, kind, and class of pipe contained in the Bid Schedule.

Payment for Furnishing And Delivering Ductile Iron Pipe will be made under the Item Number as calculated below:

The Item Numbers for Furnishing And Delivering Ductile Iron Pipe have nine characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing And Delivering Ductile Iron Pipe:

60.11

(2) The sixth character must define the Type of Joint on Ductile Iron Pipe:

R - Restrained Joint
P - Push-On Joint

(3) The seventh character must define the Class of Ductile Iron Pipe:

6 - Class 56
5 - Class 55

(4) The eighth and ninth characters must define the Diameter of the Ductile Iron Pipe. (The eighth and ninth characters representing the unit of inches for the Diameter of the Ductile Iron Pipe.) See examples below:

08 - 8-Inch
16 - 16-Inch
36 - 36-Inch

(5) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
60.11R548	FURNISHING AND DELIVERING 48-INCH DUCTILE IRON RESTRAINED JOINT PIPE (CLASS 55)	L.F.
60.11R542	FURNISHING AND DELIVERING 42-INCH DUCTILE IRON RESTRAINED JOINT PIPE (CLASS 55)	L.F.
60.11R536	FURNISHING AND DELIVERING 36-INCH DUCTILE IRON RESTRAINED JOINT PIPE (CLASS 55)	L.F.
60.11R530	FURNISHING AND DELIVERING 30-INCH DUCTILE IRON RESTRAINED JOINT PIPE (CLASS 55)	L.F.
60.11R524	FURNISHING AND DELIVERING 24-INCH DUCTILE IRON RESTRAINED JOINT PIPE (CLASS 55)	L.F.
60.11R520	FURNISHING AND DELIVERING 20-INCH DUCTILE IRON RESTRAINED JOINT PIPE (CLASS 55)	L.F.
60.11R516	FURNISHING AND DELIVERING 16-INCH DUCTILE IRON RESTRAINED JOINT PIPE (CLASS 55)	L.F.
60.11R514	FURNISHING AND DELIVERING 14-INCH DUCTILE IRON RESTRAINED JOINT PIPE (CLASS 55)	L.F.
60.11R612	FURNISHING AND DELIVERING 12-INCH DUCTILE IRON RESTRAINED JOINT PIPE (CLASS 56)	L.F.
60.11R610	FURNISHING AND DELIVERING 10-INCH DUCTILE IRON RESTRAINED JOINT PIPE (CLASS 56)	L.F.
60.11R608	FURNISHING AND DELIVERING 8-INCH DUCTILE IRON RESTRAINED JOINT PIPE (CLASS 56)	L.F.
60.11R606	FURNISHING AND DELIVERING 6-INCH DUCTILE IRON RESTRAINED JOINT PIPE (CLASS 56)	L.F.
60.11R604	FURNISHING AND DELIVERING 4-INCH DUCTILE IRON RESTRAINED JOINT PIPE (CLASS 56)	L.F.
60.11P548	FURNISHING AND DELIVERING 48-INCH DUCTILE IRON PUSH-ON JOINT PIPE (CLASS 55)	L.F.
60.11P542	FURNISHING AND DELIVERING 42-INCH DUCTILE IRON PUSH-ON JOINT PIPE (CLASS 55)	L.F.
60.11P536	FURNISHING AND DELIVERING 36-INCH DUCTILE IRON PUSH-ON JOINT PIPE (CLASS 55)	L.F.
60.11P530	FURNISHING AND DELIVERING 30-INCH DUCTILE IRON PUSH-ON JOINT PIPE (CLASS 55)	L.F.
60.11P524	FURNISHING AND DELIVERING 24-INCH DUCTILE IRON PUSH-ON JOINT PIPE (CLASS 55)	L.F.

SECTION 60.12 – LAYING DUCTILE IRON PIPE AND FITTINGS

60.12.1 DESCRIPTION

Ductile iron water main pipe must be laid as described herein.

The Contractor must install the new ductile iron water mains in the lanes indicated on the contract drawings or as determined by the Engineer.

Where the word “relay” appears on the contract drawings or in the specifications, the new main must be installed in the same location as the old main, unless otherwise directed by the Engineer.

60.12.2 MATERIALS

Ductile iron pipe must comply with the requirements of **Section 20.01 - Specifications For Ductile Iron Pipe And Accessories**. Ductile iron fittings must comply with the requirements of **Section 20.02 - Specifications For Ductile Iron Fittings And Accessories**.

60.12.3 CONSTRUCTION METHODS

(A) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** must apply to the work to be done hereunder.

(B) TRENCH WIDTH AND DEPTHS OF COVER

(1) In general the Width of Trenches must be as follows:

Unsheeted Trench - Nominal Pipe Diameter plus two (2) feet
Sheeted Trench - Nominal Pipe Diameter plus four (4) feet

Note: Trenches that are Skeleton Sheeted must be considered Unsheeted Trenches for trench width.

(2) In general all pipes must be laid with the following cover:

TABLE 60.12.3.1

24-inch and larger	4’-0” of cover
6 and 20-inch pipe	4'-0” of cover
8-inch pipe	3'-9" of cover
10-inch pipe	3'-7" of cover
12-inch pipe	3'-5" of cover
14-inch pipe	3'-3" of cover
16-inch pipe	3'-1" of cover

(C) LAYING PIPE

(1) After the trench has been excavated in accordance with the provisions of these specifications, the pipe must be brought to the side of the trench and then carefully lowered by suitable rigging and placed as herein described.

(2) Laying Pipe In Rock Trench: Where ledge rock is encountered in the trench, the new main must be laid with a minimum cover of three (3) feet over the top of the barrel of the pipe, except where a greater or lesser cover over the pipe is dictated by field conditions, as determined by the Engineer. (See **Section 70.61**.)

Where a water pipe intersects the trench or is exposed therein, and the rock is ordered removed for a distance of five (5) feet on either side or below the pipe, the water mains so located may, upon approval, be temporarily removed and later relaid and reconnected.

If the Contractor requests and receives permission to relocate a water main to avoid the excavation of rock, the Contractor must furnish the necessary pipe and fittings required to reconnect the main, and must furnish all other labor and material necessary to disconnect the pipe, temporarily cap the same, and later reconnect the cut pipe, at the Contractor’s own cost.

(D) ALL WORK TO BE INSPECTED - The Contractor is expressly prohibited from laying pipes and fittings, or from setting valves, hydrants, or other appurtenances, except under the direct supervision of the Engineer, the Engineer’s authorized agents or inspectors.

(E) CLEANING AND DISINFECTING PIPE

Prior to starting work, the Contractor will be required to show the Engineer that the Contractor has the equipment and materials available for cleaning and disinfecting pipe and maintaining it clean during the laying process, all as herein specified.

(1) Cleaning Pipe:

Pipes or fittings delivered to the site of the work must be stored in a fashion which would prevent the entrance of surface drainage, excavated material, or other foreign matter into the pipe.

Prior to laying any pipe and fittings, the interiors must be thoroughly flushed with clean water of sufficient volume and pressure from a hose to ensure the removal of all foreign matter that may have been introduced during the storage period. After all visible dirt or other foreign material has been removed from the pipe and fittings but before they are installed, the Contractor must thoroughly spray the inside surfaces of all pipes and fittings with a one percent (1%) hypochlorite solution. The hypochlorite solution application and cleaning must be repeated as often as required to keep the pipes and fittings free of dirt or foreign matter.

After each pipe and fitting has been sprayed with the hypochlorite solution, the ends of the pipe or fitting must be sealed by means of an approved type of wooden or rubber plug, which must be thoroughly cleaned and washed with the same hypochlorite solution before being inserted into the ends of the pipe or fitting. The plugs must not be removed until the pipe or fitting is lowered into the trench ready for immediate socketing of the joint. If the plugs have been removed prior to this time, the Contractor must then repeat the processing of cleaning and disinfecting the pipe, and inserting the plugs.

(2) Disinfection Of Pipe:

After the main has been laid, but prior to being put into service, it must be thoroughly disinfected with chlorine concentration as follows:

25-PPM;	24-hour contact time (dry lay)
100-PPM;	3-hour contact time (dry lay)
300-PPM;	15-minute contact time (relay)

DRY LAYS - (i.e., main is isolated from distribution system and does not have to be put into service immediately) The required chlorine solution must be injected through a tap inserted in the line for that purpose by the Contractor, the point of application to be at one end of the pipe section with the bleed at the opposite end.

Chlorine residual must be monitored at the bleed end to determine if the proper chlorine concentration is reached. When the proper concentration is reached, the required contact period must begin.

When using 100-PPM solution for three (3) hours, if the concentration goes below 50-PPM during disinfecting, chlorine must be added to bring the concentration back to 100-PPM.

When using 25-PPM solution for twenty-four (24) hours, the chlorine residual must be checked at the end of twenty-four (24) hours. If the residual is less than 10-PPM, the above procedure must be repeated.

After the mains are sufficiently disinfected they must be thoroughly flushed. Samples will then be obtained and tested. The main will not be put into service until such time that the test results have been found acceptable.

RELAYS OR WETLAYS - (i.e., main must be put into service as soon as possible) Chlorine powder must be distributed uniformly in the main during installation of the pipe to obtain the 300-PPM concentration. This solution must have a minimum contact time of fifteen (15) minutes and be thoroughly flushed before putting the main into service and opening the service lines. This should be accomplished by having the one and one-half (1-1/2) inch tap used for flushing opened only slightly during the first fifteen (15) minutes followed by complete flushing of the system of all excess chlorine. In all cases, this flushing must not be less than fifteen (15) minutes after the tap is fully open.

At tie-ins where flushing cannot be accomplished without the possibility of a heavy concentration of chlorine entering the distribution system, disinfecting procedures may be altered at the discretion of the Engineer. However, all new pipes must be thoroughly cleaned and sprayed with a one percent (1%) hypochlorite solution prior to installation and flushed thoroughly.

In all cases, the main must not be put into service for domestic consumption until the sanitary condition of the interior of the main is satisfactory to the Engineer.

Should the Contractor neglect or refuse to comply with any of the above stipulated provisions for cleaning and disinfecting the pipes and fittings and maintaining them clean while the pipe is being laid, then the Department may, without further notice, stop all work on the contract until the Contractor complies.

(F) BEDDING AND FOUNDATION OF PIPES

(1) On Earth: The pipes must be laid to the required line and grade, wherever necessary sandbags must be used to accomplish this purpose. Well-tamped bedding consisting of select granular backfill must be placed under the pipe for the entire width of the trench. Particular care must be taken in backfilling the trench to secure a firm and continuous bed for the support of the pipe where no special foundation is required.

(2) Concrete Supports: Concrete cradles must support the pipe under such conditions as hereinafter stated and as shown on **Standard Drawing No. 45700-W** on file at the office of the Engineer or as otherwise required by the contract drawings.

Where it is required to support the pipe on unyielding soil stratum located much deeper than the bottom of the pipe, the pipe for such length, as directed, must be supported on concrete saddles, which are to be supported on individual piers carried to this deep stratum, or on a reinforced concrete mat, as shown on **Standard Drawing No. 45700-W**.

Where the trench is in fresh fill or in soil of low bearing capacity, the pipe, where and as directed, must be laid on concrete saddles, supported on a continuous reinforced concrete mat.

Where specified and directed the pipe must be supported on concrete cradles and piles.

Concrete saddles, cradles and mats must be constructed in accordance with **Standard Drawing No. 45700-W** on file in the office of the Engineer or as otherwise required and as shown on the contract drawings or ordered. The placing of supports under the pipe must not, however, relieve the Contractor from the work of backfilling the trench with select granular backfill material, as ordered, and providing a firm and continuous bed for the pipe by compacting the fill under and around the pipe and between the cradles.

(3) On Rock: Where the bottom of the trench is in rock, see **Section 70.61** of these specifications.

(4) Screened Gravel Or Screened Broken Stone Bedding: To the extent required and as directed by the Engineer, the new mains must be installed with a bed of gravel, or broken stone below the pipe as shown on **Standard Drawing No. 44292-B-Z** or on the contract drawings or as ordered by the Engineer as specified in **Section 65.71** of these specifications.

(5) Shallow Cover: Where mains 24-inches and smaller are laid with covers of 2’-0” or less, the Contractor must provide protection in accordance with **Standard Drawing No. 42063-Y** or as directed by the Engineer.

Where mains 24-inches and smaller are laid with covers between 2’-6” and 2’-0”, the Contractor must provide steel plates only over the main with dimensions as shown on **Standard Drawing No. 46464-Z** or as directed by the Engineer.

Where mains 30-inches and larger are laid with covers of 2’-6” or less, the Contractor must provide protection in accordance with **Standard Drawing No. 46464-Z** or as directed by the Engineer.

Covers over the new mains must not be less than 1’-6”.

(6) Filter Fabric: Furnishing and installing ground stabilization filter fabric must be in accordance with **Section 65.31** of these specifications.

(7) Requirements regarding backfilling of trenches described in **Section 73.41** of these specifications must be observed.

(G) TEMPORARY CLOSURE OF ACCESS MANHOLES AND ENDS OF PIPES - The Contractor must devise a method for the temporary closure of access manholes and open ends of pipe to prevent unauthorized access to water supply facilities when the construction site is unattended by the Contractor's personnel.

The temporary closure must be such that it can be removed only by using special tools or methods available only to authorized personnel of the Contractor.

The Contractor must submit the Contractor's proposed method to the Engineer for approval before construction begins.

(H) JOINTS - All joints on new ductile iron pipe 20-inches and less in diameter must be restrained as specified in **Section 20.01 - Specifications For Ductile Iron Pipe And Accessories**.

Joints on ductile iron pipe 24-inches and larger in diameter must be restrained within the lengths specified in TABLE 60.12.3.4. Outside of these limits of required pipe restraint, ductile iron pipe 24-inches and larger in diameter must have push-on joints.

When using push-on joint pipe and/or mechanical joint fittings, the joints must be made as herein described and in accordance with ANSI/AWWA C600.

(1) Push-On Joint Pipe With Field-Lok Gaskets:

(a) The inside of the bell and outside of the spigot end must be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter.

(b) The circular rubber gasket must be flexed inward and inserted in the gasket recess of the bell.

(c) A thin film of gasket lubricant must be applied to the inside surface of the gasket and the spigot end of the bell.

(d) The spigot end of the pipe must be entered into the socket with care used to keep the joint from contacting the ground. The joint must then be completed by forcing the plain end to the bottom of the socket with a forked tool or jack-type tool or other device approved by the Engineer. Pipe that is not furnished with a depth mark must be marked before assembly to assure that the spigot end is inserted to the full depth of the joint. Field cut pipe lengths must be filed or ground to duplicate the spigot end of such pipe as manufactured, and thus remove the rough edges of the cut pipe that may damage the gasket. Complete assembly instructions must be made available from the pipe manufacturer.

(2) Mechanical Joint Fittings:

The inside of the bell mechanical joint and the outside of the spigot end of the pipe (8-inch length) must be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter, and then painted with a soap solution made by dissolving one-half (1/2) cup of granulated soap in one (1) gallon of water. Lubrication and additional cleaning should be provided by brushing both the gasket and the plain end with soapy water or an approved pipe lubricant meeting the requirements of ANSI/AWWA C111/A21.11, just prior to slipping the gasket onto the plain end for joint assembly.

(a) Plain Glands - Plain Glands will not be accepted.

(b) Wedge Restraint Gland - Place the gland on the plain end with the lip extension toward the plain end, followed by the gasket.

Insert the pipe into the socket and press the gasket firmly and evenly into the gasket recess. Keep the joint straight during assembly.

Push the gland toward the socket and center it around the pipe with the gland lip against the gasket. Insert bolts and hand tighten nuts. Make any deflections required after the joint assembly but before tightening the bolts.

Tighten the bolts to the normal range of bolt torque (see table below) while at all times maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. This can be accomplished by partially tightening the bottom bolt first, then the top bolt, next the bolts at either side, finally the remaining bolts. Repeat the process until all bolts are within the appropriate range of torque. The use of a torque-indicating wrench will facilitate this procedure.

TABLE 60.12.3.2 – Mechanical Joint Bolt Torque

JOINT SIZE (in.)	BOLT SIZE (in.)	RANGE OF TORQUE (ft-lbs)
3	5/8	45-60
4-24	3/4	75-90
30-36	1	100-120
42-64	1-3/4	120-150

Tighten the torque limiting twist off nuts in a clockwise direction until all wedges are in firm contact with the pipe surface. Continue tightening in an alternate manner until all of the nuts have been twisted off.

If removal is necessary, utilize the 5/8-inch hex head. If reassembly is required, assemble the joint in the same manner as above; tighten the wedge bolt to 90-ft-lbs.

(3) Flanged Joints:

(a) Material for flanges and accessories must be as per **Section 20.01 - Specifications For Ductile Iron Pipe And Accessories**.

(b) Flanges must be installed as outlined in AWWA Manual M-11 or as directed by the Engineer.

(c) Bolts and studs for flanges with full face rubber gaskets must be installed with the nominal axial loads as per the following table. Torque wrenches must be calibrated at least once each working day by tightening, in a device capable of indicating actual bolt tension, not less than three (3) typical bolts and studs of each diameter chosen from the bolts and studs installed. The device must be as manufactured by Skidmore Wilhelm Manufacturing Company, or approved equivalent.

TABLE 60.12.3.3

PIPE DIAMETER (inches)	NOMINAL AXIAL LOAD (kips)
6 to 8	5
12	10
20	11
24 to 30	12
36	16
48	17
60 to 72	26

(l) RESTRAINED PIPE JOINTS - Must be as per **Section 20.01 - Specifications For Ductile Iron Pipe And Accessories**.

Typical minimum lengths of required restraint for pipe and various fittings with 150-psi test pressure and with a cover varying from two (2) feet to six (6) feet of well-tamped sand backfill are shown in TABLE 60.12.3.4

For intermediate heights of cover, the required length of restraint may be taken as the average of those shown for the preceding lower and the following higher value of cover.

Lengths of restraint shown in TABLE 60.12.3.4 are applicable on both the downstream and upstream sides of fittings.

For determining the length of restraint required for test pressure higher or lower than that of 150-psi, the lengths shown in TABLE 60.12.4 must be increased or decreased by the ratio of the specified test pressure to 150-psi, respectively.

TABLE 60.12.3.4
TYPICAL MINIMUM LENGTHS OF REQUIRED PIPE RESTRAINT
LINEAR FEET FOR AVERAGE SOIL CONDITIONS (SAND) AND FOR TEST PRESSURE OF 150-PSI

DIA. (in)	COVER (ft)	HORIZONTAL BENDS				VERTICAL BENDS				VALVES AND CAPS	REDUCERS		TEES
		90°	45°	22-1/2°	11-1/4°	90°	45°	22-1/2°	11-1/4°		SIZE	LENGTH	
8	2	24	14	8	4	32	21	13	8	48	8x6 8x4	21 35	0
	4	12	7	4	2	16	12	7	4	24	8x6 8x4	11 18	0
	6	8	5	3	2	11	8	5	3	16	8x6 8x4	7 12	0
12	2	35	20	11	6	47	32	20	11	74	12x8 12x6	41 55	20
	4	19	11	6	3	25	18	11	6	37	12x8 12x6	20 28	0
	6	13	8	4	2	17	12	8	4	25	12x8 12x6	14 18	0
20	2	55	31	17	9	77	50	30	17	125	20x16 20x12	45 80	57
	4	30	18	10	5	42	30	18	10	63	20x16 20x12	23 40	10
	6	21	12	7	4	28	20	12	7	42	20x16 20x12	15 27	0
24	2	65	36	20	10	91	59	35	20	151	24x20 24x16	46 84	76
	4	36	21	12	6	49	36	21	12	75	24x20 24x16	23 42	19
	6	25	15	8	4	34	23	15	9	50	24x20 24x16	15 28	0
30	2	78	42	23	12	111	70	42	23	190	30x24 30x20	68 106	99
	4	44	25	14	8	61	45	25	14	95	30x24 30x20	34 53	32
	6	31	18	10	5	42	29	18	11	63	30x24 30x20	23 35	9
36	2	89	48	26	14	130	81	47	26	228	36x30 36x24 36x20	70 127 158	124
	4	52	29	16	9	72	54	29	17	114	36x30 36x24 36x20	35 64 80	45
	6	36	21	12	6	50	34	21	12	76	36x30 36x24 36x20	23 42 53	18
48	2	110	58	31	16	164	99	57	31	306	48x36 48x30	134 187	165
	4	66	36	20	11	94	72	37	21	153	48x36 48x30	67 93	69
	6	47	27	15	8	66	44	27	15	102	48x36 48x30	45 62	34

(J) CUTTING PIPE - The Contractor, when required, must cut ductile iron pipe. Where any pipe is damaged in cutting, the damaged sections will not be accepted. Undamaged sections and cut portions of straight pipe may be incorporated in the work.

For worker safety and to ensure square clean cuts, the default method for cutting ductile iron pipe in a trench is with a tool or machine that clamps to the pipe, such as:

- Reciprocating "guillotine" pipe saws;
- Rotary wheel type cutting or milling type machines manufactured by CS Unitec (model 580027000), E.H. Wachs (model Trav-L-Cutter), Fein (model RSG 1500 A), or approved equal;

If approved in writing by the Commissioner, the Contractor may opt to cut ductile iron pipe in a trench freehand using a cut-off saw ("cut-off machine" or "power cutter"), abrasive chainsaw, ring saw, hacksaw, or similar. If the Contractor opts to freehand cut ductile iron pipe, the following requirements must be met, at the Contractor's sole expense:

- Sufficient blocking, to provide a fixed support, must be provided to prevent the pipe section from moving and the joint from binding to prevent the saw blade from kicking back during cutting;
- The trench must be excavated with sufficient width to allow the worker to have a full range motion with the saw – scalloping of the trench walls to accommodate the saw or the worker is not permitted; and
- The trench must be excavated with sufficient depth below the pipe's invert to allow the invert to be cut with the lower portion of the saw's blade (to prevent cutting with the front or upper segments that can result in kickback or the saw climbing).

In all cases, the Contractor must operate the cutting tools in strict compliance with all OSHA requirements and the tool manufacturer's written recommendations and all costs associated with the safe performance of this task are at the Contractor's sole expense.

The use of "squeeze" type cutters, cutting torches, diamond points, and dog chisels will not be permitted.

(K) CONNECTING AND RELAYING EXISTING MAINS

(1) Whenever it is necessary to connect with or relay existing water mains, the Contractor must make such connections or alterations.

(2) Sections of the existing mains, except caps, which must be cut out for making the required connections or changes, and which are not required in reconnecting the mains, will become the property of the Contractor and must be removed and disposed of by the Contractor.

(3) Wet Connections: The cuts in the mains for water services requiring wet connections will be made by Department of Environmental Protection forces. The Contractor must do all other work, including the setting of the wet connection sleeves and valves.

(L) SHUTDOWNS FOR MAKING CONNECTIONS WITH EXISTING MAINS - Shutdowns of any portion of the water service, to make connections with the existing mains, must be made only with the consent of the Engineer. When any main is shut off for such purposes, the work on the connection must be carried on continuously by the Contractor and with all possible dispatch until the water is again turned on into the main.

The Engineer will identify situations where people and institutions have special water needs or anyone for whom temporary water shut off will pose special hazards or problems. The shutdown may be made between 7 P.M. and 7 A.M. or on weekends, as directed by the Engineer.

In general, no water main shutdowns will be made prior to 8:30 A.M.

Water supply shutdowns will not be permitted unless the 9:30 A.M. temperature is at least twenty-seven (27) degrees Fahrenheit and rising unless specific permission to do so is obtained from the Engineer.

The Contractor must notify the Engineer at least one (1) week prior to the date when the Contractor wishes a main shut down, and if approved, the Department of Environmental Protection must shut down the main at the time stipulated. The Contractor must deliver individual notices to residents and businesses at least by the afternoon before the scheduled water shut-off notifying residents and businesses that water service will be interrupted. The locations to be given Notices must be as directed by the Engineer. Shutdowns for making connections will not be made unless and until the Contractor has everything on the ground in readiness for the work. If, on account of failure to shut down any main due to any difficulty encountered or to any act or omission on the part of The City, the work of connection is delayed, no other claim will be allowed to the Contractor for

such delay, except an extension of the time specified for the performance of the work herein provided equal to the time which may have been lost by such delay.

(M) LAYING TEMPORARY CONNECTIONS AND INSTALLING TEMPORARY CAP ASSEMBLIES AND/OR BULKHEADS

(1) When new water mains are laid and it becomes necessary to provide a temporary connection between the existing main and new mains laid under this contract (regardless of whether the new and existing water mains are in the same trench or are offset in two different trenches), the Contractor must, if ordered, provide all labor, equipment, and facilities for laying, maintaining and removing when directed, temporary connections and appurtenances. If City forces do laying of temporary connections, the Contractor must make all required equipment and facilities available to them. No payment will be made for providing temporary house services which may be required when making a temporary connection between the existing and new main.

(2) (a) Temporary cap assemblies on distribution water mains (20” and less in diameter) must consist of a 2-foot long spigot/spigot ductile iron pipe with a mechanical joint cap restrained to the pipe with a “wedge-type” retainer gland and a minimum 2-inch tap on the pipe section.

(b) Temporary cap assemblies on distribution water mains (20” and less in diameter) must be restrained and braced in a manner sufficient to support system working pressures, and thrust forces.

(c) The 2-inch tap required as part of the temporary cap assembly is to be utilized to allow air to escape while filling the main in addition to allow for proper flushing of the main.

(d) Restraint and bracing as well as temporary cap assemblies/bulkheads for water mains greater than 20” in diameter must be submitted for approval by the Engineer prior to being utilized.

(N) FIELD TEST OF MAINS

(1) Leakage Test - For Mains 20-Inch And Larger: The work of laying the pipes and fittings, and of setting valves and hydrants must be of such character as to leave all the pipes and connections watertight. To insure these conditions, the Contractor must subject 20-inch mains and all mains of larger diameter and their appurtenances to a proof by water pressure test of not less than 150-psi held for two (2) hours.

If the new main is to replace an existing main and the pressure test is deemed impractical, the requirement for pressure testing may be waived, in which case a deduction amounting to one percent (1%) of the price bid for item(s) labeled "LAYING DUCTILE IRON PIPE AND FITTINGS" for water main, as shown in the Bid Schedule for the corresponding size will be taken. The Contractor's attention is specifically called to the necessity of carefully and thoroughly making up the joints without any leakage.

(a) The tests must be made between valves as far as practicable in sections of approximately one thousand (1,000) feet in length, or as directed, and within twelve (12) working days after the completion of such sections of mains. Temporary caps must be placed where necessary to permit the making of tests where valves are not available, as directed by the Engineer.

(b) Leakage must be defined as the quantity of water that must be supplied into the newly laid pipe, or any valve section thereof, to maintain pressure in the pipe within 5-psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water. Leakage must not be measured by a drop in pressure in a test section over a period of time.

(c) The leakage from the mains and connections for each section tested, while the test pressure is maintained, must not be greater than that calculated by the following formula AWWA C600-17:

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

L = Allowable leakage in gallons per hour
S = Length of pipe tested in feet
D = Nominal diameter of the pipe in inches
P = 150-psi as the average test pressure

To determine the rate of leakage, the Contractor must, as required, furnish a suitable pump, pressure gauge, and water meter or other appliance for measuring the amount of water pumped. These instruments must be tested for accuracy as frequently as directed.

The pressure must be raised to the required test pressure, as noted on the contract drawings or in the specifications, and it must be maintained for a period of not less than one (1) hour. The amount of water forced into the main during this time must be determined and this amount must be compared with the allowable leakage computed by formula, to determine whether or not the test section of main is acceptable. The Contractor must furnish all the necessary labor and material to make the tests and to perform any work incidental thereto.

The trench must be backfilled immediately after the pipe is laid and before the test is made, unless otherwise ordered or approved by the Engineer. If the leakage is at a greater rate than specified, the Contractor must re-excavate the trench where necessary and must repair or relay the joints and replace defective work until the leakage is reduced to the allowable amount.

No payment will be made for the laying of pipes 20-inch and larger until such time that the above field tests have been satisfactorily made.

(2) Open-Trench Test - For Mains Smaller Than 20-Inch: This test must apply to all mains smaller than 20-inch, and to new 20-inch and larger mains replacing existing mains and where the pressure test, as previously specified, is impracticable.

(a) The pipe trench must not be backfilled until the pipe, fittings, and joints have passed the open-trench test. All exposed pipe, fittings, and joints must be thoroughly inspected during the open-trench test.

(b) The section to be tested must be subjected to a water pressure equal to the line pressure in the area but in no case less than forty (40) pounds per square inch. The Contractor must, as required, furnish a pressure gauge to measure the line pressure. Should the line pressure be below forty (40) pounds per square inch, the Contractor must furnish a suitable pump and pressure gauge to attain and measure the test pressure. The instruments must be tested for accuracy as frequently as directed.

(c) Any joint showing visible leaks must be remade until tight. If, after remaking the joint, the joint still shows visible leakage, the Contractor must replace the defective joint in such a manner as to attain no visible leakage.

The Contractor must replace any cracked or defective pipe or fitting and the test repeated until no visible leaks on the section being tested are obtained.

(d) After all visible leaks or other defects have been repaired to the satisfaction of the Engineer, the trench must be backfilled.

(3) Delay In Testing Mains: Whenever the testing of any section of main is delayed beyond the time hereinbefore specified, the Engineer must notify the Contractor in writing to make the test forthwith, and, if this order is not complied with within five (5) days from the date of said notice, the Department may make the required test and deduct the cost thereof, including the cost of any excavation or other work necessary to make the joints, valves, etc., watertight, from the amount due to or become due the Contractor under this contract.

(O) TEMPORARY CAPS - Where it is impracticable to test between valves, or near connections to existing mains, the Contractor must, as directed, temporarily place caps or plugs on the mains and test the section of the new main so closed. The Contractor must furnish all necessary caps and plugs as required.

(P) POLYETHYLENE WRAP - The Contractor must encase the new ductile iron mains and appurtenances to be installed in an approved loose 8-mil thick polyethylene wrap, where required and ordered by the Engineer, as specified in **Section 65.21** of these specifications.

(Q) ALTERATIONS IN SEWERS - Whenever it must become necessary on the line of the water main trench to alter, remove, or relay any portion of a sewer, a culvert, or other structure connected therewith, the Contractor must do such work in such form and manner as ordered, directed, or approved by the Engineer.

All temporary installation and permanent restoration of sewers must conform to the design standards and specifications. Design drawings for such work must be submitted to the Engineer for review and approval. Construction must be conducted in the presence and at the direction of the Engineer.

(R) OFFSETTING DUCTILE IRON WATER MAINS 20-INCHES AND LESS IN DIAMETER - If in the course of the actual progress of work, the Engineer finds that it is necessary to change the locations of mains or the arrangement of connections, or to alter existing mains in a manner other than that described by the drawings, such changes must be made by the Contractor as directed. Payment for all work done will be made for the actual work performed and at the unit prices established as provided in the Bid Schedule, irrespective of changes in lengths, quantities, or locations made during the progress of the work sufficient to carry out the intent of the contract.

Offsetting required to avoid City Structures will be paid for under the unit prices bid by the Contractor in the contract, regardless of the lane in which the main is installed.

Horizontal Offsets required to avoid utilities will be paid for under the unit prices bid by the Contractor in the contract, regardless of the lane in which the main is installed.

Vertical or Rolled (Combination Horizontal and Vertical) Offsets required to avoid utilities are not considered to be a part of this contract and must be a matter of adjustment between the Contractor and the affected Utility. The Engineer must make the determination as to the type of Offset required whether it is Horizontal, Vertical, or Rolled.

60.12.4 MEASUREMENT

(1) The quantity of payment for laying 30-inch and larger ductile iron pipe must be the length of the new mains laid including fittings measured in linear feet along the axis of the pipes already installed as part of the contract work. The laying length of valves and fittings must be included for purposes of this calculation. No allowances for 30-inch and larger fittings will be provided.

(2) The quantity of payment for laying 24-inch and smaller ductile iron pipe must be the length of the new mains laid including fittings measured in linear feet along the axis of the pipes already installed as part of the contract work. The laying length of valves and fittings must be included for purposes of this calculation as well as the allowances for fittings installed as stipulated below:

ALLOWANCES FOR FITTINGS, 24-INCHES AND SMALLER
MECHANICAL JOINT FITTINGS

For each cap or plug	One (1) foot of pipe
For each bend, reducer, offset or sleeve	Two (2) feet of pipe
For each three-way	Three (3) feet of pipe
For each four-way	Four (4) feet of pipe

(3) The larger size of reducers and the larger size of the run on three-ways and four-ways must be used as the basis of payment for lay lengths and allowances.

(4) For pipe and fitting sizes smaller than 16”, the unit price used for payment of work done on pipes or fittings of a size not covered by the Bid Schedule will be obtained by taking the unit price of the nearest larger size contained in the Bid Schedule.

60.12.5 PRICE TO COVER

(1) No Payment For Removal And Disposal Of Existing Pipe And Appurtenances: No separate or additional payment will be made for the removal and disposal of existing pipe, valves, valve supports, castings, chambers, manholes, etc. where the new pipe to be installed is laid, including all required earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**) necessary to accommodate new work, regardless of whether such removal is shown on the drawings or ordered by the Engineer. Payment will be deemed included in the prices bid for all items of work.

(2) No Payment For Removal And Disposal Of Existing Casting On Abandoned Water Mains: No separate or additional payment will be made for the removal and disposal of castings where the existing water main pipe is to be abandoned, including all required earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**), and any additional backfill material required

and necessary to remove the castings and properly abandon the appurtenances, regardless of whether such removal is shown on the drawings or ordered by the Engineer. Payment will be deemed included in the prices bid for all items of work.

(3) Compensation For Bands, Rods, Washers, Nuts And Bolts, Etc.: Payment for furnishing, delivering, and installing bands, rods, washers, nuts and bolts, and all other materials required to restrain pipe joints that are ordered by the Engineer to protect against unbalanced pressures will be made to the Contractor at the unit prices bid for Item No. 65.11BR - FURNISHING, DELIVERING AND INSTALLING BANDS, RODS, WASHERS, ETC., COMPLETE, FOR RESTRAINING JOINTS. (See **Section 65.11**.)

(4) Offsetting required to avoid utilities as noted in **Subsection 60.12.3(R)** above will be paid for under the unit prices bid by the Contractor in the contract, regardless of the lane in which the main is installed.

(5) (a) The cost of installing 30-inch and larger mechanical joint fittings and wedge restraint glands must be included in the unit prices bid by the Contractor for item(s) labeled "LAYING DUCTILE IRON PIPE AND FITTINGS".

(b) The cost of installing 24-inch and smaller mechanical joint fittings and wedge restraint glands must be included in the unit prices bid by the Contractor for item(s) labeled "LAYING DUCTILE IRON PIPE AND FITTINGS" (which includes allowances for 24-inch and smaller mechanical joint fittings).

(6) All excess materials must remain the property of the Contractor.

(7) The contract price for "LAYING DUCTILE IRON PIPE AND FITTINGS" must be the unit price bid per linear foot for each size and must cover the cost of all labor, material, plant, equipment, samples, tests, and insurance required and necessary to lay the ductile iron pipe as shown or specified, including all required earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); and do all other work necessary and incidental thereto in order to complete this work all in accordance with the plans and specifications and as directed by the Engineer.

(8) The cost of all the labor and materials required to place supports, mats, cradles, and protection must be paid for under the applicable bid item located in the Bid Schedule.

(9) No separate payment will be made to the Contractor for the temporary closure of access manholes and ends of pipes 12-inches in diameter or larger, but payment must be included in the prices bid for all items of work.

(10) (a) No separate or additional payment will be made to the Contractor for furnishing, delivering, installing, restraining, bracing, and removing temporary cap assemblies/bulkheads for water mains as ordered by the Engineer. The costs thereof must be included in the unit prices bid for all items of the contract.

(b) Payment for temporary valves (i.e. construction valves) and its associated fittings ordered by the Engineer during the course of the work to be installed will be paid for at the same rates as for valves and fittings permanently installed. Construction valves that are paid for but not incorporated into the final Work remain the property of the City, and must be delivered to a NYC DEP yard as directed by the Engineer at no additional or separate cost.

(c) If ordered by the Engineer, removal of valves (i.e. construction valves) and its associated fittings, including their transfer and disposal must be included in the prices bid for all items of the contract. No separate or additional payment will be made for this work.

(d) Payment For Temporary Connections: When new mains are laid and it becomes necessary to provide a temporary connection between the existing and new mains the following method of payment must apply: The Contractor must be paid once for furnishing and delivering pipes and fittings used in temporary connections. The Contractor must also be paid for laying the temporary pipe connection and fitting using the appropriate pipe laying item for each time that the Contractor is directed to use them throughout the project as directed by the Engineer.

(11) (a) Payment for furnishing and delivering 30-inch and larger ductile iron fittings must be paid for under the applicable bid item in the Bid Schedule for the quantity of each of the fittings furnished and delivered.

(b) Payment for furnishing and delivering 24-inch and smaller ductile iron fittings must be paid for under the applicable bid item in the Bid Schedule for the quantity of weight in tons of the fittings furnished and delivered as follows:

(1) Fittings: The weight for payment must be based on the bare body weights listed in ANSI/AWWA Standard C110/A21.10, for ductile iron fittings only.

(2) Wedge Restraint Glands: For fitting or rodding purposes, the weight for payment must be based on the weights listed in the latest edition of EBAA Iron, Inc., Eastland, Texas 76448, catalog for Megalug restraint glands.

(c) Bolts, nuts, and gaskets must be considered as having been included in the prices stipulated for furnishing and delivering the fittings.

(12) The Contractor's attention is specifically called to the fact that, in both sheeted and unsheeted trenches, no extra payment must be made for furnishing and placing select granular backfill (substituted or otherwise) in the lower portion of the trench even if the Contractor has to bring in imported fill to backfill said lower portion of the trench. “Lower portion of the trench” is defined as: a width of trench two (2) feet wider than the nominal diameter of pipe in unsheeted trenches; four (4) feet wider than the nominal diameter of pipe in sheeted trenches; and from six (6) inches below the barrel of the pipe to twelve (12) inches above the barrel of the pipe for both sheeted and unsheeted trench types. The cost of all such work, including the cost of removing and disposing of excavated material that cannot be reused in the lower portion of the trench must be deemed included in the prices bid for item(s) labeled “LAYING DUCTILE IRON PIPE AND FITTINGS”.

(13) No Extra Payment For Flanges: No extra payment will be made for flanges on straight pipe and fittings, but payment thereof will be included in the unit prices bid for item(s) labeled "FURNISHING AND DELIVERING DUCTILE IRON PIPE” and item(s) labeled “LAYING DUCTILE IRON PIPE AND FITTINGS”.

No extra payment will be made for insulated and non-insulated flange joints indicated on the standard and contract drawings, but payment thereof will be deemed included in the prices bid for all items of work.

(14) Compensation for all work as required by the drawings and specifications, or as ordered by the Engineer but not included specifically in the Bid Schedule must be included in the prices bid for all items of the contract. No separate or additional payment will be made for this work.

Payment for Laying Ductile Iron Pipe And Fittings will be made under the Item Number as calculated below:

The Item Numbers for Laying Ductile Iron Pipe And Fittings have eight characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Laying Ductile Iron Pipe And Fittings:

60.12

(2) The sixth character must define Ductile Iron Pipe And Fittings:

D - Ductile Iron Pipe And Fittings

(3) The seventh and eighth characters must define the Diameter of the Ductile Iron Pipe And Fittings. (The seventh and eighth characters representing the unit of inches for the Diameter of the Ductile Iron Pipe And Fittings.) See examples below:

08 - 8-Inch
16 - 16-Inch
36 - 36-Inch

(4) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
60.12D48	LAYING 48-INCH DUCTILE IRON PIPE AND FITTINGS	L.F.
60.12D42	LAYING 42-INCH DUCTILE IRON PIPE AND FITTINGS	L.F.
60.12D36	LAYING 36-INCH DUCTILE IRON PIPE AND FITTINGS	L.F.
60.12D30	LAYING 30-INCH DUCTILE IRON PIPE AND FITTINGS	L.F.
60.12D24	LAYING 24-INCH DUCTILE IRON PIPE AND FITTINGS	L.F.
60.12D20	LAYING 20-INCH DUCTILE IRON PIPE AND FITTINGS	L.F.
60.12D16	LAYING 16-INCH DUCTILE IRON PIPE AND FITTINGS	L.F.
60.12D14	LAYING 14-INCH DUCTILE IRON PIPE AND FITTINGS	L.F.
60.12D12	LAYING 12-INCH DUCTILE IRON PIPE AND FITTINGS	L.F.

Item No.	Description	Pay Unit
60.12D10	LAYING 10-INCH DUCTILE IRON PIPE AND FITTINGS	L.F.
60.12D08	LAYING 8-INCH DUCTILE IRON PIPE AND FITTINGS	L.F.
60.12D06	LAYING 6-INCH DUCTILE IRON PIPE AND FITTINGS	L.F.
60.12D04	LAYING 4-INCH DUCTILE IRON PIPE AND FITTINGS	L.F.

SECTION 60.13 – FURNISHING AND DELIVERING DUCTILE IRON FITTINGS

60.13.1 DESCRIPTION

These specifications are applicable for furnishing and delivering ductile iron fittings.

This includes all bends, 3-ways, 4-ways, caps, offsets, plugs, reducers, and sleeves complete with all accessories, including wedge type restraint glands.

60.13.2 MATERIALS

All fittings and their accessories must conform to the requirements of **Section 20.02 - Specifications For Ductile Iron Fittings And Accessories**.

60.13.3 CONSTRUCTION METHODS

Prior to ordering any ductile iron fittings, the Contractor must submit to the Engineer a vendor list for approval. Within five (5) consecutive calendar days after receiving vendor approval, the Contractor must submit evidence to the Department of Design and Construction of having ordered the material from an acceptable foundry.

Material must be manufactured at least ten (10) days before delivery to the site to allow for proper inspection and recording of accepted fittings.

60.13.4 MEASUREMENT

(1) For furnishing and delivering 30-inch and larger ductile iron fittings the quantity to be paid for the fittings must be the number of each of the fittings furnished and delivered.

(2) For furnishing and delivering 24-inch and smaller ductile iron fittings the quantity to be paid for the fittings must be the weight in tons of the fittings furnished and delivered as follows:

(a) Fittings: The weight for payment must be based on the bare body weights listed in ANSI/AWWA Standard C110/A21.10, for ductile iron fittings only.

(b) Wedge Restraint Glands: For fitting or rodding purposes, the weight for payment must be based on the weights listed in the latest edition of EBAA Iron, Inc., Eastland, Texas 76448, catalog for Megalug restraint glands.

(3) For fitting sizes smaller than 16”, the unit price used for payment of work done on fittings of a size not covered by the Bid Schedule will be obtained by taking the unit price of the nearest larger size contained in the Bid Schedule.

60.13.5 PRICE TO COVER

(1) Payment for furnishing and delivering 30-inch and larger ductile iron fittings must be made under the bid item(s) for “FURNISHING AND DELIVERING DUCTILE IRON MECHANICAL JOINT FITTINGS” for the size, class and type fittings as contained in the Bid Schedule.

(2) Payment for furnishing and delivering 24-inch and smaller ductile iron fittings must be made under bid item No. 60.13M0A24 - FURNISHING AND DELIVERING DUCTILE IRON MECHANICAL JOINT 24-INCH DIAMETER AND SMALLER FITTINGS, INCLUDING WEDGE TYPE RETAINER GLANDS as contained in the Bid Schedule.

(3) Payment for bolts, nuts, and gaskets must be considered as having been included in the prices stipulated for the furnishing and delivering of the fittings.

(4) No extra payment will be made for insulated and non-insulated flanged joints indicated on the standard and contract drawings, but payment thereof will be deemed included in the prices bid for all items of work.

Payment for Furnishing And Delivering Ductile Iron Fittings will be made under the Item Number as calculated below:

The Item Numbers for Furnishing And Delivering Ductile Iron Fittings have ten characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing And Delivering Ductile Iron Fittings:

(2) The sixth character must define the Type of Joint on Ductile Iron Fittings:

M - Mechanical Joint

(3) The seventh character must define the Class of Ductile Iron Fittings:

6 - Class 56
5 - Class 55
0 - Class 55 (24-Inch Thru 14-Inch); Class 56 (12-Inch And Smaller)

(4) The eighth character must define the Kind of Ductile Iron Fittings:

A - All Kinds Of Fittings (24-Inch And Smaller)
B - Bends (All Degree Bends)
R - Reducers (To All Reduced Sizes)
T - Tees (3-Way and 4-Way)
C - Caps
O - Offsets (All Offset Distances)
S - Sleeves
P - Plugs

(5) The ninth and tenth characters must define the Diameter of the Ductile Iron Fittings (On Reducers the Largest Diameter). (The ninth and tenth characters representing the unit of inches for the Diameter of the Ductile Iron Fittings.) See examples below:

24 - 24-Inch and Smaller
48 - 48-Inch

(6) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
60.13M0A24	FURNISHING AND DELIVERING DUCTILE IRON MECHANICAL JOINT 24-INCH DIAMETER AND SMALLER FITTINGS, INCLUDING WEDGE TYPE RETAINER GLANDS	TONS
60.13M5B48	FURNISHING AND DELIVERING 48-INCH DUCTILE IRON MECHANICAL JOINT BENDS (CLASS 55)	EACH
60.13M5B42	FURNISHING AND DELIVERING 42-INCH DUCTILE IRON MECHANICAL JOINT BENDS (CLASS 55)	EACH
60.13M5B36	FURNISHING AND DELIVERING 36-INCH DUCTILE IRON MECHANICAL JOINT BENDS (CLASS 55)	EACH
60.13M5B30	FURNISHING AND DELIVERING 30-INCH DUCTILE IRON MECHANICAL JOINT BENDS (CLASS 55)	EACH
60.13M5R48	FURNISHING AND DELIVERING 48-INCH DUCTILE IRON MECHANICAL JOINT REDUCERS (CLASS 55)	EACH
60.13M5R42	FURNISHING AND DELIVERING 42-INCH DUCTILE IRON MECHANICAL JOINT REDUCERS (CLASS 55)	EACH
60.13M5R36	FURNISHING AND DELIVERING 36-INCH DUCTILE IRON MECHANICAL JOINT REDUCERS (CLASS 55)	EACH
60.13M5R30	FURNISHING AND DELIVERING 30-INCH DUCTILE IRON MECHANICAL JOINT REDUCERS (CLASS 55)	EACH
60.13M5T48	FURNISHING AND DELIVERING 48-INCH DUCTILE IRON MECHANICAL JOINT TEES (CLASS 55)	EACH
60.13M5T42	FURNISHING AND DELIVERING 42-INCH DUCTILE IRON MECHANICAL JOINT TEES (CLASS 55)	EACH
60.13M5T36	FURNISHING AND DELIVERING 36-INCH DUCTILE IRON MECHANICAL JOINT TEES (CLASS 55)	EACH
60.13M5T30	FURNISHING AND DELIVERING 30-INCH DUCTILE IRON MECHANICAL JOINT TEES (CLASS 55)	EACH
60.13M5C48	FURNISHING AND DELIVERING 48-INCH DUCTILE IRON MECHANICAL JOINT CAPS (CLASS 55)	EACH

Item No.	Description	Pay Unit
60.13M5C42	FURNISHING AND DELIVERING 42-INCH DUCTILE IRON MECHANICAL JOINT CAPS (CLASS 55)	EACH
60.13M5C36	FURNISHING AND DELIVERING 36-INCH DUCTILE IRON MECHANICAL JOINT CAPS (CLASS 55)	EACH
60.13M5C30	FURNISHING AND DELIVERING 30-INCH DUCTILE IRON MECHANICAL JOINT CAPS (CLASS 55)	EACH
60.13M5O48	FURNISHING AND DELIVERING 48-INCH DUCTILE IRON MECHANICAL JOINT OFFSETS (CLASS 55)	EACH
60.13M5O42	FURNISHING AND DELIVERING 42-INCH DUCTILE IRON MECHANICAL JOINT OFFSETS (CLASS 55)	EACH
60.13M5O36	FURNISHING AND DELIVERING 36-INCH DUCTILE IRON MECHANICAL JOINT OFFSETS (CLASS 55)	EACH
60.13M5O30	FURNISHING AND DELIVERING 30-INCH DUCTILE IRON MECHANICAL JOINT OFFSETS (CLASS 55)	EACH
60.13M5S48	FURNISHING AND DELIVERING 48-INCH DUCTILE IRON MECHANICAL JOINT SLEEVES (CLASS 55)	EACH
60.13M5S42	FURNISHING AND DELIVERING 42-INCH DUCTILE IRON MECHANICAL JOINT SLEEVES (CLASS 55)	EACH
60.13M5S36	FURNISHING AND DELIVERING 36-INCH DUCTILE IRON MECHANICAL JOINT SLEEVES (CLASS 55)	EACH
60.13M5S30	FURNISHING AND DELIVERING 30-INCH DUCTILE IRON MECHANICAL JOINT SLEEVES (CLASS 55)	EACH
60.13M5P48	FURNISHING AND DELIVERING 48-INCH DUCTILE IRON MECHANICAL JOINT PLUGS (CLASS 55)	EACH
60.13M5P42	FURNISHING AND DELIVERING 42-INCH DUCTILE IRON MECHANICAL JOINT PLUGS (CLASS 55)	EACH
60.13M5P36	FURNISHING AND DELIVERING 36-INCH DUCTILE IRON MECHANICAL JOINT PLUGS (CLASS 55)	EACH
60.13M5P30	FURNISHING AND DELIVERING 30-INCH DUCTILE IRON MECHANICAL JOINT PLUGS (CLASS 55)	EACH

SECTION 60.20 – FURNISHING, DELIVERING, AND LAYING STEEL PIPE AND APPURTENANCES

60.20.1 DESCRIPTION

Furnishing, Delivering And Laying Steel Pipe And Appurtenances must be done in accordance with **New York City Department of Environmental Protection (NYC DEP) Specifications For Trunk Main Work. (This publication includes Special Provisions For Trunk Main Work; and, Specification For Furnishing, Delivering And Laying Steel Pipe And Appurtenances.)**

60.20.2 PRICE TO COVER

Payments for all Steel Pipe and Appurtenance work must be made in accordance with **Sections 60.21 through 60.29** and in accordance with **New York City Department of Environmental Protection (NYC DEP) Specifications For Trunk Main Work. (This publication includes Special Provisions For Trunk Main Work; and, Specification For Furnishing, Delivering And Laying Steel Pipe And Appurtenances.)**.

SECTION 60.21 – FURNISHING, DELIVERING, AND LAYING STRAIGHT STEEL PIPE

60.21.1 DESCRIPTION

Furnishing, Delivering And Laying Straight Steel Pipe must be done in accordance with **Section 60.20**, and as shown, specified or ordered.

60.21.2 MEASUREMENT

The quantities of straight steel pipes to be measured for payment must be the number of linear feet of each size straight steel pipe actually furnished, delivered and laid, complete, as shown, specified or required and as measured along the center line axis of the pipe as installed.

60.21.3 PRICE TO COVER

The contract price for "FURNISHING, DELIVERING, AND LAYING STRAIGHT STEEL PIPE" must be the unit price bid per linear foot for each size and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to furnish, deliver and lay straight steel pipe as shown or specified, including all required earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); pumping; bridging; cleaning; welding; jointing; lining; coating; connections; backfilling; fabrication; inspection and testing; preparation, submittal and approval of all required shop drawings and designs; obtaining all necessary permits; furnish and install all other items necessary to complete this work; and do all other work necessary and incidental thereto in order to complete this work all in accordance with the plans and specifications and as directed by the Engineer.

Payment for the "FURNISHING, DELIVERING, AND LAYING STRAIGHT STEEL PIPE" must be made under the applicable bid item(s) of the Bid Schedule, and in accordance with **Subsection 60.20.2** and as specified herein.

Payment for Furnishing, Delivering, And Laying Straight Steel Pipe will be made under the Item Number as calculated below:

The Item Numbers for Furnishing, Delivering, And Laying Straight Steel Pipe have eleven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing, Delivering, And Laying Straight Steel Pipe:

60.21

(2) The sixth and seventh characters must define Straight Steel Pipe:

SP - Straight Steel Pipe

(3) The eighth and ninth characters must define the Wall Thickness of the Steel Pipe. (The eighth character representing the Wall Thickness in 1/8-inch increments, and the ninth character representing Wall Thickness.):

4T - 4/8-Inch or 1/2-Inch Wall Thickness
5T - 5/8-Inch Wall Thickness
6T - 6/8-Inch or 3/4-Inch Wall Thickness

(4) The tenth and eleventh characters must define the Diameter of the Straight Steel Pipe. (The tenth and eleventh characters representing the unit of inches for the Diameter of the Straight Steel Pipe.) See examples below:

08 - 8-Inch
36 - 36-Inch
72 - 72-Inch

(5) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
60.21SP6T72	FURNISHING, DELIVERING, AND LAYING 72-INCH STRAIGHT STEEL PIPE, 3/4-INCH WALL THICKNESS	L.F.
60.21SP6T66	FURNISHING, DELIVERING, AND LAYING 66-INCH STRAIGHT STEEL PIPE, 3/4-INCH WALL THICKNESS	L.F.
60.21SP5T60	FURNISHING, DELIVERING, AND LAYING 60-INCH STRAIGHT STEEL PIPE, 5/8-INCH WALL THICKNESS	L.F.
60.21SP5T54	FURNISHING, DELIVERING, AND LAYING 54-INCH STRAIGHT STEEL PIPE, 5/8-INCH WALL THICKNESS	L.F.
60.21SP5T48	FURNISHING, DELIVERING, AND LAYING 48-INCH STRAIGHT STEEL PIPE, 5/8-INCH WALL THICKNESS	L.F.
60.21SP4T48	FURNISHING, DELIVERING, AND LAYING 48-INCH STRAIGHT STEEL PIPE, 1/2-INCH WALL THICKNESS	L.F.
60.21SP4T42	FURNISHING, DELIVERING, AND LAYING 42-INCH STRAIGHT STEEL PIPE, 1/2-INCH WALL THICKNESS	L.F.
60.21SP3T36	FURNISHING, DELIVERING, AND LAYING 36-INCH STRAIGHT STEEL PIPE, 3/8-INCH WALL THICKNESS	L.F.
60.21SP3T30	FURNISHING, DELIVERING, AND LAYING 30-INCH STRAIGHT STEEL PIPE, 3/8-INCH WALL THICKNESS	L.F.
60.21SP3T24	FURNISHING, DELIVERING, AND LAYING 24-INCH STRAIGHT STEEL PIPE, 3/8-INCH WALL THICKNESS	L.F.
60.21SP3T20	FURNISHING, DELIVERING, AND LAYING 20-INCH STRAIGHT STEEL PIPE, 3/8-INCH WALL THICKNESS	L.F.
60.21SP3T16	FURNISHING, DELIVERING, AND LAYING 16-INCH STRAIGHT STEEL PIPE, 3/8-INCH WALL THICKNESS	L.F.
60.21SP3T14	FURNISHING, DELIVERING, AND LAYING 14-INCH STRAIGHT STEEL PIPE, 3/8-INCH WALL THICKNESS	L.F.
60.21SP3T12	FURNISHING, DELIVERING, AND LAYING 12-INCH STRAIGHT STEEL PIPE, 3/8-INCH WALL THICKNESS	L.F.
60.21SP3T10	FURNISHING, DELIVERING, AND LAYING 10-INCH STRAIGHT STEEL PIPE, 3/8-INCH WALL THICKNESS	L.F.
60.21SP3T08	FURNISHING, DELIVERING, AND LAYING 8-INCH STRAIGHT STEEL PIPE, 3/8-INCH WALL THICKNESS	L.F.

SECTION 60.22 – FURNISHING, DELIVERING, AND LAYING STEEL BENDS AND REDUCERS

60.22.1 DESCRIPTION

Furnishing, Delivering, And Laying Steel Bends And Reducers must be done in accordance with **Section 60.20**, and as shown, specified or ordered.

60.22.2 MEASUREMENT

The quantities of steel bends and reducers to be measured for payment must be the number of linear feet of each size steel bend and reducer actually furnished, delivered and laid, complete, as shown, specified or required and as measured along the center line axis of the bend and reducer as installed.

The larger size of reducers must be used as the basis of payment for furnishing, delivering, and laying lengths.

60.22.3 PRICE TO COVER

The contract price for "FURNISHING, DELIVERING, AND LAYING STEEL BENDS AND REDUCERS" must be the unit price bid per linear foot for each size and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to furnish, deliver and lay steel bends and reducers as shown or specified, including all required earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); pumping; bridging; cleaning; welding; jointing; lining; coating; connections; backfilling; fabrication; inspection and testing; preparation, submittal and approval of all required shop drawings and designs; obtaining all necessary permits; furnish and install all other items necessary to complete this work; and do all other work necessary and incidental thereto in order to complete this work all in accordance with the plans and specifications and as directed by the Engineer.

Payment for the "FURNISHING, DELIVERING, AND LAYING STEEL BENDS AND REDUCERS" must be made under the applicable bid item(s) of the Bid Schedule, and in accordance with **Subsection 60.20.2** and as specified herein.

Payment for Furnishing, Delivering, And Laying Steel Bends And Reducers will be made under the Item Number as calculated below:

The Item Numbers for Furnishing, Delivering, And Laying Steel Bends And Reducers have eleven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing, Delivering, And Laying Steel Bends And Reducers:

60.22

(2) The sixth and seventh characters must define Steel Bends And Reducers. (For all degree bends, and to all smaller reducer diameters.):

BR - Steel Bends And Reducers

(3) The eighth and ninth characters must define the Wall Thickness of the Steel Bends and Reducers. (The eighth character representing the wall thickness in 1/8-inch increments, and the ninth character representing Wall Thickness.):

4T - 4/8-Inch or 1/2-Inch Wall Thickness
5T - 5/8-Inch Wall Thickness
6T - 6/8-Inch or 3/4-Inch Wall Thickness

(4) The tenth and eleventh characters must define the Larger Diameter of the Steel Bends and Reducers. (The tenth and eleventh characters representing the unit of inches for the Larger Diameter of the Steel Bends and Reducers.) See examples below:

08 - 8-Inch
36 - 36-Inch
72 - 72-Inch

(5) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
60.22BR6T72	FURNISHING, DELIVERING AND LAYING 72-INCH STEEL BENDS AND REDUCERS, 3/4-INCH WALL THICKNESS	L.F.
60.22BR6T66	FURNISHING, DELIVERING AND LAYING 66-INCH STEEL BENDS AND REDUCERS, 3/4-INCH WALL THICKNESS	L.F.
60.22BR5T60	FURNISHING, DELIVERING AND LAYING 60-INCH STEEL BENDS AND REDUCERS, 5/8-INCH WALL THICKNESS	L.F.
60.22BR5T54	FURNISHING, DELIVERING AND LAYING 54-INCH STEEL BENDS AND REDUCERS, 5/8-INCH WALL THICKNESS	L.F.
60.22BR5T48	FURNISHING, DELIVERING AND LAYING 48-INCH STEEL BENDS AND REDUCERS, 5/8-INCH WALL THICKNESS	L.F.
60.22BR4T48	FURNISHING, DELIVERING AND LAYING 48-INCH STEEL BENDS AND REDUCERS, 1/2-INCH WALL THICKNESS	L.F.
60.22BR4T42	FURNISHING, DELIVERING AND LAYING 42-INCH STEEL BENDS AND REDUCERS, 1/2-INCH WALL THICKNESS	L.F.
60.22BR3T36	FURNISHING, DELIVERING AND LAYING 36-INCH STEEL BENDS AND REDUCERS, 3/8-INCH WALL THICKNESS	L.F.
60.22BR3T30	FURNISHING, DELIVERING AND LAYING 30-INCH STEEL BENDS AND REDUCERS, 3/8-INCH WALL THICKNESS	L.F.
60.22BR3T24	FURNISHING, DELIVERING AND LAYING 24-INCH STEEL BENDS AND REDUCERS, 3/8-INCH WALL THICKNESS	L.F.
60.22BR3T20	FURNISHING, DELIVERING AND LAYING 20-INCH STEEL BENDS AND REDUCERS, 3/8-INCH WALL THICKNESS	L.F.
60.22BR3T16	FURNISHING, DELIVERING AND LAYING 16-INCH STEEL BENDS AND REDUCERS, 3/8-INCH WALL THICKNESS	L.F.
60.22BR3T14	FURNISHING, DELIVERING AND LAYING 14-INCH STEEL BENDS AND REDUCERS, 3/8-INCH WALL THICKNESS	L.F.
60.22BR3T12	FURNISHING, DELIVERING AND LAYING 12-INCH STEEL BENDS AND REDUCERS, 3/8-INCH WALL THICKNESS	L.F.
60.22BR3T10	FURNISHING, DELIVERING AND LAYING 10-INCH STEEL BENDS AND REDUCERS, 3/8-INCH WALL THICKNESS	L.F.
60.22BR3T08	FURNISHING, DELIVERING AND LAYING 8-INCH STEEL BENDS AND REDUCERS, 3/8-INCH WALL THICKNESS	L.F.

SECTION 60.23 – FURNISHING, DELIVERING, AND INSTALLING STEEL TEES

60.23.1 DESCRIPTION

Furnishing, Delivering, And Installing Steel Tees must be done in accordance with **Section 60.20**, and as shown, specified, or ordered.

60.23.2 MEASUREMENT

The quantities of steel tees to be measured for payment must be the number of each size steel tee actually furnished, delivered and installed, complete, as shown, specified, or required.

60.23.3 PRICE TO COVER

The contract price for "FURNISHING, DELIVERING AND INSTALLING STEEL TEES" must be the unit price bid per each size and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to furnish, deliver and install steel tees as shown or specified, including all required earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); pumping; bridging; cleaning; welding; jointing; lining; coating; connections; backfilling; fabrication; inspection and testing; preparation, submittal and approval of all required shop drawings and designs; obtaining all necessary permits; furnish and install all other items necessary to complete this work; and do all other work necessary and incidental thereto in order to complete this work all in accordance with the plans and specifications and as directed by the Engineer.

Payment for the "FURNISHING, DELIVERING AND INSTALLING STEEL TEES" must be made under the applicable bid item(s) of the Bid Schedule, and in accordance with **Subsection 60.20.2** and as specified herein.

Payment for Furnishing, Delivering And Installing Steel Tees will be made under the Item Number as calculated below:

The Item Numbers for Furnishing, Delivering And Installing Steel Tees have twelve characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing, Delivering And Installing Steel Tees:

60.23

(2) The sixth and seventh characters must define Steel Tee:

ST - Steel Tee

(3) The eighth, ninth and tenth characters must define the Tee Branch and its Diameter. (The eighth and ninth characters representing the unit of inches for the Diameter of the Tee Branch, and the tenth character representing Tee Branch.) See examples below:

36T - 36-Inch Tee Branch
72T - 72-Inch Tee Branch

(4) The eleventh and twelfth characters must define the Diameter of the Main Line. (The tenth and eleventh characters representing the unit of inches for the Diameter of the Main Line.) See examples below:

30 - 30-Inch
72 - 72-Inch

(5) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
60.23ST72T72	FURNISHING, DELIVERING AND INSTALLING 72-INCH X 72-INCH STEEL TEE	EACH
60.23ST60T72	FURNISHING, DELIVERING AND INSTALLING 72-INCH X 60-INCH STEEL TEE	EACH
60.23ST66T66	FURNISHING, DELIVERING AND INSTALLING 66-INCH X 66-INCH STEEL TEE	EACH
60.23ST60T60	FURNISHING, DELIVERING AND INSTALLING 60-INCH X 60-INCH STEEL TEE	EACH

Item No.	Description	Pay Unit
60.23ST48T60	FURNISHING, DELIVERING AND INSTALLING 60-INCH X 48-INCH STEEL TEE	EACH
60.23ST54T54	FURNISHING, DELIVERING AND INSTALLING 54-INCH X 54-INCH STEEL TEE	EACH
60.23ST48T48	FURNISHING, DELIVERING AND INSTALLING 48-INCH X 48-INCH STEEL TEE	EACH
60.23ST36T48	FURNISHING, DELIVERING AND INSTALLING 48-INCH X 36-INCH STEEL TEE	EACH
60.23ST42T42	FURNISHING, DELIVERING AND INSTALLING 42-INCH X 42-INCH STEEL TEE	EACH
60.23ST36T36	FURNISHING, DELIVERING AND INSTALLING 36-INCH X 36-INCH STEEL TEE	EACH
60.23ST30T36	FURNISHING, DELIVERING AND INSTALLING 36-INCH X 30-INCH STEEL TEE	EACH
60.23ST30T30	FURNISHING, DELIVERING AND INSTALLING 30-INCH X 30-INCH STEEL TEE	EACH
60.23ST24T30	FURNISHING, DELIVERING AND INSTALLING 30-INCH X 24-INCH STEEL TEE	EACH
60.23ST24T24	FURNISHING, DELIVERING AND INSTALLING 24-INCH X 24-INCH STEEL TEE	EACH

SECTION 60.24 – FURNISHING, DELIVERING, AND INSTALLING STEEL BULKHEADS

60.24.1 DESCRIPTION

Furnishing, Delivering And Installing Steel Bulkheads must be done in accordance with **Section 60.20**, and as shown, specified or ordered.

60.24.2 MEASUREMENT

The quantities of steel bulkheads to be measured for payment must be the number of each size steel bulkhead actually furnished, delivered and installed, complete, as shown, specified or required.

60.24.3 PRICE TO COVER

The contract price for "FURNISHING, DELIVERING AND INSTALLING STEEL BULKHEADS" must be the unit price bid per each size and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to furnish, deliver and install steel bulkheads as shown or specified, including all required earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); pumping; bridging; cleaning; welding; jointing; lining; coating; connections; backfilling; fabrication; inspection and testing; preparation, submittal and approval of all required shop drawings and designs; obtaining all necessary permits; furnish and install all other items necessary to complete this work; and do all other work necessary and incidental thereto in order to complete this work all in accordance with the plans and specifications and as directed by the Engineer.

Payment for the "FURNISHING, DELIVERING AND INSTALLING STEEL BULKHEADS" must be made under the applicable bid item(s) of the Bid Schedule, and in accordance with **Subsection 60.20.2** and as specified herein.

Payment for Furnishing, Delivering And Installing Steel Bulkheads will be made under the Item Number as calculated below:

The Item Numbers for Furnishing, Delivering And Installing Steel Bulkheads have nine characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing, Delivering And Installing Steel Bulkheads:

60.24

(2) The sixth and seventh characters must define Steel Bulkhead:

SB - Steel Bulkhead

(3) The eighth and ninth characters must define the Diameter of the Steel Bulkhead. (The eighth and ninth characters representing the unit of inches for the Diameter of the Steel Bulkhead.) See examples below:

36 - 36-Inch
72 - 72-Inch

(4) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
60.24SB72	FURNISHING, DELIVERING AND INSTALLING 72-INCH STEEL BULKHEAD	EACH
60.24SB66	FURNISHING, DELIVERING AND INSTALLING 66-INCH STEEL BULKHEAD	EACH
60.24SB60	FURNISHING, DELIVERING AND INSTALLING 60-INCH STEEL BULKHEAD	EACH
60.24SB54	FURNISHING, DELIVERING AND INSTALLING 54-INCH STEEL BULKHEAD	EACH
60.24SB48	FURNISHING, DELIVERING AND INSTALLING 48-INCH STEEL BULKHEAD	EACH
60.24SB42	FURNISHING, DELIVERING AND INSTALLING 42-INCH STEEL BULKHEAD	EACH
60.24SB36	FURNISHING, DELIVERING AND INSTALLING 36-INCH STEEL BULKHEAD	EACH
60.24SB30	FURNISHING, DELIVERING AND INSTALLING 30-INCH STEEL BULKHEAD	EACH
60.24SB24	FURNISHING, DELIVERING AND INSTALLING 24-INCH STEEL BULKHEAD	EACH
60.24SB20	FURNISHING, DELIVERING AND INSTALLING 20-INCH STEEL BULKHEAD	EACH

SECTION 60.25 – FURNISHING, DELIVERING, AND INSTALLING PLATE STEEL OUTLETS ON STEEL PIPE

60.25.1 DESCRIPTION

Furnishing, Delivering And Installing Plate Steel Outlets On Steel Pipe must be done in accordance with **Section 60.20**, and as shown, specified or ordered.

60.25.2 MEASUREMENT

The quantity of plate steel outlets on steel pipe to be measured for payment must be the number of pounds of plate steel outlets on steel pipe actually furnished, delivered and installed, complete, as shown, specified or required.

60.25.3 PRICE TO COVER

The contract price for Item No. 60.25PSO - FURNISHING, DELIVERING AND INSTALLING PLATE STEEL OUTLETS ON STEEL PIPE, ACCESS MANHOLE OUTLETS WITH COVERS, AND NUTS AND BOLTS COMPLETE must be the unit price bid per pound and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to furnish, deliver and install plate steel outlets on steel pipe, access manhole outlets with covers, and nuts, bolts and washer as shown or specified, including cleaning; connections; fabrication; inspection and testing; preparation, submittal and approval of all required shop drawings and designs; obtaining all necessary permits; and do all other work necessary and incidental thereto in order to complete this work all in accordance with the plans and specifications and as directed by the Engineer.

Payment for Item No. 60.25PSO - FURNISHING, DELIVERING AND INSTALLING PLATE STEEL OUTLETS ON STEEL PIPE, ACCESS MANHOLE OUTLETS WITH COVERS, AND NUTS AND BOLTS COMPLETE must be made under the applicable bid item of the Bid Schedule, and in accordance with **Subsection 60.20.2** and as specified herein.

Payment for Furnishing, Delivering And Installing Plate Steel Outlets On Steel Pipe will be made under the Item Number as calculated below:

The Item Number for Furnishing, Delivering And Installing Plate Steel Outlets On Steel Pipe has eight characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing, Delivering And Installing Plate Steel Outlets On Steel Pipe:

60.25

(2) The sixth, seventh and eighth characters must define Plate Steel Outlets On Steel Pipe:

PSO - Plate Steel Outlets On Steel Pipe (All Size Steel Pipe)

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
60.25PSO	FURNISHING, DELIVERING AND INSTALLING PLATE STEEL OUTLETS ON STEEL PIPE, ACCESS MANHOLE OUTLETS WITH COVERS, AND NUTS AND BOLTS COMPLETE	LBS.

SECTION 60.26 – FURNISHING, DELIVERING, AND INSTALLING STEEL MANIFOLDS

60.26.1 DESCRIPTION

Furnishing, Delivering And Installing Steel Manifolds must be done in accordance with **Section 60.20**, and as shown, specified or ordered.

60.26.2 MEASUREMENT

The quantities of steel manifolds to be measured for payment must be the number of each size and type steel manifold actually furnished, delivered and installed, complete, as shown, specified or required.

60.26.3 PRICE TO COVER

The contract price for "FURNISHING, DELIVERING AND INSTALLING STEEL MANIFOLDS" must be the unit price bid per each size and type and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to furnish, deliver and install steel manifolds as shown or specified, including all required earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); pumping; bridging; cleaning; welding; jointing; lining; coating; connections; backfilling; fabrication; inspection and testing; preparation, submittal and approval of all required shop drawings and designs; obtaining all necessary permits; furnish and install all other items necessary to complete this work; and do all other work necessary and incidental thereto in order to complete this work all in accordance with the plans and specifications and as directed by the Engineer.

Payment for the "FURNISHING, DELIVERING AND INSTALLING STEEL MANIFOLDS" must be made under the applicable bid item(s) of the Bid Schedule, and in accordance with **Subsection 60.20.2** and as specified herein.

Payment for Furnishing, Delivering And Installing Steel Manifolds will be made under the Item Number as calculated below:

The Item Numbers for Furnishing, Delivering And Installing Steel Manifolds have ten characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing, Delivering And Installing Steel Manifolds:

60.26

(2) The sixth character must define Steel Manifold:

M - Steel Manifold

(3) The seventh and eighth characters must define the Diameter of the Straight Header portion of the Steel Manifold. (The eighth and ninth characters representing the unit of inches for the Diameter of the Straight Header portion of the Steel Manifold.) See examples below:

48 - 48-Inch
72 - 72-Inch

(4) The ninth character must be an alphabetical character (A, B, C, etc.), with each Specific Manifold's Specifications (Thickness, number and sizes of outlets, thicknesses of outlets, etc.) being assigned a specific alphabetical character:

(5) The tenth character must define Steel Manifold With or Without Blow-Off Outlet Connection:

A - Without Blow-Off Outlet Connection
B - With Blow-Off Outlet Connection

(6) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
60.26M72AA	FURNISHING, DELIVERING AND INSTALLING STEEL MANIFOLD WITH 72-INCH STRAIGHT HEADER 1-INCH THICKNESS, ONE 60-INCH OUTLET 7/8-INCH THICKNESS, THREE 30-INCH OUTLETS 3/4-INCH THICKNESS AND TWO 72-INCH BULKHEADS 3/4-INCH THICKNESS, ETC., COMPLETE	EACH
60.26M72BA	FURNISHING, DELIVERING AND INSTALLING STEEL MANIFOLD WITH 72-INCH STRAIGHT HEADER 1-INCH THICKNESS, ONE 48-INCH OUTLET 3/4-INCH THICKNESS, THREE 30-INCH OUTLETS 3/4-INCH THICKNESS AND TWO 72-INCH BULKHEADS 3/4-INCH THICKNESS, ETC., COMPLETE	EACH
60.26M60AA	FURNISHING, DELIVERING AND INSTALLING STEEL MANIFOLD WITH 60-INCH STRAIGHT HEADER 7/8-INCH THICKNESS, ONE 48-INCH OUTLET 3/4-INCH THICKNESS, FOUR 24-INCH OUTLETS 1/2-INCH THICKNESS AND TWO 60-INCH BULKHEADS 7/8-INCH THICKNESS, ETC., COMPLETE	EACH
60.26M60AB	FURNISHING, DELIVERING AND INSTALLING STEEL MANIFOLD WITH 60-IN. STRAIGHT HEADER 7/8-IN. THICK., ONE 48-IN. OUTLET 3/4-IN. THICK., FOUR 24-IN. OUTLETS 1/2-IN. THICK.. TWO 60-IN. BULKHEADS 7\8-IN. THICK. AND 6-IN. BLOW-OFF OUTLET CONNECTION, ETC., COMPLETE	EACH
60.26M60BA	FURNISHING, DELIVERING AND INSTALLING STEEL MANIFOLD WITH 60-INCH STRAIGHT HEADER 7/8-INCH THICKNESS, ONE 36-INCH OUTLET 5/8-INCH THICKNESS, FOUR 24-INCH OUTLETS 1/2-INCH THICKNESS AND TWO 60-INCH BULKHEADS 7/8-INCH THICKNESS, ETC., COMPLETE	EACH
60.26M60BB	FURNISHING, DELIVERING AND INSTALLING STEEL MANIFOLD WITH 60-IN. STRAIGHT HEADER 7/8-IN. THICK., ONE 36-IN. OUTLET 5/8-IN. THICK., FOUR 24-IN. OUTLETS 1/2-IN. THICK.. TWO 60-IN. BULKHEADS 7\8-IN. THICK. AND 6-IN. BLOW-OFF OUTLET CONNECTION, ETC., COMPLETE	EACH
60.26M48AA	FURNISHING, DELIVERING AND INSTALLING STEEL MANIFOLD WITH 48-INCH STRAIGHT HEADER 3/4-INCH THICKNESS, ONE 36-INCH OUTLET 5/8-INCH THICKNESS, THREE 24-INCH OUTLETS 1/2-INCH THICKNESS AND TWO 48-INCH BULKHEADS 3/4-INCH THICKNESS, ETC., COMPLETE	EACH
60.26M48AB	FURNISHING, DELIVERING AND INSTALLING STEEL MANIFOLD WITH 48-IN. STRAIGHT HEADER 3/4-IN. THICK., ONE 36-IN. OUTLET 5/8-IN. THICK., THREE 24-IN. OUTLETS 1/2-IN. THICK.. TWO 48-IN. BULKHEADS 3\4-IN. THICK. AND 6-IN. BLOW-OFF OUTLET CONNECTION, ETC., COMPLETE	EACH
60.26M48BB	FURNISHING, DELIVERING AND INSTALLING STEEL MANIFOLD WITH 48-IN. STRAIGHT HEADER 1/2-IN. THICK., ONE 36-IN. OUTLET 3/8-IN. THICK., THREE 20-IN. OUTLETS 3/8-IN. THICK.. TWO 48-IN. BULKHEADS 1/2-IN. THICK. AND 6-IN. BLOW-OFF OUTLET CONNECTION, ETC., COMPLETE	EACH

SECTION 60.27 – FURNISHING, DELIVERING, AND INSTALLING COUPLINGS

60.27.1 DESCRIPTION

Furnishing, Delivering And Installing Couplings must be done in accordance with **Section 60.20**, and as shown, specified or ordered.

60.27.2 MEASUREMENT

The quantities of couplings to be measured for payment must be the number of each size and type coupling actually furnished, delivered and installed, complete, as shown, specified or required.

60.27.3 PRICE TO COVER

The contract price for "FURNISHING, DELIVERING AND INSTALLING COUPLINGS" must be the unit price bid per each size and type and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to furnish, deliver and install couplings as shown or specified, including nuts, bolts and washer; cleaning; connections; inspection and testing; obtaining all necessary permits; and do all other work necessary and incidental thereto in order to complete this work all in accordance with the plans and specifications and as directed by the Engineer.

Payment for the "FURNISHING, DELIVERING AND INSTALLING COUPLINGS" must be made under the applicable bid item(s) of the Bid Schedule, and in accordance with **Subsection 60.20.2** and as specified herein.

Payment for Furnishing, Delivering And Installing Couplings will be made under the Item Number as calculated below:

The Item Numbers for Furnishing, Delivering And Installing Couplings have ten characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing, Delivering And Installing Couplings:

60.27

(2) The sixth, seventh and eighth characters must define Type of Coupling:

BSC - Bolted, Sleeve-Type Stainless Steel Insulating Coupling
HSC - Bolted, Sleeve-Type Stainless Steel Insulating Coupling With Harnessed Joint
GSC - Grooved-Style Coupling
RSC - Bolted, Split Sleeve-Type Restrained Coupling

(3) The ninth and tenth characters must define the Diameter of the Coupling. (The ninth and tenth characters representing the unit of inches for the Diameter of the Coupling.) See examples below:

30 - 30-Inch
72 - 72-Inch

(4) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
60.27BSC72	FURNISHING, DELIVERING AND INSTALLING 72-INCH DIAMETER BOLTED, SLEEVE-TYPE STAINLESS STEEL INSULATING COUPLING	EACH
60.27BSC66	FURNISHING, DELIVERING AND INSTALLING 66-INCH DIAMETER BOLTED, SLEEVE-TYPE STAINLESS STEEL INSULATING COUPLING	EACH
60.27BSC60	FURNISHING, DELIVERING AND INSTALLING 60-INCH DIAMETER BOLTED, SLEEVE-TYPE STAINLESS STEEL INSULATING COUPLING	EACH
60.27BSC54	FURNISHING, DELIVERING AND INSTALLING 54-INCH DIAMETER BOLTED, SLEEVE-TYPE STAINLESS STEEL INSULATING COUPLING	EACH
60.27BSC48	FURNISHING, DELIVERING AND INSTALLING 48-INCH DIAMETER BOLTED, SLEEVE-TYPE STAINLESS STEEL INSULATING COUPLING	EACH
60.27BSC42	FURNISHING, DELIVERING AND INSTALLING 42-INCH DIAMETER BOLTED, SLEEVE-TYPE STAINLESS STEEL INSULATING COUPLING	EACH

Item No.	Description	Pay Unit
60.27BSC36	FURNISHING, DELIVERING AND INSTALLING 36-INCH DIAMETER BOLTED, SLEEVE-TYPE STAINLESS STEEL INSULATING COUPLING	EACH
60.27BSC30	FURNISHING, DELIVERING AND INSTALLING 30-INCH DIAMETER BOLTED, SLEEVE-TYPE STAINLESS STEEL INSULATING COUPLING	EACH
60.27HSC72	FURNISHING, DELIVERING AND INSTALLING 72-INCH DIAMETER BOLTED, SLEEVE-TYPE STAINLESS STEEL INSULATING COUPLING WITH HARNESSED JOINT	EACH
60.27HSC66	FURNISHING, DELIVERING AND INSTALLING 66-INCH DIAMETER BOLTED, SLEEVE-TYPE STAINLESS STEEL INSULATING COUPLING WITH HARNESSED JOINT	EACH
60.27HSC60	FURNISHING, DELIVERING AND INSTALLING 60-INCH DIAMETER BOLTED, SLEEVE-TYPE STAINLESS STEEL INSULATING COUPLING WITH HARNESSED JOINT	EACH
60.27HSC54	FURNISHING, DELIVERING AND INSTALLING 54-INCH DIAMETER BOLTED, SLEEVE-TYPE STAINLESS STEEL INSULATING COUPLING WITH HARNESSED JOINT	EACH
60.27HSC48	FURNISHING, DELIVERING AND INSTALLING 48-INCH DIAMETER BOLTED, SLEEVE-TYPE STAINLESS STEEL INSULATING COUPLING WITH HARNESSED JOINT	EACH
60.27HSC42	FURNISHING, DELIVERING AND INSTALLING 42-INCH DIAMETER BOLTED, SLEEVE-TYPE STAINLESS STEEL INSULATING COUPLING WITH HARNESSED JOINT	EACH
60.27HSC36	FURNISHING, DELIVERING AND INSTALLING 36-INCH DIAMETER BOLTED, SLEEVE-TYPE STAINLESS STEEL INSULATING COUPLING WITH HARNESSED JOINT	EACH
60.27HSC30	FURNISHING, DELIVERING AND INSTALLING 30-INCH DIAMETER BOLTED, SLEEVE-TYPE STAINLESS STEEL INSULATING COUPLING WITH HARNESSED JOINT	EACH
60.27GSC72	FURNISHING, DELIVERING AND INSTALLING 72-INCH DIAMETER GROOVED-STYLE COUPLING	EACH
60.27GSC66	FURNISHING, DELIVERING AND INSTALLING 66-INCH DIAMETER GROOVED-STYLE COUPLING	EACH
60.27GSC60	FURNISHING, DELIVERING AND INSTALLING 60-INCH DIAMETER GROOVED-STYLE COUPLING	EACH
60.27GSC54	FURNISHING, DELIVERING AND INSTALLING 54-INCH DIAMETER GROOVED-STYLE COUPLING	EACH
60.27GSC48	FURNISHING, DELIVERING AND INSTALLING 48-INCH DIAMETER GROOVED-STYLE COUPLING	EACH
60.27GSC42	FURNISHING, DELIVERING AND INSTALLING 42-INCH DIAMETER GROOVED-STYLE COUPLING	EACH
60.27GSC36	FURNISHING, DELIVERING AND INSTALLING 36-INCH DIAMETER GROOVED-STYLE COUPLING	EACH
60.27GSC30	FURNISHING, DELIVERING AND INSTALLING 30-INCH DIAMETER GROOVED-STYLE COUPLING	EACH
60.27RSC72	FURNISHING, DELIVERING AND INSTALLING 72-INCH DIAMETER BOLTED, SPLIT SLEEVE-TYPE RESTRAINED COUPLING	EACH
60.27RSC66	FURNISHING, DELIVERING AND INSTALLING 66-INCH DIAMETER BOLTED, SPLIT SLEEVE-TYPE RESTRAINED COUPLING	EACH
60.27RSC60	FURNISHING, DELIVERING AND INSTALLING 60-INCH DIAMETER BOLTED, SPLIT SLEEVE-TYPE RESTRAINED COUPLING	EACH
60.27RSC54	FURNISHING, DELIVERING AND INSTALLING 54-INCH DIAMETER BOLTED, SPLIT SLEEVE-TYPE RESTRAINED COUPLING	EACH
60.27RSC48	FURNISHING, DELIVERING AND INSTALLING 48-INCH DIAMETER BOLTED, SPLIT SLEEVE-TYPE RESTRAINED COUPLING	EACH
60.27RSC42	FURNISHING, DELIVERING AND INSTALLING 42-INCH DIAMETER BOLTED, SPLIT SLEEVE-TYPE RESTRAINED COUPLING	EACH
60.27RSC36	FURNISHING, DELIVERING AND INSTALLING 36-INCH DIAMETER BOLTED, SPLIT SLEEVE-TYPE RESTRAINED COUPLING	EACH

Item No.	Description	Pay Unit
60.27RSC30	FURNISHING, DELIVERING AND INSTALLING 30-INCH DIAMETER BOLTED, SPLIT SLEEVE-TYPE RESTRAINED COUPLING	EACH

SECTION 60.28 – FURNISHING, DELIVERING, AND INSTALLING SPECIAL APPURTENANCES

60.28.1 DESCRIPTION

Furnishing, Delivering And Installing Special Appurtenances must be done in accordance with **Section 60.20**, and as shown, specified or ordered.

60.28.2 MEASUREMENT

The quantities of special appurtenances to be measured for payment must be the specified unit for the special appurtenance actually furnished, delivered and installed, complete, as shown, specified or required.

60.28.3 PRICE TO COVER

The contract price for "FURNISHING, DELIVERING AND INSTALLING SPECIAL APPURTENANCES" must be the unit price bid as specified and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to furnish, deliver and install special appurtenances as shown or specified, including all required earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); pumping; bridging; hardware, cleaning; welding; jointing; lining; coating; connections; backfilling; fabrication; inspection and testing; preparation, submittal and approval of all required shop drawings and designs; obtaining all necessary permits; furnish and install all other items necessary to complete the work; and do all other work necessary and incidental thereto in order to complete the work all in accordance with the plans and specifications and as directed by the Engineer.

Payment for the "FURNISHING, DELIVERING AND INSTALLING SPECIAL APPURTENANCES" must be made under the applicable bid item(s) of the Bid Schedule, and in accordance with **Subsection 60.20.2** and as specified herein.

Payment for Furnishing, Delivering And Installing Special Appurtenances will be made under the Item Number as calculated below:

The Item Numbers for Furnishing, Delivering And Installing Special Appurtenances have variable number of characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing, Delivering And Installing Special Appurtenances:

60.28

(2) All additional characters must define each Specific Special Appurtenance's Specifications:

xxxxx - Specific Special Appurtenance's Specifications

(3) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
60.28SRP48A	FURNISHING, DELIVERING AND INSTALLING 48-INCH STRAIGHT STEEL RISER PIPE, 3/4-INCH WALL THICKNESS, WITH STIFFENING RINGS AND TWO FLANGED ENDS	V.F.
60.28SFB48A	FURNISHING, DELIVERING AND INSTALLING 48-INCH STEEL FLANGED 90-DEGREE BENDS WITH STIFFENING RINGS, 3/4-INCH WALL THICKNESS, CONNECTING THE 48-INCH DUCTILE IRON PIPE WITH 48-INCH STEEL RISERS	EACH
60.28CSA48A	FURNISHING, DELIVERING AND INSTALLING 48-INCH CONCRETE TO STEEL ADAPTER	EACH
60.28SC48X48A	FURNISHING, DELIVERING AND INSTALLING 48-INCH X 48-INCH INNER DIAMETER SHAFT CAP, 7/8-INCH THICKNESS, WITH FLANGES AND 2-INCH CORPORATION STOP	EACH
60.28WT36ERC48	FURNISHING, DELIVERING AND INSTALLING 36-INCH WET TAP ON EXISTING 48-INCH REINFORCED CONCRETE STEEL CYLINDER WATER MAIN INCLUDING 36-INCH TAPPING VALVE, COMPLETE	L.S.
60.28WT20ERC48	FURNISHING, DELIVERING AND INSTALLING 20-INCH WET TAP ON EXISTING 48-INCH REINFORCED CONCRETE STEEL CYLINDER WATER MAIN INCLUDING 20-INCH TAPPING VALVE, COMPLETE	L.S.

Item No.	Description	Pay Unit
60.28WCS20ES60	FURNISHING, DELIVERING AND INSTALLING 20-INCH WET CONNECTION SLEEVE ON EXISTING 60-INCH STEEL WATER MAIN	EACH
60.28WCS20EC48	FURNISHING, DELIVERING AND INSTALLING 20-INCH WET CONNECTION SLEEVE ON EXISTING 48-INCH CONCRETE WATER MAIN	EACH
60.28xxxxx	(As Specified In Bid Schedule)	(Varies)

SECTION 60.29 – FURNISHING, INSTALLING, AND TESTING CORROSION CONTROL AND/OR CATHODIC PROTECTION SYSTEM

60.29.1 DESCRIPTION

Furnishing, Installing And Testing Corrosion Control And/Or Cathodic Protection System must be done in accordance with **Section 60.20**, and as shown, specified or ordered.

60.29.2 MEASUREMENT

The quantity of corrosion control and/or cathodic protection system to be measured for payment must be lump sum price for each corrosion control and/or cathodic protection system actually furnished, installed and tested, complete, as shown, specified or required.

60.29.3 PRICE TO COVER

The contract price for Item No. 60.29CP - FURNISHING, INSTALLING AND TESTING CORROSION CONTROL AND/OR CATHODIC PROTECTION SYSTEM must be the unit price bid per lump sum for each and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to furnish, install and test corrosion control and/or cathodic protection system as shown or specified, including fabrication; inspection and testing; preparation, submittal and approval of all required shop drawings and designs; reports; obtaining all necessary permits; and do all other work necessary and incidental thereto in order to complete this work all in accordance with the plans and specifications and as directed by the Engineer.

Payment for Item No. 60.29CP - FURNISHING, INSTALLING AND TESTING CORROSION CONTROL AND/OR CATHODIC PROTECTION SYSTEM must be made under the applicable bid item of the Bid Schedule, and in accordance with **Subsection 60.20.2** and as specified herein.

Payment for Furnishing, Installing And Testing Corrosion Control And/Or Cathodic Protection System will be made under the Item Number as calculated below:

The Item Number for Furnishing, Installing And Testing Corrosion Control And/Or Cathodic Protection System has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing, Installing And Testing Corrosion Control And/Or Cathodic Protection System:

60.29

(2) The sixth and seventh characters must define Furnishing, Installing And Testing Corrosion Control And/Or Cathodic Protection System:

CP - Furnishing, Installing And Testing Corrosion Control And/Or Cathodic Protection System Mechanical Joint

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
60.29CP	FURNISHING, INSTALLING AND TESTING CORROSION CONTROL AND/OR CATHODIC PROTECTION SYSTEM	L.S.

SECTION 60.31 – WATER MAINS IN JACKED STEEL SLEEVES

60.31.1 INTENT

This section describes construction of ductile iron water main or steel water main carrier pipe in jacked steel sleeves.

60.31.2 DESCRIPTION

(A) GENERAL

(1) The sleeves and water main carrier pipes must be constructed to the sizes, kinds, classes, and wall thicknesses of pipe specified and in accordance with the details shown on the contract drawings. The construction of the water mains herein must be by means of the jacking of a steel sleeve with the use of microtunneling techniques and the insertion of a carrier pipe.

Microtunneling is defined as the trenchless installation of the pipe by jacking the pipe behind a remotely controlled tunnel boring machine. The Microtunnel Boring Machine (MTBM) must be capable of adequately and safely counter-balancing prevailing hydrostatic conditions and must be a slurry shield tunnel boring machine or an earth pressure-balanced shield tunnel boring machine or an approved equal.

(2) The Contractor will be permitted to submit for written approval by the Engineer an alternate method of jacking of a steel sleeve other than by microtunneling techniques specified in **Subsection 60.31.2(A)(1)**. Such alternate method must comply with all applicable specifications of this **Section 60.31**, the determination as to which specifications are applicable must be the sole authority of the Engineer. If the alternate pipe jacking tunneling method is not capable of tunneling through rock and boulders of all sizes, and requires the manual excavation, removal, and disposal of rock and boulders at the tunnel face, then no separate or additional payment will be made for this manual rock and boulder excavation, removal, and disposal. If the alternate pipe jacking tunneling method is not capable of performing in saturated ground, and requires the installation of a dewatering system so as to work in “the dry”, then no separate or additional payment will be made for this dewatering system installation, operation, and removal. The cost for all labor, materials, plant, equipment, and insurance required and necessary to excavate, remove, and dispose of all rock and boulders within the tunnel section, and to install, operate, and remove the dewatering system must be deemed included in the prices bid per linear foot for the respective “WATER MAIN IN JACKED STEEL SLEEVE” items.

(3) It must be the Contractor’s responsibility to choose the shaft excavation and support methods, and the type of tunnel boring machine and its equipment and accessories to be used to complete the tunnel bore.

The Contractor must replace any equipment deemed necessary in order to complete the tunnel bore. This includes the rock or soil cutter head and any other required equipment. No additional or separate payment will be made for any equipment replacement that is required to complete the tunnel bore, with the exception of that allowed under **Section 70.53 - Allowance For Boulder Removal**.

(B) GEOTECHNICAL CONDITIONS

Geotechnical data provided by the City is for information purposes only. The Contractor must perform the Contractor’s own geotechnical investigations to ensure that the type of tunnel boring machine (together with equipment and accessories) the Contractor chooses to use is capable of completing the tunnel bore and remove all materials (i.e. soil, boulders, rock, etc.) encountered.

The Contractor must thoroughly investigate the geotechnical conditions of the strata through which the tunnel boring is to be accomplished. After performing this thorough investigation the Contractor must prepare a construction report in accordance with **Section 76.11 - Construction Report** for the approval of the Engineer. (See **Subsection 60.31.3 - Submittals, paragraph (1)**).

60.31.3 SUBMITTALS

The Contractor must submit the following:

(1) Before commencing any operations associated with the construction of water mains in jacked steel sleeves, the Contractor must submit the construction report specified above. In addition to the requirements specified in **Section 76.11**, the construction report must contain all investigative geotechnical information and determinations as to tunnel boring feasibility, and all means and methods

of construction that will be required to complete the tunnel bore. The Construction Report must also state the Contractor's assumptions regarding the subsurface conditions to be encountered during shaft and microtunnel construction.

(2) Details of tunneling machine the Contractor chooses to use together with required equipment and accessories. Include the following:

(a) Machine specifications (including but not limited to equipment, accessories, means, and methods of spoil removal) together with a letter from the microtunneling machine manufacturer demonstrating that the selected machine together with equipment, accessories, and means and methods of spoil removal is capable of progressing through the anticipated subsurface conditions, and capable of removing spoils effectively.

(b) For Slurry Shield System: Details of MTBM slurry system and soil separation methods including proposed slurry formulations and calculations of the system capacity to handle flows at all proposed distances and changes of elevations to and from the MTBM.

(c) For Earth Pressure-Balance System: Details of MTBM conveyance system and material transport methods including calculations of the system capacity to handle removal or flows at all proposed distances and changes of elevations to and from the MTBM.

(d) Jacking system details (jacks and jacking frames), method of operation, thrust capacity, and sleeve details. Describe method of control to prevent the maximum allowable jacking force from being exceeded.

(e) Description of lubrication mix equipment and procedure for lubricating the pipe during jacking operations, including estimated volume for the anticipated soils.

(f) Active Direction Control details and means of controlling line and grade.

(3) Before commencing any operations associated with the construction of water mains in jacked steel sleeves, the Contractor must submit a detailed description of the proposed method of installation including locations and dimensions of launching/receiving shafts (including intermediate launching shafts), insertion procedures, and all shop drawings required for review and approval by the Engineer. These submittals must include procedural details to allow the Engineer to evaluate the procedure to be used. All pertinent dimensions, material properties, and design calculations must be shown.

(4) Theoretical jacking force calculations and pipe material calculations must be prepared and submitted. It is the sole responsibility of the Contractor to determine the maximum anticipated construction loads, including maximum jacking forces, Factor of Safety, and to ensure that the anticipated loads are implemented in the manufacturer's design of the pipe. These calculations must be submitted to the Engineer for review and approval, and must bear the signature and seal of a Licensed Professional Engineer, currently registered in the State of New York.

(5) Prepare and submit a proposed contingency plan for potential situations that may occur during tunneling operations. This submittal must at a minimum address the following scenarios:

(a) The MTBM hits an obstruction.

(b) Cuttings do not settle/separate with the equipment on site.

(c) The target laser is distorted by heat and/or humidity or has been knocked out of alignment. Describe which operational parameters will be observed/measured/recorded so that it can be determined if the above are occurring or have just occurred.

(d) The jacking pressures start to increase rapidly and there is reasonable concern for completing jacking operations to the receiving shaft.

(e) The MTBM "freezes" during jacking operations.

(6) Unless otherwise provided for in the contract documents, a proposed plan showing locations of required geotechnical instrumentation and any other Contractor proposed instrumentation. Include product information indicating the instrumentation sizes, material types, specifications, installation procedures, locations, and other pertinent data. The instrumentation installation specialist performing the installation of the geotechnical instrumentation must have adequate experience; proof of this experience must be included with this plan.

(7) Shaft Excavation and Support submittal, bearing the signature and seal of a Licensed Professional Engineer, currently registered in the State of New York, must include:

(a) Detailed narrative outlining the construction sequence.

(b) Engineering calculations, assumptions, and methodologies for the design of the shaft excavation support system. The Contractor must design excavation support systems and working slabs to withstand earth and hydrostatic pressures, bottom heave, equipment loads, applicable traffic and construction loads, and other surcharge loads to allow the safe construction of the tunnel and associated structures without excessive movement or settlement of the ground, and to prevent damage to adjacent structures, streets, and utilities. Use lateral earth pressures consistent with ground conditions, soil properties (type, composition, compaction, moisture content, etc.), water table, etc., described in the contract documents and in accordance with NYC, AISC, and ACI code provisions, as applicable. Each component of the shaft excavation and support system must be designed to safely support the maximum combination of loads and other conditions that may occur during construction. These submittals must consider all beginning, intermediate, and final construction stages of shaft installation. The Contractor must also submit the Contractor's groundwater control system.

(c) Break-out and Break-in plans indicating type of support installed to transfer loads and maintain excavation support, groundwater control, and stability of the excavation when a MTBM exits or enters a shaft. Contractor must utilize shaft launch and exit seals to prevent inflow of groundwater, slurry, lubrication, and soil. Seals must be sized to accommodate microtunneling boring machine and jacking pipe, and must not impair the performance of the shaft excavation support system. Groundwater inflows at each seal must be less than five (5) gallons per minute, and total soil inflows at each seal must be less than two (2) cubic feet for the entire duration of the jacking operation. Seal design/installation must incorporate localized ground improvement as necessary to meet these criteria.

(d) Microtunneling machine thrust block design and details for the launching shaft. The thrust block must be perpendicular to the proposed pipe alignment. The thrust block must be designed to support the maximum jacking pressure developed by the main jacking system.

Note that review of the Contractor's Shaft Excavation and Support submittal by the Engineer does not relieve the Contractor and its design consultants of their responsibility to provide and maintain an adequate support system achieving the specified requirements.

(8) Excess Materials Disposal Plan: Excess materials disposal plan must include treatment (as applicable), transportation methods and routes, disposal location details for excess excavated materials (soil, rock, etc.), and disposal methods for groundwater generated during construction of tunnel and shafts. Included in this plan must be estimated quantities for disposal of all excess excavated materials and groundwater.

(9) Proposed insertion plan for grout fill of annular space between the water main carrier pipe and steel sleeve. Grouting fill of annular space plan must include details of grout fill materials (including source), installation procedures, equipment utilized, grout fill quality control measures, and means of protecting new water main facilities during grout fill placement. Such method must be capable of filling all voids between the steel sleeve and the carrier pipe for the entire length, and must not be capable of damaging the water main carrier pipe and it's jointing, nor capable of damaging or misaligning the brace and support spacers installed to align and insulate the water main carrier pipe, nor cause any leakage of grout to the outside soil area of the steel sleeve.

(10) Shop drawings must be submitted in accordance with all applicable provisions of **Subsection 40.05.5 - Shop Drawings**, as required. Design criteria must be submitted in accordance with all applicable requirements of **Subsection 40.05.6 - Design Criteria**, as required.

(11) The Contractor must allow a minimum of four (4) weeks for review.

(12) All the above must be submitted as a complete package. All designs must bear the signature and seal of a Licensed Professional Engineer, currently registered in the State of New York

(13) Work associated with the construction of water mains in jacked steel sleeves must not commence until the Contractor receives all required approved shop drawing from the Department of Design and Construction, Division of Infrastructure.

(14) Upon the completion of microtunneling/pipe-jacking activities the Contractor will be required to submit a report that will include copies of all Daily Logs along with a description of any unusual events or problems encountered during microtunneling/pipe-jacking operation. In addition, all numerical data must be entered into Excel Format. A copy of the Excel file must be submitted along with this report.

60.31.4 MATERIALS

(A) Steel carrier pipe and steel fittings must comply with the requirements of **New York City Department of Environmental Protection (NYC DEP) Specifications For Trunk Main Work. (This publication includes Special Provisions For Trunk Main Work; and, Specification For Furnishing, Delivering And Laying Steel Pipe And Appurtenances.)**

(B) Ductile iron carrier pipe must comply with the requirements of **Section 20.01 - Specifications For Ductile Iron Pipe And Accessories** . Ductile iron fittings must comply with the requirements of **Section 20.02 - Specifications For Ductile Iron Fittings And Accessories (Section 2.02)**.

(C) Joints for ductile iron pipe must be restrained joint, and must be TR-FLEX, as manufactured by U.S. Pipe Company, or approved equal. The joints must be pressure rated for 150-psi.

(D) Steel Sleeves must have an outer diameter (O.D.) as shown or specified and must have a minimum sleeve thickness as specified in table below. The steel must conform to ASTM A1097 (plates: ASTM A283, Grade C) and API (American Petroleum Institute) std. 5L, Grade B for electric-fusion (Arc)-weld and yield strength respectively. The jacked steel sleeve must be designed to withstand jacking thrust as well as external loads (including but not limited to skin friction, friction due to weight of pipe, face pressure due to strata type, and face pressure required to counteract slurry pressure). A factor of safety of 2.5 must be used for jacking thrusts. Hydrostatic tests will not be required for steel sleeves.

TABLE 60.31.4

MINIMUM SLEEVE O.D.	MINIMUM SLEEVE THICKNESS
30”	0.532”
36”	0.563”
42”	0.594”
48”	0.625”
54”	0.688”
60”	0.750”
66”	0.875”
72”	1.000”

All connections between successive steel sleeve pipe lengths must be continuously butt welded. Welds must be made in conformance with AWS D1.1. However, mechanical Permalok joint connections will be permitted in lieu of butt welded joints between successive steel casing pipe providing this joint can be shown to be capable of withstanding the installation loads.

(E) Grout utilized to fill the voids between the steel sleeve and the water main carrier pipe must be Low Weight Cement Grout as described below:

Low Weight Cement Grout:

(a) Grout must consist of neat Portland cement, water, Mearlcrete Foam Liquid concentrate, and other materials as manufactured and recommended by the Aerix Industries or approved equal.

(b) Portland cement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**, and must be Type II.

(c) Mixing water must be a maximum of six (6) gallons per bag of cement (water/cement ratio is 0.53), and be potable, free from deleterious amounts of acid, alkali, salts, oils, and organic materials.

(d) Wet Density must be 95-lb/ft^3 maximum.
Dry Density must be 90-lb/ft^3 maximum.
Minimum 7-Day Compressive Strength must be 300-psi.
Minimum 28-Day Compressive Strength must be 1,000-psi.

(F) Grout utilized to fill the voids between the outside of the jacked sleeve and the soil/rock must be Pressure Grout as described below:

Pressure Grout:

(a) Pressure grout must consist of neat Portland cement or it must be mixed in a proportion by volume of one (1) part Portland cement and one (1) part sand or it must be mixed by volume of one (1) part Portland cement to one and one-half (1-1/2) parts lime flour and one-fiftieth (1/50) part Interplast IV.

(b) All parts must be mixed with clean fresh water to the desired consistency. In no case must more than eight (8) gallons of water be mixed per bag of cement.

60.31.5 METHODS

(A) GENERAL

The Contractor must install launching and receiving shafts at the locations and in accordance with the requirements shown, specified, ordered, or approved. Excavation support system for each shaft must be as shown, specified, ordered, or approved. Shafts must be properly constructed and braced to withstand both external loads (soil, water, etc.) and internal jacking loads. The Contractor must furnish, install, and remove to the extent required; thrust blocks or whatever provisions may be required in driving the sleeve forward. A jacking frame with integrated pipe guides or steel rails or beams embedded in concrete must be used in the launching shaft for placement and alignment of each piece of sleeve during installation procedures. Special care must be taken when setting the pipe guide rails to ensure correctness of the alignment, grade, and stability. Jacking operations must not commence until the concrete thrust block has attained the required strength.

The steel sleeve must be jacked into position by the use of jacks of sufficient capacity to push the pipe and microtunneling machine through the existing strata (soil and/or rock). Intermediate launching shafts must be provided as required. Upon completion of each jacked section (launching shaft to receiving shaft), the Contractor must immediately pressure grout from the interior of the steel sleeve in conformance with **Subsection 60.31.10**.

The Contractor must follow the recommendations of the pipe manufacturer regarding the installation of the water main carrier pipe. The recommended installation method used by the Contractor must be such that no damage will occur to the carrier pipe when it is inserted.

The Contractor must install the water main carrier pipe approximately in the center of the steel sleeve. Water main carrier pipe must be properly braced and supported with spacers that are electrically insulated from the steel sleeve. The brace and support spacers must be installed and positioned in accordance with the manufacturer's recommendations and must not inhibit the flow of grout. The Contractor must submit design and method of bracing (including but not limited to type and location of spacers, and floatation design concerns) prior to installation of carrier pipe for approval by the Engineer. Proper precautions must be taken by the Contractor to prevent floatation or motion of the carrier pipe during the grouting operation.

The excavated shafts must be dewatered wherever required due to groundwater conditions. Dewatering activities must not impair the performance of the microtunneling equipment or process. The Contractor must lower and maintain the groundwater level below the invert of the steel sleeve at all times during construction by dewatering means to prevent inflow of water or water and soil into the shafts. The Contractor must meet all applicable requirements for groundwater treatment and disposal.

(B) CONTROL OF LINE AND GRADE

(1) Lines and grades must conform to the requirements of **Subsection 10.09** and as amended herein. The Contractor must establish the baselines and benchmarks in accordance with this contract.

(2) The Contractor must submit to the Engineer copies of field notes used to establish all lines and grades. However, the Contractor remains fully responsible for the accuracy of the Contractor's work. All survey work must be performed under the direction of a New York State Licensed Surveyor and all submissions must be sealed and signed by the Licensed Surveyor.

(3) If there is any movement during construction, it must be the Contractor's responsibility to detect and correct it as required. When the excavation is off-line or grade, the Contractor must return

to the design line and/or grade over the remaining portion of the drive at a rate of no more than one (1) inch per twenty-five (25) feet.

(4) The microtunnel excavation and run of jacked pipe must be controlled in such a manner that the deviation from grade is not more than one (1) inch nor from line more than three (3) inches. The Contractor must make note of all possible encumbrances and structures in the line of work, which may restrict clearances.

(5) Record the exact position of the microtunnel boring machine a minimum of once per shift to ensure the alignment is within the specified tolerances. Make the survey at the microtunnel boring machine to allow immediate correction of misalignment before allowable tolerances are exceeded. The tunnel guidance system may be used; however, select times to measure and record this information after the air temperatures have stabilized throughout the pipe to ensure accurate readings.

(C) EQUIPMENT

(1) The microtunnel boring machine must be capable of controlling the volume of excavated material removed from the excavation face at all times. In addition, the microtunnel boring machine must:

(a) Be capable of maintaining the excavation face under wet, dry, and adverse soil conditions and prevent loss of ground through the machine. The MTBM must provide satisfactory support of the excavation face at all times.

(b) Be articulated to allow steering.

(c) Incorporate a suitable seal between the microtunnel boring machine and the leading pipe.

(d) Provide protection to the electric and hydraulic motors and operating controls against water damage.

(e) Use bi-directional drive on the cutter-head wheel, and/or adjustable fins or other means, to control roll.

(f) Be capable of exerting a controllable pressure against the face, during both excavation and shutdown periods, to support the excavation face, prevent groundwater inflows, prevent running and flowing soils, and prevent loss of ground.

(g) Be capable of controlling the volume of excavated material removed at the excavation face and coordinating the machine advance rate to avoid over excavation.

(i) For Slurry Shield System: Include an automated spoil transportation slurry system that balances the groundwater and face pressures by the use of a slurry pressure balance system. System must be capable of adjustment required to maintain stability of the excavation face for the subsurface conditions to be encountered and must monitor and continuously balance the groundwater and face pressure to prevent loss of slurry or uncontrolled groundwater inflow.

(ii) For Earth Pressure-Balance System: Include an automated spoil transportation system that balances the groundwater and face pressures by the use of an earth pressure-balance system that controls the rate of passage of excavated material through the balanced screw auger or valves on the screw conveyer. System must be capable of adjustment required to maintain stability of the excavation face for the subsurface conditions to be encountered and must monitor and continuously balance the groundwater and face pressure to prevent uncontrolled groundwater inflow.

(h) Be fully steerable both horizontally and vertically.

(i) Be capable of injecting lubricant between sleeve and strata to reduce friction between sleeve and strata.

(2) Guidance of the microtunnel boring machine must be through a remote console by means of active direction control, in or adjacent to the launching shaft. At a minimum, the thrust force, rate of advance, distance along heading, deviation from line, and deviation from grade must be monitored and displayed on the remote console.

(D) SAFETY

The Contractor must carry out the Contractor's operations in strict accordance with OSHA, NYC, and the Manufacturer's safety requirements.

The Contractor must provide adequate ventilation in the shafts at all times. Air quality in the shafts must be tested immediately prior to each change in shift. Air quality in the jacked pipe must be tested prior to personnel entry and periodically thereafter as required by law.

The Contractor must provide adequate lighting in the tunnel shafts and around equipment being utilized. Power and lighting circuits must be separated and thoroughly insulated.

(E) CLEANLINESS AND DISINFECTING PIPE

The inside of the carrier pipe must be thoroughly cleaned before installation and kept clean during installation. Pipe ends must be capped or plugged as necessary to maintain cleanliness throughout installation.

After the water main has been installed, complete, but prior to being put into service, the water main must be thoroughly disinfected in accordance with the requirements of the specifications.

(F) GEOTECHNICAL INSTRUMENTATION

The Contractor must install and monitor geotechnical instrumentation at the locations and in accordance with the requirements shown, specified, ordered, or approved.

60.31.6 QUALIFICATIONS

The microtunneling/pipe-jacking Contractor or subcontractor performing the work required under this contract must be experienced in work of this nature and must have successfully completed a minimum of two (2) tunneling projects in the last five (5) years using pressurized face microtunneling/pipe-jacking equipment with a closed face tunnel shield and positive controlled face pressure. One of the successfully completed projects must have been in similar ground conditions (strata type and hydrostatic head), as to those anticipated on this contract. The Contractor must submit a description of such projects, which must include at a minimum, a listing of the locations, dates of projects, owners, pipe types and sizes, type of equipment utilized, ground conditions, drive lengths, maximum line and grade deviations, and other information relevant to the issue of the successful completion of such projects.

The microtunneling/pipe-jacking project superintendent must have adequate experience in managing microtunneling/pipe-jacking projects similar to this contract.

The microtunneling/pipe-jacking machine operator(s) must have adequate experience in using the same type of equipment required for this project, namely, pressurized face microtunneling/pipe-jacking equipment with a closed face tunnel shield and positive, controllable tunnel face pressure.

Prior to the start of work, the Contractor will be required to submit the name and resume of the microtunneling/pipe-jacking subcontractor for approval.

60.31.7 REPORTING REQUIREMENTS

The Contractor must maintain a Daily Log of all microtunneling/pipe-jacking activities. A copy of this log must be submitted to the Engineer on a daily basis. The log, at a minimum, must record the following in relationship to the advancement rate: (Advancement rate utilized for recording must be in one (1) foot intervals, unless otherwise directed by the Engineer.)

(1) Date and Time compared to the advancement rate.
(2) Total Jacking Pressures compared to the advancement rate, including all peak pressures.
(3) Cutter Head Torque compared to the advancement rate.
(4) Position of the Tunnel Boring Machine with respect to the design line and grade.
(5) Amounts, times, and locations of lubrication.
(6) Unusual events or problems encountered.
(7) Upon completion of a bore (launching shaft to receiving shaft), the locations, pressures, and amounts of grout placed to fill all voids between the outside of the jacked sleeve and the soil/rock.

60.31.8 CLEANING

Prior to the insertion of the carrier pipe, the Contractor will be required to remove and properly dispose of all sediments and deposits from within the steel sleeve.

The Contractor must furnish all water and pumping equipment necessary for the cleaning operation. The sleeve must be clean and entirely free from projections that might interfere with the insertion of the carrier pipe through it.

60.31.9 INSPECTION AND TESTING

Immediately after the completion of the cleaning operation, the Engineer will conduct (unless waived in writing by the Engineer) a visual inspection of the steel sleeve for any defect or leakage so those repairs, if necessary, can be made. No carrier pipe must be installed until authorized by the Engineer.

The Contractor must provide the Engineer, without charge, all facilities and assistance necessary to perform this visual inspection of the steel sleeve, and for obtaining any information the Engineer requires in order to access the progress and manner of the work performed.

The entire installation procedure must be rigorously inspected as herein specified, but inspection must not relieve the Contractor of responsibility to furnish material and perform work in accordance with the specifications. If at any time it is found that the pipe insertion procedure is not in accordance with these specifications, the pipe so installed will be subject to rejection.

After the water main carrier pipe has been inserted into the steel sleeve and prior to grouting between the steel sleeve and the carrier pipe, the Contractor must perform the following tests:

(i) For Ductile Iron Water Main Carrier Pipe - Combined pressure and leakage test in accordance with the requirements of these specifications, and as directed by the Engineer.

(ii) For Steel Water Main Carrier Pipe - Hydrostatic pressure test in accordance with the requirements of **New York City Department of Environmental Protection (NYC DEP) Specifications For Trunk Main Work**, and as directed by the Engineer.

If a section fails to pass the test specified above, the Contractor must locate, uncover, and repair or replace the defective pipe, pipe fitting, or joint to the satisfaction of the Engineer, all at the Contractor's own expense.

60.31.10 GROUTING

(A) GROUT FILL OUTSIDE JACKED SLEEVE

Upon completion of a jacked section (launching shaft to receiving shaft), the Contractor must immediately pressure grout from the interior of the steel sleeve. Pressure grout must be placed under pressure to fill all annular voids between the outside of the jacked sleeve and the soil/rock.

Systems of standard pipe, fittings, hose and special grouting outlets embedded in the sleeve must be provided by the Contractor. Care must be taken to ensure that parts of the system are maintained free from dirt. Cement grout must be forced under pressure into the grouting connections. Grouting must start at the lowest connections and must proceed until grout begins to flow from upper connections. Connections must then be made to those holes and the operation continued to completion. During the grouting process, each grout plug must be removed and the grout-mixing machine must be connected to the hole by means of a hose and nipple cut to the same thread as the screw plug.

The sleeve must have grout holes equipped with pipe half couplings. Three (3) grout holes spaced one hundred twenty (120) degrees on center must be installed on each section of pipe. The two (2) inch standard pipe half couplings welded into the holes in the sleeve must be provided with threaded cast iron plugs. Plugs must be no less than five-eighths (5/8) inch in diameter.

Apparatus for mixing and placing grout must be capable of mixing effectively and stirring the grout and then forcing it into the grout connections in a continuous uninterrupted flow. When grouting is completed the grout plugs in each section must be screwed into the grout holes for their full length and tightened to provide a watertight seal.

The Contractor must take all necessary precautions to prevent grout from escaping and setting on inner surface of steel sleeve. The Contractor must remove such grout and restore the surface to its original condition.

The Contractor must provide the Engineer all facilities necessary for the inspection of pressure grouting operation to ensure complete filling of the annular void. These facilities must include removing of grout plugs as required for inspection behind the steel sleeve. Any voids found must be grouted at once as directed by the Engineer.

The Contractor must keep and furnish to the Engineer an accurate log of grouting operations, pressures, rates of pumping, amount of cement for each change in water/cement ratio, and such other data as are required by the Engineer. The log must be supplied by the Contractor to the Engineer or the Engineer's representative after each shift.

After completion of pressure grouting, the water main carrier pipe must be installed in the center of the steel sleeve.

(B) GROUT FILL AROUND CARRIER PIPE

After the carrier pipe is satisfactorily installed and passes inspection and testing, the carrier pipe must be secured to the steel sleeve at each end with a 12-inch thick concrete plug. Unless otherwise shown on the contract drawings, the Contractor must submit along with the required submittal in **Subsection 60.31.3** the design of these concrete plugs. The design of these concrete plugs must incorporate a method for securing the concrete plugs to the ends of the steel sleeve and carrier pipe so as to be capable of withstanding the grouting pressures without slippage or blow-out at the ends. The concrete plugs design must include an air relief port located at the highest (top) point of the plug.

After approval by the Engineer, the entire annular space between the inside of the steel sleeve and the outside of the water main carrier pipe must be filled with Low Weight Cement Grout in one continuous uninterrupted operation in a manner to prevent occurrence of any voids between the steel sleeve and the carrier pipe.

The grout fill must be placed by pneumatic or pumping equipment under a pressure between 10-psi and 15-psi to ensure that the entire void space has been evenly and completely filled. The pressure must be continuously monitored and care must be taken to avoid pressures above 15-psi. Equipment and methods of placement of the grout fill will be subject to review by the Engineer.

The volume of the grout being placed must be monitored and recorded. A comparison between the theoretical volume and the actual volume of grout placed must be done and any discrepancies must be brought to the attention of the Engineer.

The Contractor must also fill the holes used to place the grout.

60.31.11 MEASUREMENT

The quantity of water main in jacked steel sleeve to be measured for payment must be the number of linear feet of each size, kind, class, and wall thickness of water main carrier pipe together with jacked steel sleeve incorporated in the work, complete, as shown, specified or required, measured horizontally along the center line of water main. Measurement must be from inside face of launching shaft to inside face of receiving shaft.

60.31.12 PRICE TO COVER

The contract price for "WATER MAINS IN JACKED STEEL SLEEVES" must be the unit price bid per linear foot for each size, kind, class, and wall thickness of water main carrier pipe together with jacked steel sleeve and must cover the cost of all labor, materials, plant, equipment, samples, tests, and insurance required and necessary to construct the water mains in jacked steel sleeves to the sizes and to the lines and grades shown, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**), additional subsurface investigations, geotechnical instrumentation, all sheeting and bracing, pumping, bridging, connections, backfilling, launching and receiving shafts (including intermediate launching shafts), complete (including temporary excavation supports, groundwater control, thrust block, jacking frame, launch and exit seals, etc.), installation of steel sleeves, grouting required to fill voids between the outside of the jacked steel sleeve and the soil/rock, cleaning of carrier pipe and steel sleeves, installation of water main carrier pipe in steel sleeves, inspection and testing, grouting required to fill the voids between the inside of steel sleeves and the outside of water main carrier pipe, disinfection of water main pipe, preparation, submittal and approval of all required shop drawings and designs, obtaining of all necessary permits, and furnishing and installing all other items necessary to complete this work and do all work incidental thereto, all in accordance with the contract drawings, specifications, and standards, and as directed by the Engineer.

In addition, included in the price hereunder must be the cost of all labor and materials necessary to remove all specified and ordered structures and appurtenances that may be in the launching and receiving shafts and in the line of the work and to do all the work incidental thereto, all in accordance with **Subsections 10.13 and 10.28** of the specifications and as directed by the Engineer.

Payment for Water Mains In Jacked Steel Sleeves will be made under the Item Number as calculated below:

The Item Numbers for Water Mains In Jacked Steel Sleeves have eleven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Water Mains In Jacked Steel Sleeves:

60.31

(2) The sixth character must define the Kind of Water Main Carrier Pipe:

D - Ductile Iron Restrained Joint Pipe
S - Steel Pipe (Welded)

(3) The seventh and eighth characters must define the Diameter of Water Main Carrier Pipe. (The seventh and eighth characters representing the unit of inches for the Diameter of the Water Main Carrier Pipe.) See examples below:

08 - 8-Inch
20 - 20-Inch
48 - 48-Inch

(4) The ninth character must define the Class of Ductile Iron Water Main Carrier Pipe; or the Wall Thickness of Steel Water Main Carrier Pipe. (Wall thickness is in 1/8-inch increments.):

3 - 3/8-Inch Wall Thickness
4 - 4/8-Inch or 1/2-Inch Wall Thickness
5 - Class 55; or 5/8-Inch Wall Thickness
6 - Class 56; or 6/8-Inch or 3/4-Inch Wall Thickness

(5) The tenth and eleventh characters must define the Diameter of the Jacked Steel Sleeve Pipe. (The tenth and eleventh characters representing the unit of inches for the Diameter of the Jacked Steel Sleeve Pipe.) See examples below:

30 - 30-Inch
66 - 66-Inch

(6) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	**Description**	**Pay Unit**
60.31D48372	48-INCH DUCTILE IRON PIPE (CLASS 55) WATER MAIN IN JACKED 72-INCH STEEL SLEEVE	L.F.
60.31D20536	20-INCH DUCTILE IRON PIPE (CLASS 55) WATER MAIN IN JACKED 36-INCH STEEL SLEEVE	L.F.
60.31D12630	12-INCH DUCTILE IRON PIPE (CLASS 56) WATER MAIN IN JACKED 30-INCH STEEL SLEEVE	L.F.
60.31S48472	48-INCH STEEL PIPE (1/2-INCH WALL THICKNESS) WATER MAIN IN JACKED 72-INCH STEEL SLEEVE	L.F.

SECTION 61.11 – FURNISHING AND DELIVERING GATE VALVES

61.11.1 DESCRIPTION

This specification describes furnishing and delivering of double disc 3-inch to 20-inch gate valves, resilient seated 3-inch to 20-inch gate valves, and resilient seated 3-inch to 12-inch tapping valves.

Unless otherwise specified in the contract documents or ordered in writing by the Engineer, only resilient seated gate valves and tapping valves must be furnished and delivered by the Contractor on the contract.

61.11.2 MATERIALS

Double disc 3-inch to 20-inch gate valves must be in compliance with **Section 20.06 - DOUBLE DISC GATE VALVES** for double disc 3-inch to 20-inch gate valves with various end connections for water supply system.

Resilient-seated 3-inch to 20-inch gate valves and resilient seated 3-inch to 12-inch tapping valves must be in compliance with **Section 20.05 - Standard Specifications For Resilient-Seated 3-Inch Through 20-Inch Gate Valves With Various End Connections And 3-Inch Through 12-Inch Tapping Valves**.

61.11.3 CONSTRUCTION METHODS

All submittals, testing, and packaging must be in compliance with **Section 20.05 - Standard Specifications For Resilient-Seated 3-Inch Through 20-Inch Gate Valves With Various End Connections And 3-Inch Through 12-Inch Tapping Valves and Section 20.06 - Standard Specifications For Double Disc 3-Inch To 20-Inch Gate Valves With Various End Connections For Water Supply System**.

61.11.4 MEASUREMENT

The quantity of gate valves measured for payment must be the number of gate valves of each size and kind actually furnished and delivered by the Contractor as ordered and approved by the Engineer.

For valve sizes smaller than 16", the unit price used for payment of work done on valves of a size not covered by the Bid Schedule will be obtained by taking the unit price of the nearest larger size contained in the Bid Schedule.

61.11.5 PRICE TO COVER

The contract price for "FURNISHING AND DELIVERING GATE (OR TAPPING) VALVES COMPLETE WITH WEDGE TYPE RETAINER GLANDS" must be the unit price bid per each size and kind of gate valve furnished and delivered and must cover the cost of all labor, equipment, materials, plant, samples, tests, and insurance required and necessary to furnish and deliver gate valves in the manner specified herein. No separate or additional payment will be made for any costs associated with the work of furnishing and delivering gate valves.

Payment for Furnishing And Delivering Gate Valves Complete With Wedge Type Retainer Glands will be made under the Item Number as calculated below:

The Item Numbers for Furnishing And Delivering Gate Valves Complete With Wedge Type Retainer Glands have ten characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing And Delivering Gate Valves Complete With Wedge Type Retainer Glands:

61.11

(2) The sixth character must define the Kind of Gate Valves:

D - Ductile Iron Gate Valve (Double-Disc and Resilient-Seated)
T - Tapping Valve

(3) The seventh and eighth characters must define either the Type of Joints on Ductile Iron Gate Valves or the Type of Connection on the Tapping Valves:

FM - Flanged-Mechanical Joint
MM - Mechanical Joint (Both Sides)
FF - Flanged Joint (Both Sides)
WC - Wet Connection

(4) The ninth and tenth characters must define the Size (Diameter) of the Gate Valve or Tapping Valve. (The ninth and tenth characters representing the unit of inches for the Size (Diameter) of the Gate Valve or Tapping Valve.) See examples below:

08 - 8-Inch
16 - 16-Inch

(5) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
61.11DFM20	FURNISHING AND DELIVERING 20-INCH FLANGED-MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11DFM16	FURNISHING AND DELIVERING 16-INCH FLANGED-MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11DFM14	FURNISHING AND DELIVERING 14-INCH FLANGED-MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11DFM12	FURNISHING AND DELIVERING 12-INCH FLANGED-MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11DFM10	FURNISHING AND DELIVERING 10-INCH FLANGED-MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11DFM08	FURNISHING AND DELIVERING 8-INCH FLANGED-MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11DFM06	FURNISHING AND DELIVERING 6-INCH FLANGED-MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11DFM04	FURNISHING AND DELIVERING 4-INCH FLANGED-MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11DMM20	FURNISHING AND DELIVERING 20-INCH MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11DMM16	FURNISHING AND DELIVERING 16-INCH MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11DMM14	FURNISHING AND DELIVERING 14-INCH MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11DMM12	FURNISHING AND DELIVERING 12-INCH MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11DMM10	FURNISHING AND DELIVERING 10-INCH MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11DMM08	FURNISHING AND DELIVERING 8-INCH MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11DMM06	FURNISHING AND DELIVERING 6-INCH MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11DMM04	FURNISHING AND DELIVERING 4-INCH MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11DFF20	FURNISHING AND DELIVERING 20-INCH FLANGED JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11DFF16	FURNISHING AND DELIVERING 16-INCH FLANGED JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11DFF14	FURNISHING AND DELIVERING 14-INCH FLANGED JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11DFF12	FURNISHING AND DELIVERING 12-INCH FLANGED JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH

Item No.	Description	Pay Unit
61.11DFF10	FURNISHING AND DELIVERING 10-INCH FLANGED JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11DFF08	FURNISHING AND DELIVERING 8-INCH FLANGED JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11DFF06	FURNISHING AND DELIVERING 6-INCH FLANGED JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11DFF04	FURNISHING AND DELIVERING 4-INCH FLANGED JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11TWC12	FURNISHING AND DELIVERING 12-INCH WET CONNECTION TAPPING VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11TWC10	FURNISHING AND DELIVERING 10-INCH WET CONNECTION TAPPING VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11TWC08	FURNISHING AND DELIVERING 8-INCH WET CONNECTION TAPPING VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11TWC06	FURNISHING AND DELIVERING 6-INCH WET CONNECTION TAPPING VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11TWC04	FURNISHING AND DELIVERING 4-INCH WET CONNECTION TAPPING VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.11TWC03	FURNISHING AND DELIVERING 3-INCH WET CONNECTION TAPPING VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH

SECTION 61.12 – SETTING GATE VALVES

61.12.1 DESCRIPTION

This specification describes the installation of double disc 3-inch to 20-inch gate valves, resilient seated 3-inch to 20-inch gate valves, and resilient seated 3-inch to 12-inch tapping valves. It also describes the installing of manhole frames (skirts and heads) and covers.

Unless otherwise specified in the contract documents or ordered in writing by the Engineer, only resilient seated gate valves and tapping valves must be installed by the Contractor on the contract.

61.12.2 MATERIALS

Double disc 3-inch to 20-inch gate valves must be in compliance with **Section 20.06 - Standard Specifications For Double Disc 3-Inch To 20-Inch Gate Valves With Various End Connections For Water Supply System**.

Resilient-seated 3-inch to 20-inch gate valves and resilient seated 3-inch to 12-inch tapping valves must be in compliance with **Section 20.05 - Standard Specifications For Resilient-Seated 3-Inch Through 20-Inch Gate Valves With Various End Connections And 3-Inch Through 12-Inch Tapping Valves**.

Manhole frames (skirts and heads) and covers must be in compliance with **Section 20.07 - Standard Specification For Iron Castings**.

61.12.3 CONSTRUCTION METHODS

(A) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

(B) EXCAVATION - Ample excavation must be made by the Contractor for the purpose of setting the valves and making the joints, as herein provided for laying pipes and appurtenances, and for the construction of valve manholes and chambers.

Where the excavation is in a wet trench, and so ordered by the Engineer, the Contractor must place crushed stone (three-quarter (3/4) inch to one-quarter (1/4) inch crushed stone complying with ASTM Designation C33, Size No. 67) or select granular fill under the masonry footing as shown on **Standard Drawing No. 11576-A-Z**. Payment for the crushed stone or select granular fill will be deemed to be included in the unit price bid for setting valves.

(C) VALVE BOXES - Valve boxes must be set for line valves of twenty (20) inches or less in diameter. A foundation or footing of Portland cement concrete, or concrete blocks, as shown on **Standard Drawing No. 11576-A-Z** laid on firmly compacted ground, must be built under all valve boxes. The boxes must be fitted together securely, so that the cover is flush and even with the existing surface of the street. Before the permanent paving is laid, the Contractor must, if necessary, raise or lower the box and cover so that the cover must be even with the final surface of the new paving.

61.12.4 MEASUREMENT

The quantity of gate valves measured for payment must be the number of gate valves of each size and kind actually set by the Contractor as ordered and approved by the Engineer.

For valve sizes smaller than 16”, the unit price used for payment of work done on valves of a size not covered by the Bid Schedule will be obtained by taking the unit price of the nearest larger size contained in the Bid Schedule.

61.12.5 PRICE TO COVER

(A) The contract price for “SETTING GATE (OR TAPPING) VALVES COMPLETE WITH WEDGE TYPE RETAINER GLANDS” must be the unit price bid per each size and kind of gate valve set and must cover the cost of all labor, equipment, materials, plant, samples, tests, and insurance required and necessary to set gate valves in the manner specified herein. No separate or additional payment will be made for any costs associated with the work of setting gate valves.

(B) No direct payment will be made for the removal of gate valves. Payment will be deemed included in the unit price for setting new gate valves.

(C) There will be no direct payment for furnishing and installing waterproofing for valve chambers, including waterstops. Payment will be deemed included in the prices bid for all items of work.

(D) Payment for the chamber concrete, reinforcing steel, structural steel, miscellaneous steel, manhole steps, brick masonry, and pipe-to-wall penetration seals must be made under their respective bid items.

Steel sleeves and anchor/water stop plates must be paid for under the bid item(s) for "FURNISHING, DELIVERING, AND INSTALLING PIPE-TO-WALL PENETRATION SEAL, INCLUDING STEEL SLEEVE AND ANCHOR/WATER STOP PLATE", as contained in the Bid Schedule.

(E) The cost of installing the various castings must be included in the prices bid for the various items of the contract.

(F) Payment for the furnishing, delivering and installing of 36-inch cast iron manhole heads and covers must be made under Item No. 63.11MH - FURNISHING, DELIVERING, AND INSTALLING 36-INCH CAST IRON MANHOLE HEADS AND COVERS.

Payment for Setting Gate Valves Complete With Wedge Type Retainer Glands will be made under the Item Number as calculated below:

The Item Numbers for Setting Gate Valves Complete With Wedge Type Retainer Glands have ten characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Setting Gate Valves Complete With Wedge Type Retainer Glands:

61.12

(2) The sixth character must define the Kind of Gate Valves:

D - Ductile Iron Gate Valve (Double-Disc and Resilient-Seated)
T - Tapping Valve

(3) The seventh and eighth characters must define either the Type of Joints on Ductile Iron Gate Valves or the Type of Connection on the Tapping Valves:

FM - Flanged-Mechanical Joint
MM - Mechanical Joint (Both Sides)
FF - Flanged Joint (Both Sides)
WC - Wet Connection

(4) The ninth and tenth characters must define the Size (Diameter) of the Gate Valve or Tapping Valve. (The ninth and tenth characters representing the unit of inches for the Size (Diameter) of the Gate Valve or Tapping Valve.) See examples below:

08 - 8-Inch

16 - 16-Inch

(5) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
61.12DFM20	SETTING 20-INCH FLANGED-MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12DFM16	SETTING 16-INCH FLANGED-MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12DFM14	SETTING 14-INCH FLANGED-MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12DFM12	SETTING 12-INCH FLANGED-MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12DFM10	SETTING 10-INCH FLANGED-MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12DFM08	SETTING 8-INCH FLANGED-MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12DFM06	SETTING 6-INCH FLANGED-MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12DFM04	SETTING 4-INCH FLANGED-MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH

Item No.	Description	Pay Unit
61.12DMM20	SETTING 20-INCH MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12DMM16	SETTING 16-INCH MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12DMM14	SETTING 14-INCH MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12DMM12	SETTING 12-INCH MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12DMM10	SETTING 10-INCH MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12DMM08	SETTING 8-INCH MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12DMM06	SETTING 6-INCH MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12DMM04	SETTING 4-INCH MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12DFF20	SETTING 20-INCH FLANGED JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12DFF16	SETTING 16-INCH FLANGED JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12DFF14	SETTING 14-INCH FLANGED JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12DFF12	SETTING 12-INCH FLANGED JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12DFF10	SETTING 10-INCH FLANGED JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12DFF08	SETTING 8-INCH FLANGED JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12DFF06	SETTING 6-INCH FLANGED JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12DFF04	SETTING 4-INCH FLANGED JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12TWC12	SETTING 12-INCH WET CONNECTION TAPPING VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12TWC10	SETTING 10-INCH WET CONNECTION TAPPING VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12TWC08	SETTING 8-INCH WET CONNECTION TAPPING VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12TWC06	SETTING 6-INCH WET CONNECTION TAPPING VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12TWC04	SETTING 4-INCH WET CONNECTION TAPPING VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH
61.12TWC03	SETTING 3-INCH WET CONNECTION TAPPING VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND	EACH

SECTION 61.13 THROUGH SECTION 61.20 (NO TEXT)

SECTION 61.21 – FURNISHING, DELIVERING, AND INSTALLING BUTTERFLY VALVES AND EXPANSION JOINTS

61.21.1 DESCRIPTION

This specification describes furnishing, delivering and installing of butterfly valves 24-inch to 72-inch with manual actuators (30-inch thru 72-inch with by-pass arrangement and outlets). It also describes the furnishing, delivering and installing of expansion joints (30-inch thru 72-inch) for butterfly valves including 6-inch by-pass outlets.

61.21.2 MATERIALS

Butterfly valves 24-inch to 72-inch with manual actuators must be in compliance with **Section 20.03 - Standard Specifications For Butterfly Valves 24-Inch To 72-Inch With Manual Actuators**.

61.21.3 CONSTRUCTION METHODS

(A) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

(B) All submittals, testing and packaging must be in compliance with **Section 20.03 - Standard Specifications For Butterfly Valves 24-Inch To 72-Inch With Manual Actuators**.

(C) The butterfly valves must be installed at the locations and in accordance with the general layout of piping shown on the contract drawings. Such locations and layout may, however, be varied, as required, by actual conditions during the progress of the work, in accordance with the directions of the Engineer. All butterfly valves with manual actuators together with expansion joints and by-pass arrangements must be housed in a chamber. All butterfly valves, expansion joints, by-pass arrangements, outlets and chambers must be installed and /or constructed in accordance with the latest revisions of the standard drawings and/or as shown on the contract drawing. The Contractor may be required to submit installation drawings of all butterfly valves, expansion joints, by-pass arrangements, outlets and chambers for approval.

(D) EXCAVATION - Ample excavation must be made by the Contractor for the purpose of installing the chambers together with valves, expansion joints, by-pass arrangements and outlets, as herein provided for installing butterfly valves and appurtenances, and for the construction of valve chambers.

(E) Expansion joints will be of the slip type, Dresser Style 63, Type III or Baker Expansion Joint, Type 3, Series 403 or approved equal. Slip pipe must be stainless steel.

All internal and external steel surfaces of each expansion joint, except the slip pipe, must be cleaned and sand blasted in full accordance with Steel Structures Painting Council Specifications SSPC-SP5, White Metal Blast Cleaning. Since these surfaces will be required to function satisfactorily in submerged service, the Contractor is specifically advised that Commercial or Near-White blast cleaning is NOT ACCEPTABLE .

Immediately after cleaning, such surfaces will be primed and later finished with two coats of a National Sanitation Foundation (NSF) approved material specifically formulated for potable water usage and applied in accordance with the manufacturer's instructions. After assembly, defects in coating must be rectified.

61.21.4 MEASUREMENT

(A) The quantity of butterfly valves (30-inch thru 72-inch) with manual actuators (including by-pass arrangements and outlets) measured for payment must be the number of butterfly valves (30-inch thru 72-inch) with manual actuators (including by-pass arrangements and outlets) of each size actually furnished, delivered and installed by the Contractor as shown, specified or ordered.

(B) The quantity of butterfly valves (24-inch) with manual actuators measured for payment must be the number of butterfly valves (24-inch) with manual actuators of each size actually furnished, delivered and installed by the Contractor as shown, specified or ordered.

(C) The quantity of expansion joints (30-inch thru 72-inch) for butterfly valves (including 6-inch by-pass outlets) measured for payment must be the number of expansion joints (30-inch thru 72-inch) for butterfly valves (including 6-inch by-pass outlets) of each size actually furnished, delivered and installed by the Contractor as shown, specified or ordered.

61.21.5 PRICE TO COVER

(A) The contract price for “FURNISHING, DELIVERING AND INSTALLING BUTTERFLY VALVE (30-INCH THRU 72-INCH) WITH BY-PASS ARRANGEMENT AND OUTLET, COMPLETE” must be the unit price bid per each size of butterfly valve (30-inch thru 72-inch) with by-pass arrangement and outlet furnished, delivered and installed and must cover the cost of all labor, equipment, materials, plant, samples, tests and insurance required and necessary to furnish, deliver and install butterfly valves (30-inch thru 72-inch) in the manner specified herein. No separate or additional payment will be made for any costs associated with the work of furnishing, delivering and installing the by-pass arrangements and outlets to be installed with the butterfly valves (30-inch thru 72-inch).

(B) The contract price for Item No. 61.21BVO24 - FURNISHING, DELIVERING AND INSTALLING BUTTERFLY VALVE (24-INCH), COMPLETE must be the unit price bid per each size of butterfly valve (24-inch) furnished, delivered and installed and must cover the cost of all labor, equipment, materials, plant, samples, tests and insurance required and necessary to furnish, deliver and install butterfly valves (24-inch) in the manner specified herein.

(C) The contract price for “FURNISHING, DELIVERING AND INSTALLING EXPANSION JOINT (30-INCH THRU 72-INCH) FOR BUTTERFLY VALVE INCLUDING 6-INCH BY-PASS OUTLET” must be the unit price bid per each size of expansion joint (30-inch thru 72-inch) for butterfly valve including 6-inch by-pass outlet furnished, delivered and installed and must cover the cost of all labor, equipment, materials, plant, samples, tests and insurance required and necessary to furnish, deliver and install expansion joints (30-inch thru 72-inch) for butterfly valves including 6-inch by-pass outlets in the manner specified herein. No separate or additional payment will be made for any costs associated with the work of furnishing, delivering and installing the 6-inch by-pass outlets to be installed with the expansion joints (30-inch thru 72-inch).

(D) Payment for the chamber concrete, reinforcing steel, structural steel, miscellaneous steel, manhole steps, brick masonry and pipe-to-wall penetration seals; and for piping and other type valves must be made under their respective bid items.

Steel sleeves and anchor/water stop plates must be paid for under the bid item(s) for "FURNISHING, DELIVERING AND INSTALLING PIPE-TO-WALL PENETRATION SEAL, INCLUDING STEEL SLEEVE AND ANCHOR/WATER STOP PLATE", as contained in the Bid Schedule.

Payment for the furnishing, delivering and installing of 36-inch cast iron manhole heads and covers must be made under Item No. 63.11MH - FURNISHING, DELIVERING AND INSTALLING 36-INCH CAST IRON MANHOLE HEADS AND COVERS.

There will be no direct payment for furnishing and installing waterproofing for chambers, including waterstops. Payment will be deemed included in the prices bid for all items of work.

Payment for Furnishing, Delivering And Installing Butterfly Valves (30-Inch Thru 72-Inch) With By-Pass Arrangement And Outlet, Complete; Furnishing, Delivering And Installing Butterfly Valves (24-Inch), Complete; and for; Furnishing, Delivering And Installing Expansion Joints (30-Inch Thru 72-Inch) For Butterfly Valves Including 6-Inch By-Pass Outlet will be made under the Item Number as calculated below:

The Item Numbers for Furnishing, Delivering And Installing Butterfly Valves (30-Inch Thru 72-Inch) With By-Pass Arrangement And Outlet, Complete; Furnishing, Delivering And Installing Butterfly Valves (24-Inch), Complete; and for; Furnishing, Delivering And Installing Expansion Joints (30-Inch Thru 72-Inch) For Butterfly Valves Including 6-Inch By-Pass Outlet have ten characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing, Delivering And Installing Butterfly Valves (30-Inch Thru 72-Inch) With By-Pass Arrangement And Outlet, Complete; Furnishing, Delivering And Installing Butterfly Valves (24-Inch), Complete; and; Furnishing, Delivering And Installing Expansion Joints (30-Inch Thru 72-Inch) For Butterfly Valves Including 6-Inch By-Pass Outlet:

(2) The sixth, seventh and eighth characters must define Butterfly Valves (30-Inch Thru 72-Inch) With By-Pass Arrangement And Outlet, Complete; Butterfly Valves (24-Inch), Complete; and; Expansion Joints (30-Inch Thru 72-Inch) For Butterfly Valves Including 6-Inch By-Pass Outlet:

BVB - Butterfly Valves (30-Inch Thru 72-Inch) With By-Pass Arrangement And Outlet, Complete
BVO - Butterfly Valves (24-Inch), Complete (No By-Pass Arrangement And Outlet)
EJB - Expansion Joints (30-Inch Thru 72-Inch) For Butterfly Valves Including 6-Inch By-Pass Outlet

(3) The ninth and tenth characters must define the Size (Diameter) of the Butterfly Valves, and the Size (Diameter) of the Expansion Joints. (The ninth and tenth characters representing the unit of inches for the Size (Diameter) of the Butterfly Valves, and the Size (Diameter) of the Expansion Joints.) See examples below:

24 - 24-Inch
66 - 66-Inch

(4) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
61.21BVB72	FURNISHING, DELIVERING AND INSTALLING 72-INCH BUTTERFLY VALVE WITH BY-PASS ARRANGEMENT AND OUTLET, COMPLETE	EACH
61.21BVB66	FURNISHING, DELIVERING AND INSTALLING 66-INCH BUTTERFLY VALVE WITH BY-PASS ARRANGEMENT AND OUTLET, COMPLETE	EACH
61.21BVB60	FURNISHING, DELIVERING AND INSTALLING 60-INCH BUTTERFLY VALVE WITH BY-PASS ARRANGEMENT AND OUTLET, COMPLETE	EACH
61.21BVB54	FURNISHING, DELIVERING AND INSTALLING 54-INCH BUTTERFLY VALVE WITH BY-PASS ARRANGEMENT AND OUTLET, COMPLETE	EACH
61.21BVB48	FURNISHING, DELIVERING AND INSTALLING 48-INCH BUTTERFLY VALVE WITH BY-PASS ARRANGEMENT AND OUTLET, COMPLETE	EACH
61.21BVB42	FURNISHING, DELIVERING AND INSTALLING 42-INCH BUTTERFLY VALVE WITH BY-PASS ARRANGEMENT AND OUTLET, COMPLETE	EACH
61.21BVB36	FURNISHING, DELIVERING AND INSTALLING 36-INCH BUTTERFLY VALVE WITH BY-PASS ARRANGEMENT AND OUTLET, COMPLETE	EACH
61.21BVB30	FURNISHING, DELIVERING AND INSTALLING 30-INCH BUTTERFLY VALVE WITH BY-PASS ARRANGEMENT AND OUTLET, COMPLETE	EACH
61.21BVO24	FURNISHING, DELIVERING AND INSTALLING 24-INCH BUTTERFLY VALVE, COMPLETE	EACH
61.21EJB72	FURNISHING, DELIVERING AND INSTALLING 72-INCH EXPANSION JOINT FOR BUTTERFLY VALVE INCLUDING 6-INCH BY-PASS OUTLET	EACH
61.21EJB66	FURNISHING, DELIVERING AND INSTALLING 66-INCH EXPANSION JOINT FOR BUTTERFLY VALVE INCLUDING 6-INCH BY-PASS OUTLET	EACH
61.21EJB60	FURNISHING, DELIVERING AND INSTALLING 60-INCH EXPANSION JOINT FOR BUTTERFLY VALVE INCLUDING 6-INCH BY-PASS OUTLET	EACH
61.21EJB54	FURNISHING, DELIVERING AND INSTALLING 54-INCH EXPANSION JOINT FOR BUTTERFLY VALVE INCLUDING 6-INCH BY-PASS OUTLET	EACH
61.21EJB48	FURNISHING, DELIVERING AND INSTALLING 48-INCH EXPANSION JOINT FOR BUTTERFLY VALVE INCLUDING 6-INCH BY-PASS OUTLET	EACH
61.21EJB42	FURNISHING, DELIVERING AND INSTALLING 42-INCH EXPANSION JOINT FOR BUTTERFLY VALVE INCLUDING 6-INCH BY-PASS OUTLET	EACH
61.21EJB36	FURNISHING, DELIVERING AND INSTALLING 36-INCH EXPANSION JOINT FOR BUTTERFLY VALVE INCLUDING 6-INCH BY-PASS OUTLET	EACH
61.21EJB30	FURNISHING, DELIVERING AND INSTALLING 30-INCH EXPANSION JOINT FOR BUTTERFLY VALVE INCLUDING 6-INCH BY-PASS OUTLET	EACH

SECTION 61.31 – FURNISHING, DELIVERING, AND INSTALLING PRESSURE REGULATOR (REDUCING) VALVES

61.31.1 DESCRIPTION

These specifications are applicable for installing pressure regulator (reducing) valves with its appurtenant valves and piping.

61.31.2 MATERIALS

Pressure regulator valves must be in compliance with **Section 20.04 - Standard Specifications For Pressure Reducing Valves 8-Inch Through 30-Inch Nominal Pipe Size**.

61.31.3 CONSTRUCTION METHODS

(A) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

(B) The pressure regulator valves must be installed at the locations and in accordance with the general layout of piping shown on the contract drawings. Such locations and layout may, however, be varied, as required, by actual conditions during the progress of the work, in accordance with the directions of the Engineer. The 12-inch and 20-inch pressure regulating valves and adjacent gate valves must be housed in a chamber which must be constructed by the Contractor in accordance with the details shown on **Standard Drawing No. 19840-A-X**, "Standard Regulator Chambers," latest revision. The Contractor may be required to submit installation drawings of 8-inch, 16-inch, 24-inch and 30-inch pressure regulator valves for approval.

In order to provide ease of access for the NYC Department of Environmental Protection (NYC DEP) operational personnel, the valve piping control valves and petcocks must be installed on the same side of the distribution line and in close proximity of the access ladder of the concrete chamber. This will eliminate the need for field personnel to climb over the distribution piping to adjust the valve settings. The orientation must be specified by Department of Environmental Protection, Bureau of Water and Sewer Operations (DEP-BWSO) or NYC Department of Design and Construction (NYCDDC) as applicable.

(C) Installing the pressure-regulating valve must be as follows:

(1) Control piping should be removed before lowering the regulator into the trench and reassembled after the regulator has been lowered into the chamber.
(2) Suitable rigging such as padded nylon slings must be used to carefully lower the regulator. Chains will not be allowed.
(3) When installing the valve, the inlet flange should be matched with the upstream end of the pipe and the control piping should be on the left hand side of the valve when looking into the inlet flange of the regulator.
(4) Regulator must be supported as shown on **Standard Drawing No. 19840-A-X**. Care must be taken to keep bottom cap vent hole opened to the atmosphere.

(D) Starting up the pressure regulator valve:

(1) Close all ball valves in control piping.
(2) Crack open downstream gate valve, 2-3 turns.
(3) Check if all joints are tight and not leaking.
(4) Open strainer bleed cock.
(5) Open top cap air vent.
(6) Open inlet control piping ball valve.
(7) When air is purged, close strainer bleed cock and close top cap air vent.
(8) Completely open downstream gate valve.
(9) Crack open upstream gate valve, 2-3 turns.
(10) Open pilot ball valve.
(11) Once inlet pressure regulator is controlling 50-psi, completely open the upstream gate valve.

(E) After the pressure regulating valves have been tested under service conditions, the Contractor must make such modifications, including substitution of the entire apparatus, if necessary, as may be necessary to cause them to function in all respects in accordance with the specifications throughout the required maintenance period of the contract.

61.31.4 MEASUREMENT

The quantity of pressure regulating valves measured for payment must be the number of regulators of each size actually furnished, delivered and installed by the Contractor and approved by the Engineer.

61.31.5 PRICE TO COVER

(A) The contract price for "FURNISHING, DELIVERING AND INSTALLING PRESSURE REGULATOR VALVE" must be the unit price bid per each size and kind of pressure regulator valve furnished, delivered and installed and must cover the cost of all labor, equipment, materials, plant, samples, tests and insurance required and necessary to furnish, deliver and install pressure regulator valves in the manner specified herein. No separate or additional payment will be made for any costs associated with the work of furnishing, delivering and installing pressure regulator valves.

(B) Payment for the chamber concrete, reinforcing steel, structural steel, miscellaneous steel, manhole steps, brick masonry and pipe-to-wall penetration seals; and for gate valves, piping and castings must be made under their respective bid items.

There will be no direct payment for furnishing and installing waterproofing for chambers, including waterstops. Payment will be deemed included in the prices bid for all items of work.

Payment for Furnishing, Delivering And Installing Pressure Regulator Valves will be made under the Item Number as calculated below:

The Item Numbers for Furnishing, Delivering And Installing Pressure Regulator Valve have nine characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing, Delivering And Installing Pressure Regulator Valves:

61.31

(2) The sixth and seventh characters must define Pressure Regulator Valves:

PV - Pressure Regulator Valves

(3) The eighth and ninth characters must define the Size (Diameter) of the Pressure Regulator Valves. (The seventh and eighth characters representing the unit of inches for the Size (Diameter) of the Pressure Regulator Valves.) See examples below:

08 - 8-Inch
24 - 24-Inch

(4) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
61.31PV30	FURNISHING, DELIVERING AND INSTALLING 30-INCH PRESSURE REGULATOR VALVE	EACH
61.31PV24	FURNISHING, DELIVERING AND INSTALLING 24-INCH PRESSURE REGULATOR VALVE	EACH
61.31PV20	FURNISHING, DELIVERING AND INSTALLING 20-INCH PRESSURE REGULATOR VALVE	EACH
61.31PV16	FURNISHING, DELIVERING AND INSTALLING 16-INCH PRESSURE REGULATOR VALVE	EACH
61.31PV12	FURNISHING, DELIVERING AND INSTALLING 12-INCH PRESSURE REGULATOR VALVE	EACH
61.31PV10	FURNISHING, DELIVERING AND INSTALLING 10-INCH PRESSURE REGULATOR VALVE	EACH
61.31PV08	FURNISHING, DELIVERING AND INSTALLING 8-INCH PRESSURE REGULATOR VALVE	EACH

SECTION 62.11 – FURNISHING AND DELIVERING HYDRANTS

62.11.1 DESCRIPTION

This section describes furnishing and delivering of new fire hydrants.

62.11.2 MATERIALS

Fire hydrants must be in accordance with **Section 20.08 - Standard Specifications For Dry-Barrel Fire Hydrants And Extension Kits**.

62.11.3 CONSTRUCTION METHODS

Prior to ordering any hydrants, the Contractor must submit to the Engineer a vendor list for The Engineer's approval. Within five (5) consecutive calendar days after receiving vendor approval, the Contractor must submit evidence to the Department of Design and Construction of having ordered the material from an acceptable foundry.

All hydrants must be manufactured at least ten (10) consecutive calendar days before delivery to the site to allow for proper inspection, acceptance and recording of the accepted hydrants.

After the completion of manufacture and inspection of the hydrants to be furnished by the Contractor (but prior to the shipment thereof), the Contractor must furnish a detailed schedule of the hydrants that constitutes the content of each shipment. This schedule must be delivered to the Engineer. The schedule must give in numerical order the description and number of each and every article constituting the shipment. The Contractor must not make shipments until the schedule has been checked and approved in writing by the Engineer.

The Engineer must approve storage of hydrants and appurtenances within the project limits. On-site storage is limited to hydrants and appurtenances projected for use within seven (7) calendar days, as per the Contractor's approved schedule. The Engineer reserves the right to limit the storage of on-site materials to three (3) calendar days in business or congested areas.

Hydrants must be supported upon wooden blocks of sufficient size to prevent injury to the pavement.

The Contractor is responsible for the hydrants until they are finally accepted and incorporated in the work.

During any suspension of the work, all materials delivered upon but not placed in the work, must be neatly piled so as not to obstruct public travel, or must be removed from the work site at the direction of the Engineer; hydrants, if directed, must be temporarily stored at a site designated by the Contractor and approved in writing by the Engineer.

Unless so removed by the Contractor, within ten (10) calendar days of written notice from the Engineer, the Engineer may have the materials moved at the expense of the Contractor.

62.11.4 MEASUREMENT

The quantity of fire hydrants to be measured for payment must be the number of hydrants supplied by the Contractor as ordered and approved by the Engineer.

62.11.5 PRICE TO COVER

The contract price for "FURNISHING AND DELIVERING HYDRANTS" must be the unit price bid per each hydrant furnished and delivered, and must cover the cost of all labor, equipment, materials, plant, samples, tests, and insurance required and necessary to furnish and deliver hydrants in the manner specified herein. No separate or additional payment will be made for any costs associated with the work of furnishing and delivering hydrants. Payment for furnishing and delivering hydrants will be made under the bid item(s) labeled "FURNISHING AND DELIVERING HYDRANTS" as contained in the Bid Schedule.

Payment for Furnishing And Delivering Hydrants will be made under the Item Number as calculated below:

The Item Numbers for Furnishing And Delivering Hydrants have seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing And Delivering Hydrants:

(2) The sixth and seventh characters must define the Type of Hydrants Furnished and Delivered:

SD - All NYC DEP Approved Type Hydrants
SS - Smith Type Hydrant (S-2-LP) Only (Historical Districts)

(3) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
62.11SD	FURNISHING AND DELIVERING HYDRANTS	EACH
62.11SS	FURNISHING AND DELIVERING HYDRANTS - SMITH TYPE (S-2-LP)	EACH

SECTION 62.12 – SETTING HYDRANTS

62.12.1 DESCRIPTION

This section describes the setting of fire hydrants.

62.12.2 MATERIALS

All new hydrants ordered installed or required to replace existing hydrants; and, existing hydrants ordered retained and adjusted to new grade, removed and reset, or reconnected to new or existing water mains must be two-piece "Breakaway" hydrants, Types S-2-LP or D-2-LP, as shown on the latest revisions of BWSO **Standard Drawing Nos. 43250-Z or 43142-Z**, respectively, and as specified in accordance with **Section 20.08 - Standard Specifications For Dry-Barrel Fire Hydrants And Extension Kits**.

In addition, existing hydrants ordered retained must be less than ten (10) years old from date of casting, and must be in good working order as determined by the Engineer.

62.12.3 CONSTRUCTION METHODS

(A) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

(B) HYDRANT INSTALLATION - Hydrants must be installed at the location shown on the drawings or where directed by the Engineer and in accordance with AWWA Standard C600, entitled "Installation of Ductile Iron Water Mains, and Their Appurtenances", and as described herein or ordered by the Engineer.

All hydrants must be provided with concrete collars, in accordance with **Subsection 62.12.4.** All new hydrants must be provided with fenders. All existing hydrants within the limits of project and do not have fenders installed must be provided with fenders. All fenders must be installed in accordance with **Section 62.14**.

All hydrants must stand plumb and straight, each of their nozzles facing the curb at an angle of 45-degrees.

Hydrants must be set to final grade, as ordered by the Engineer, so that the break-away coupling system is accessible, and not restrained in any manner to prevent proper operation or hinder its replacement. (**See Standard Drawing Nos. 43250-Z or 43142-Z**) If street grades are adjusted to new grades, existing hydrant heights must be adjusted in accordance with **Subsection 62.12.3(H)** and as ordered by the Engineer. Extension kits are not to be used on new hydrants.

Each hydrant must be connected to the main with a 6-inch diameter branch controlled by a 6-inch valve installed with valve box and appurtenances as shown on the latest revision of BWSO **Standard Drawing No. WM0020**, " Hydrant Setting Methods & Drain Base".

Drainage must, in general, be provided at the base of the hydrant by one of the following methods that may be ordered by the Engineer:

(a) by setting the hydrant upon a cast iron drain base and connecting it to the latter with 3/4-inch diameter brass pipe, Tubeloy or soft-temper copper tubing, and brass fittings, as shown on the latest revision of BWSO **Standard Drawing No. WM0020**.

(b) by connecting the hydrant by means of a 3/4-inch diameter Tubeloy or soft-temper copper tubing, and all necessary brass fittings, to a cast iron drain base, as shown on the latest revision of BWSO **Standard Drawing No. WM0020**.

Hydrants set in accordance with method (b) must be set upon a stone or concrete block base not less than one (1) foot square and six (6) inches thick.

The hydrants, in general must be set according to the method described under (a). Method (b) may be used only when required due to site conditions and ordered by the Engineer.

When the drain outlets of hydrants are set below the ground water level, the above-specified drainage facilities must be omitted, the drain outlet of the hydrant suitably plugged, as directed by the Engineer, and the hydrant set upon a stone or concrete block not less than one (1) foot square and six (6) inches thick. On the roadway face of the hydrant, there must be stenciled, in white paint the letter “P”, "four (4) to six (6) inches in height, matching the main size stencil. The quality of paint is hereinafter specified.

(C) RECESS VAULTS FOR HYDRANTS - Where sidewalk or building vaults occupy the space needed for hydrant setting, recess vaults will be required for the setting of the hydrant.

Where the Contractor is ordered to construct recess vaults in existing sidewalk or building vaults, to allow for the installation of hydrants, the Contractor must construct it in accordance with designs furnished by the NYCDDC.

Where recess vaults are constructed by others, the hydrant must be set therein by the Contractor and no adjustment in payment other than herein allowed for the hydrant drainage will be made to the Contractor.

(D) LAYING DRAIN PIPE – When the hydrant is not set on the cast iron hydrant drain, the drain pipe from the hydrant to the cast iron hydrant drain must, in general, be laid in the trench made for laying the hydrant branch and must be uniformly sloped to meet the top of the cast iron hydrant drain. Care must be taken to avoid kinking the pipe or tubing where bending is required.

(E) PAINTING COLORS AND NUMERALS - After the hydrants have been set and adjusted, all hydrants, whether new, reset, or adjusted, must be field painted as follows:

1. The hydrant above the ground line must be thoroughly cleaned, all rust removed, and the existing paint scuffed for overcoating.
2. The hydrants must receive two coats of field paint.
    a. The field paint must be a quick drying enamel.
    b. The field paint must be applied by brush.
    c. The paint color must be as follows:
        i. The standpipe, barrel, and nozzle above the ground line:
            1. When connected to a water main less than 24": Black
            2. When connected to a water main 24" or greater: Safety Red
        ii. Dome/Bonnet: bright aluminum
3. The water main size must be stenciled on the hydrant's roadway face.
    a. The paint for the size stencil must be white exterior oil-type paint.
    b. The numeral must be between 4" to 6" high.
    c. The stencil must be applied in one coat and must cover completely and solidly.

All painting must meet the following requirements:

1. Shop paints must be as specified in **Section 20.08 – Standard Specifications for Dry-Barrel Fire Hydrants and Extension Kits.**
2. Field paints to be used must be approved by the Engineer.
3. No painting must be done in wet or freezing weather, on surfaces with visible moisture, or on previously painted surfaces before the paint has thoroughly set.
4. The Contractor must furnish and put up conspicuous signs around the hydrant warning "WET PAINT".

(F) RESETTING CURBING - All curbing disturbed or removed in the course of installing the hydrants must be reset by the Contractor in accordance with the specifications of the Agency, Department, or Bureau having jurisdiction. If the Contractor damages the existing curbing, the Contractor must furnish at the Contractor's own cost and expense new curbing to replace the damaged curbing.

(G) ADJUSTING ORDERED RETAINED EXISTING HYDRANT TO NEW GRADE

(1) Adjusting To A Higher New Grade: Existing hydrants ordered retained by the Engineer and which require adjustment at the same location to a higher new grade must be raised to the height specified by the Engineer by the use of an extension kit.

(2) Adjusting To A Lower New Grade: Existing hydrants ordered retained by the Engineer and which require adjustment to a lower new grade at the same location must be excavated, removed, and stored so as to not cause any damage to the existing hydrants. The existing hydrant must then be reset at the same location to the lower new grade and reconnected to the existing branch as required and directed by the Engineer.

(H) RELOCATING AND RESETTING EXISTING HYDRANTS ORDERED RETAINED - Existing hydrants ordered retained by the Engineer and which require relocation and resetting at another location must be excavated, removed, and stored so as to not cause any damage to the existing hydrants. The existing hydrants must then be reset at the locations specified by the Engineer and reconnected to the branches or to the water mains as required and directed by the Engineer.

(I) DAMAGE TO EXISTING HYDRANTS ORDERED RETAINED - Any existing hydrant ordered retained that is damaged as a result of the Contractor's construction operations must be replaced with a new hydrant at the Contractor's sole expense.

Where damage is caused only to the drain base due to the Contractor's construction operations, the drain base must be replaced by the Contractor at the Contractor's sole expense.

If the Contractor elects to furnish a new hydrant after removal of an existing hydrant ordered retained, no payment will be made for the new hydrant and its cost must be at the sole expense of the Contractor.

Replacement hydrants must be furnished at the correct size, without the use of extension kits, at the sole expense of the Contractor.

62.12.4 CONCRETE COLLARS FOR HYDRANTS AND HYDRANT FENDERS

62.12.4.1 DESCRIPTION

This subsection describes concrete collars for hydrants and hydrant fenders.

62.12.4.2 MATERIALS

Concrete must be in accordance with **General Specification 11 - Concrete, as modified in Section 23.01**, Class B-32, Type IA or Type IIA, as specified.

62.12.4.3 CONSTRUCTION METHODS

Concrete collar around hydrant and hydrant fenders must be in accordance with the layout, dimensions, and methods shown on **Standard Drawing No. WM0030** or as approved by the Engineer. Concrete collar around hydrant and oversize hydrant fenders must be in accordance with the layout, dimensions, and methods shown on **Standard Drawing No. WM0031** or as approved by the Engineer.

(A) Where the hydrant, which is to be connected to a new main, is located in an unpaved area, a square-shaped concrete collar, two (2) feet in the least dimension measured from the outer perimeter of the hydrant barrel, six (6) inches thick, and flush with the finished or existing surface, must be placed around the hydrant.

(B) Where the hydrant and hydrant fenders are installed in an unpaved area such as between existing or proposed sidewalk and curb, the concrete collar must be installed in accordance with the layout, dimensions, and methods shown on **Standard Drawing No. WM0030**.

(C) Where the hydrant and oversize hydrant fenders are installed in an unpaved area such as between existing or proposed sidewalk and curb, the concrete collar must be installed in accordance with the layout, dimensions, and methods shown on **Standard Drawing No. WM0031**.

62.12.5 MEASUREMENT

The quantity to be measured for payment must be the number of hydrants actually installed, reinstalled, and adjusted to new grade as required or ordered, complete, in-place.

62.12.6 PRICE TO COVER

(1) The contract price for Item No. 62.12SG - SETTING HYDRANTS COMPLETE WITH WEDGE TYPE RETAINER GLANDS must be the unit price bid per each hydrant installed and must cover the cost of all labor, equipment, materials, plant, samples, tests, and insurance required and necessary to install hydrants in the manner specified herein and must include the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); backfilling; drain pipe and cast iron hydrant drain; and all other work necessary to complete this work and do all work incidental thereto, all in accordance with the plans and specifications and as directed by the Engineer. Payment for installing hydrants must be made under bid Item No. 62.12SG - SETTING HYDRANTS COMPLETE WITH WEDGE TYPE RETAINER GLANDS as contained in the Bid Schedule.

    In addition, included in the price for Item No. 62.12SG - SETTING HYDRANTS COMPLETE WITH WEDGE TYPE RETAINER GLANDS must be the cost for the protection and storage of existing hydrants ordered removed and retained.

(2) Payment will be made to the Contractor for each recess vault constructed under the applicable items: Item No. 65.51PC - FURNISHING AND PLACING CAST-IN-PLACE CONCRETE CLASS 40 AND PRECAST CONCRETE CLASS 50, Item No. 65.61SS - FURNISHING, DELIVERING AND PLACING STRUCTURAL, REINFORCING AND MISCELLANEOUS STEEL, and Item No. 73.11AB - ADDITIONAL

BRICK MASONRY. Payment will be made for the actual quantity placed as directed and approved by the Engineer.

The cost of all necessary waterproofing and all other work incidental to the vault construction must be included in the prices bid for the above items. No separate or additional payments will be made for this work.

(3) Payment for the cost of all labor, materials, and equipment required and necessary to adjust at the same location existing hydrants ordered retained by the Engineer to a higher new grade by the use of an extension kit must be made under Item No. 62.12SE - SETTING HYDRANTS TO NEW GRADE USING EXTENSION KITS.

(4) Payment for the cost of all labor, materials, and equipment required and necessary to adjust at the same location existing hydrants ordered retained by the Engineer to a lower new grade must be made under the respective items: Item No. 62.13RH - REMOVING HYDRANTS, Item No. 62.12SG - SETTING HYDRANTS COMPLETE WITH WEDGE TYPE RETAINER GLANDS, Item No. 60.11R606 - FURNISHING AND DELIVERING 6-INCH DUCTILE IRON RESTRAINED JOINT PIPE (CLASS 56), Item No. 60.12D06 - LAYING 6-INCH DUCTILE IRON PIPE AND FITTINGS, Item No. 60.13M0A24 - FURNISHING AND DELIVERING DUCTILE IRON MECHANICAL JOINT 24-INCH DIAMETER AND SMALLER FITTINGS, INCLUDING WEDGE TYPE RETAINER GLANDS, Item No. 61.11DMM06 - FURNISHING AND DELIVERING 6-INCH MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND, Item No. 61.12DMM06 - SETTING 6-INCH MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND, and/or Item No. 63.11VC - FURNISHING AND DELIVERING VARIOUS CASTINGS.

(5) Payment for the cost of all labor, materials, and equipment required and necessary to relocate and reset at another location existing hydrants ordered retained by the Engineer must be made under the respective items: Item No. 62.13RH - REMOVING HYDRANTS, Item No. 62.12SG - SETTING HYDRANTS COMPLETE WITH WEDGE TYPE RETAINER GLANDS, Item No. 60.11R606 - FURNISHING AND DELIVERING 6-INCH DUCTILE IRON RESTRAINED JOINT PIPE (CLASS 56), Item No. 60.12D06 - LAYING 6-INCH DUCTILE IRON PIPE AND FITTINGS, Item No. 60.13M0A24 - FURNISHING AND DELIVERING DUCTILE IRON MECHANICAL JOINT 24-INCH DIAMETER AND SMALLER FITTINGS, INCLUDING WEDGE TYPE RETAINER GLANDS, Item No. 61.11DMM06 - FURNISHING AND DELIVERING 6-INCH MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND, Item No. 61.12DMM06 - SETTING 6-INCH MECHANICAL JOINT DUCTILE IRON GATE VALVE COMPLETE WITH WEDGE TYPE RETAINER GLAND, and/or Item No. 63.11VC - FURNISHING AND DELIVERING VARIOUS CASTINGS.

(6) Concrete sidewalks, including expansion joints and finishing thereof, must conform to the requirements of NYCDOT Highway item(s) labeled “4” CONCRETE SIDEWALK (UNPIGMENTED)” or “4” CONCRETE SIDEWALK (PIGMENTED)”, as applicable. Payment for placing that portion of the concrete collar that exceeds the thickness of the proposed sidewalk will be made under the prices bid for Item No. 62.12SG - SETTING HYDRANTS COMPLETE WITH WEDGE TYPE RETAINER GLANDS, and Item No. 62.12SE - SETTING HYDRANTS TO NEW GRADE USING EXTENSION KITS, and the balance will be paid for under the appropriate items specified above for placing 4” thick concrete sidewalks.

Payment for Setting Hydrants will be made under the Item Number as calculated below:

The Item Numbers for Setting Hydrants have seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Setting Hydrants:

62.12

(2) The sixth and seventh characters must define the Kind of Hydrant Setting:

SG - Setting Hydrants Complete With Wedge Type Retainer Glands
SE - Setting Hydrants To New Grade Using Extension Kits

(3) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
62.12SG	SETTING HYDRANTS COMPLETE WITH WEDGE TYPE RETAINER GLANDS	EACH
62.12SE	SETTING HYDRANTS TO NEW GRADE USING EXTENSION KITS	EACH

SECTION 62.13 – REMOVING HYDRANTS

62.13.1 DESCRIPTION

This section describes the removal of fire hydrants.

62.13.2 CONSTRUCTION METHODS

(A) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

(B) REMOVAL OF HYDRANTS - Unless ordered retained, the Contractor must remove hydrants found on the existing mains that are designated by the Engineer to be removed or abandoned. All hydrants removed will become the Contractor's property. Cast iron drain bases are deemed to be part of the hydrants. Any hydrant specified, shown, or ordered retained must be connected to the new main or to an existing main to be kept in service as directed by the Engineer.

(C) All openings made by removing hydrants must have temporary pavement placed by the Contractor as soon as the openings have been backfilled, and then the Contractor must permanently restore all pavements and sidewalks that are disturbed.

(D) RESETTING CURBING - All curbing disturbed or removed in the course of removing the hydrants must be reset by the Contractor in accordance with the specifications of the Agency, Department, or Bureau having jurisdiction. If the Contractor damages the existing curbing, the Contractor must furnish at the Contractor's own cost and expense new curbing to replace the damaged curbing.

62.13.3 MEASUREMENT

The quantity to be measured for payment must be the number of hydrants removed as required.

62.13.4 PRICE TO COVER

The contract price for Item No. 62.13RH - REMOVING HYDRANTS must be a unit price bid per each kind of hydrant removed together with drain base and must cover the cost of all labor, materials, plant, equipment, and insurance required to complete the work, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); backfilling; cleaning up; hauling away and disposing of all removed materials (except as otherwise specified herein), together with all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans, specifications and standards, and as directed by the Engineer and the Department of Environmental Protection.

Included in the price hereunder must be the cost of all labor and materials necessary to remove all required existing hydrant fenders, hydrant valves, branch pipe, and castings, including drain basins.

Payment for Removing Hydrants will be made under the Item Number as calculated below:

The Item Number for Removing Hydrants has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Removing Hydrants:

62.13

(2) The sixth and seventh characters must define Removing Hydrants:

RH - Removing Hydrants

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
62.13RH	REMOVING HYDRANTS	EACH

SECTION 62.14 – FURNISHING, DELIVERING, AND INSTALLING HYDRANT FENDERS

62.14.1 DESCRIPTION

This section describes the furnishing, delivering, and installing of hydrant fenders.

62.14.2 MATERIALS

(A) All hydrant fenders installed or replaced must be 5-inch steel pipe Schedule 80, as shown on **Standard Drawing No. WM0030**.

(B) All oversize hydrant fenders installed or replaced must be 8-inch steel pipe Schedule 80, as shown on **Standard Drawing No. WM0031**.

62.14.3 CONSTRUCTION METHODS

(A) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

(B) Steel pipe hydrant fenders must be installed where required, encased in concrete collars, and painted in accordance with the applicable layout and method, and other pertinent details shown on the latest revision of **Standard Drawing No. WM0030** or as directed.

(C) If the installation of the hydrant fenders is in a heavy traffic area, a DDC field representative may specify the use of oversize hydrant fenders. Steel pipe oversize hydrant fenders must be installed where required, encased in concrete collars, and painted in accordance with the applicable layout and method, and other pertinent details shown on the latest revision of **Standard Drawing No. WM0031** or as directed.

(D) All hydrant fenders must be cleaned and field painted, matching the quality requirements specified in **Section 20.08**. All field paint must be applied by brush, with a minimum of two coats applied per the manufacturer's recommendations. Fenders supplied under Item 62.14FS must be painted a bright aluminum color, and fenders supplied under Item 62.14FD must be painted black. After painting, reflective tape must be applied to the fender per **Standard Drawing No. WM0030**, **Standard Drawing No. WM0031**, or as directed.

(E) The fender caps must be screwed on tightly to prevent removal.

62.14.4 MEASUREMENT

The quantity to be measured for payment must be the number of each hydrant fender installed as approved by the Engineer.

62.14.5 PRICE TO COVER

The contract price for "FURNISHING, DELIVERING, AND INSTALLING HYDRANT FENDERS" must be a unit price bid per each kind of hydrant fender furnished, delivered, and installed and must cover the cost of all labor, materials, plant, equipment, and insurance required to complete the work, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); backfilling; cleaning up; hauling away of all removed materials, together with all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans, specifications, and standards, and as directed by the Engineer and the Department of Environmental Protection.

Concrete sidewalks, including expansion joints and finishing thereof, must conform to the requirements of NYCDOT Highway item(s) labeled "4" CONCRETE SIDEWALK (UNPIGMENTED)" or "4" CONCRETE SIDEWALK (PIGMENTED)", as applicable. Payment for placing that portion of the concrete collar that exceeds the thickness of the proposed sidewalk will be made under the prices bid for item(s) labeled "FURNISHING, DELIVERING, AND INSTALLING HYDRANT FENDERS", and the balance will be paid for under the appropriate items specified above for placing 4" thick concrete sidewalks.

Payment for Furnishing, Delivering, And Installing Hydrant Fenders will be made under the Item Number as calculated below:

The Item Numbers for Furnishing, Delivering, And Installing Hydrant Fenders have seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing, Delivering, And Installing Hydrant Fenders:

62.14

(2) The sixth and seventh characters must define the Kind of Hydrant Fenders:

FS - Hydrant Fenders (Standard)
FD - Hydrant Fenders With Decorative Caps (Black) (Historical Districts)

(3) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
62.14FS	FURNISHING, DELIVERING, AND INSTALLING HYDRANT FENDERS	EACH
62.14FD	FURNISHING, DELIVERING, AND INSTALLING HYDRANT FENDERS WITH DECORATIVE CAPS (BLACK)	EACH

SECTION 63.11 – FURNISHING AND DELIVERING VARIOUS CASTINGS, ETC.

63.11.1 DESCRIPTION

This section describes furnishing and delivering various castings, including, but not limited to, hydrant valve boxes, main line valve boxes, cast iron drains, 24-inch and 36-inch manhole frames (skirts and heads) and covers, etc.

63.11.2 MATERIALS

The various castings must be in accordance with **Section 20.07 - Standard Specification For Iron Castings**.

63.11.3 DETAILS

Prior to ordering any special castings, the Contractor must submit to the Engineer a vendor list for approval. Within five (5) consecutive calendar days after receiving vendor approval, the Contractor must submit evidence to the Department of Design and Construction of having ordered the applicable castings required for the contract and approved by the Engineer from an acceptable foundry.

Material must be manufactured at least ten (10) days before delivery to the site to allow for proper inspection and recording of accepted castings.

63.11.4 MEASUREMENT

The quantity to be measured for payment must be the number of tons of castings furnished as required and complete.

63.11.5 PRICE TO COVER

Payment for furnishing and delivering various castings must be made under bid Item No. 63.11VC - FURNISHING AND DELIVERING VARIOUS CASTINGS as contained in the Bid Schedule.

The cost of installing the various castings must be included in the prices bid for the various items of the contract.

63.11.6 SEPARATE PAYMENT

Separate payment will be made by weight in tons for the furnishing, delivering and installing of 36-inch cast iron manhole heads and covers under Item No. 63.11MH - FURNISHING, DELIVERING AND INSTALLING 36-INCH CAST IRON MANHOLE HEADS AND COVERS.

Separate payment will be made by number of each manhole step furnished, delivered and installed under Item No. 63.11MS - FURNISHING, DELIVERING AND INSTALLING MANHOLE STEPS TYPE PS2-PF.

Payment for Furnishing And Delivering Various Castings; Furnishing, Delivering And Installing 36-Inch Cast Iron Manhole Heads And Covers; and, Furnishing, Delivering And Installing Manhole Steps Type PS2-PF will be made under the Item Number as calculated below:

The Item Numbers for Furnishing And Delivering Various Castings; Furnishing, Delivering And Installing 36-Inch Cast Iron Manhole Heads And Covers; and, Furnishing, Delivering And Installing Manhole Steps Type PS2-PF have seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing And Delivering Various Castings; Furnishing, Delivering And Installing 36-Inch Cast Iron Manhole Heads And Covers; and, Furnishing, Delivering And Installing Manhole Steps Type PS2-PF:

63.11

(2) The sixth and seventh characters must define the Kind of Castings:

VC - Various Castings
MH - 36-Inch Cast Iron Manhole Heads And Covers
MS - Manhole Steps Type PS2-PF

(3) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
63.11VC	FURNISHING AND DELIVERING VARIOUS CASTINGS	TONS
63.11MH	FURNISHING, DELIVERING AND INSTALLING 36-INCH CAST IRON MANHOLE HEADS AND COVERS	TONS
63.11MS	FURNISHING, DELIVERING AND INSTALLING MANHOLE STEPS TYPE PS2-PF	EACH

SECTION 64.11 – WITHDRAWING AND REPLACING HOUSE SERVICES

64.11.1 DESCRIPTION

This section describes the withdrawing and replacing house services using screw taps or wet connection sleeves.

64.11.2 MATERIALS

The wet connection sleeves and screw taps must be in accordance with **Section 20.09 - Standard Specifications For Stainless Steel Tapping Sleeves With Branch Connections For Flanged Tapping Valve Or Mechanical Joint Tapping Valve and Section 20.10 - Specifications For Corporation Stops And Quarter Bends**.

64.11.3 CONSTRUCTION METHODS

(A) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

(B) REPLACING CONNECTIONS - The Contractor must replace all house service or other connections found on the mains and branches connected thereto which are to be abandoned or removed. Except where otherwise specified, house services must not be transferred from the existing main, to be abandoned or removed, to a new main until the sanitary condition of the interior of the main is found to be satisfactory to the Engineer. When the connections to be transferred to mains smaller than 10-inch are two (2) inches or more in diameter, or on 10-inch or larger mains, larger than two (2) inches in diameter, they must be replaced with a branch of such size as may be directed and a valve must be placed on the connection. If any reducer or other special casting is required which the Department has not ordered the Contractor to furnish under this contract, such casting will be furnished by the Contractor and must be set by the Contractor. When the house connections found on the existing mains are smaller than specified in **Section 20.10 - Specifications For Corporation Stops And Quarter Bends**, taps of the same size must be made on the new mains, unless otherwise directed, except that all taps smaller than 3/4-inch found on the existing mains must be replaced by 3/4-inch taps, and the size of the gooseneck must not be less than 3/4-inch. The connections must be made using brass corporation cocks with a tapered screw fitted for tapered screw taps and with tailpieces, all of which will be furnished by the Contractor.

In all instances where house services are to be transferred from mains to be abandoned or removed to the new mains, new taps and tailpieces, new goosenecks, and new extension piping to the extent made necessary by the service transfer, must be utilized in the new work, and the existing tap must be destroyed. Extreme care must be taken in excavating for tap transfers to prevent injury to the existing service pipes.

Where the house service pipes are to be extended for lengths greater than five (5) feet, the sizes of the house service extension pipes and the goosenecks must be the same size as the existing house service pipes, but in no case smaller than one (1) inch.

(C) TRANSFERRING CONNECTIONS - After the new main has been laid and found to be in a satisfactory sanitary condition and the taps made, the Contractor must reconnect the house connections to the new main, furnishing all the labor and material necessary to make all the connections complete. If, after the house connection is made, there is interference in the flow of water in the service pipe, the Contractor must blow out the same with a force pump. If the service pipe is of cast or wrought iron and cannot be blown out, the Contractor will not be required to do any further work in repairing or replacing the house service, unless the stoppage in the service pipe is, in the opinion of the Engineer, due to improper work or carelessness on the part of the Contractor.

The Engineer will identify situations where people and institutions have special water needs or anyone for whom temporary water shut-off will pose special hazards or problems. The shutdown in these instances may be made between 7 p.m. and 7 a.m. or on weekends as directed by the Engineer. Whenever a shutdown affects buildings where water is used for domestic purposes, the making of connections to existing mains, or the changing of house service connections, may be made during the daytime, but the water must not be turned off from any premises for a longer period than twelve (12) hours, unless special permission is obtained from the Engineer. Where the valves provided under this contract are so located that the length of main between valves is too great to allow, the replacing of the house connections and the making of the necessary main connections within twelve (12) hours, the Contractor must place caps or plugs, so that the period during which the water is turned off must not be longer than twelve (12) hours. These caps or plugs will be furnished by the

Contractor, and the Contractor must replace any that handling or removing may damage. The Contractor will in no case be allowed to cut off the flow of water through any main, unless the Engineer grants permission.

The Contractor must notify the Engineer at least one (1) week prior to the date when the Contractor wishes a main shut down, and if the time set is approved, the Department of Environmental Protection must shut down the main at the time stipulated. The Contractor must deliver individual notices to residents and businesses at least by the afternoon before the scheduled water shut-off notifying residents and businesses that water service will be interrupted. Shutdowns for making connections will not be made unless and until the Contractor has everything in readiness for the work before and after a shutdown is made, the work must be carried on continuously until the water is again turned on. If, on account of failure to shut down any main, due to any difficulty encountered, or to any act or omission on the part of The City, the work of connection is delayed, no other claim will be allowed by the Contractor for such delay except an extension of the time specified for the performance of the work equal to the time which may have been lost by such delay.

(D) WET CONNECTIONS - Department force will make the cuts in the mains for services requiring wet connections. The Contractor must do all other work, including the setting of the wet connection sleeves and valves, placing the cutting machine in position, and all required excavation.

(E) LICENSED AND BONDED PLUMBERS - The installation, transfer, alteration, or repair of house services must be made only by licensed and bonded plumbers who are duly registered in the office of the NYCDOB in the borough in which the work is to be performed.

(F) HOUSE SERVICES - Whenever an existing lead service line must be reconnected to a new piece of copper tubing or brass service pipe, installed as part of a water main project, the connection must be made using an approved mechanical coupling. A wiped (soldered) connection will no longer be acceptable.

Where the existing house service connection is lead, galvanized steel, or galvanized iron, house service lines shall not be extended or partially replaced, but shall be fully replaced to the house control valve, per Section 20-03 (s) of the NYC DEP Rules Governing and Restricting the Use and Supply of Water (RCNY Title 15 Chapter 20). This requirement will not apply to replacing or reconnecting the corporation stop, gooseneck, or offset swing joints where the house service connection remains intact. The connection to the intact house service connection must be made using the Lead-Pak Coupling manufactured by the Ford Meter Box Co, Inc. or approved equal.

64.11.4 MEASUREMENT

The quantities to be measured for payment must be the number of house connections withdrawn and installed as required, complete, in place.

64.11.5 PRICE TO COVER

The contract prices for Item No. 64.11ST - WITHDRAWING AND REPLACING HOUSE SERVICES USING SMALLER THAN 1-1/2-INCH SCREW TAPS and Item No. 64.11EL - WITHDRAWING AND REPLACING HOUSE SERVICES USING 1-1/2-INCH OR LARGER SCREW TAPS must be a unit price bid per each withdrawal and replacement of service and must cover the cost of all labor, materials, plant, equipment, and insurance required to complete the work, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); backfilling; cleaning up; hauling away of all materials, together with all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans, specifications, and standards, and as directed by the Engineer and the Department of Environmental Protection.

Payment for Withdrawing And Replacing House Services will be made under the Item Number as calculated below:

The Item Numbers for Withdrawing And Replacing House Services have seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Withdrawing And Replacing House Services:

64.11

(2) The sixth and seventh characters must define the Size of the Screw Taps used:

ST - Smaller Than 1-1/2-Inch Screw Taps
EL - 1-1/2-Inch Or Larger Screw Taps

(3) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
64.11ST	WITHDRAWING AND REPLACING HOUSE SERVICES USING SMALLER THAN 1-1/2-INCH SCREW TAPS	EACH
64.11EL	WITHDRAWING AND REPLACING HOUSE SERVICES USING 1-1/2-INCH OR LARGER SCREW TAPS	EACH

SECTION 64.12 – EXTENDING HOUSE SERVICE WATER CONNECTIONS, AND CUTTING AND OFFSETTING HOUSE SERVICE WATER CONNECTIONS

64.12.1 DESCRIPTION

This section describes extending house service water connections and replacing deteriorated house service connections, and, cutting and offsetting house service water connections. A service pipe is defined as that portion of the water pipe extending from the public water main to the house control valve, the building or to a point where the supply is fully metered.

64.12.2 MATERIALS

All service pipe, insulation and jacketing must be in accordance with **Section 25.01**.

64.12.3 CONSTRUCTION METHODS

(A) WORK INCLUDED - Where it is necessary, in the opinion of the Engineer, to cut house water service to lay new mains or where the services are to be extended in transferring from an existing main to a new, or to an existing parallel main, the Contractor must furnish the necessary pipe for such work and all other materials and labor incidental to making the connection complete, including the cutting of the service and the stopping of the flow of water through the same.

If the cut house service line is lead, galvanized steel, or galvanized iron, it must be fully replaced to the house control valve.

Where the house services are cut and are not to be transferred to a new main, the length of old pipe cut out must not exceed one (1) foot and the new pipe to replace the old pipe must only be of such length as is required, in the opinion of the Engineer, to permit the laying of the new main.

The Contractor must replace a house service that is deemed sufficiently deteriorated by the Engineer. A sufficiently deteriorated service must be defined as a service that in the opinion of the Engineer will not withstand the ongoing construction activities surrounding it. The length of service to be replaced will be determined by the Engineer and as dictated by the limit of improved pavement restoration found in the contract.

(B) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

(C) SERVICES TO BE STRAIGHT - Each new service pipe must be laid in a straight line at right angles to the street main and extending from the tap to the main house control valve. Where the surface or subsurface conditions make it impracticable to install a service pipe in accordance with the above conditions, it may be otherwise laid, provided the plumber submits a plan showing the proposed alternative location of the service pipe, and procures the written approval of the Department. The driving of a service pipe through the ground is prohibited.

(D) GOOSENECK AND OFFSET SWING JOINTS ON SERVICE CONNECTION - Unless otherwise authorized by the Department of Design and Construction, each brass or copper tubing service must have at least three (3) feet of copper tubing formed in a gooseneck connection to the tap and laid to the right hand, facing the tap. Each brass or copper pipe with threaded joints must have, at the tap or wet connection, an offset swing joint consisting of four (4) elbows and three (3) pieces of pipe, each piece of pipe not less than two (2) feet in length, laid to the right side facing the connection. Connections to the City main by ductile iron or cast iron must be made directly; offset swing joints must not be used.

Where buildings are constructed on pile foundations or other unyielding supports, the brass or copper tubing service must have two (2) goosenecks, and the brass or copper pipe with threaded joints must have two (2) offset swing joints, one (1) at the tap or the wet connection, laid to the right side facing the main, and one (1) immediately outside the building, laid to the right side facing the building, with a sleeve to carry the service through the foundation wall.

(E) COVER FOR SERVICE PIPE - All service pipes must be installed and maintained at a depth of at least three and one-half (3-1/2) feet and no more than six (6) feet below ground unless written permission to vary this requirement is obtained from the Department of Design and Construction. Where a service pipe has less than three and one-half (3-1/2) feet of cover, due to subsurface conditions, it must be insulated and protected, if required, in a manner approved by the Department of Design and Construction.

A service pipe must not be laid within twelve (12) inches of any other subsurface structure, conduit or pipe, nor directly below and parallel with subsurface structure, conduit or pipe.

(F) INSULATION FOR SERVICE PIPE

(1) All surfaces to be insulated must be cleaned of all scale, rust, oil and foreign matter and must be dry and free of frost prior to and during application of insulation.
(2) Sandblasting and priming of surfaces to be insulated are at the discretion of the Engineer.
(3) All testing of piping to be insulated must be completed prior to the application of any insulation materials.
(4) All insulation and accessory materials must be stored in an area that is dry and protected from weather before and during insulation application.
(5) Insulation should be provided with a factory-applied jacket as described in **Subsection 25.01.3**.
(6) Insulation must be applied based on the approved manufacturer's requirements and as approved by the Engineer.
(7) There must be no openings, folds, wrinkles or pinholes in the jacketing or the mastic finish.
(8) The Contractor must have the Engineer approve the insulation and finish application procedures before, during and after the application.

(G) SERVICE IN SEWER TRENCH - Service pipe laid in a sewer or construction trench must be protected from settlement by supports or by securely benching the service in side earth wall.

(H) BACKFILL - After a tap has been inserted or service pipe installed, the backfill around and one (1) foot over the main and service must be Select Granular Fill and carefully tamped under and around the main and service. The remainder of the backfill must be Approved Excavated Suitable Fill and must be satisfactorily compacted either by tamping or flushing, or both. Where tunneling has been permitted the backfill of the tunnel portion must be well compacted with Select Granular Fill.

(I) TEST OF SERVICE PIPE - Each new service pipe or repaired service pipe must be subjected to a water test under the street main pressure by the plumber in the presence of the tapper or inspector. All pipes and appurtenances must remain uncovered for the duration of the test and must show no sign of leakage. Subject to the discretion of the Department when any question arise as to the installation being in conformity with these specifications, internal hydrostatic test as specifies for materials may be applied.

64.12.4 MEASUREMENT

The quantities of extending house service water connections to be measured for payment must be the number of linear feet of pipe incorporated in the work, complete, as shown, specified or required, measured from the center line of an existing main to a new water main that requires additional footage to service a house.

The quantities of replacing deteriorated house services to be measured for payment must be the number of linear feet of pipe incorporated in the work, complete, as shown, specified or required, measured from the center line of the new water main to a point as determined by the Engineer.

The quantities of cut and offset house service water connections to be measured for payment must be the number of linear feet of pipe incorporated in the work, complete, as shown, specified or required, measured from between the splice points along the line of the offset as determined by the Engineer.

64.12.5 PRICE TO COVER

(A) COMPENSATION FOR EXTENDING HOUSE SERVICE LINES - Where the new mains are laid at a distance of more than three (3) feet measured center-line to center-line from the existing main (excluding the linear measurement of the goose-neck), compensation will be made to the Contractor at the unit price bid for all materials and sizes under the appropriate bid items; Item No. 64.12ESLT - EXTENDING HOUSE SERVICE WATER CONNECTIONS (LESS THAN 3-INCH DIAMETER), and Item No. 64.12ESEG - EXTENDING HOUSE SERVICE WATER CONNECTIONS (EQUAL TO OR GREATER THAN 3-INCH DIAMETER).

The above compensation is in addition to the applicable contract item(s) for "WITHDRAWING AND REPLACING HOUSE SERVICES", various sizes, located in the bid schedule and must be only for that distance beyond the three (3) feet as measured above. It must cover the cost of all labor, materials, plant, equipment and insurance required to complete the work, including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); backfilling; cleaning up; hauling away of all materials, together with all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans, specifications and standards, and as directed by the Engineer and the Department of Environmental Protection. Related work such as pavement excavation and temporary and final restoration, rock or boulder excavation, sheeting, etc. must be paid under their applicable items.

(B) COMPENSATION FOR REPLACING DETERIORATED HOUSE SERVICE LINES - Compensation for replacing deteriorated house services will be made under the item(s) for "EXTENDING HOUSE SERVICE WATER CONNECTIONS", various sizes, located in the bid schedule. It must cover the cost of all labor, materials, plant, equipment and insurance required to complete the work including the earth excavation of all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**); backfilling; cleaning up; hauling away of all materials, together with all other items necessary to complete this work and do all work incidental thereto, all in accordance with the plans, specifications and standards, and as directed by the Engineer and the Department of Environmental Protection. Related work such as pavement excavation and temporary and final restoration, rock or boulder excavation, sheeting, etc. must be paid under their applicable items.

The above compensation is in addition to the applicable bid item(s) for "WITHDRAWING AND REPLACING HOUSE SERVICES", various sizes, located in the bid schedule.

No direct payment will be made to the Contractor for insulating service pipes, where required. All costs associated with furnishing, delivering and installing insulation and appurtenances will be deemed included in the item(s) "WITHDRAWING AND REPLACING HOUSE SERVICES", various sizes, and "EXTENDING HOUSE SERVICE WATER CONNECTIONS" various sizes, located in the bid schedule.

(C) COMPENSATION FOR CUTTING AND OFFSETTING HOUSE SERVICE LINES - Payment for offsetting house service water connections will be made under Item No. 64.12COLT - CUTTING AND OFFSETTING HOUSE SERVICE WATER CONNECTIONS (LESS THAN 3-INCH DIAMETER), and Item No. 64.12COEG - CUTTING AND OFFSETTING HOUSE SERVICE WATER CONNECTIONS (EQUAL TO OR GREATER THAN 3-INCH DIAMETER) only when it is necessary to cut and offset the service in order to avoid interference with the new main in its final position. No payment will be made to the Contractor for services which can be offset without cutting or where services are cut merely for Contractor's ease in the installation of new mains.

Payment for Extending House Service Water Connections; And, Cutting And Offsetting House Service Water Connections will be made under the Item Number as calculated below:

The Item Numbers for Extending House Service Water Connections; And, Cutting And Offsetting House Service Water Connections have nine characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Extending House Service Water Connections; And, Cutting And Offsetting House Service Water Connections:

64.12

(2) The sixth and seventh characters must define Extending House Service Water Connections; And, Cutting And Offsetting House Service Water Connections:

ES - Extending House Service Water Connections
CO - Cutting And Offsetting House Service Water Connections

(3) The eighth and ninth characters must define the Size (Diameter) of the House Service Pipes:

LT - Less Than 3-Inch Diameter
EG - Equal To Or Greater Than 3-Inch Diameter

(4) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
64.12ESLT	EXTENDING HOUSE SERVICE WATER CONNECTIONS (LESS THAN 3-INCH DIAMETER)	L.F.
64.12ESEG	EXTENDING HOUSE SERVICE WATER CONNECTIONS (EQUAL TO OR GREATER THAN 3-INCH DIAMETER)	L.F.
64.12COLT	CUTTING AND OFFSETTING HOUSE SERVICE WATER CONNECTIONS (LESS THAN 3-INCH DIAMETER)	L.F.
64.12COEG	CUTTING AND OFFSETTING HOUSE SERVICE WATER CONNECTIONS (EQUAL TO OR GREATER THAN 3-INCH DIAMETER)	L.F.

SECTION 64.13 – FURNISHING, DELIVERING, AND INSTALLING WET CONNECTION SLEEVES

64.13.1 DESCRIPTION

This section describes the furnishing, delivering and installation of wet connection sleeves for this contract.

64.13.2 MATERIALS

Wet connection sleeves must be in accordance with **Section 20.09 - Standard Specifications For Stainless Steel Tapping Sleeves With Branch Connections For Flanged Tapping Valve Or Mechanical Joint Tapping Valve**.

64.13.3 CONSTRUCTION METHODS

The Contractor must adhere to **Section 64.11 - Withdrawing And Replacing House Services**.

Department force will make the cuts in mains for services requiring wet connections. The Contractor must do all other work, including the setting of the wet connection sleeves and valves and placing the cutting machine in position.

64.13.4 MEASUREMENT

The quantity of wet connection sleeves to be measured for payment must be the actual number of sleeves furnished, delivered and installed. Payment will be made under the various respective contract item(s) for "FURNISHING, DELIVERING AND INSTALLING WET CONNECTION SLEEVE ON WATER MAIN PIPE WITH VARIOUS OUTLETS" and will be paid for based upon the size of pipe the sleeve will be installed on regardless of the size of the outgoing branch (i.e. A wet connection sleeve on 12-inch water main pipe with a 3-inch outlet will be paid as a wet connection sleeve on 12-inch water main pipe; a wet connection sleeve on 12-inch water main pipe with a 6-inch outlet will also be paid for as a wet connection sleeve on 12-inch water main pipe; etc.).

64.13.5 PRICE TO COVER

The contract price for “FURNISHING, DELIVERING AND INSTALLING WET CONNECTION SLEEVE ON WATER MAIN PIPE WITH VARIOUS OUTLETS” must be a unit price bid per each size wet connection sleeve installed and must cover the cost of all labor, materials, plant, equipment and insurance required to complete the work in the manner herein set forth and specified. No separate or additional payment will be made under any other item or items of the contract for labor, equipment or materials used in connection with the work under this item, but the costs thereof must be considered as having been included in the amount(s) stipulated for this item.

Payment for Furnishing, Delivering And Installing Wet Connection Sleeves On Water Main Pipe With Various Outlets will be made under the Item Number as calculated below:

The Item Numbers for Furnishing, Delivering And Installing Wet Connection Sleeves On Water Main Pipe With Various Outlets have nine characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing, Delivering And Installing Wet Connection Sleeves On Water Main Pipe With Various Outlets:

64.13

(2) The sixth and seventh characters must define Wet Connection Sleeves On Water Main Pipe With Various Outlets:

WC - Wet Connection Sleeves On Water Main Pipe With Various Outlets

(3) The eighth and ninth characters must define the Size (Diameter) of the Water Main Pipe the Wet Connection Sleeve is on. (The eighth and ninth characters representing the unit of inches for the Size (Diameter) of the Water Main Pipe the Wet Connection Sleeve is on.) See examples below:

06 - 6-Inch
20 - 20-Inch

(4) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
64.13WC24	FURNISHING, DELIVERING AND INSTALLING WET CONNECTION SLEEVE ON 24-INCH WATER MAIN PIPE WITH VARIOUS OUTLETS	EACH
64.13WC20	FURNISHING, DELIVERING AND INSTALLING WET CONNECTION SLEEVE ON 20-INCH WATER MAIN PIPE WITH VARIOUS OUTLETS	EACH
64.13WC16	FURNISHING, DELIVERING AND INSTALLING WET CONNECTION SLEEVE ON 16-INCH WATER MAIN PIPE WITH VARIOUS OUTLETS	EACH
64.13WC14	FURNISHING, DELIVERING AND INSTALLING WET CONNECTION SLEEVE ON 14-INCH WATER MAIN PIPE WITH VARIOUS OUTLETS	EACH
64.13WC12	FURNISHING, DELIVERING AND INSTALLING WET CONNECTION SLEEVE ON 12-INCH WATER MAIN PIPE WITH VARIOUS OUTLETS	EACH
64.13WC10	FURNISHING, DELIVERING AND INSTALLING WET CONNECTION SLEEVE ON 10-INCH WATER MAIN PIPE WITH VARIOUS OUTLETS	EACH
64.13WC08	FURNISHING, DELIVERING AND INSTALLING WET CONNECTION SLEEVE ON 8-INCH WATER MAIN PIPE WITH VARIOUS OUTLETS	EACH
64.13WC06	FURNISHING, DELIVERING AND INSTALLING WET CONNECTION SLEEVE ON 6-INCH WATER MAIN PIPE WITH VARIOUS OUTLETS	EACH
64.13WC04	FURNISHING, DELIVERING AND INSTALLING WET CONNECTION SLEEVE ON 4-INCH WATER MAIN PIPE WITH VARIOUS OUTLETS	EACH

SECTION 65.11 – FURNISHING, DELIVERING, AND INSTALLING BAND, RODS, WASHERS, NUTS AND BOLTS

65.11.1 DESCRIPTION

This section describes the furnishing, delivering and installation of bands, rods, washers, nuts and bolts for this contract.

65.11.2 MATERIALS

Bands, rods, washers, nuts and bolts must be in accordance with **Section 23.05** of these specifications.

65.11.3 CONSTRUCTION METHODS

In order to protect against unbalanced pressures, the Contractor may use, if approved by the Engineer; bands and rods to restrain piping to meet the minimum lengths of required restraint as described in **Subsection 60.12.3(I)** of these specifications. Bands and rods must only be used where it is impractical to install new ductile iron restrained joint pipe to meet the aforementioned requirements.

65.11.4 MEASUREMENT

The quantity of bands, rods, washers, nuts and bolts to be measured for payment must be the weight in pounds as shown on **Standard Drawing No. 20731-Z-C** actually furnished and delivered and incorporated into the work, complete, as shown, specified or required.

65.11.5 PRICE TO COVER

Payment for furnishing, delivering and installing bands, rods, washers, nuts and bolts and all other materials required to restrain pipe joints that are ordered by the Engineer to protect against unbalanced pressures will be made to the Contractor under the unit price bid for contract Item No. 65.11BR - FURNISHING, DELIVERING AND INSTALLING BANDS, RODS, WASHERS, ETC., COMPLETE, FOR RESTRAINING JOINTS.

65.11.6 NO PAYMENT

No direct payment will be made for steel bolts, nuts and washers used to connect flanges. Payment will be deemed included in prices bid for all items of the contract. All bolts, nuts and washers removed during the course of the work must be replaced with new steel bolts, nuts and washers.

No direct payment will be made for application of protective coating to bolts, nuts, and flanges. Payment will be deemed included in prices bid for all items of the contract.

Payment for Furnishing, Delivering And Installing Bands, Rods, Washers, Etc., Complete, For Restraining Joints will be made under the Item Number as calculated below:

The Item Number for Furnishing, Delivering And Installing Bands, Rods, Washers, Etc., Complete, For Restraining Joints has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing, Delivering And Installing Bands, Rods, Washers, Etc., Complete, For Restraining Joints:

65.11

(2) The sixth and seventh characters must define Furnishing, Delivering And Installing Bands, Rods, Washers, Etc., Complete, For Restraining Joints:

BR - Furnishing, Delivering And Installing Bands, Rods, Washers, Etc., Complete, For Restraining Joints

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
65.11BR	FURNISHING, DELIVERING AND INSTALLING BANDS, RODS, WASHERS, ETC., COMPLETE, FOR RESTRAINING JOINTS	LBS.

SECTION 65.21 – FURNISHING AND PLACING POLYETHYLENE SLEEVE

65.21.1 DESCRIPTION

This section describes the furnishing, delivering and placing of Polyethylene Sleeve up to and including 20-inch diameter pipe.

65.21.2 MATERIALS

Polyethylene sleeve must be in accordance with **Section 25.02**.

65.21.3 CONSTRUCTION METHODS

(A) The Contractor must encase the new ductile iron mains and appurtenances (i.e., straight pipe, bends, reducers and offsets) to be installed in an approved loose 8-mil thick polyethylene sleeve, where required and ordered by the Engineer, in accordance with Method "A" of ANSI/AWWA C105/A21.5. Method "A" is outlined below for the Contractor's information:

(1) The pipe must be picked up by a crane or trenching machine at the side of the trench, using either a sling or pipe tongs, and raised about three (3) feet off the ground. A polyethylene tube, cut approximately two (2) feet longer than the length of the pipe, must be slipped over the spigot end of the pipe and bunched up, accordion fashion, between the end of the pipe and the sling.

(2) The pipe must be lowered into the trench; the spigot seated into the bell of the adjacent installed pipe or fitting, and the pipe must then be lowered to the bottom. A bell hole must be provided in the trench bottom to facilitate the wrapping of the joint.

(3) The pipe joint must then be made up.

(4) The sling must be removed from the center of the pipe and hooked into the bell cavity. The bell must be raised 3 to 4-inches and the tube of polyethylene film must be slipped along the full length of the pipe barrel. Enough of the film should be left bunched up, accordion fashion, at each end of the pipe, to overlap the adjoining pipe or fitting about one (1) foot.

(5) To make the overlapped joint wrap, the film must be pulled over the bell of the pipe, folded around the adjacent spigot, and wrapped with a minimum of three (3) circumferential turns of 2-inches wide polyethylene adhesive tape in order to secure the tube of film to the pipe. The tube on the adjacent pipe must then be pulled over the first wrap on the pipe bell and secured in place behind the bell, using a minimum of three (3) circumferential turns of the polyethylene adhesive tape.

(6) The resulting loose wrap on the barrel of the pipe must be pulled snugly around the barrel of the pipe, the excess material folded over the top, and the fold held in place, by means of short strips of polyethylene adhesive tape, at intervals of about three (3) feet along the pipe barrel.

(7) Taps must be made by tapping through the polyethylene sleeve and taping around the screw tap.

(8) To avoid damage to the polyethylene sleeve, the trench must be backfilled by hand for the first foot of cover with Select Granular Fill.

(B) All other appurtenances (i.e., three-ways, four-ways, valves, taps, service connections, etc.), repairs and junctions between wrapped and unwrapped pipe not mentioned in paragraph (A) above must be encased as specified in ANSI/AWWA C105/A21.5.

65.21.4 MEASUREMENT

The quantity of polyethylene sleeve to be measured for payment must be the number of linear feet of ductile iron pipe water main wrapped and incorporated into the work.

65.21.5 PRICE TO COVER

Payment for furnishing, delivering and placing polyethylene sleeve will be made under the unit price bid for Item No. 65.21PS - FURNISHING AND PLACING POLYETHYLENE SLEEVE.

Payment for Furnishing And Placing Polyethylene Sleeve will be made under the Item Number as calculated below:

The Item Number for Furnishing And Placing Polyethylene Sleeve has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing And Placing Polyethylene Sleeve:

65.21

(2) The sixth and seventh characters must define Furnishing And Placing Polyethylene Sleeve:

PS - Furnishing And Placing Polyethylene Sleeve (Not Less Than Item)

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
65.21PS	FURNISHING AND PLACING POLYETHYLENE SLEEVE (NOT LESS THAN $XX.XX/L.F.)	L.F.

SECTION 65.31 – FURNISHING, DELIVERING, AND PLACING FILTER FABRIC

65.31.1 DESCRIPTION

This section describes the furnishing, delivering and placing of ground stabilization Filter Fabric.

65.31.2 MATERIALS

Filter fabric must be in accordance with **Section 25.03**.

65.31.3 CONSTRUCTION METHODS

(A) DESCRIPTION - The Contractor must furnish, deliver and install ground stabilization filter fabric in water main trenches as shown on **Standard Drawing No. 44292-B-Z** to the extent required and as directed by the Engineer.

(B) PLACEMENT OF MATERIAL - Filter fabrics, which are subject to deterioration by Ultraviolet rays, must be protected from sunlight during transport and storage.

Fabric (those subject to damage from sunlight as well as those that are not) must not be left exposed more than two (2) weeks before being covered by backfill.

(1) Bedding Trench: When screened gravel or screened broken stone bedding is required, the ground stabilization filter fabric must be placed in the bedding trench so as to conform loosely to the shape of the trench. The bedding material must then be placed and compacted as specified in the specification for gravel or broken stone bedding of pipe.

The ground stabilization filter fabric must then be folded over the top of the bedding material to produce a minimum overlap of twelve (12) inches.

(2) Pipe Installation Trench: The ground stabilization filter fabric must be placed in the trench, if ordered, on top of the ground stabilization filter fabric covering the bedding so as to conform loosely to the shape of the trench. The pipe must be installed and the backfill placed and compacted up to the base of the existing or proposed pavement as specified in the specifications. The ground stabilization filter fabric must then be folded over the top of the backfill material to produce a minimum overlap of twelve (12) inches.

(3) Overlap in Longitudinal Direction: Successive sheets installed in the longitudinal direction (parallel to the pipe) must be overlapped a minimum of twelve (12) inches.

65.31.4 MEASUREMENT

The quantity to be measured for payment for furnishing, delivering and installing ground stabilization filter fabric must be the number of square feet measured in place actually incorporated into the work in accordance with the payment lines shown on **Standard Drawing No. 44292-B-Z** or on the contract drawings or as ordered by the Engineer.

The area of ground stabilization filter fabric must be calculated by multiplying the actual width of the ground stabilization filter fabric required to completely surround the bedding or refill material, as applicable, with the actual length of installation. The quantity to be paid for must include a longitudinal top overlap of maximum twelve (12) inches.

No payment will be made for top overlaps exceeding twelve (12) inches, nor will payment be made for additional longitudinal or any peripheral overlap.

65.31.5 PRICE TO COVER

Payment for furnishing, delivering and placing ground stabilization filter fabric will be made under the unit price bid for Item No. 65.31FF - FURNISHING, DELIVERING AND PLACING FILTER FABRIC.

Payment for Furnishing, Delivering And Placing Filter Fabric will be made under the Item Number as calculated below:

The Item Number for Furnishing, Delivering And Placing Filter Fabric has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing, Delivering And Placing Filter Fabric:

(2) The sixth and seventh characters must define Furnishing, Delivering And Placing Filter Fabric:

FF - Furnishing, Delivering And Placing Filter Fabric (Not Less Than Item)

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
65.31FF	FURNISHING, DELIVERING AND PLACING FILTER FABRIC (NOT LESS THAN $XX.XX/S.F.)	S.F.

SECTION 65.41 – FURNISHING, DELIVERING, AND INSTALLING PIPE-TO-WALL PENETRATION SEAL

65.41.1 DESCRIPTION

This section describes the furnishing, delivering and installing of pipe-to-wall penetration seals including steel sleeves and anchor/water stop plates.

65.41.2 MATERIALS

All pipe-to-wall penetration seals including steel sleeves and anchor/water stop plates must be in accordance with the standard drawings.

65.41.3 CONSTRUCTION METHODS

All pipe-to-wall penetration seals including steel sleeves and anchor/water stop plates must be installed in accordance with the standard drawings.

65.41.4 MEASUREMENT

The quantity of pipe-to-wall penetration seals including steel sleeves and anchor/water stop plates measured for payment must be the number of each size pipe-to-wall penetration seal including steel sleeve and anchor/water stop plate furnished, delivered and installed by the Contractor.

65.41.5 PRICE TO COVER

The contract price for "FURNISHING, DELIVERING AND INSTALLING PIPE-TO-WALL PENETRATION SEAL, INCLUDING STEEL SLEEVE AND ANCHOR/WATER STOP PLATE" must be the unit price bid per each size pipe-to-wall penetration seal including steel sleeve and anchor/water stop plate furnished, delivered and installed and must cover the cost of all labor, equipment, materials, plant, samples, tests and insurance required and necessary to furnish, deliver and install pipe-to-wall penetration seals including steel sleeves and anchor/water stop plates in the manner specified herein and as directed by the Engineer.

Payment for Furnishing, Delivering And Installing Pipe-To-Wall Penetration Seal, Including Steel Sleeve And Anchor/Water Stop Plate will be made under the Item Number as calculated below:

The Item Numbers for Furnishing, Delivering And Installing Pipe-To-Wall Penetration Seal, Including Steel Sleeve And Anchor/Water Stop Plate have nine characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing, Delivering And Installing Pipe-To-Wall Penetration Seal, Including Steel Sleeve And Anchor/Water Stop Plate:

65.41

(2) The sixth and seventh characters must define Pipe-To-Wall Penetration Seal, Including Steel Sleeve And Anchor/Water Stop Plate:

PS - Pipe-To-Wall Penetration Seal, Including Steel Sleeve And Anchor/Water Stop Plate

(3) The eighth and ninth characters must define the Size (Diameter) of the Pipe-To-Wall Penetration Seal. (The eighth and ninth characters representing the unit of inches for the Size (Diameter) of the Pipe-To-Wall Penetration Seal.) See examples below:

08 - 8-Inch
24 - 24-Inch
72 - 72-Inch

(4) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
65.41PS72	FURNISHING, DELIVERING AND INSTALLING 72-INCH PIPE-TO-WALL PENETRATION SEAL, INCLUDING STEEL SLEEVE AND ANCHOR/WATER STOP PLATE	EACH
65.41PS66	FURNISHING, DELIVERING AND INSTALLING 66-INCH PIPE-TO-WALL PENETRATION SEAL, INCLUDING STEEL SLEEVE AND ANCHOR/WATER STOP PLATE	EACH
65.41PS60	FURNISHING, DELIVERING AND INSTALLING 60-INCH PIPE-TO-WALL PENETRATION SEAL, INCLUDING STEEL SLEEVE AND ANCHOR/WATER STOP PLATE	EACH
65.41PS54	FURNISHING, DELIVERING AND INSTALLING 54-INCH PIPE-TO-WALL PENETRATION SEAL, INCLUDING STEEL SLEEVE AND ANCHOR/WATER STOP PLATE	EACH
65.41PS48	FURNISHING, DELIVERING AND INSTALLING 48-INCH PIPE-TO-WALL PENETRATION SEAL, INCLUDING STEEL SLEEVE AND ANCHOR/WATER STOP PLATE	EACH
65.41PS42	FURNISHING, DELIVERING AND INSTALLING 42-INCH PIPE-TO-WALL PENETRATION SEAL, INCLUDING STEEL SLEEVE AND ANCHOR/WATER STOP PLATE	EACH
65.41PS36	FURNISHING, DELIVERING AND INSTALLING 36-INCH PIPE-TO-WALL PENETRATION SEAL, INCLUDING STEEL SLEEVE AND ANCHOR/WATER STOP PLATE	EACH
65.41PS30	FURNISHING, DELIVERING AND INSTALLING 30-INCH PIPE-TO-WALL PENETRATION SEAL, INCLUDING STEEL SLEEVE AND ANCHOR/WATER STOP PLATE	EACH
65.41PS24	FURNISHING, DELIVERING AND INSTALLING 24-INCH PIPE-TO-WALL PENETRATION SEAL, INCLUDING STEEL SLEEVE AND ANCHOR/WATER STOP PLATE	EACH
65.41PS20	FURNISHING, DELIVERING AND INSTALLING 20-INCH PIPE-TO-WALL PENETRATION SEAL, INCLUDING STEEL SLEEVE AND ANCHOR/WATER STOP PLATE	EACH
65.41PS16	FURNISHING, DELIVERING AND INSTALLING 16-INCH PIPE-TO-WALL PENETRATION SEAL, INCLUDING STEEL SLEEVE AND ANCHOR/WATER STOP PLATE	EACH
65.41PS14	FURNISHING, DELIVERING AND INSTALLING 14-INCH PIPE-TO-WALL PENETRATION SEAL, INCLUDING STEEL SLEEVE AND ANCHOR/WATER STOP PLATE	EACH
65.41PS12	FURNISHING, DELIVERING AND INSTALLING 12-INCH PIPE-TO-WALL PENETRATION SEAL, INCLUDING STEEL SLEEVE AND ANCHOR/WATER STOP PLATE	EACH
65.41PS10	FURNISHING, DELIVERING AND INSTALLING 10-INCH PIPE-TO-WALL PENETRATION SEAL, INCLUDING STEEL SLEEVE AND ANCHOR/WATER STOP PLATE	EACH
65.41PS08	FURNISHING, DELIVERING AND INSTALLING 8-INCH PIPE-TO-WALL PENETRATION SEAL, INCLUDING STEEL SLEEVE AND ANCHOR/WATER STOP PLATE	EACH
65.41PS06	FURNISHING, DELIVERING AND INSTALLING 6-INCH PIPE-TO-WALL PENETRATION SEAL, INCLUDING STEEL SLEEVE AND ANCHOR/WATER STOP PLATE	EACH
65.41PS04	FURNISHING, DELIVERING AND INSTALLING 4-INCH PIPE-TO-WALL PENETRATION SEAL, INCLUDING STEEL SLEEVE AND ANCHOR/WATER STOP PLATE	EACH

SECTION 65.51 – FURNISHING AND PLACING CONCRETE

65.51.1 DESCRIPTION

This section describes the use of concrete for the construction of water main structures (i.e., manholes, chambers, recess vaults, cradles, saddles, piers, pipe foundations, etc.) as approved by the Engineer.

65.51.2 MATERIAL

All concrete must be in accordance with **General Specification 11 - Concrete, as modified in Section 23.01**.

65.51.3 CONSTRUCTION METHODS

(1) The Contractor must furnish, deliver and place concrete and other concrete related work as required by the contract drawings or as ordered by the Engineer.

(2) The Contractor must perform the work in accordance with New York City Department of Environmental Protection **General Specification 11 - Concrete, as modified in Section 23.01**.

(3) Concrete must be of the dimension shown on the drawings.

65.51.4 MEASUREMENT

(1) The quantity of concrete to be measured for payment must be the number of cubic yards of concrete incorporated into the work, complete, as shown, specified or required.

(2) The number of cubic yards of concrete must be the actual volume of concrete placed in the work in conformance with the contract drawings and contract documents.

(3) When concrete is to be paid for by lump sum or by linear foot, or by the square foot, or by the square yard of completed structure, it will not be measured for payment under the concrete item unless specifically so stated on the contract drawings or shown in the Bid Schedule.

(4) Deductions will be made for the volume of openings, the areas of which are greater than one (1) square foot and for bevels on beams, columns and in wall openings when such bevels exceed four (4) inches on the diagonal faces.

(5) Deductions will not be made for the portion of piles embedded in concrete foundations.

(6) Deductions will not be made for expansion joints, structural steel, steel reinforcement, nor for conduits and pipes with a sectional area less than one (1) square foot.

65.51.5 PRICE TO COVER

The contract price for Item No. 65.51PC - FURNISHING AND PLACING CAST-IN-PLACE CONCRETE CLASS 40 AND PRECAST CONCRETE CLASS 50 must be unit price bid per cubic yard and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required to furnish, deliver and do all work incidental thereto, all in accordance with the plans, specifications and standards and as directed by the Engineer.

65.51.6 NO SEPARATE PAYMENT

(1) No payment will be made for concrete or cement placed outside the lines and grades indicated, specified or ordered in writing by the Engineer, or placed to fill unauthorized excavation or used for replacing defective work.

(2) No payment will be made for concrete or cement specified to be included in the lump sum price bid for a structure.

Payment Furnishing And Placing Cast-In-Place Concrete Class 40 And Precast Concrete Class 50 will be made under the Item Number as calculated below:

The Item Number for Furnishing And Placing Cast-In-Place Concrete Class 40 And Precast Concrete Class 50 has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing And Placing Cast-In-Place Concrete Class 40 And Precast Concrete Class 50:

(2) The sixth and seventh characters must define Furnishing And Placing Cast-In-Place Concrete Class 40 And Precast Concrete Class 50:

PC - Furnishing And Placing Cast-In-Place Concrete Class 40 And Precast Concrete Class 50

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	**Description**	**Pay Unit**
65.51PC	FURNISHING AND PLACING CAST-IN-PLACE CONCRETE CLASS 40 AND PRECAST CONCRETE CLASS 50	C.Y.

SECTION 65.61 – FURNISHING, DELIVERING, AND PLACING STRUCTURAL, REINFORCING AND MISCELLANEOUS STEEL

65.61.1 DESCRIPTION

This section describes the use of structural, reinforcing and miscellaneous steel for the construction of chambers, manholes and pipe foundations as approved by the Engineer.

65.61.2 MATERIALS

All steel, reinforcing, structural and miscellaneous, must be in accordance with **Section 23.05**.

65.61.3 CONSTRUCTION METHODS

(1) WORK INCLUDED - The Contractor must furnish, deliver and place Steel I beams, expanded metal or any other structural steel or steel shapes, steps, ladders, bands, bolts, nuts, washers, and other steel work required by the drawings or ordered by the Engineer.

(2) PAINTING - Steel surfaces must be cleaned and painted in accordance with **Subsection 23.05.5**, and as directed by the Engineer.

65.61.4 MEASUREMENT

The quantity of structural, reinforcing and miscellaneous steel to be measured for payment must be the number of pounds of structural, reinforcing and miscellaneous steel incorporated into the work, complete, as shown, specified or required.

65.61.5 PRICE TO COVER

The contract price for Item No. 65.61SS - FURNISHING, DELIVERING AND PLACING STRUCTURAL, REINFORCING AND MISCELLANEOUS STEEL must be the unit price bid per pound of structural, reinforcing and miscellaneous steel and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required to furnish, deliver and place the structural, reinforcing and miscellaneous steel and do all work incidental thereto, all in accordance with the plans, specifications and standards and as directed by the Engineer.

Payment for Furnishing, Delivering And Placing Structural, Reinforcing And Miscellaneous Steel will be made under the Item Number as calculated below:

The Item Number for Furnishing, Delivering And Placing Structural, Reinforcing And Miscellaneous Steel has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing, Delivering And Placing Structural, Reinforcing And Miscellaneous Steel:

65.61

(2) The sixth and seventh characters must define Furnishing, Delivering And Placing Structural, Reinforcing And Miscellaneous Steel:

SS - Furnishing, Delivering And Placing Structural, Reinforcing And Miscellaneous Steel

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
65.61SS	FURNISHING, DELIVERING AND PLACING STRUCTURAL, REINFORCING AND MISCELLANEOUS STEEL	LBS.

SECTION 65.71 – FURNISHING, DELIVERING, AND PLACING SCREENED GRAVEL OR SCREENED BROKEN STONE BEDDING

65.71.1 DESCRIPTION

This section describes the furnishing, delivering and placing of screened gravel or screened broken stone bedding.

65.71.2 MATERIALS

Screened gravel or screened broken stone bedding must be in accordance with **Section 26.02**.

65.71.3 CONSTRUCTION METHODS

To the extent required and as directed by the Engineer, the new mains must be installed with a bed of gravel, or broken stone below the pipe as shown on **Standard Drawing No. 44292-B-Z** or on the contract drawings or as ordered by the Engineer.

It must be placed in horizontal layers not exceeding 6-inches in thickness. Each layer must be tamped sufficiently with approved mechanical tampers to secure the required compaction.

65.71.4 MEASUREMENT

The quantity of screened gravel or screened broken stone bedding to be measured for payment must be the number of cubic yards of compacted volume of screened gravel or screened broken stone bedding in place as determined by the Engineer, within the payment lines shown on **Standard Drawing No. 44292-B-Z** or on the contract drawings or as ordered by the Engineer.

65.71.5 PRICE TO COVER

Payment for furnishing, delivering and placing screened gravel or screened broken stone bedding will be made under the unit price bid for Item No. 65.71SG - FURNISHING, DELIVERING AND PLACING SCREENED GRAVEL OR SCREENED BROKEN STONE BEDDING.

65.71.6 ADDITIONAL PAYMENT

Payment for the cost for all additional excavation required below the normal trench subgrade excavation limit in order to place the gravel or broken stone bedding to the depth shown, specified or ordered, must be made under the unit price bid for item(s) labeled “ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS”. All additional excavation must comply with the requirements of **Section 73.31 - Additional Earth Excavation Including Test Pits**.

Payment for Furnishing, Delivering And Placing Screened Gravel Or Screened Broken Stone Bedding will be made under the Item Number as calculated below:

The Item Number for Furnishing, Delivering And Placing Screened Gravel Or Screened Broken Stone Bedding has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing, Delivering And Placing Screened Gravel Or Screened Broken Stone Bedding:

65.71

(2) The sixth and seventh characters must define Furnishing, Delivering And Placing Screened Gravel Or Screened Broken Stone Bedding:

SG - Furnishing, Delivering And Placing Screened Gravel Or Screened Broken Stone Bedding

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
65.71SG	FURNISHING, DELIVERING AND PLACING SCREENED GRAVEL OR SCREENED BROKEN STONE BEDDING	C.Y.

SECTION 66.11 – ALLOWANCE FOR WATER MAIN OFFSETS

66.11.1 DESCRIPTION

Under this section the Contractor must be required to perform the complete installation of water main offset work as directed by the Engineer. This item must be used exclusively for the additional costs associated with performing the complete installation of water main offset work as directed by the Engineer on the following type reconstruction contracts only: (Emergency Reconstruction Of Vitrified Clay Pipe Sewer Contracts; Emergency Reconstruction Of Cement Pipe Sewer Contracts; Pedestrian Ramp Contracts; Sidewalk Contracts; and, Catch Basin Contracts).

No guarantee is given that this allowance for additional costs associated with the work required for the complete installation of water main offsets will in fact be required in the contract. The estimated price in the Bid Schedule is included in the total bid solely to insure a method of payment for performing the complete installation of water main offset work as directed by the Engineer.

Payment made under this Item No. 66.11WO - ALLOWANCE FOR WATER MAIN OFFSETS must be equal to the sum total of all vouchers submitted by the Contractor as payment for the cost of performing water main offset work as approved by the Engineer. Payment under this item, including partial payments, will not be made until the Contractor has furnished satisfactory evidence to the Engineer that the Contractor has performed water main offset work.

The voucher for the payment must be submitted to the Engineer on a monthly basis.

The “fixed sum” in the Bid Schedule is for bidding purposes only and must not be varied in the bid; however, the Contractor will be paid only for the actual water main offset work performed regardless of the fixed sum, which may be more or less than the fixed amount.

All water main offset work must be performed in accordance with the applicable sections of the Standard Water Main Specifications and as directed by the Engineer.

Payment for Allowance For Water Main Offsets will be made under the Item Number as calculated below:

The Item Number for Allowance For Water Main Offsets has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Allowance For Water Main Offsets:

66.11

(2) The sixth and seventh characters must define Allowance For Water Main Offsets:

WO - Allowance For Water Main Offsets

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
66.11WO	ALLOWANCE FOR WATER MAIN OFFSETS (This Item Is Only For Use On Emergency Reconstruction Of Vitrified Clay Pipe Sewer Contracts; Emergency Reconstruction Of Cement Pipe Sewer Contracts; Pedestrian Ramp Contracts; Sidewalk Contracts; and, Catch Basin Contracts; When Requested By DEP.)	F.S.

(NO TEXT ON THIS PAGE)

CITY OF NEW YORK

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF WATER AND SEWER OPERATIONS

DIVISION VII – CLASSIFIED SECTIONS OF GENERAL WORK

SECTIONS 70.11 TO 79.91

(NO TEXT ON THIS PAGE)

SECTION 70.11 -- PILES

70.11.1 DESCRIPTION

(A) Piles of the kinds and types, and of the sizes and shapes shown, specified or ordered for sewer and water main construction must be furnished, driven and/or installed and cut off and capped at the locations, to the slopes, to the depths and to the elevations shown or required on the plans and standards, and as specified in the specifications, and as directed by the Engineer. This work must include the providing and installation of driving shoes and all other hardware where required, flame-cutting, placement of concrete fill in steel pipe piles, welding, bolting, riveting, splicing, spudding, augering, rotary drilling, pile surveys, drawings, schedules, decking, plating, analysis and corrective measures, and all other work hereinafter outlined and such other related work to insure a satisfactory pile foundation installation.

(B) Examination Of The Site:

(1) Prior to starting pile driving and/or installations, the Contractor must make a documented inspection of the existing structures, site conditions, pavement and improvements within the radius of influence and adjacent to the pile driving and/or installation site to examine and record their present condition.

The Contractor must prepare a preconstruction report in accordance with **Section 76.11 - Construction Report**.

(2) The Contractor must fully examine the existing conditions within the project limits to ensure that the Contractor's equipment can operate without damage to or relocation of existing infrastructure, facilities or structures. The Contractor must provide all required equipment, modified if needed to accommodate site conditions, including restricted headroom and other headroom limitations. If available, the Contractor must review the boring logs showing subsurface conditions.

(3) The Contractor must be required to prepare a report of all such conditions, verified by the photographs and signed by the Contractor's Professional Engineer, which must be reviewed by the Engineer to verify the existing site conditions and all pre-existing damage that may be affected by the piling work. Such work must be included in the preconstruction report.

(C) Qualifications:

The work must be performed by the Contractor or a subcontractor experienced in the specified foundation system and piling under similar subsurface conditions. The Contractor performing the work described in this specification must submit proof that the Contractor or subcontractor has successfully completed a minimum of two (2) projects in the last three (3) years on which the Contractor or subcontractor has successfully designed, tested and driven and/or installed piles.

The Contractor must also submit proof that the Contractor has employed a Licensed Professional Engineer, currently registered in the State of New York, having experience in the construction (designing, planning, testing and inspection phases) of at a minimum two (2) completed pile driving and/or installation projects over the past three (3) years. The Professional Engineer must be directly responsible for the work. The Contractor must not use manufacturers' representatives to satisfy the Contractor's responsible engineer requirements of this section.

In addition, the Engineer will review and approve the Contractor's key field personnel to be employed during driving and/or installation of the piles.

70.11.2 MATERIALS

(A) TIMBER PILES

(1) Timber piles and driving shoes must comply with the requirements of **Section 24.02**.

(2) Preservative treatment for timber piles must comply with the requirements of **Section 24.03**.

(B) STRUCTURAL STEEL H-PILES

(1) Steel piles must be new rolled structural steel H-sections.

(2) The material in steel piles and splices must conform to structural steel, in accordance with ASTM A1018.

(C) STEEL PIPE PILES

(1) Steel pipe piles must be spiral weld or seamless steel pipe conforming to ASTM A252, Grade 3. The steel pipe piles must further conform to the requirements specified herein and to the applicable requirements of the New York City Building Code. The ends of each steel pipe pile must be perpendicular to its axis. Metal to metal bearing joints must be machine cut. Other joints may be flame-cut.

(2) Unless otherwise shown or specified, all steel pipe piles must have an outer diameter of twelve (12) inches and have a minimum shell thickness of five-sixteenths (5/16) of an inch. In addition, all steel pipe piles must be provided with sixty (60) degree conical points. These conical points must be P-13006 as manufactured by Associated Pile and Fitting Corporation (Parsippany, NJ) or approved equal.

(3) All steel pipe piles must be filled with concrete. Concrete must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

70.11.3 GENERAL PILE INSTALLATION PROVISIONS

(A) TEST PILES - The Contractor must be responsible for the proper length of piles required to reach bedrock or refusal as defined herein for timber piles and to develop the specified bearing capacity loads as defined herein for structural steel H-piles and concrete filled steel pipe piles. Unless otherwise specified in the contract documents or in writing by the Engineer, the Contractor must be required to drive test piles and perform load tests in order to obtain this necessary information. Test piles must be of the same size, shape, kind and type as those specified for incorporation in the work, and the equipment and method of installation of test piles must be the same as those to be used in the installation of the permanent piles. Such load tests must be performed sufficiently in advance of the start of the Contractor's pile installation operation so as to prevent delay in the progress of the work.

Test loads may be applied by jacking against anchor piles, by jacking against a loaded platform, by direct application of weights or by other approved methods. The Contractor must secure the services of a Licensed Professional Engineer, currently registered in the State of New York and experienced in load test design, to design and supervise the load test(s) complete with recommendations as to the number and location of load tests, the method of load tests, and the set-up and procedure of load tests. The Professional Engineer must submit recommendations and designs to the Engineer for approval prior to the start of load testing.

The maximum test load must be twice the proposed working load value of the pile. The load test must be made in accordance with ASTM D1143, Procedure B: Maintained Test. After completion of the last load decrement, the final rebound must be recorded twenty-four (24) hours after the entire test load has been removed. The maximum allowable pile load must be one-half (1/2) that which causes a net settlement of not more than one-hundredth (1/100) of an inch per ton of total test load or must be one-half (1/2) that which causes a gross settlement of one (1) inch, whichever is less.

Test piles which are driven and/or installed in proper locations to bedrock or refusal for timber piles or to the specified loads for structural steel H-piles and concrete filled steel pipe piles, and entirely acceptable to the Engineer, must remain in place, be incorporated in the work, and will be paid for at the respective prices bid for contract Item No. 70.11TT - TIMBER PILES (TREATED), or for Item No. 70.11TU - TIMBER PILES (UNTREATED), or for Item No. 70.11SH - STRUCTURAL STEEL H PILES, or for Item No. 70.11CS - CONCRETE FILLED STEEL PIPE PILES.

All test piles other than those specifically accepted by the Engineer for permanent incorporation in the work and all temporary piles installed in order to satisfactorily perform load tests must be removed when ordered. No separate or additional payment will be made for such test piles not permanently incorporated in the work nor for temporary piles installed in order to satisfactorily perform load tests, but the cost of installation and removal thereof must be included in the prices bid for all items of the contract.

No separate or additional payment will be made for load tests including the cost for their design and supervision by a Professional Engineer, the excavation of load test pile pits, equipment and methods for performing load tests, backfilling and compaction of load test pile pits, temporary and permanent restoration of all disturbed sidewalk and pavement areas above pits (unless items for temporary and permanent restoration are otherwise provided in the Bid Schedule), and all work incidental thereto, but the cost thereof must be included in the prices bid per vertical foot for the respective pile items.

If the Contractor, at the Contractor's own discretion, decides to utilize equipment or methods other than those used for the passed load test, then additional load tests must be performed solely at the Contractor's expense prior to the start of the Contractor's pile installation operation.

(B) DRIVING AND/OR INSTALLATION SCHEDULE - Prior to the commencement of pile installation operations the Contractor must submit to the Engineer, for approval, six (6) copies of a pile plan showing the locations of all proposed piles. All piles indicated on the plan must be numbered and must indicate all proposed piles for the sewers, water mains and associated structures, and the sequence of the pile installation operation.

(C) PILE LOCATION SURVEYS - The Contractor must conduct all required pile location surveys prior to commencement of the Contractor's pile installation operations. The Contractor must be responsible for establishing and locating all lines and levels, and for the correctness of all pile locations and slopes.

(D) DRIVING AND/OR INSTALLATION OF PILES

(1) Piles must not be driven and/or installed within fifty (50) feet of concrete placed for structures, cradles, etc. that is less than seven (7) days old, or within fifty (50) feet of any steel pipe pile in which concrete has been placed less than forty-eight (48) hours before, unless otherwise approved in writing by the Engineer.

(2) All piles must be installed to a minimum depth of ten (10) feet below subgrade.

(3) NUMBER AND ARRANGEMENT OF PILES - The number and arrangement of piles as shown on the plans and standards must be considered as typical, but the Engineer reserves the right to change the number of piles and their arrangement at any location in accordance with conditions encountered during construction.

(4) PILE DRIVING - All piles must be driven and/or installed and spaced as shown on the plans and standards or as directed by the Engineer. All piles must be driven and/or installed in the presence of the Engineer or the Engineer's representative. All piles must be driven and/or installed in the same manner, with the same equipment, and to the same final resistance as was reached for test piles which were successfully load tested.

(5) The Contractor must mark the pile driver ways legibly with paint at intervals of one (1) foot, fixing the zero point where directed. All piles must be plainly marked with keel or paint to indicate length installed.

(6) PERMANENT PILES – Permanent piles must not be driven except at the locations where the excavation has been completed to subgrade. All timber piles (except brace, batter or spur piles) must be driven vertically to bedrock or to the specified refusal, and must be cut off at the elevations shown, or as directed. All structural steel H piles and steel pipe piles (except brace, batter or spur piles) must be driven vertically to the specified loads, and must be flame-cut and capped at the elevations shown, or as directed.

(7) Pile drivers must be provided with adequate leads to insure effective guiding for both the hammer and the pile being driven and/or installed.

(8) BROKEN PILES - Piles broken in driving must be withdrawn or abandoned and replaced with sound piles. No payment will be made for piles that are not permanently incorporated in the work.

(9) CUT OFF - After being driven, all piles must be accurately cut off or flame-cut and capped at the required elevations.

Any vertical or brace, batter or spur pile that is driven too low to cut off or to flame-cut and cap at the required elevations must be removed or abandoned if it cannot be removed and a longer pile driven in its place.

(10) DRIVING SHOES - When ordered by the Engineer, the Contractor will be required to point the small ends of the timber piles and shoe them with approved metal driving shoes. These must be T-9168 Arrow Points as manufactured by Associated Pile and Fitting Corporation (Parsippany, NJ) or approved equal.

(11) BRACE, BATTER OR SPUR PILES - Where shown on the plans, brace, batter or spur piles must be driven and/or installed to the slopes shown or directed, and to the specified bearing capacity

value or specified refusal. The springing of vertical piles into braced, battered or spurred positions will not be permitted. Brace, batter or spur structural steel H piles and steel pipe piles must be driven and/or installed to a bearing capacity of twenty-five (25) percent greater than that specified for vertical structural steel H piles and steel pipe piles. Tops of brace, batter or spur piles must be framed, bolted, strapped or fastened to adjoining piles or structure or to each other as shown on the plan, or as directed. All connections, except fastenings for wood lagging, must be either welded, riveted or bolted with high strength bolts, as shown, specified or directed.

(12) REFUSAL - All timber piles must be driven and/or installed to bedrock or to refusal. Refusal must be that depth where the safe bearing value of the timber pile reaches the specified design load capacity as calculated from the formulas indicated herein.

Unless otherwise specified, or shown on the plans, all timber piles must be driven to an allowable bearing capacity of twenty (20) tons.

Structural steel H piles and steel pipe piles must be installed to a penetration which will result in an allowable bearing capacity as shown, specified or ordered.

Each pile must be driven and/or installed continuously until the required refusal or bearing capacity has been obtained.

(13) DRIVING BRACE, BATTER OR SPUR PILES - The brace, batter or spur piles must be driven with a hammer of the same weight as that used in driving the vertical piles. Allowance must be made in the effective fall of the hammer to compensate for the canting of the leads. Special rigid inclined guiding leads of an approved design must be provided for the driving of the brace, batter or spur piles. When directed, a heavier hammer must be used.

(14) Hammer and piles must be supported in rigid leads designed to hold the pile firmly in position and alignment and in axial alignment with the hammer.

(15) Driving must be a continuous operation, but when driving is interrupted before final penetration is reached, the record of penetration must not be taken until at least a twelve (12) inch penetration has been obtained on resumption of driving. Piles, which in the opinion of the Engineer, are so damaged as to destroy their usefulness, must be removed and replaced with new piles.

(16) The driving of piles with followers is prohibited unless otherwise permitted by the Engineer.

(17) Each vertical pile must be driven by power hammer.

(18) Piles must be installed in such sequence as to prevent distortion or injury to piles in place.

(E) RESEATING - When installing piles in clusters, or under any conditions of relatively close spacing, observations must be made to determine any uplift of the piles. If uplift occurs, piles so affected must be reseated to either the original resistance or elevation or both as required by the Engineer. No separate or additional payment will be made for any required reseating of piles.

(F) OBSTRUCTIONS TO PILE INSTALLATION - In parts of the construction area, debris, boulders, or other obstructions may be encountered, making it difficult to install a pile(s) in the location(s) required by the pile plan and the Engineer. In such cases, the City may order the Contractor to resort to spudding, augering, drilling, or to other means to overcome the obstruction or may order the piles to be abandoned and additional piles installed.

Where the top of an obstruction is encountered three (3) feet or less below the subgrade of a trench, the Engineer may order the removal of the obstruction so as to clear a way for the pile(s). Payment for the cost of excavating to whatever depth required to remove obstruction, removing the obstruction and filling to subgrade must be made under the prices bid for the respective contract item(s) labeled "ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS", for Item No. 70.51EO - EXCAVATION OF BOULDERS IN OPEN CUT and for Item No. 70.71SB - STONE BALLAST. No separate or additional payment will be made for the removal and reinstallation of the pile at the same location and to the depth at which the top of the obstruction was encountered, the cost must be included in the price bid per vertical foot for the respective pile item. Payment for the installation of a pile length at the same location can only be made once, no matter how many time the pile has to be removed in order to remove the obstruction. No separate or additional payment will be made for any mobilization or other work incidental thereto.

Where the top of an obstruction is encountered greater than three (3) feet below the subgrade of a trench, and it is deemed necessary by the Engineer to over excavate to remove the obstruction in order to clear a

way for the pile(s), payment for the cost of this over excavation to whatever depth required to remove the obstruction, removing the obstruction and filling to subgrade must be made under the prices bid for the respective contract item(s) labeled "ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS", for Item No. 70.51EO - EXCAVATION OF BOULDERS IN OPEN CUT and for Item No. 70.71SB - STONE BALLAST. No separate or additional payment will be made for the removal and reinstallation of the pile at the same location and to the depth at which the top of the obstruction was encountered, the cost must be included in the price bid per vertical foot for the respective pile item. Payment for the installation of a pile length at the same location can only be made once, no matter how many time the pile has to be removed in order to remove the obstruction. No separate or additional payment will be made for any mobilization or other work incidental thereto.

The Contractor must have on hand suitable equipment for spudding, augering or drilling through buried timbers, cribbing, boulders and other obstructions, and must employ this equipment, when directed, in a manner satisfactory to the Engineer.

When spudding, augering or drilling is ordered by the City, payment therefore will be made to the Contractor in accordance with the requirements of **Subsection 70.11.3(L).**

If means other than spudding, augering, drilling or removal as stated herein are ordered for the purpose of overcoming obstructions, payment therefore will be made to the Contractor in accordance with **Articles 25 and 26** of the Contract.

Where due to an obstruction the Engineer deems it necessary to abandon a pile in place or remove the pile for installation at a different location, payment for the cost of the length of pile abandoned from the tip of the abandoned pile to the height of cutoff or for the length of pile removed from the tip of the removed pile to the height of the subgrade of the trench must be made under the prices bid per vertical foot for the respective pile item. No separate or additional payment will be made for any mobilization or other work incidental thereto.

(G) DEFECTIVE OR DAMAGED PILES - When any pile that has been installed is damaged or gets out of alignment by loss of contact with the driving apparatus or exceeds the TAGOs hereinafter specified it will be rejected. If in the opinion of the Engineer, the pile is unsuitable or otherwise does not conform to the requirements of the contract, such pile will be rejected. Rejected piles must be withdrawn or abandoned and cut off below subgrade, as ordered by the Engineer. Additional pile or piles must be installed in locations designated by the Engineer to replace rejected piles, and pile caps must be redesigned and enlarged as approved by the Engineer, at no additional cost to the City. No separate or additional payment will be made for the withdrawal or for the abandoning and cutting off below subgrade of rejected piles, the cost together with additional excavation, stone ballast fill and all work incidental thereto must be included in the prices bid for the respective pile items.

(H) TOLERANCES FOR PILES - Piles as finally placed, must not have a variation of more than one (1) percent of their exposed length from the vertical or from the batter as shown on the plans or as ordered. The center of each pile at the level of cutoff must not vary from its designed center more than such distance that would produce stress in any pile group that is more than ten (10) percent greater than its designed stress, or so as to change the shape of the pile group making it necessary to redesign the pile cap.

A tolerance of four (4) inches from the designed lateral location will be permitted in the installation of piles, without reduction in load capacity, provided that such variation does not produce a load on any pile more than ten (10) percent greater than its designed load bearing capacity.

Reference is made to **Subsection 70.11.3(B)** wherein the Contractor is to submit a pile location plan. If piles are installed at locations other than as shown on the approved pile plan and fail to satisfy all conditions for tolerances as stated herein then additional piles and enlarged pile caps must be installed as directed by the Engineer and solely at the Contractor's expense.

Where piles are installed off the designed location but within the allowable tolerances, the distance from the edge of piles to the outside of concrete pile cap must be a minimum of twelve (12) inches and any additional costs involved in meeting these requirements must be at the expense of the Contractor.

Payment will be made in accordance with the **Subsection 70.11.3(I)** for piles driven outside of tolerances due to obstructions. The Engineer must determine whether or not a pile(s) was driven outside of tolerances due to obstructions and the Engineer’s determination will be final.

(I) SHIFTING OF PILE(S) DUE TO OBSTRUCTIONS - Where piles are ordered by the Engineer to be shifted due to obstructions, the Engineer must prepare a redesign of the pile cap (if required). This redesign may entail the installation of additional piles and/or the construction of a larger pile cap. Payment for the installation of additional piles due to obstructions will be made under the respective pile item. Payment for the increased quantities of earth excavation, stone ballast, concrete and steel reinforcing bars required due to the enlargement of the pile caps caused by obstructions must be made under the prices bid for the contract item(s) labeled "ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS", for Item No. 70.71SB - STONE BALLAST, for Item No. 73.21AC - ADDITIONAL CONCRETE and for Item No. 73.51AS - ADDITIONAL STEEL REINFORCING BARS.

(J) ANALYSIS AND CORRECTIVE MEASURES - The Engineer in accordance with **Subsections 70.11.3(G) and 70.11.3(H)** must analyze conditions at each pile cap and must determine whether corrective measures are required to keep pile loads within allowable limits.

The cost of required additional piles, their installation, any modification of pile cap details, etc. in order to implement corrective measures as ordered by the Engineer must be borne totally by the Contractor in the case of rejected, defective, damaged or improperly installed piles.

(K) PILE DRIVING INSTALLATION RECORDS - The Engineer will keep records of all piles driven and/or installed. The Contractor must cooperate with the Engineer to obtain all necessary data. The data must include type and size of pile, location, the type and size of hammer, type and dimensions of cushion block, actual number of blows per minute delivered throughout the driving by the hammer, number of blows required for each foot of penetration, elevation to which the pile penetrated under its own weight and under the weight of the hammer, final elevation of tip of pile, complete jetting information (if jetting is permitted), notation of interruption during driving including length of time, the elevation of the pile tip and cause of interruption, and such other information as the Engineer may deem necessary.

(L) SPUDDING, AUGERING, DRILLING - Spudding, augering and drilling is required for clearing obstructions as indicated in **Subsection 70.11.3, paragraph (F)**, and also for reducing the peak particle velocity of vibrations associated with pile driving, and as ordered by the Engineer.

Spudding, augering or drilling time must be as computed by the Engineer from the time pile driving stops to the time pile driving resumes as hereinafter described, provided no interim delay occurs due to the fault of the Contractor. Spudding, augering or drilling time includes the time it takes to extract the pile, the time it takes to place the spud, auger or drill in the leads, the time it take to spud, auger or drill, the actual time it takes to remove the spud, auger or drill and the time it takes to replace the pile in the leads and in the position (at the location and to the depth the pile had penetrated at time pile driving ceased) for driving and/or installation to resume. The diameter of the spud, auger or drill must be limited to two-thirds (2/3) the diameter of the pile. The depth of spudding, augering or drilling must be limited to three-quarters (3/4) of the length of the pile being driven.

No spudding, augering or drilling must be performed unless approved by the Engineer and done in the presence of the Engineer. The method employed (spudding, augering or drilling) must be performed at the direction of the Engineer.

Payment for spudding, augering and drilling when ordered by the Engineer, will be made at the unit prices bid under the respective contract Item No. 70.11TT - TIMBER PILES (TREATED), or for Item No. 70.11TU - TREATED PILES (UNTREATED), or for Item No. 70.11SH - STRUCTURAL STEEL H PILES, or for Item No. 70.11CS - CONCRETE FILLED STEEL PIPE PILES at the rate of one (1) vertical foot of pile for each five (5) minutes of spudding, augering or drilling. No separate or additional payment will be made for any mobilization or other work incidental thereto.

(M) JETTING - In driving piles where the desired penetration through dense material (i.e. sand, gravel, etc.) cannot be obtained, the Contractor may be required to use water jets. Piles must be jetted only with the written approval of the Engineer. Sufficient jets and adequate water pressure must be used to freely erode the material adjacent to the pile without impairing the bearing capacity of the piles already in place.

Before the desired penetration is reached the jets must be withdrawn and the piles must be driven with the hammer alone for the last four (4) feet, or more if necessary, to attain the required bearing capacity value.

No separate payment will be made for jetting when ordered by the Engineer to facilitate the installation of piles through dense material in order to reach the penetration required by the contract documents. The cost of jetting must be included in the prices bid under the respective contract Item No. 70.11TT - TIMBER

PILES (TREATED), or for Item No. 70.11TU - TIMBER PILES (UNTREATED), or for Item No. 70.11SH - STRUCTURAL STEEL H PILES, or for Item No. 70.11CS - CONCRETE FILLED STEEL PIPE PILES.

(N) EXISTING PILES AND ABANDONED PILES - Where existing piles are encountered along the line of the proposed sewer or water main or within the limits of the structure, or where new piles are ordered abandoned, all such existing piles or abandoned piles must be cut to a minimum of one (1) foot below the subgrade of the trench.

In the event that the location of an existing pile conflicts with the proposed location of a new pile, it must be the decision of the Engineer as to an alternate location for the installation of the new pile and for any shift of pile cap location or whether to remove the existing pile.

Payment for the cost of excavating, cutting existing piles one (1) foot below the subgrade and filling to subgrade must be included in the prices bid under the respective contract item(s) labeled "ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS" and for Item No. 70.71SB - STONE BALLAST.

Payment for the cost of removal of the existing pile(s) as determined by the Engineer must be made in accordance with **Articles 25 and 26** of the Contract, unless there is a specific item for the removal of existing piles in the contract.

All abandoned steel pipe piles must be compactly filled from the tip of the pile to the height of cutoff with select granular fill material. No separate or additional payment will be made for the compact filling of abandoned steel pipe piles with select granular fill material.

(O) SPLICING - Splicing of piles must be such that the resultant vertical and lateral loads are adequately transmitted. Splices must be so constructed so as to maintain the alignment and position of the component parts during installation of the pile and thereafter.

The manner in which timber piles longer than sixty (60) feet must be spliced is specified under **Section 24.02**.

For structural steel H piles only one (1) splice per pile will be permitted. Splices for structural steel H piles must be designed to develop the full strength of the pile. The Contractor must submit details of the splices for structural steel H piles to the Engineer for approval.

For steel pipe piles a “Drive On Splicer” as manufactured by Associated Pile and Fitting Corporation (Parsippany, NJ) or approved equal must be acceptable whenever a maximum of two (2) splices are anticipated. Wheresoever more than two (2) splices are anticipated all splices must be welded.

All splices for brace, batter or spur structural steel H piles or steel pipe piles must be welded.

Shop and field welding on piles must be done in accordance with AWS D1.1 - Structural Welding Code. Qualifications of welding procedures and operators must be in accordance with "Standard Qualification Procedure" requirements of AWS. Welding electrodes must comply with AWS D1.1, and be of proper classification for type of weld and material to be welded.

Records must be kept of test results, welding procedures and for each qualified welding operator. Copies of these records must be made available for review by the Engineer.

No separate or additional payment will be made for splicing but the cost thereof must be included in the prices bid under the respective contract Item No. 70.11TT - TIMBER PILES (TREATED), or for Item No. 70.11TU - TIMBER PILES (UNTREATED), or for Item No. 70.11SH - STRUCTURAL STEEL H PILES, or for Item No. 70.11CS - CONCRETE FILLED STEEL PIPE PILES.

(P) PILE SHOES - Each pile shoe furnished and installed on timber piles, when ordered by the Engineer, will be paid for as one (1) vertical foot of pile at the unit price bid for under the respective contract Item No. 70.11TT - TIMBER PILES (TREATED), or for Item No. 70.11TU - TIMBER PILES (UNTREATED).

(Q) LIMITS OF PILE SECTION FOR SEWERS OR WATER MAINS - The limits of the pile section for sewers or water mains shown on the plans may be changed by the Engineer at any location, depending upon the conditions encountered during construction.

The length of the pile section for sewer or water main may be increased or decreased where directed by the Engineer, effectively altering the estimated quantities of piles and related items bid under the contract.

The Engineer may also alter affected appurtenant structure locations (i.e. chamber, manhole, etc.), particularly where they are located at the beginning and the end of the pile section sewer or water main limits.

The deletion of items and/or quantities either in part or in whole must form no basis for any claim for anticipated profits or for loss of profits.

70.11.4 SAFE OR ALLOWABLE LOAD

(A) The safe or allowable load of the piles must be determined from the driving formulas stated below:

(1) When specified in the contract documents or in writing by the Engineer that load test are not required for piles, the formula to be used must be as follows:

$$P = \frac{2E}{S + 0.2}$$

(2) For piles where load tests have been made as required in these specifications, the formula to be used must be as follows:

$$P = \frac{KE}{S + 0.2}$$

P = Safe or Allowable Load in Pounds
E = Actual (not rated) Energy of Hammer per Blow in Foot Pounds
S = Average Penetration in Inches per Blow for the Last Five (5) to Ten (10) Blows

The Engineer from the results of the load tests must determine the value of K.

(3) Should subsurface conditions be encountered which, in the opinion of the Engineer, render the above formulas inapplicable, the safe or allowable load of the pile must be as determined by the Engineer.

(4) The above formulas are applicable under the following conditions:

(a) The hammer has a free fall.
(b) The head of the pile is not bruised or crushed.
(c) The penetration is uniform.
(d) There is no appreciable bounce after the blow.
(e) The strokes per minute of the ram are within the range of strokes per minute established by the manufacturer.

(B) In the event it is discovered that piles are being damaged due to driving, the Contractor when directed by the Engineer, must change driving equipment so that a hammer with lighter striking parts will be used. Work must not continue with a hammer or driving equipment that in the opinion of the Engineer is likely to damage the piles.

70.11.5 TIMBER PILES

Piles must be driven with power hammers developing energy per blow between nine thousand (9,000) and sixteen thousand (16,000) foot-pounds. An approved driving cap must be used. The hammer used must have a fixed stroke. Hammers capable of providing multiple driving energies must not be used, unless approved by the Commissioner.

70.11.6 STRUCTURAL STEEL H PILES

Piles must be driven with power hammers developing energy per blow between fifteen thousand (15,000) and twenty-four thousand (24,000) foot-pounds. An approved steel driving head must be used. The hammer used must have a fixed stroke. Hammers capable of providing multiple driving energies must not be used, unless approved by the Commissioner.

70.11.7 STEEL PIPE PILES

(A) Piles must be driven with power hammers developing energy per blow between fifteen thousand (15,000) and twenty-four thousand (24,000) foot-pounds. The hammer used must have a fixed stroke. Hammers capable of providing multiple driving energies must not be used, unless approved by the

Commissioner. Suitable anvils or cushions, if required, must be used to prevent undue damage to the pipe pile butt. Anvils and cushions must be of a material that will not permit excessive loss of hammer energy.

(B) PLACING CONCRETE - Prior to placing concrete the piles must be internally inspected by the Engineer. All material and equipment necessary or required for internal inspection must be supplied by the Contractor for the Engineer's use at no additional cost. Any pile shells partly or wholly collapsed or containing water, soil or other foreign materials must be rejected by the Engineer. Any cost a Contractor must incur in order to render a rejected pipe pile suitable must be borne solely by the Contractor.

Concrete cannot be placed in any pile of a group until all piles in that group have been driven, internally inspected, found free of water and foreign material and have been approved. Also, concrete cannot be placed in any pipe pile that is within fifty (50) feet of an ongoing pile driving operation.

Concrete must be placed through a funnel in a continuous operation and must be solidly compacted as approved by the Engineer.

70.11.8 MEASUREMENT

The quantities of timber piles (treated or untreated), structural steel H piles and concrete filled steel pipe piles to be measured for payment must be the number of vertical feet of each size, type and kind of pile, measured from pile point to cutoff, furnished and permanently incorporated in the work in accordance with the plans, standards and specifications and as directed by the Engineer.

70.11.9 PRICE TO COVER

The contract price for Item No. 70.11TT - TIMBER PILES (TREATED), and for Item No. 70.11TU - TIMBER PILES (UNTREATED) must be the unit price bid per vertical foot for each type of timber pile and must cover the cost of all labor, materials, plant, equipment, samples, tests, and insurance required and necessary to furnish, treat, drive and/or install, jet, splice, cut off, fasten shoes (except when there is a contract price for driving shoes) and permanently incorporate in the work all timber piles required or ordered, together with load tests and all work incidental thereto, all in accordance with the plans, standards and specifications, and as directed by the Engineer.

The contract price for Item No. 70.11SH - STRUCTURAL STEEL H PILES must be the unit price bid per vertical foot for each size and type of structural steel H pile and must cover the cost of all labor, materials, plant, equipment, samples, tests, and insurance required and necessary to furnish, drive and/or install, jet, splice, flame-cut, cap, frame, and permanently incorporate in the work all structural steel H piles required or ordered, together with load tests and all work incidental thereto, all in accordance with the plans, standards and specifications, and as directed by the Engineer.

The contract price for Item No. 70.11CS - CONCRETE FILLED STEEL PIPE PILES must be the unit price bid per vertical foot for each size and type of concrete filled steel pipe pile and must cover the cost of all labor, materials, plant, equipment, samples, tests, and insurance required and necessary to furnish, drive and/or install, jet, splice, flame-cut, cap, frame, and permanently incorporate in the work all concrete filled steel pipe piles required or ordered, together with load tests, conical points, concrete fill and all work incidental thereto, all in accordance with the plans, standards and specifications, and as directed by the Engineer.

Included in the contract prices hereinabove must also be the cost for all connections and guide works.

70.11.10 NO SEPARATE PAYMENT

No separate or additional payment will be made for test piles that are not permanently incorporated into the work, for piles driven by the Contractor for temporary use, and for any other piles not permanently incorporated into the work. No separate or additional payment will be made for load tests.

Payment for Piles will be made under the Item Number as calculated below:

The Item Numbers for Piles have seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Piles:

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(2) The sixth and seventh characters must define the Kind of Pile:

TT - Timber Piles (Treated) (Not Less Than Item)
TU - Timber Piles (Untreated) (Not Less Than Item)
SH - Structural Steel H Piles (Not Less Than Item)
CS - Concrete Filled Steel Pipe Piles (Not Less Than Item)

(3) The Item Numbers together with Description and Pay Unit price per vertical foot as provided in the Bid Schedule are provided below:

Item No.	**Description**	**Pay Unit**
70.11TT	TIMBER PILES (TREATED) (NOT LESS THAN $XX.XX/V.F.)	V.F.
70.11TU	TIMBER PILES (UNTREATED) (NOT LESS THAN $XX.XX/V.F.)	V.F.
70.11SH	STRUCTURAL STEEL H PILES (NOT LESS THAN $XX.XX/V.F.)	V.F.
70.11CS	CONCRETE FILLED STEEL PIPE PILES (NOT LESS THAN $XX.XX/V.F.)	V.F.

SECTION 70.12 – CONTINUOUS FLIGHT AUGER (CFA) PILES

70.12.1 DESCRIPTION

(A) Continuous flight auger (CFA) piles shown, specified, or ordered for sewer and water main construction must be furnished, installed, and cutoff and capped at the locations, to the depths and to the elevations shown or required on the plans and standards, and as specified in the specifications, and as directed by the Engineer. The Contractor must furnish all labor and material and perform all operations necessary to install continuous flight auger piles to an axial capacity as shown, specified, or ordered, and to insure a satisfactory pile foundation installation.

(B) Examination Of The Site:

(1) Prior to starting pile installations, the Contractor must make a documented inspection of the existing structures, site conditions, pavement, and improvements within the radius of influence and adjacent to the pile installation site to examine and record their present condition.

The Contractor must prepare a preconstruction report in accordance with **Section 76.11 - Construction Report**.

(2) The Contractor must fully examine the existing conditions within the project limits to ensure that the Contractor's equipment can operate without damage to or relocation of existing infrastructure, facilities, or structures. The Contractor must provide all required equipment, modified if needed to accommodate site conditions, including restricted headroom and other headroom limitations. If available, the Contractor must review the boring logs showing subsurface conditions.

(3) The Contractor must be required to prepare a report of all such conditions, verified by the photographs and signed by the Contractor's Professional Engineer, which must be reviewed by the Engineer to verify the existing site conditions and all pre-existing damage that may be affected by the CFA piling work. Such work must be included in the preconstruction report.

(C) Qualifications:

The work must be performed by the Contractor or a subcontractor experienced in the specified foundation system and CFA piling under similar subsurface conditions. The Contractor performing the work described in this specification must submit proof that the Contractor or subcontractor has successfully completed a minimum of two (2) projects in the last three (3) years on which the Contractor or subcontractor has successfully designed, tested and installed CFA piles.

The Contractor must also submit proof that the Contractor has employed a Licensed Professional Engineer, currently registered in the State of New York, having experience in the construction (designing, planning, testing, and inspection phases) of at a minimum two (2) completed CFA pile installation projects over the past three (3) years. The Professional Engineer must be directly responsible for the work. The Contractor must not use manufacturers' representatives to satisfy the Contractor's responsible engineer requirements of this section.

In addition, the Engineer will review and approve the Contractor's key field personnel to be employed during installation of the CFA piles.

70.12.2 MATERIALS

(A) GROUT

(1) Grout Mix - General: The grout used must consist of a mixture of Portland cement, admixture, sand, and water that is proportioned and mixed to provide a mortar capable of maintaining the solids in suspension without appreciable water gain, and that also may be placed without difficulty, and such that it will laterally penetrate and fill any voids in the adjacent subsurface material.

(2) Grout Mix - Strength: The Contractor's grout mix design must provide an ultimate compressive strength of 2,500-psi at three (3) days in accordance with the provisions of ASTM C109. Three (3) days strength is required for the construction of the pile caps, concrete pad, etc. The grout mix must be proportioned to provide a hardened mortar having an ultimate compressive strength of at least 4,000-psi at 28-days when testing a core from a pile or at least 4,500-psi when testing a cube in accordance with the provisions of ASTM C109.

(3) Grout Mix - Components: The requirements for the components of the grout are listed below. Information regarding the mix design and testing, water source, fine aggregate, admixture(s), and cement supplier must be submitted to the Engineer for approval prior to placing grout.

(a) Cement must conform to ASTM C150, Type II, low alkali.

(b) Grout admixture must conform to ASTM C494 and/or ASTM C937. The admixture must be so selected to: increase workability, reduce water, produce early and ultimate high strength, control setting time, compensate for shrinkage, and reduce fluid loss (i.e. reduce bleeding).

The Contractor must verify that the use of admixture(s) must not result in a reduction in the long term strength and/or imperviousness of the grout, nor must it create an environment to accelerate corrosion of the steel pipe and/or reinforcement bars. The admixture(s) must be used only after the approval of the Engineer.

(c) Sand must meet the requirements of ASTM C144 fine aggregates, except as specified herein. The sand must be well graded from fine to coarse with a fineness modulus between 2.3 and 3.1.

(d) Water for grout must conform to AASHTO T26 and must be potable, clean, and free from substances that may be injurious to cement or reinforcing steel and may be harmful to the setting, strength, development or durability of the concrete.

(B) REINFORCEMENT CAGE (OR STEEL PIPES-IF APPROVED)

(1) CFA piles must be reinforced for their entire length, and must meet the design load requirements of the project. If approved by the Engineer steel pipes may be used in addition to or in place of the reinforcement bars (paragraph (3), below).

(2) Deformed steel bars comprising the reinforcement cage must have a minimum yield strength of 60-ksi, conforming to ASTM A615, Grade 60.

(3) Steel pipes can be used as an alternate to the reinforcement cage, if approved by the Engineer. If used, steel pipes must conform to ASTM A252, Grade 2 or 3 except that the yield strength must be a minimum 36-ksi, must include tolerances for pipe diameter, edge alignment, end match marking, roundness, and straightness, and must conform to the steel pile splice welding requirements. The carbon equivalency (CE) as defined in AWS D1.1, Section X15.1, must not exceed 0.45. The sulfur content must not exceed 0.05%. Steel pipe must not be joined by welded lap splicing. Steel pipe seams and splices must be complete penetration welds. Partial welds of steel pipe may be restored.

(4) The longitudinal reinforcement area must be a minimum of two percent (2%) of the gross concrete area of the pile

70.12.3 SUBMITTALS

(A) The Contractor must install CFA piles as shown on the pile section and elevation drawings to depths and elevations shown on the plan and profiles. Prior to installation, the Contractor must submit shop drawings, which include working drawings and material specifications, for the approval of the Engineer. Shop drawings must include, but not be limited to:

(1) Means And Methods:

(a) Detailed step-by-step description of the proposed CFA pile construction procedure, including personnel, testing, and equipment to assure quality control of grout preparation and pile installation. This step-by-step procedure must be shown on the working drawings in sufficient detail to allow the Engineer to monitor the construction and quality of the CFA piles.

(b) Details of the proposed installation equipment, including manufacturer’s information, make, model, power, rated capacity, grout pump discharge volume and pressures, etc. Also include a detailed description of the drilling equipment and methods proposed to be used to provide drill hole support and prevent detrimental ground movements.

(c) Proposed procedure for control and balancing of the extraction of the continuous flight auger during the grout injection process (for example, the grout pressure and volume monitoring versus auger extraction progress).

(d) Methods and equipment for placing, positioning, and supporting the steel pipe and/or reinforcing cage and the details for the Contractor's vibrator equipment that may be required to install it.

(e) Welding procedure for the reinforcement which must be certified by a qualified welding specialist.

(f) Methods and equipment for accurately monitoring and recording the grout depth, grout volume, and grout pressure as the grout is being placed and augers are being withdrawn. Also, describe the procedure for post-grouting as a contingency, should post-grouting become necessary.

(g) The grouting equipment (pump and batching equipment) capacity and relation to the grouting demand and working conditions, as well as provisions for back-up equipment and spare parts.

(h) Information on space requirements for installation equipment that verifies that the proposed equipment can perform at the site.

(i) Plan describing how drilling fluids and excess waste grout will be controlled and disposed of.

(j) Contingency procedures for clearing or drilling through obstructions, handling blockage of pipes or lines, or equipment breakdown.

(k) Pile Load Test Setup. (See **Subsection 70.12.5, paragraph (A), subparagraphs (3) and (4)**.)

(2) Materials:

(a) Material certification and specifications, including a certified mill test report for the reinforcing bars used in the cage, or, if approved, the steel pipe reinforcement. The ultimate strength, yield strength, elongation, and material properties composition must be included.

(b) Grout mix design and type of materials to be used in the grout, including certified laboratory testing data and results, trial batch reports, and estimated curing time for grout to achieve specified strength. (See also **Subsection 70.12.5 paragraph (B)**.)

(3) Records, Report and Plans:

(a) Pile location plan, size and numbering system.

(b) Pile location survey during installation.

(c) Additional pile locations (for test piles and reaction piles).

(d) Final pile location survey.

(e) Sample of pile record form including grout mix and sample details.

(f) Pile installation sequence and final pile tip and cutoff elevations.

(g) Test pile report.

(h) Procedure For Grouting Rate Calculations: The calculations must be based on the initial pump pressures or static head on the grout and losses throughout the placing system, including the anticipated head of groundwater to be displaced.

(B) REVIEW AND APPROVAL OF SUBMITTED SHOP DRAWINGS

(1) Pile Installation Schedule: Work must not begin until the required submittals have been received, reviewed, and accepted in writing by the Engineer. The Contractor must provide the above submittals prior to initiating CFA pile construction. The Contractor must allow the Engineer a minimum of ten (10) business days to review the shop drawings and submittals after a complete set has been received. Additional time required due to incomplete or unacceptable submittals must not be cause for delay or impact claims. All costs associated with incomplete or unacceptable Contractor submittals must be the responsibility of the Contractor. No CFA pile construction work must commence without all required submittals being approved.

(2) The Contractor must have six (6) copies of the shop drawings and associated submittals prepared by a Licensed Professional Engineer, currently registered in the State of New York. Such drawings must be submitted together with CFA piles design calculations and both drawings and design calculations must bear the imprint of the Professional Engineer's seal and signature. These shop drawings must be on sheets twenty-seven (27) inches by forty (40) inches with one-half (1/2) inch marginal space on three (3) sides and a two (2) inch marginal space for binding on the left side. Each shop drawing must be dated and contain the name of the project and the contract number.

(C) PROJECT RECORD DOCUMENTS

(1) Upon completion of installation of all piles, the Contractor must submit to the Engineer mylars of drawings, showing the types and installed locations of all piles, including obstructed, damaged, and additional piles, as related to their column lines, the center of the utility pad or other reference points and lines, percentage out of plumb, the cutoff elevation, and length below cutoff for each pile.

(2) The mylars must be the same size as the contract drawings.

70.12.4 GENERAL PILE INSTALLATION PROVISIONS

(A) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

(B) PERFORMANCE REQUIREMENTS

(1) The Contractor is be responsible for the installation of the CFA piles, which must conform to the plans and specifications.

(2) Pile design loadings, grout strengths, reinforcement, and dimensions are as shown on the contract drawings or specified in this specification.

(3) CFA piles must be installed by rotating a continuous-flight hollow-shaft auger into the ground to a minimum embedment depth shown on the pile design and approved by the Engineer or specified in the specifications. The auger must be fitted with a protective cap on the outlet at the base of the central stem. The protective cap must be detached under the pressure of the grout.

(4) Other removal methods must not be used unless such methods are reviewed and approved by the Engineer prior to pile installation.

(5) Pressurized grout must be injected concurrently through the hollow shaft (stem) as the auger is being withdrawn. The continuous flight augers must be withdrawn while rotating the auger in the same direction as during the boring stage. The Contractor must adjust the rotation of the auger and the flow of grout so as to prevent collapse of the sides of the hole.

(6) Reinforcing cage or an alternative reinforcement element (for example steel pipe-if approved by the Engineer) must be placed immediately after grout injection and must conform to the details shown on the contract drawings or specified in this specification. Following the completion of the grouting, the cage or pipe is lifted and placed centrally over the pile. It must then be lowered into the grout. If the reinforcing cage does not slide in without difficulty, the Contractor must use a vibrator to lower the cage to the design depth.

(7) The Contractor must install test piles as specified in **Subsection 70.12.5, paragraph (A)**.

(8) During installation of the piles, the Contractor must develop a monitoring program for lateral movements and settlements. This program must be implemented by a Licensed Land Surveyor, currently registered in the State of New York, hired by the Contractor. Monitoring must be done on a daily basis and the data must be submitted to the Engineer for the Engineer's review within 24-hours of monitoring.

(9) Load tests must be performed as specified in **Subsection 70.12.5**.

(C) PILE INSTALLATION, GENERAL

(1) The CFA piles must only be installed after submission, review, and approval of the submittals listed in **Subsection 70.12.3**.

(2) Prior to the start of drilling, the leads must be marked in one (1) foot increments so that the withdrawal rate of the auger and the number of pump strokes per five (5) feet of withdrawal can be monitored by the Engineer's Field Inspector.

(3) The hole through which the high-strength mortar is injected during the placement of the pile must be located at the bottom of the auger head, below the bar containing the cutting teeth. The grout must be injected (pumped) typically 150-psi above hydrostatic pressure.

(4) The auger head must be fitted with a protective cap at the base of the central stem. The protective cap must be detached under the pressure of the grout. The Contractor's grout pump must be a positive displacement type pump and must be capable of developing displacement pressures at the pump of not less than 350-psi. Other removal methods must not be used unless such methods are reviewed and approved by the Engineer prior to such use.

(5) The auger flighting must be continuous, with no gaps or breaks, and must always be advanced at a continuous rate to prevent removal of excess soil. The pitch of the auger flighting must not exceed nine (9) inches, unless otherwise approved by the Engineer.

(6) Piling leads must be prevented from rotating by a stabilizing arm.

(7) Auger hoisting equipment must be so designed as to enable the auger to be withdrawn smoothly and steadily. Auger in excess of 40-feet in length must be provided with a traveling guide.

(8) The reinforcement cage, as detailed on the contract drawings, must be placed immediately after grout injection and extraction of the continuous flight auger.

(9) Centralizers must be placed at 10-feet spacing as shown on the drawings. Alternative centralizers can be used only after the review and approval of the Engineer.

(10) Each truckload of grout must be tested using the Flow Cone Test ASTM C939, except a 3/4-inch opening must be used rather than the 1/2-inch opening specified. Grout fluidity of between 10 and 25-seconds must be maintained.

(11) The spoil that accumulates around the auger during injection of the grout must be cleared away so that the installation can be properly inspected. Should water or ponding collect at the top of a freshly-grouted pile, the water must be removed immediately by bailing-out and replaced with fresh grout. A protective cover must be provided for each pile after installation.

(D) DRILLING

(1) The installation must be performed in an orderly sequence progressing in one direction across each foundation element. Leads and auger must be carefully plumbed before installation.

(2) Under no circumstances must the augers be extracted from the drilled hole before placement of grout.

(3) Each pile must be continuously installed at the locations indicated, to the elevation or depth shown on the contract drawings or in the specifications.

(4) The center of gravity must be carefully maintained for each group or cluster of piles to conform to the locations shown on the contract drawings.

(5) Pile centers must be located to an accuracy of ±3-inches. Piles must be plumb within two (2) percent.

(6) The holes in the bottom of the auger must be plugged with a protective cap while being advanced into the ground. The plug must be removed by grout pressure or by other approved means as described in **Subsection 70.12.4, paragraph (C), subparagraph (4)**, above.

(7) When installing piles within 20-feet of existing structures, attention must be paid to minimize the potential of "running" sands which may result in accidental removal of excess material during drilling, in turn causing subsidence of surrounding soils and possible damage to existing structures. The Contractor must develop measures to mitigate against accidental "running" of sands. At a minimum, the auger rotations required to advance or withdraw a fixed length must be limited (for example, limit to two rotations or less per flight advance) and auger rotation must be immediately stopped following the reaching of the maximum depth and cannot start again until grouting has begun.

(8) Piles installed on the same day must not be any closer than six (6) pile diameters (i.e. 6-feet for a 12-inch diameter pile), as measured from center to center, of each other.

(9) Accurate records must be maintained showing the depth to which piles are placed and the quantity of mortar placed. Any unusual conditions encountered during pile installation must be noted.

(10) The excess spoil that accumulates around the auger due to drilling process and grout injection must be promptly cleared away.

(E) GROUT MIXING AND PUMPING

(1) Only approved mixing and pumping equipment must be used in the preparation and handling of grout. A screen to remove oversized particles must be placed at the pump inlet. All soil or other rust inhibitors must be removed from the mixing drums, stirring mechanisms, and other portions of the equipment in contact with the grout before the mixers are used.

(2) All materials must be accurately measured by volume or weight as they are fed into the mixer. The time of mixing must be not less than one (1) minute. If agitated continuously, the grout may be held in the mixer or agitator for a period not exceeding two (2) hours at temperatures below 70ºF (Fahrenheit) and for a period not exceeding one and one-half (1-1/2) hours at higher temperatures. Grout must not be placed when the grout temperature falls below 40ºF or exceeds 100ºF, unless approved procedures for cold and hot weather are followed. The grout must be protected from physical damage or reduced strength which could be caused by frost, freezing action, or low temperatures, or from damage during high temperatures in accordance with ACI 305/306. When a set retarding admixture is used, the grout may be held for a period of one (1) hour at temperatures up to 105ºF.

(3) The grout must be pumped with pressure through a tremie pipe or a set of packers as the auger is withdrawn, allowing the grout to fill the hole under pressure, preventing its collapse and permitting lateral retention of the mortar into the surrounding soil. The pressure required to do this must be typically 150-psi above hydrostatic pressure, unless increased or decreased by the Engineer's approval. A tremie pipe or the tip of the continuous flight augers must be embedded at least three (3) inches from the top of the grout at all times during its withdrawal from the hole. A second pressure gauge must be provided, located as close to the auger rig as possible such that it is just touching the ground when the auger is in the raised position and such that it can continuously be monitored by the operator and the inspector. At the start of grout pumping, the auger must be lifted between six (6) and twelve (12) inches of the bottom to facilitate expelling the tip plug. The auger must then be lowered back down to the previously established tip elevation.

(4) The grout pump must be provided with a calibrated pressure gauge in clear view of the equipment operator. A digital counter must be used to measure the number of grout pump strokes during installation.

(a) The grout pump must be calibrated at the beginning of work to determine the number of pump strokes to fill a 55-gallon drum with grout. The average volume per stroke must be used as a guideline in estimating the amount of grout pumped into the drill hole. The volume per stroke determined by calibration must be correlated/compared with the manufacturer's literature.

(b) The pump must be recalibrated following repair or switching pumps or at least once at the request of the Engineer during pile installation.

(c) The Contractor must have on hand a spare counter and a spare pump. The spare pump must be utilized when the primary pump is not functioning properly and when directed by the Engineer.

(F) GROUT PLACEMENT

(1) Grout must be placed in the pile hole as soon as is practicable after mixing, and in no case must grout be used which does not reach its final position in the pile hole within one and one-half (1-1/2) hours after truck mixed grout leaves the plant, as evidenced by the delivery ticket given to the Inspector.

(2) Positive rotation of the auger must be maintained throughout placement of the grout. The rate of grout injection and rate of auger withdrawal from the soil must be so coordinated as to maintain, at all times, a positive pressure on the gauges, which will, in turn, indicate the existence of a removing pressure on the bottom of the auger flight.

(a) The total volume of grout must be at least 15 percent greater than the theoretical volume for each five (5) foot segment of pile, except after grout is flowing at the ground surface from the auger blade, the theoretical volume as a minimum per five (5) foot segment must be pumped. However, the total volume of grout pumped must be at least 25 percent greater than the theoretical volume of the pile.

(b) Augers must not be withdrawn until soil cuttings or water is observed issuing at the surface. If pumping of grout is interrupted for any reason or if a return at the surface is noted, the Contractor must reinsert the auger at least five (5) feet into the pile and regrout.

(3) If less grout is placed than the net volume required for any five (5) foot increment, the pile must be reinstalled by rotating the auger to the bottom of the pile, followed by the controlled removal of the auger and grout injection.

(4) A head of at least 10-feet of grout above the injection point must be maintained around the perimeter of the auger flights during raising of the auger, so that the grout has a displacing action, removing any loose material from the hole. This head must be initially established by raising the auger six (6) inches from the bottom while rotating, pumping grout until a sufficient quantity is measured, lowering the auger to its original level, and finally starting the removal process.

(5) The grout quantity must be determined by counting pump strokes and using the predetermined grout volume per pump stroke.

(6) If the grout volume is in excess of 50 percent of the theoretical volume for any two (2) consecutive five (5) foot intervals, the Contractor must reduce pressure, fill the hole with grout while extracting the augers, and stop work after the augers are fully withdrawn. Reinforcement must not be inserted into such piles. The Engineer and the Contractor must then conduct a joint survey to investigate whether the grout has leaked into adjacent utilities, basements, or other below-ground structures. If no such leak is established, the piles in question must be redrilled between six (6) and twelve (12) hours of stoppage to full length, regrouted and the pile must be completed as specified.

(7) The level of grout in completed piles must be inspected at least twice between two (2) hours and eight (8) hours after completion for settlement. Should grout settlement occur, the Contractor must fill the pile with grout only after removal of deleterious materials that may have accumulated. The level of grout must not be permitted to settle below the groundwater table prior to initial set.

(8) Special attention must be paid to inspecting the level of grout in a completed pile while installing an adjacent pile within six (6) pile diameters.

(9) The magnitude of removing pressure and performance of other augering and grouting operations, such as the rate of augering, rate of grout injection, and control of grout return around the auger flight, are dependent on soil conditions and equipment capability and must be entirely the responsibility of the Contractor.

(G) REINFORCEMENT AND REINFORCEMENT INSTALLATION

(1) Reinforcing steel assemblies must be detailed and fabricated in accordance with the manual of Standard Practice For Detailing Reinforced Concrete Structures (ACI-Edition).

(2) The Contractor must use centralizers as shown on the drawings for proper centering of steel reinforcing to be installed in the piles. If the Contractor proposes an alternative centralizer, the Contractor must submit its characteristics for the Engineer’s review and approval.

(3) The bars must be spliced by complete penetration welding in conformance with AWS D1.1 (Structural Welding Code). Lap splicing is not allowed.

(4) The reinforcement cage (or steel pipe) must be designed to facilitate their placing to the required depth thorough grout. The main reinforcing element must be provided in continuous lengths without joints (except for welded joints-see below).

(5) Where reinforcing cages are used, hoops, in lieu of helical bindings must be used. The hoops must be tack welded in conformance with AWS D1.1.

(6) Following the completion of grouting, the reinforcing cage (or the steel pipe) must be lifted and placed centrally over the pile and must then be lowered into the grout.

(7) Should the reinforcement fail to slide freely to the required depth, then the Contractor must use a vibrator to facilitate the placement of the reinforcement. The Engineer must be informed of in advance of any use of a vibrator.

(8) The reinforcement must be supported at such a level that it will maintain the required projection above the final pile cutoff level.

(H) JETTING

Jetting must not be used for CFA pile installation.

(I) OBSTRUCTIONS

(1) Uncontrolled fill and other subsurface materials at the site may contain obstructions to augering. In the event that non-augerable material is encountered, such as cobbles, boulders, concrete ledge, metal, timbers, or debris which causes the rate of penetration to be reduced to less than one (1) foot per minute or causes the pile to drift from its location, the pile must be completed to the depth of the non-augerable material in accordance with these specifications.

(2) The length of such short piles must be included in the total linear feet of piles for payment.

(3) If required by the Engineer, one or more additional adjacent piles must be placed and the length of these additional piles must also be included in the total linear feet of piles for payment.

(J) TOLERANCE

(1) Piles must be installed from the ground surface existing after excavation work has been completed.

(2) Piles must not be out of alignment by more than two (2) percent of their length. The center of each pile at the level of cutoff must not vary from its designated center by more than such distance that the stress in any pile group is more than ten (10) percent greater than its designated stress, as determined by the Engineer.

(3) A tolerance of three (3) inches from the design location will be permitted in the installation of the piles, without reduction in load capacity, provided that such variation does not produce a load on any pile more than ten (10) percent greater than its design load bearing capacity, as determined by the Engineer.

(4) Piles must not be left partially completed overnight but must be completely grouted and protected at the termination of each day's operation.

(K) PILE CUTOFF

(1) All piles must be cutoff to true planes at the elevation shown on the contract drawings.

(2) If and where the pile cutoff is near or above the surrounding ground, or above the bottom of the excavation, the Contractor must install sleeve or a casing pipe of proper diameter and at least eighteen (18) inches in length around the pile top to protect the pile and reinforcement from accidental damage.

(3) Cutoffs are the property of the Contractor and must be disposed of off-site.

(L) PILE SURVEY

(1) The Contractor must engage the services of a New York State Licensed Surveyor, approved by the Engineer, for the performance of the survey work. The Contractor must, at such times so as not to interfere with the progress of the installation, make surveys of the installed piles. The installed location of each pile must be established by survey and shown on drawings prepared for this purpose.

(2) Copies of the drawings must be submitted by the Contractor in accordance with the provisions as hereinafter specified in this **Subsection 70.12.4, paragraph (L)** and **Subsection 70.12.4, paragraph (M)**. Survey information may be submitted on several drawings, each covering a partial area only, as the job progresses, in order to expedite the approval of the work.

(3) Upon completion of all pile installation, the Contractor must submit to the Engineer, mylars of drawings showing installed location of all piles as related to their utility lines, center of concrete or stone bedding or other reference points and lines, percentage out of plumb, the cutoff elevation, and length below cutoff for each pile. Mylars must be the same size as the contract drawings. The final as built survey plan must be signed and sealed by the Contractor's Land Surveyor licensed in New York State.

(M) ANALYSIS AND CORRECTIVE MEASURES

(1) The analysis called for herein will be performed by the Engineer.

(2) The Engineer will analyze the conditions at each pile to determine whether corrective measures are required. If corrective measures are not required, approval will be given for proceeding with the work.

(3) The Engineer will determine the corrective measures required to keep pile loads within the allowable limits. Corrective measures, for any piles installed more than three (3) inches from the plan location, will be determined by the Engineer. If the corrective measures are not deemed feasible, the pile must be removed in its entirety and replaced by another pile installed in the design location.

(4) If corrective measures involve the installation of additional piles, the Engineer will prepare supplemental drawings showing the details of the required corrective work.

(a) The Engineer will then obtain the approval of the supplemental drawing(s) by the Assistant Commissioner.

(b) After the approval of the Assistant Commissioner has been obtained for the supplemental drawing(s), a copy of the approved amendment and/or print of the drawing(s) stamped "Inspector's Copy", together with the original tracing of the drawing, will be filed by the New York City Department of Design and Construction as part of the permanent records of the contract.

(c) After approval, copies of the drawing(s) will be issued to the Contractor and the work must be installed in accordance with the drawings.

(5) Cost of Additional Work

(a) The cost of redesigning of the pile caps, concrete pads, and/or provide/install additional reinforcement/concrete due to rejected, damaged, defective, or incorrectly installed piles must be borne by the Contractor at no additional cost to the City.

(b) The cost of installing additional piles (as called for on the supplemental drawings for the corrective measures) must be borne by the Contractor in the case of rejected, defective, damaged, or incorrectly installed piles.

(c) The cost will be borne by the City in the case of obstructed piles ordered abandoned by the Engineer, or in the case of modifications required because of the presence of obstructions.

(d) Payment for corrective work necessitated by obstructed piles will be made in accordance with the contract unit price.

(N) DAMAGED OR MISPLACED PILES

(1) All damaged or misplaced piles must be removed or abandoned, and new piles must be driven as directed by the Engineer at no cost to the City.

(2) Abandoned piles must be cut off one (1) foot below cutoff elevation shown on the contract drawings or specified in the specifications.

(3) All cutoff sections must be removed from the site by the Contractor.

(O) REJECTED PILES

(1) When any pile exceeds the installation tolerances specified in **Subsection 70.12.4, paragraph (J)**, the Engineer must determine whether it must be rejected.

(2) When any pile has been so damaged as to be, in the opinion of the Engineer, unsuitable, or otherwise does not conform with the requirements of the contract, such piles must be rejected.

(3) Rejected piles must be cutoff at an elevation as directed by the Engineer.

(P) ADDITIONAL PILES

Additional piles must be installed in locations designated by the Engineer to replace rejected piles, at no additional cost to the City.

(Q) PRODUCTION PILES

(1) All piles, within the area of uniform subsurface conditions pertaining to a given load-tested pile of satisfactory performance, must be installed in the same manner as the successful load tested pile, and must bear in or on the same bearing stratum as the load tested pile.

(2) The same equipment (or heavier equipment of the same type) that was used to install the load tested pile must be used to install all other building piles, and the equipment must be operated identically.

(3) All piles must be of the same type, shape, and equal or greater external dimensions as the load tested pile.

(R) INSPECTION

(1) All inspections will be performed by the Engineer designated for controlled inspection.

(2) The installation of each pile is a mandatory hold point for which prior notification of the Engineer is required, and installation of each pile must be performed in the presence of the Engineer. Installation records will be kept by the Engineer.

(3) The Contractor must cooperate with the Engineer and must mark the leads, prior to the start of drilling, in one (1) foot increments for monitoring the auger.

70.12.5 TESTING

(A) TEST PILES AND LOAD TESTS

(1) The Contractor must be responsible for the proper length of the piles required to develop the specified loads. The piles must be of sufficient length so that when they are installed to their final position, the tops will be at or above the elevation or depth shown.

(2) In accordance with **Subsection 10.33 - Boring Records**, it must be the Contractor's responsibility:

(a) To make application for inspection and review of these data and the physical samples described thereon in order to select the proper length of test piles.

(b) To obtain any additional subsurface data the Contractor deems required or necessary.

(3) The Contractor must determine the lengths of the reaction piles required to develop the specified loads by installing test piles. The location and number of test piles must be selected by the Engineer. The test piles must be of the same material and construction as the permanent piles, installed using the same equipment. In the event different equipment is used, test piles will also be required to ensure the quality and capacity of the piles meet the requirements of these specifications.

(a) Arrangement: The Contractor must provide all equipment, instruments, personnel, accessories, and appurtenances required for the tests as required in ASTM D1143 (Procedure B: Maintained Test) and ASTM D3689 (Procedure B: Maintained Test) and as indicated below. The Contractor must place reaction piles and beams, as required, to transmit load into the test pile. Calibrated pressure gauges must be used to determine the actual load placed on the test pile.

(i) The Contractor must prepare complete detailed shop drawings showing how the test will be performed, how the reaction piles will be placed, and how the jacking beams will be anchored to the test piles and the reaction piles.

(ii) The Contractor's shop drawings must include date and calibration curves on all instruments and accessories used in the tests. The entire test setup and test procedure will be subject to the approval of the Engineer prior to the installation of the reaction piles and load test apparatus.

(b) Procedure: Test loads must be applied by direct weight or by means of a hydraulic jack. The loading platform or box must be carefully constructed to provide a concentric load on the pile. If direct weight is employed, the loading increments must be applied without impact or jar. The weight of the loading platform or box must be obtained prior to the test, and this weight must be considered as the first increment of load. If a hydraulic jack is employed, facilities for maintaining each increment of desired load constant under increasing settlement must be provided. The gage and the jack must be calibrated as a unit.

(i) Increment: The test load must be twice the proposed working load of the pile. The test load must be applied in seven increments, at loads of 15 percent, 30 percent, 45 percent, 60 percent, 75 percent, 90 percent, 100 percent, 115 percent, 130 percent 145 percent, 160 percent, 175 percent, 190 percent, and 200 percent of the proposed working load. After the incremental test load has been applied, and for each increment thereafter, the test load must remain in place until there is no measurable settlement in a 2-hour period. The total test load must remain in place until settlement does not exceed one one-thousands of a foot (0.001-feet) in twelve (12) hours. The total load must be removed in decrements not exceeding 25 percent of the total load at one (1) hour intervals or longer. The rebound must be recorded after each decrement is removed, and the final rebound must be recorded twelve (12) hours after the entire test load has been removed.

(ii) Observation: Under each load increment, settlement observations must be made and recorded at one-half (1/2) minute, one (1) minute, two (2) minutes, and three (3) minutes. At each load interval, a constant time of three (3) minutes must be maintained.

(iii) The allowable net settlement of the test pile at two hundred (200) percent of the proposed working load is three-quarters (3/4) inch, where net settlement equals gross settlement due to the total test load, minus the rebound, after removing all of the test load.

(4) Submittal: The entire test program will be observed by the Engineer. All the test data must be submitted to the Engineer for the Engineer's review and interpretation. These data from the tests will establish site installing criteria. Upon completion of the test program, the Contractor must remove all equipment and restore the site to the condition and satisfaction of the Engineer.

(5) The Engineer must be notified at least forty-eight (48) hours in advance so that the Engineer may be present at the commencement of the test pile(s) installation and for the test program.

(6) The test piles, if and when installed at the location of permanent piles, will be accepted as a permanent load-bearing pile only if approved by the Engineer.

(7) Payment for load tests must be made in accordance with **Subsection 70.12.9**.

(B) TESTING OF GROUT

(1) The grout mix selections and proportions must be established based on the provisions of ACI 301.

(2) The grout mix must be tested by a testing laboratory to be engaged by the Contractor and approved by the Engineer, by making one (1) set of 2-inch cubes in accordance with ASTM C109 or C780 Annex 6 for each day during which piles are placed, or for every three (3) piles, whichever is greater and for every time water is added to the mix at the site. A set of cubes must consist of two (2) cubes to be tested at seven (7) days, two (2) cubes to be tested at twenty-eight (28) days, and two (2) cubes for backup in case of damage to the other specimens, or earlier test (i.e. three (3) days).

70.12.6 MEASUREMENT

The quantities of continuous flight auger (CFA) piles in vertical feet to be measured for payment of the unit price bid will be the actual length of piles installed and left in place in conformity with the contract drawings and specifications. The vertical footage of pile to be measured for payment must be the length in place below the elevation or depth of cutoff measured to the elevation or depth of the pile tip shown on the drawings.

70.12.7 PRICE TO COVER

The contract price for Item No. 70.12AN - CONTINUOUS FLIGHT AUGER (CFA) PILES must be the unit price bid per vertical foot and must cover the cost of all labor, materials, plant, equipment, samples, tests (except load tests), and insurance required and necessary to furnish, drill, install, cut, cap, and permanently incorporate in the work all continuous flight auger (CFA) piles, grout, reinforcing bars and/or steel pipe, required or ordered, together with all work incidental thereto, all in accordance with the plans and specifications, and as directed by the Engineer.

Included in the contract price herein must also be the cost for all design submittals, shop drawing submittals, documentation, connections, and guide works.

70.12.8 NO SEPARATE PAYMENT

(A) No separate payment will be made for concrete, reinforcement, a steel pipe or reinforcing bar, rejected piles, removing damaged piles, piles installed for temporary use or for the convenience of the Contractor, disposal of auger spoils, pile surveys and related drawings, pile cutoffs and their disposal off site. The costs thereof must be included in the unit price bid for Item No. 70.12AN - CONTINUOUS FLIGHT AUGER (CFA) PILES.

(B) No separate payment will be made for excavating for pile installation, clearing obstructions and installing piles through obstructions, replacing unsuitable materials required due to pile installation procedures, and for furnishing, placing and compacting fill and backfill material required due to pile installation procedures; the costs thereof must be included in the unit price bid for all items of the contract. Also, no payment will be made for any condition survey, additional borings, any laboratory testing, site photography, delays due to site conditions, access, traffic conditions, permits, etc.

70.12.9 SEPARATE PAYMENT

Separate payment will be made for load tests for CFA piles. Payment for the cost for each CFA pile load test, including all labor, materials, plant, equipment, tests, and insurance required and necessary to complete the CFA pile load test must be made under the contract price bid for Item No. 70.12AT - CONTINUOUS FLIGHT AUGER (CFA) PILES, LOAD TEST. Included in price bid hereunder must be the cost of reaction piles and the actual pile tests.

Payment for Continuous Flight Auger (CFA) Piles will be made under the Item Number as calculated below:

The Item Numbers for Continuous Flight Auger (CFA) Piles have seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Continuous Flight Auger (CFA) Piles:

70.12

(2) The sixth character must define Continuous Flight Auger (CFA) Piles:

A - Continuous Flight Auger (CFA) Piles

(3) The seventh character must define the Type of Work:

N - Installation (Complete)
T - Load Test

(4) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
70.12AN	CONTINUOUS FLIGHT AUGER (CFA) PILES	V.F.
70.12AT	CONTINUOUS FLIGHT AUGER (CFA) PILES, LOAD TEST	EACH

SECTION 70.13 – MINI-PILES (GROUTED)

70.13.1 DESCRIPTION

(A) This section covers additional requirements and specifications for the installation of rotary-drilled cast-in-situ thirty (30) ton capacity mini-piles as shown on the contract drawings and as directed by the Engineer. This section must be used in conjunction with the requirements of **Section 70.11 - Piles**.

The work consists of furnishing all necessary labor, materials, and equipment to perform the work necessary to install permanent mini-piles of thirty (30) ton compressive capacity as per the specifications described herein and as shown on the contract drawings.

The Contractor is advised that headroom clearance may be restricted and may require special pile installation equipment.

No additional payment will be made for the use of different equipment as deemed necessary to complete the work as described herein. All costs must be included in the price bid for Item No. 70.13MN - MINI-PILES (GROUTED).

(B) Examination Of The Site:

(1) Prior to starting pile installations, the Contractor must make a documented inspection of the existing structures, site conditions, pavement, and improvements within the radius of influence and adjacent to the pile installation site to examine and record their present condition.

The Contractor must prepare a preconstruction report in accordance with **Section 76.11 - Construction Report**.

(2) The Contractor must fully examine the existing conditions within the project limits to ensure that the Contractor's equipment can operate without damage to or relocation of existing infrastructure, facilities, or structures. The Contractor must provide all required equipment, modified if needed to accommodate site conditions, including restricted headroom and other headroom limitations. If available, the Contractor must review the boring logs showing subsurface conditions.

(3) The Contractor must be required to prepare a report of all such conditions, verified by the photographs and signed by the Contractor's Professional Engineer, which must be reviewed by the Engineer to verify the existing site conditions and all pre-existing damage that may be affected by the mini-piling work. Such work must be included in the preconstruction report.

(C) Qualifications:

The work must be performed by the Contractor or a subcontractor experienced in the specified foundation system and mini-piling under similar subsurface conditions. The Contractor performing the work described in this specification must submit proof that the Contractor or subcontractor has successfully completed a minimum of two (2) projects in the last three (3) years on which the Contractor or subcontractor has successfully designed, tested, and installed mini-piles.

The Contractor must also submit proof that the Contractor has employed a Licensed Professional Engineer, currently registered in the State of New York, having experience in the construction (designing, planning, testing, and inspection phases) of at a minimum two (2) completed mini-pile installation projects over the past three (3) years. The Professional Engineer must be directly responsible for the work. The Contractor must not use manufacturers' representatives to satisfy the Contractor's responsible engineer requirements of this section.

In addition, the Engineer will review and approve the Contractor's key field personnel to be employed during installation of the mini-piles.

70.13.2 MATERIAL AND EQUIPMENT

Contractor must provide the following equipment and materials for the installation of the mini-piles:

(A) Equipment:

(1) Klemm 704 Hydraulic Drilling Rig or approved equal

(2) Drilling Rods and Drill Tools

(3) Grout Pump/Mixer

(4) Storage Container, as required

(5) Water Tanks, as required

(6) Lifting Equipment, as required

(B) Material:

(1) Grout: 4,000-psi at 28-days

(2) Threadbar: Minimum 60-ksi, Epoxy Coated (ASTM A775/AASHTO M282 or ASTM A936 or approved equal)

(3) Steel Shell: Minimum 36-ksi (yield strength); Minimum Outer Diameter of 8.625-inches, with a Minimum Shell Thickness of five-sixteenths (5/16) of an inch

70.13.3 MINI-PILE (GROUTED) CONSTRUCTION

(A) Drilling The Pile: The drilling procedure for the mini-piles is water flush duplex drilling or a water and polymer drilling mud mixture as necessary. Duplex drilling involves the simultaneous advancement of the casing with an approved cutting shoe and drill bit to provide temporary support to the borehole. The drill bit must not extend closer than one (1) foot above the casing tip. A duplex drive head with ports on the sides is used to eject the flush. Water for flushing will be delivered to the duplex head via a jetting pump connected to a water hydrant or storage tank.

The use of air to remove soils from casing is not allowed.

The drill crew must visually examine the drill spoils during installation of the pile. The Contractor must ensure that the pile is drilled to the required depth and visually check borehole stability at all times. Where borehole instability is apparent or suspected, the Contractor must inform the Engineer and appropriate actions must be specified.

The final borehole depth must be measured by the driller, checked by the Contractor, and recorded on the Daily Report. On reaching the required depth, the borehole must be water flushed to remove any remaining debris. Spoils arising from drilling and flushing of the borehole must be deposited around the pile for disposal by the Contractor.

The Contractor must prepare and submit to the NYC Department of Design and Construction (NYCDDC) full-length installation records for each mini-pile installed.

(B) Placing Reinforcement: A No. 8 all-thread reinforcing bar must be used to reinforce each pile. The reinforcing bar must be centralized within the borehole by wrap-round spacers. The bars must be spliced using proprietary full strength couplers until the required depth is reached. Each length must be hoisted into position manually or by using the lifting arm mounted on the drill rig. The lower bar must be held in position inside the casing temporarily during splicing using the hydraulic clamp on the drill rig or other clamping device. A 3/4-inch diameter PVC tremie pipe must be attached to the reinforcing bar to allow grouting from the base of borehole.

(C) Placing Grout: The Contractor is responsible for ensuring that sufficient cement is ordered and grout is mixed to meet contract requirements. All grout must be mixed in accordance with the approved mix design.

The Contractor is responsible for ensuring that the correct method of grout placement is used and recorded. The grout must be pumped through a tremie pipe to the base of the pile and the hole filled prior to lifting up the temporary casing. Grout must be allowed to flow until clean grout is returned to the surface. Thereafter, the casing must be slowly withdrawn using the drill rig while maintaining a positive grout pressure of a minimum of 50-psi. The casing must be withdrawn to the required design depth and then pushed back two (2) feet to form the unbonded length.

The Engineer must be immediately notified of any significant loss of grout. The Contractor must be responsible for checking and recording the final grout level in the pile relative to the ground level or site datum on the Daily Report.

70.13.4 QUALITY ASSURANCE

An independent testing laboratory must test each batch of grout mixed as follows: Make a set of six (6) grout cubes each day. Two (2) grout cubes each must be tested at three (3), seven (7), and twenty-eight (28) days for compressive strength in accordance with ASTM C109 or C780 Annex 6.

The Contractor must install all piles in the presence of the Engineer.

70.13.5 LOAD TEST FOR MINI-PILES

Load test for mini-piles must be in accordance with ASTM D1143 (Procedure B: Maintained Test) and as directed by the Engineer. The cost for mini-piles load test, including all material, labor, and equipment must be paid under bid Item No. 70.13MT - MINI-PILES, LOAD TEST.

The load test must be conducted to two times the design load plus any anticipated downdrag load. The net settlement of the test pile must not exceed three-quarter (3/4) inch" when tested, where net settlement equals gross settlement due to the total test load, minus the rebound after removing all of the test load.

70.13.6 MINI-PILE (GROUTED) INSTALLATION NOTES

(A) Install grouted piles at locations shown on contract drawing, and as directed by the Engineer.

(B) The drilling equipment must be a hydraulic mini-drill rig capable of 5,000 ft-lbs of torque and 10,000lbs of crowd (pushing load). The drill must have a self-contained hydraulic double acting cylinder grout pump capable of 600-psi pressure and hydraulic grout mixer.

(C) The diameter of the cutting shoe of the casing must not exceed the outer diameter of the casing by more than 0.25-inch.

(D) The pile must be reinforced with No. 8, Grade 60, threadbar with spacers at ten (10) feet on centers and couplers as required. Threadbar must be epoxy coated (ASTM A775) or approved equal.

(E) Grout must produce a compressive strength of 4,000-psi in seven (7) days. The Contractor must design a grout mixture, which is expected to produce 4,000-psi in seven (7) days and submit it to NYCDDC for approval.

(F) Grout must be mixed thoroughly with a high-shear colloidal type mixer capable of handling a minimum of six (6) bag mixes.

(G) Grout must be pumped using a hydraulic pump capable of 600-psi pressure and capable of a minimum of sixty (60) gallons per minute capacity.

(H) A set of six (6) cubes of grout samples (2-inch by 2-inch) must be taken for each day during which mini-piles are grouted. The cube samples must be tested by an independent testing laboratory in accordance with the concrete section of the specifications.

(I) The Contractor must submit for approval shop drawings showing materials to be used, grout mix design, drilling equipment, grout mixer, grout pump, drilling fluid to be used, threadbar, pile installation log to be used, and the installation procedures to be used.

70.13.7 MINI-PILE (GROUTED) DESIGN AND SHOP DRAWINGS SUBMITTAL

(A) Before commencing any mini-pile installation operations, the Contractor must have approved shop drawings from the Department of Design and Construction for mini-piles (grouted). The shop drawings must include, but not be limited to, materials to be used, grout mix design, drilling equipment, grout mixer, grout pump, drilling fluid to be used, threadbar, pile installation log to be used, and the installation to be used.

(B) The Contractor must submit for approval six (6) copies of the shop drawings for the design of mini-piles including, but not limited to all requirements as above-mentioned; and allow a minimum of three (3) weeks to review the same.

(C) The Contractor must have these drawings prepared by a Licensed Professional Engineer, currently registered in the State of New York. Such drawings must be submitted together with mini-piles design calculations and both drawings and design calculations must bear the imprint of the Licensed Professional Engineer’s seal and signature. These shop drawings must be on sheets twenty-seven (27) inches by forty (40) inches with one-half (1/2) inch marginal space on three (3) sides and a two (2) inch marginal space for binding on the left side. Each shop drawing must be dated and contain the name of the project and the contract number.

70.13.8 MEASUREMENT

The quantities of Mini-Piles to be measured for payment must be the number of vertical feet measured from pile tip to cutoff, furnished, and permanently incorporated in the work in accordance with the plans, standards, and specifications and as directed by the Engineer.

70.13.9 PRICE TO COVER

The contract price for Item No. 70.13MN - MINI-PILES (GROUTED) must be the unit price bid per vertical foot and must cover the cost of all labor, materials, plant, equipment, samples, tests, shop drawings, shop drawings preparation, and insurance required and necessary to furnish, and/or install, and permanently incorporate in the work all rotary cast-in-situ mini-piles (grouted) required all in accordance with the plans, standards, and specifications, and as directed by the Engineer.

Included in the contract prices hereinabove must also be the cost for all connections and guide works.

70.13.10 NO SEPARATE PAYMENT

No separate or additional payment will be made for test piles, which are not permanently incorporated into the work, for piles installed by the Contractor for temporary use, and for any other piles not permanently incorporated into the work.

Payment for Mini-Piles (Grouted) will be made under the Item Number as calculated below:

The Item Numbers for Mini-Piles (Grouted) have seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Mini-Piles (Grouted):

70.13

(2) The sixth character must define Mini-Piles (Grouted):

M - Mini-Piles (Grouted)

(3) The seventh character must define the Type of Work:

N - Installation (Complete)
T - Load Test

(4) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
70.13MN	MINI-PILES (GROUTED)	V.F.
70.13MT	MINI-PILES, LOAD TEST	EACH

SECTION 70.21 – DECKING

70.21.1 DESCRIPTION

When and where specified in the contract documents (i.e. plans, specifications, addenda or traffic stipulations) or required by the Engineer, decking for open trenches must be provided as shown, specified or required.

Decking must be defined as a temporary timber mat roadway structure over trenches and excavations built flush with the existing roadway for vehicular and pedestrian traffic.

Steel plates must not be included for payment under this decking section. The cost of all labor, materials, equipment, insurance and incidentals necessary to furnish, place, anchor, and ramp steel plates, when and where directed, in order to comply with the requirements of the NYCDOT Office of Construction Mitigation and Coordination (OCMC) traffic stipulations, the directions of the Engineer, and the Contractor's construction operations must be included in the prices bid for all contract items of work.

70.21.2 MATERIALS

(A) Timber and lumber must be new or acceptable used timber and lumber free from injurious defects.

(B) Timber and lumber bracing, bridging and decking must conform to the requirements of **Section 23.06**.

(C) Steel beams and girders must comply with the requirements of **Section 23.05**, except that approved used material will be permitted. Steel used for decking must conform to the requirements of the ASTM A36 and all other applicable requirements of ASTM.

(D) Bolts must conform to the requirements of ASTM A307 or ASTM A325, or as otherwise shown on approved shop drawings.

70.21.3 CONSTRUCTION METHODS

The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder. The requirements of **Section 40.05** apply, except as otherwise herein amended.

70.21.4 DESIGN CRITERIA

(A) Design criteria must conform to the requirements set forth in **Subsection 40.05.6.**

(B) Decking must be installed in such a way as not to disturb or damage either existing or new pavement, and the existing utilities and structures occupying the area adjacent to the trench and within the influence lines of the timber mats as placed in **Subsection 40.05.6(G)(2)**.

70.21.5 SHOP DRAWINGS

Detailed shop drawings and design calculations must be prepared for each and every decking system and must be submitted in accordance with **Subsection 40.05.5**.

70.21.6 MEASUREMENT AND PAYMENT

The quantity of decking to be measured for payment must be the number of square yards of decking placed, complete, as shown, specified or ordered. Pay limits for decking must be from inside face of sheeting line to inside face of sheeting line measured perpendicularly across the trench.

Payment will be made for decking only for the initial installation over a specific area. Whenever decking is removed and installed over a new area, payment will be made in the same manner as if it were an initial installation. Whenever decking is removed and reinstalled over an enlarged area, then only the additional new area of the enlargement will be measured for payment under this item.

No payment will be made for movement of decking made for the Contractor's convenience; for removal and subsequent replacement over a given area; or for the interchanging of decking between initial installations.

70.21.7 PRICE TO COVER

The contract price for Item No. 70.21DK - DECKING must be the unit price bid per square yard for decking and must cover the cost of all labor, materials, plant, equipment, and insurance required and necessary to fabricate, place, maintain and remove the decking system, and do all work incidental thereto, all in accordance with the plans and specifications, and as directed by the Engineer.

Included in the price hereunder must be the cost of all labor and materials required and necessary to place supports or timber mat decking beyond the sheeting limits as specified herein, and do all work incidental thereto.

The decking over any specific trench area will be paid for only once during the life of the contract.

Payment for Decking will be made under the Item Number as calculated below:

The Item Number for Decking has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Decking:

70.21

(2) The sixth and seventh characters must define Decking:

DK - Decking

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	**Description**	**Pay Unit**
70.21DK	DECKING	S.Y.

SECTION 70.31 – FENCING

70.31.1 DESCRIPTION

The Contractor must completely enclose by temporary fences all excavations, steep embankments, open shops and storage areas and all other potentially hazardous locations as soon as such condition exists and as ordered by the Engineer. The fencing is in addition to any provisions that the Contractor would normally follow to safeguard the Contractor's work operations and in no way reduces the Contractor's obligations as provided in the contract.

70.31.2 MATERIALS

Fencing must be five (5) foot high above the existing surface and must be constructed in ten (10) linear foot removable sections to facilitate construction. Each section must consist of three (3) horizontal rails of 2" x 8" lumber nailed at each end to 2" x 8" vertical posts. The lower rail must be located not more than six (6) inches above ground or street surface. The posts must be of sufficient height to be firmly anchored in a manner approved by the Engineer. The spaces between rails must be covered with 1/12-inch (0.083") diameter, (No. 14 B.W.G.) iron wire (both directions) of an electrically welded rectangular mesh, with openings no greater than two (2) inches wide by four (4) inches high.

70.31.3 CONSTRUCTION METHODS

(A) The Contractor is solely responsible for the furnishing, erecting, relocating, maintenance and removal and replacement of all temporary fencing required under this contract.

The Contractor must maintain all fencing in a satisfactory and safe condition. The Contractor must replace, at no additional cost to the City, any and all fencing that the Engineer deems cannot be maintained and/or fails to meet the requirements of this section.

(B) The Contractor is permitted to remove such portions of the fencing as are required for the purpose of performing the Contractor's construction operations during working hours, providing that the public is continuously safeguarded by other satisfactory means during these construction operations. In all such cases the sections of fencing removed must be restored to their original locations at the end of each workday.

70.31.4 MEASUREMENT

The quantity of fencing to be measured for payment is the number of linear feet of temporary fencing incorporated into the work, complete, as shown, specified or required.

70.31.5 PRICE TO COVER

The contract price for Item No. 70.31FN - FENCING is the unit price bid per linear foot for fencing and must cover the cost of all labor, materials, plant, equipment and insurance required and necessary to furnish, erect, relocate, maintain and remove and replace all temporary fencing and to do all work incidental thereto, all in accordance with the plans and specifications, and as directed by the Engineer.

Payment for Fencing will be made under the Item Number as calculated below:

The Item Number for Fencing has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Fencing:

70.31

(2) The sixth and seventh characters must define Fencing:

FN - Fencing (Not Less Than Item)

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
70.31FN	FENCING (NOT LESS THAN $XX.XX/L.F.)	L.F.

SECTION 70.41 – SHORING, BRACING, UNDERPINNING, SUPPORTING, PROTECTING, AND MAINTAINING OF BUILDINGS AND/OR STRUCTURES

70.41.1 INTENT

Under this section the Contractor is required to inspect, examine, shore, brace, support, protect, maintain and/or permanently underpin buildings and/or structures specifically shown on the plans, and specified in the contract documents to be shored, braced, supported, protected, maintained and/or permanently underpinned.

70.41.2 WORK TO BE PERFORMED

Before the start of this work, the Contractor must engage the services of a licensed New York State Professional Engineer who specializes in foundation and underpinning work. The Professional Engineer's experience papers and name of the firm must be submitted for approval before the work. Upon acceptance of the Professional Engineer's services, the following work must be performed:

(1) Obtain official building and/or structure records from the local building department, and/or other city agencies that have jurisdiction over the building and/or structure;

(2) Examine the building and/or structure and make test pits if necessary to verify the existing condition of the building and/or structure and their foundations. The Professional Engineer will be required to obtain written permission of the owner to enter the building or property for inspection and examination, and for making test pits;

(3) The Professional Engineer must make quantitative analysis of each building and/or structure specified to determine whether permanent underpinning work is required with reference to the Contractor's proposed method of construction. The analysis must include, but not be limited to inclusion of the proposed method of sheeting, dewatering, change in water table, vibration due to installation of sheeting and/or piles, etc., and must state whether underpinning is required. If permanent underpinning is not required, a detailed explanation must be provided in the analysis as to why such is not needed and must specify any other remedial steps that may be required to be taken in order to protect, maintain, secure or support the building and/or structure. If permanent underpinning is deemed necessary by the analysis, the report must also propose all necessary means and methods required for the support, maintenance, protection and underpinning of the affected building and/or structure.

(4) The result of the analysis must be submitted to the Engineer for review

If by the analysis, permanent underpinning work is required, the following **Subsections 70.41.3 through 70.41.10** inclusively, must be complied with.

70.41.3 SHOP DRAWINGS AND COMPUTATIONS

Prior to the actual underpinning work, the approved Professional Engineer for this work; presumed to be the same Professional Engineer (if different, all qualification papers must be submitted for review and acceptance); must submit shop drawings together with design computations detailing the means and methods for underpinning of each building and/or structure. Shop drawings must be submitted on 27" x 40" sheets of paper with a one-half (1/2) inch marginal space on three sides and two (2) inch marginal space for binding on the left side. Computations must be submitted separately on 8-1/2" x 11" paper. Shop drawings with computations must be submitted to the Engineer for review and approval, and must bear the seal and signature of a licensed New York State Professional Engineer.

(A) Shop drawings must present the following:

(1) All working and erection dimensions.

(2) Arrangement and sectional views.

(3) Necessary details, including complete information for making connections between work under this contract and work under other contracts.

(4) Kinds of materials and finishes.

(5) Parts list and description thereof.

(B) Each shop drawing must be dated and contain:

(1) The name of this project and contract number.

(2) The description names of equipment or material covered by the drawing and the classified contract item numbers under which it is or they are required.

70.41.4 PERMITS

The Contractor must apply for all permits required in order to work at the designated location(s), and must adhere to all requirements of such permits. The Contractor must obtain all permits and consents necessary or required for the permanent underpinning of buildings and/or structures and for the reconstruction thereof. Applications for consents to enter buildings and/or properties for the purpose of permanent underpinning must state that, permanent underpinning is necessary to maintain the support of the building and/or structure in a safe condition during the construction of the sewer or water main. One counterpart of each such consent, duly signed, and acknowledged by the owner or one of the owners, executors or administrators for owner or owners and for owner or owners agents, lessees and any other persons who must have a vested or contingent interest in the building or structure, or notice of refusal if consent is not obtained, must be filed with the Engineer at least ten (10) days before the commencement of any work which would affect the building and/or structure.

The Contractor must make application for permits to NYCDOB or other city agencies having jurisdiction. Applications must include all forms, drawings, cloth prints, insurance certificates, all required fees, etc. with the result that the Contractor must have an approval by the City agency having jurisdiction before starting this work.

70.41.5 EXPERIENCE

The Contractor and/or subcontractor performing underpinning work must demonstrate to the satisfaction of the Engineer that it has sufficient prior experience in the performance of underpinning work comparable in scope to that required by this contract. The Contractor's and/or subcontractor's experience must be submitted for review and approval prior to undertaking any work described by this section.

70.41.6 MATERIALS

(A) Concrete used in permanent underpinning or in other permanent supporting construction must be Class 40, Type IIA, complying with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(B) Brick and brick masonry must comply with the requirements of **Section 23.02**.

(C) Cement mortar must comply with the requirements of **Section 23.03**.

(D) Reinforcement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(E) Structural steel must comply with the requirements of **Section 23.05**.

70.41.7 METHODS

(1) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

(2) Forms must be removed in accordance with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

70.41.8 DAMAGE TO BE MADE GOOD

Any damage to buildings, properties and structures caused by the Contractor's means and methods of construction operation, whether it is accidental or due to negligence or carelessness in performing the work required in this section, must be remedied by the Contractor at own expense, and to the satisfaction of the Engineer. No separate or additional payment will be made to the Contractor by the City for repair to and/or replacement of buildings and/or structures damaged as a result of such accident, negligence or carelessness.

Temporary shoring, bracing and other means of temporary support must be removed after completion of construction. Before removal of temporary supports, a written report must be submitted by a New York State Licensed Professional Engineer stating that the integrity of the building and/or structure is sound. This report must indicate all remedial work required to be performed prior to removal of said temporary supports.

70.41.9 PRICE TO COVER

The contract price for "SHORING, BRACING, UNDERPINNING, SUPPORTING, PROTECTING AND MAINTAINING" of Existing Building and/or Structure must be for the lump sum price bid for each building and/or structure requiring shoring, bracing, underpinning, support, protection and maintenance and must include the costs of all labor, material, plant, test pits, inspections, examinations, reports, shop drawings, computations, samples, permits, testing, equipment and insurance required and necessary for maintaining, protecting, securing, supporting and permanently underpinning the buildings and/or structures specified. It must also include all costs associated with the obtaining of all consents necessary to perform this work.

No separate payment will be made for the removal of any temporary supports or for making test pits to determine the type and depth of existing foundations or for the restoration of any buildings and/or structures damaged due to the Contractor's construction operations.

70.41.10 SEPARATE PAYMENT

In the event that a building and/or structure specified does not require support or permanent underpinning, which determination must be made only after the performance of the engineering study set out in **Subsection 70.41.2**, then the Contractor must be paid for such evaluation, study and report and all costs associated therewith, and for any remedial work required (other than support or permanent underpinning) at the rate of ten (10) percent of the Contractor's bid price for the specific contract item for "SHORING, BRACING, UNDERPINNING, SUPPORTING, PROTECTING AND MAINTAINING" of Existing Building and/or Structure.

Payment for Shoring, Bracing, Underpinning, Supporting, Protecting And Maintaining Of Buildings And/Or Structures will be made under the Item Number as calculated below:

The Item Numbers for Shoring, Bracing, Underpinning, Supporting, Protecting And Maintaining Of Buildings And/Or Structures have fifteen characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Shoring, Bracing, Underpinning, Supporting, Protecting And Maintaining Of Buildings And/Or Structures:

70.41

(2) The sixth character must define the Borough building or structure is in:

B - The Bronx
K - Brooklyn
M - Manhattan
Q - Queens
S - Staten Island

(3) The seventh, eighth, ninth, tenth and eleventh characters must define the Block Number building or structure is at, in front of, or near to; or the Structure Number:

02610 - Block No. 2610
10767 - Block No. 10767
0306A - Structure No. 306A
00012 - Structure No. 12

(4) The twelfth, thirteenth, fourteenth and fifteenth characters must define the Lot Number building or structure is at, in front of, or near to; or Description of Structure:

0000 - No Lot Number
0027 - Lot No. 27
0240 - Lot No. 240
TERC - Transit Authority Elevated Railway Column
SEVC - South Street Elevated Viaduct Column
QEHC - BQE Elevated Highway Column
XXXX - (Description Of Structure)

(5) Examples of Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
70.41Q096980017	SHORING, BRACING, UNDERPINNING, SUPPORTING, PROTECTING AND MAINTAINING OF BUILDING AT QUEENS BLOCK NO. 9698, LOT NO. 17 - ONE (1) STORY BRICK, COMMERCIAL (139-29 HILLSIDE AVENUE)	L.S.
70.41Q107670029	SHORING, BRACING, UNDERPINNING, SUPPORTING, PROTECTING AND MAINTAINING OF BUILDING AT QUEENS BLOCK NO. 10767, LOT NO. 29 - TWO (2) STORY FRAME, RESIDENTIAL (100-02 SPRINGFIELD BOULEVARD)	L.S.
70.41K022620001	SHORING, BRACING, UNDERPINNING, SUPPORTING, PROTECTING AND MAINTAINING OF BUILDING AT BROOKLYN BLOCK NO. 2262, LOT NO. 1 - ONE (1) STORY FRAME, RESIDENTIAL (19 FRANKLYN AVENUE)	L.S.
70.41Q121390001	SHORING, BRACING, UNDERPINNING, SUPPORTING, PROTECTING AND MAINTAINING OF CONCRETE RETAINING WALL OF RAMP TO J.F.K. FROM NORTH CONDUIT AVENUE AND SOUTHERN STATE PARKWAY WEST AT QUEENS BLOCK NO. 12139, LOT NO. 1	L.S.
70.41B0306ATERC	SHORING, BRACING, UNDERPINNING, SUPPORTING, PROTECTING AND MAINTAINING OF BRONX TRANSIT AUTHORITY ELEVATED RAILWAY COLUMN NO. 306A IN SOUTHERN BOULEVARD	L.S.
70.41M00012SEVC	SHORING, BRACING, UNDERPINNING, SUPPORTING, PROTECTING AND MAINTAINING OF MANHATTAN SOUTH STREET ELEVATED VIADUCT COLUMN NO. 12 IN SOUTH STREET	L.S.

SECTION 70.51 – EXCAVATION OF BOULDERS IN OPEN CUT

70.51.1 DESCRIPTION

Excavation of boulders in open cut must include the excavation, removal and disposal of boulders or parts thereof from within the limits of the sheeted and unsheeted trenches and excavations, more than one-half (1/2) cubic yard in volume. The term boulders as used herein must include riprap, rock fill, thrust blocks and loose masonry. It must not include pavement and pavement foundation, or existing sewer or water main structures.

70.51.2 CONSTRUCTION METHODS

(A) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS, Section 40.04** apply to the work to be done hereunder.

(B) NOTIFICATION AFTER REMOVAL FROM OPEN CUT - After the boulder has been removed from open cut, the Engineer must be duly notified in order that the Engineer may take such measurements required to measure the boulder. Any boulder removed from the site of the work before such measurements are taken will not be paid for.

70.51.3 MEASUREMENT

The quantity of excavation of boulders in open cut to be measured for payment must be the volume of boulders or parts thereof from within the limits of the sheeted and unsheeted trenches and excavations, more than one-half (1/2) cubic yard in volume, excavated and removed in open cut and disposed of away from the site of the work.

The volume of a boulder or parts thereof removed from open cut must be computed by multiplying the maximum cross-sectional area by seven-tenths (7/10) of the length.

Boulders one-half (1/2) cubic yard or less in volume, pavement and pavement foundations, track foundations and existing sewers, manholes, valve chambers, regulator chambers and appurtenances will not be measured for payment.

70.51.4 PRICE TO COVER

The contract price for Item No. 70.51EO - EXCAVATION OF BOULDERS IN OPEN CUT must be the unit price bid per cubic yard and must cover the cost of all labor, materials, plant, equipment and insurance required and necessary to excavate, remove and dispose of all boulders in open cut from within the limits of the sheeted and unsheeted trenches and excavations (whether whole or partial), together with all work incidental thereto, all in accordance with the plans and specifications, and as directed by the Engineer.

70.51.5 NO SEPARATE PAYMENT

No separate or additional payment will be made wherever the Contractor elects to remove an entire boulder that extends partly into the trench or excavation. Payment will only be made for that volume of the boulder that is within the limits of the sheeted and unsheeted trench or excavation. No separate or additional payment will be made for the removal of boulders or for the filling of voids left by the removal of boulders beyond the limits of the sheeted or unsheeted trench or excavation.

Payment for Excavation Of Boulders In Open Cut will be made under the Item Number as calculated below:

The Item Number for Excavation Of Boulders In Open Cut has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Excavation Of Boulders In Open Cut:

70.51

(2) The sixth and seventh characters must define Excavation Of Boulders In Open Cut:

EO - Excavation Of Boulders In Open Cut (Not Less Than Item)

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
70.51EO	EXCAVATION OF BOULDERS IN OPEN CUT (NOT LESS THAN $XX.XX/C.Y.)	C.Y.

SECTION 70.52 – EXCAVATION OF BOULDERS IN TUNNEL SECTION

70.52.1 DESCRIPTION

Excavation of boulders must include the excavation, removal and disposal of boulders or parts thereof in Tunneled Sections, specifically approved in writing by the Engineer.

The term boulder as used herein includes riprap, rock fill and loose masonry.

70.52.2 CONSTRUCTION METHODS

(A) GENERAL

The presence of boulders at the face of the tunneling machine may be difficult to ascertain. It is also anticipated that the type of machine specified will be able to remove boulders of various sizes. Should it become necessary to cease tunneling operations to physically remove a boulder then that boulder or portion thereof must be measured for payment. Boulders encountered that are broken down and removed by the tunneling machine must not be measured or estimated for payment. Payment will only be made for those boulders that have to be manually removed by gaining access to the tunnel face and removing it in total or portion thereof.

(B) NOTIFICATION

Should the advancement of the tunneling machine be halted due to the presence of a boulder the Contractor must immediately notify the Engineer.

After the boulder has been removed the Engineer must again be notified in order that the Engineer may take such measurements required to measure the boulder. Any boulder removed from the site of the work before such measurements are taken will not be paid for.

(C) REMOVAL

The Contractor will be required to properly dispose of all boulders removed from the site.

70.52.3 MEASUREMENT

The quantity of boulders in tunnel section to be measured for payment must be the volume of boulders more than one-ninth (1/9) cubic yard in volume, excavated and removed in tunnel section and disposed of away from the site of work. Whenever boulders are partially removed, only that portion of the boulder removed must be measured for payment.

70.52.4 PRICE TO COVER

The contract price for Item No. 70.52ET - EXCAVATION OF BOULDERS IN TUNNEL SECTION must be at the unit price bid per cubic yard and must cover the cost of all labor, materials, plant, equipment and insurance required and necessary to excavate, remove and dispose of all boulders in tunnel section, together with all work incidental thereto, all in accordance with the plans and specifications, and as directed by the Engineer.

No separate payment will be made for the cost of filling voids left by the removal of any boulders from within the Tunnel Section. These voids will be filled with grout as specified in **Sections 50.61, 50.62 and 60.31**, respectively, and the costs thereof must be included in the price bid per cubic yard under the Item No. 70.52ET - EXCAVATION OF BOULDERS IN TUNNEL SECTION.

70.52.5 ADDITIONAL PAYMENT

Should the presence of groundwater not permit the safe removal of a boulder at the tunnel face, as determined by the Engineer, then the Contractor may be required to install a deep well to remove the water or to initiate the use of compressed air at the tunnel face. Should either of these situations arise the Contractor must perform this additional work in accordance with **Section 70.53 - Allowance For Boulder Removal**, and as directed by the Engineer. The Contractor will be compensated for all costs associated with this additional work in accordance with **Section 70.53**. Payment will be made for the costs of installing and operating a dewatering system or, if necessary, the costs for the installation of a compressed-air plant and all costs associated with its operation including any premium labor costs associated with working in a compressed-air environment under Item No. 70.53AR - ALLOWANCE FOR BOULDER REMOVAL. No payment will be made for on site equipment downtime, including the tunnel machine, or for the payment of any idle labor forces.

Payment for Excavation Of Boulders In Tunnel Section will be made under the Item Number as calculated below:

The Item Number for Excavation Of Boulders In Tunnel Section has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Excavation Of Boulders In Tunnel Section:

70.52

(2) The sixth and seventh characters must define Excavation Of Boulders In Tunnel Section:

ET - Excavation Of Boulders In Tunnel Section

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	**Description**	**Pay Unit**
70.52ET	EXCAVATION OF BOULDERS IN TUNNEL SECTION	C.Y.

SECTION 70.53 – ALLOWANCE FOR BOULDER REMOVAL

70.53.1 DESCRIPTION

This item will be used to compensate the Contractor for additional costs associated with boulder removal whenever the presence of groundwater prevents its safe removal, as determined and specifically approved in writing by the Engineer.

Where groundwater adversely affects the removal of boulders then the Contractor will be compensated for the additional costs required to work in “the dry” as specified herein.

70.53.2 CONSTRUCTION METHODS

If, during the tunneling process, the presence of a boulder is detected that cannot be removed by the tunneling machine the Contractor will be required to access the face of the machine to manually remove the boulder. Payment for the manual removal of boulders from the face of the machine must be made in accordance with Item No. 70.52ET - EXCAVATION OF BOULDERS IN TUNNEL SECTION.

Should access to the face be restricted due to the presence of groundwater the Contractor will be required to install and operate a deep-well system to lower the groundwater.

Should this dewatering system not be able to eliminate or minimize the groundwater to permit safe removal of the boulder then the Contractor will be required to install, operate and maintain a compressed-air plant and to remove the boulder under compressed air conditions.

70.53.3 SUBMISSIONS

Prior to the start of tunneling the Contractor will be required to submit a plan for the possible installation of a deep-well dewatering system along with a preliminary estimate of the associated costs. This will include all material, equipment and labor costs along with operating expenses.

The Contractor will also be required to submit all details, including shop drawings, and costs associated with the possible installation and operation of a compressed air plant. This submission will also include the name of two (2) suppliers of a compressed air plant system.

70.53.4 MEASUREMENT

All additional costs associated with the removal of a boulder due to groundwater conditions (i.e. costs for the possible installation and operation of a deep-well dewatering system or, if necessary, the costs for the possible installation and operation of a compressed air plant including any premium labor costs associated with working in a compressed-air environment) will be paid on a Time and Material basis in accordance with **Articles 25 and 26** of the Contract except as amended herein. Payment will be made under Item No. 70.53AR - ALLOWANCE FOR BOULDER REMOVAL. This item must be used exclusively for the additional costs associated with the removal of a boulder due to groundwater conditions.

No guarantee is given that this allowance for additional costs associated with the work required for the removal of a boulder due to groundwater conditions will in fact be required in this contract. The estimated price in the Bid Schedule is included in the total bid solely to insure a method of payment for performing this work as directed by the Engineer.

Payment made under this item must be equal to the sum total of all vouchers submitted by the Contractor as payment for the cost of performing this work as approved by the Engineer. Payment under this item, including partial payments, will not be made until the Contractor has furnished satisfactory evidence to the Engineer that the Contractor has performed the work.

The voucher for the payment must be submitted to the Engineer on a monthly basis.

The “fixed sum” in the Bid Schedule is for bidding purposes only and must not be varied in the bid; however, the Contractor will be paid only for the actual work performed regardless of the fixed sum, which may be more or less than the amount fixed in the Bid Schedule.

70.53.5 NO SEPARATE PAYMENT

No separate payment will be made for any submissions required under **Subsection 70.53.3**. In addition no payment will be made for on site equipment downtime, including the costs of the tunneling machine or for the payment of any idle labor forces.

Payment for Allowance For Boulder Removal will be made under the Item Number as calculated below:

The Item Number for Allowance For Boulder Removal has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Allowance For Boulder Removal:

70.53

(2) The sixth and seventh characters must define Allowance For Boulder Removal:

AR - Allowance For Boulder Removal

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	**Description**	**Pay Unit**
70.53AR	ALLOWANCE FOR BOULDER REMOVAL	F.S.

SECTION 70.61 – ROCK EXCAVATION

70.61.1 INTENT

This section describes Rock Excavation.

70.61.2 DEFINITION, ROCK EXCAVATION

Rock excavation is the removal of a formation that cannot be excavated without the use of systematic drilling.

Rock excavation must include the excavation, removal and disposal of unbroken ledge rock from within the rock excavation payment lines as shown, specified or ordered.

70.61.3 CONSTRUCTION METHODS

(A) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

(B) ROCK SURFACE - The Contractor's attention is specifically directed to the fact that the assumed rock surfaces and estimated quantity set forth in the contract; while calculated from the best information obtainable; are approximate only, are not guaranteed to obtain the work, are given only to form a basis of comparison of bids, and are not to be considered as a binding feature of the contract. The bidders are required to examine the soundings and borings and the premises, and take such steps as may be necessary to judge for themselves the quantities and other circumstances affecting the cost of the work.

(C) NOTIFICATION BEFORE COMMENCING WORK - After ledge rock has been stripped of overlaying materials the Engineer must be duly notified in order that the Engineer may take such measurements and surveys required to measure the amount of ledge rock. Any rock excavated before such measurements are taken will not be paid for.

(D) BLASTING - No blasting will be allowed. The Contractor must use line drilling or other approved methods.

(E) EXCAVATION FOR BRANCHES - Whenever a branch for a proposed sewer or water main or extension of sewer or water main is built in rock the required trench must be excavated for a distance of not less than five (5) feet beyond the end of such branch in the direction of the proposed pipe or extension.

(F) COVER FOR NEW WATER MAINS - Where ledge rock is encountered in the trench, the new water main must be laid with a minimum cover of three (3) feet over the top of the barrel of the pipe, except where a greater or lesser cover over the pipe is dictated by field conditions, and as determined by the Engineer.

(G) PIPE SUPPORT - Where the bottom of the water main trench is in rock, the pipe must be supported on at least six (6) inches of select granular fill bedding in ground stabilization filter fabric wrap, or on concrete cradle, as approved or ordered by the Engineer and as shown on **Standard Drawing No. 45700-W**.

(H) DISPOSAL OF ROCK FROM SITE - All rock excavated from the trench must be properly disposed of immediately by the Contractor after its removal from the trenches and excavations.

70.61.4 WIDTH AND DEPTH OF ROCK EXCAVATION

The rock must be excavated to the widths and to the depths required for the pipes, cradles and foundations of the structures. (See **Section 40.02**.)

70.61.5 LENGTH OF ROCK TO BE STRIPPED

Unless otherwise specified in the contract documents or ordered in writing by the Engineer, all rock must be stripped in sections to its full depth for a minimum distance of twenty (20) feet in advance of the length of pipe permitted to be laid; however, the total length of stripped section must not be less than fifty (50) feet. The only exception to this is at its upper end or ends, where rock must be stripped to its full depth to a distance of not less than five (5) feet beyond the pipe to be built. Upon completion of this work the Engineer must be notified in order that the Engineer may measure the rock removed. No payment will be made for rock excavated before such measurement is made.

The subgrade must be checked and accepted by the Engineer before any structure is placed thereon.

70.61.6 EXPOSED STRUCTURES TO BE PROTECTED

All exposed water mains, valves, sewers, manholes, receiving basins and other structures must be carefully protected. The Contractor at the Contractor's own expense must promptly repair any damage done to such structures.

70.61.7 MEASUREMENT

The quantity of rock excavation to be measured for payment must be the volume of ledge rock removed and disposed of away from the site of the work, from between the approved vertical planes and extending from the subgrade of the trench or excavation to the rock surface that are established as defined in **Section 40.02**.

70.61.8 PRICE TO COVER

The contract price for "ROCK EXCAVATION" must be the unit price bid per cubic yard and must cover the cost of all labor, materials, plant, equipment and insurance required and necessary to remove and dispose of all ledge rock from within the limits of the rock excavation payment lines, together with all work incidental thereto, all in accordance with the plans and specifications, and as directed by the Engineer.

Filling of the voids left by the removal of ledge rock within the limits of the rock excavation payment lines must be done in accordance with **Section 40.06**. In addition, included in the price hereunder must be the cost of all labor, material, plant, equipment and insurance required and necessary to furnish and deliver acceptable clean fill material required to fill the voids left by the removal of ledge rock.

70.61.9 NO SEPARATE PAYMENT

The Contractor is notified that the cost for all labor, materials, equipment and insurance required and necessary to place, compact, sample and test acceptable clean fill material required to fill voids left by the removal of ledge rock must be included in the prices bid for all contract items of work. No separate or additional payment will be made for this work.

Payment for Rock Excavation will be made under the Item Number as calculated below:

The Item Numbers for Rock Excavation have seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Rock Excavation:

70.61

(2) The sixth and seventh characters must define Rock Excavation:

RE - Rock Excavation
RR - Rock Excavation Within Railroad Influence As Per Railroad Guidelines

(3) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
70.61RE	ROCK EXCAVATION	C.Y.
70.61RR	ROCK EXCAVATION WITHIN RAILROAD INFLUENCE AS PER RAILROAD GUIDELINES	C.Y.

SECTION 70.71 – RIPRAP, STONE BALLAST, BROKEN STONE, AND SLOPE PAVEMENT

70.71.1 DESCRIPTION

Riprap, stone ballast, broken stone and slope pavement must consist of stones placed where shown, specified or required.

Stone ballast must also be the broken stone ordered in writing by the Engineer to fill voids in the subgrade of the trench caused by the removal of boulders, rock, unsuitable subgrade material, existing sewers and associated structures.

Broken stone must also be the broken stone ordered in writing by the Engineer when due to construction consideration the Engineer deems it necessary to substitute the smaller coarse aggregate for shown or specified stone ballast.

70.71.2 MATERIALS

Riprap, stone ballast, broken stone and slope pavement must be in accordance with **Section 26.02**.

70.71.3 CONSTRUCTION METHODS

(A) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder. All riprap, stone ballast, broken stone and slope pavements must be placed as directed by the Engineer.

(B) RIPRAP - The slopes of riprap embankment exposed to water and wave action must be covered with large stones of approved dimensions.

(C) STONE BALLAST - Stone ballast must be deposited in such a manner as to form a compact mass.

(D) BROKEN STONE - Broken stone must be deposited in such a manner as to form a compact mass.

(E) SLOPE PAVEMENT - The stones must be placed by hand or derrick so as to present a fairly even surface and have their longest dimensions approximately perpendicular to the side of the embankment. At least one-third (1/3) of the stones must extend through the pavement.

70.71.4 MEASUREMENT

The quantity of riprap, stone ballast, broken stone or slope pavement to be measured for payment must be the number of cubic yards of riprap, stone ballast, broken stone or slope pavement incorporated into the work, complete, as shown, specified or required.

70.71.5 PRICE TO COVER

The contract price for Item No. 70.71RR - RIPRAP, Item No. 70.71SB - STONE BALLAST, Item No. 70.71BS - BROKEN STONE and Item No. 70.71 SP - SLOPE PAVEMENT must be the unit price bid per cubic yard for riprap, stone ballast, broken stone or slope pavement and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to furnish, deliver and place the riprap, stone ballast, broken stone or slope pavement and do all work incidental thereto, all in accordance with the plans and specifications, and as directed by the Engineer.

Where additional excavation is required or approved in writing by the Engineer below the subgrade of sewers or associated structures for placement of stone ballast, payment for this additional excavation must be paid for at the price bid for item(s) labeled "ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS".

No separate or additional payment must be made for any additional sheeting required due to the additional excavation, the cost of the additional sheeting must be included in the price bid for item(s) labeled "ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS".

Payment for Riprap, Stone Ballast, Broken Stone And Slope Pavement will be made under the Item Number as calculated below:

The Item Numbers for Riprap, Stone Ballast, Broken Stone And Slope Pavement have seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Riprap, Stone Ballast, Broken Stone And Slope Pavement:

(2) The sixth and seventh characters must define the Kind Of Material:

RR - Riprap
SB - Stone Ballast (Not Less Than Item)
BS - Broken Stone (Not Less Than Item)
SP - Slope Pavement

(3) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	**Description**	**Pay Unit**
70.71RR	RIPRAP	C.Y.
70.71SB	STONE BALLAST (NOT LESS THAN $XX.XX/C.Y.)	C.Y.
70.71BS	BROKEN STONE (NOT LESS THAN $XX.XX/C.Y.)	C.Y.
70.71SP	SLOPE PAVEMENT	C.Y.

SECTION 70.72 – GROUTED STONE PAVEMENT

70.72.1 DESCRIPTION

Grouted stone pavement must consist of stones placed on grout where shown, specified or required.

70.72.2 MATERIAL

Grouted Stone Pavement must consist of sound, quarried or spilt stones weighing 100-pounds to 200-pounds per stone. The stones must be of the same character and coloration as that used for the adjoining slope stone.

Grout must comply with the requirements of **Section 23.04**, and must be Cement and Sand Grout.

70.72.3 CONSTRUCTION METHOD

The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

Stone must be set on the exposed roof of the outfall structure with flat side facing upwards. The stones must be placed as close together as possible and must crown at the center of the structure, to the satisfaction of the Engineer. The stones must be installed on a grout bed and prior to the setting up of the grout bed additional grout must be poured and tamped into the jointing between stones. Where spaces between larger stones exceed six (6) inches, smaller stone must be placed to fill the void. Grout must fill all remaining voids and must be poured as close to the top surface of the stone as possible. The surface of the stones must remain exposed and project sufficiently to produce a rough textured face.

70.72.4 MEASUREMENT

The quantity of grouted stone pavement to be measured for payment must be the number of square yards furnished and placed on the roof of the outfall structure and in the area as shown on the contract drawings and as directed by the Engineer.

70.72.5 PRICE TO COVER

The contract price for Item No. 70.72GS - GROUTED STONE PAVEMENT must be the unit price bid per square yard for grouted stone pavement and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to furnish, deliver, and install grouted stone pavement and to do all work incidental thereto, all in accordance with the contract drawings and specifications, and as directed by the Engineer.

Payment for Grouted Stone Pavement will be made under the Item Number as calculated below:

The Item Number for Grouted Stone Pavement has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Grouted Stone Pavement:

70.72

(2) The sixth and seventh characters must define Grouted Stone Pavement:

GS - Grouted Stone Pavement

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
70.72GS	GROUTED STONE PAVEMENT	S.Y.

SECTION 70.81 – CLEAN BACKFILL

70.81.1 DESCRIPTION

Clean backfill must be the clean fill ordered in writing by the Engineer, where there is a deficiency of acceptable backfill in accordance with **Subsections 40.06.2, 40.06.6 and 40.06.8**. This backfill must be exclusive of the normal backfill requirements as specified in **Subsection 40.06.2**. Clean backfill must not be used to fill voids in the subgrade of the trenches and excavations unless otherwise specified on the plans or in the contract documents, or as ordered in writing by the Engineer. Clean backfill must not be used at any time to fill voids in the trenches and excavations; from subgrade to two (2) feet above the top of the sewer conduit (i.e. sewer pipes on cradles or encasements, reinforced concrete sewers, basin and house connections, culverts, etc.); from subgrade to one (1) foot above the top of the barrel of the water main pipe; within any area less than two (2) feet wide in its least dimension; and, within eighteen (18) inches around all underground facilities (i.e. pipes, mains, conduit, cable, etc.).

70.81.2 MATERIALS

Clean Backfill must comply with the requirements of **Subsection 26.01.2(D)**.

If approved in writing by the Engineer, excavated material determined to be unsuitable, in accordance with **Subsection 40.06.2**, may be processed (i.e. screened and/or crushed) to produce clean fill as specified herein. In such case, the material furnished in accordance with these specifications, to be used as specified in **Subsection 70.81.1** must be accepted for payment under the contract Item No. 70.81CB - CLEAN BACKFILL computed in accordance with **Subsection 70.81.4**.

70.81.3 CONSTRUCTION METHODS

The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

70.81.4 MEASUREMENTS

The quantity of clean backfill to be measured for payment must be the number of cubic yards of clean backfill, as ordered in writing by the Engineer, in place after compaction and limited to the conditions specified in **Subsection 70.81.1** of the specifications.

If actual trench widths are less than payment maximums stated in **Subsection 40.02.4(A)(2**) for sewers, and **Subsection 40.02.4(B)(1)** for water mains, those smaller widths must serve as the basis upon which the actual volume of substituted clean backfill is measured for purposes of determining additional compensation. If, however, actual trench widths exceed those maximums, no payment will be made for clean backfill placed outside these established limits. The cost of such excess backfill must be borne solely and exclusively by the Contractor.

Where impracticable to measure clean backfill in place, measurements may be made in scows and vehicles, and the quantity to be paid for will be eight-tenths (8/10) of the yardage determined by such measurements.

70.81.5 PRICE TO COVER

The contract price for Item No. 70.81CB - CLEAN BACKFILL must be the unit price bid per cubic yard for clean backfill and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to furnish and deliver the clean backfill material and to do all work incidental thereto, all in accordance with the plans and specifications, and as directed by the Engineer.

The Contractor is notified that the cost for all labor, materials, plant, equipment and insurance required and necessary to place, compact, sample and test provided acceptable clean backfill must be included in the prices bid for all contract items of work.

Payment for Clean Backfill will be made under the Item Number as calculated below:

The Item Number for Clean Backfill has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Clean Backfill:

(2) The sixth and seventh characters must define Clean Backfill:

CB - Clean Backfill (Not Less Than Item)

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
70.81CB	CLEAN BACKFILL (NOT LESS THAN $XX.XX/C.Y.)	C.Y.

SECTION 70.91 -- SHEETING

70.91.1 DESCRIPTION

This section describes the use of Sheeting in water main trenches and excavations only.

70.91.2 MATERIALS

All sheeting materials must comply with **Subsection 40.05.3**.

70.91.3 CONSTRUCTION METHODS

To prevent injury to workmen or to avoid damaging existing water pipes, structures, and pavements and their foundations through caving or sliding of the banks of a trench or other excavation, protection must be provided for all excavation work except where a determination is made by the Contractor, the Engineer or the Engineer's inspector at the work site that the nature of the excavation does not require protection.

Excavation protection, when required, must be provided in accordance with the requirements of:

(1) U.S. Occupational Safety and Health Administration (OSHA) Construction Safety and Health Regulations, Part No. 1926, Subpart P;

(2) 23 NYCRR, Subpart 23-4 – Excavation Operations;

(3) 16 NYCRR, Part 753 – Protection of Underground Facilities;

(4) Special requirements detailed below.

NOTE: Whenever an interpretation difference exists as to selecting the applicable requirements, that of the most stringent one must govern.

(A) SPECIAL REQUIREMENTS

Unless specifically ordered otherwise by the Engineer or the Engineer's inspector at the work site, the following Special Requirements must be adhered to:

(a) Trenches For Water Main Pipe 12-Inch In Diameter And Less

In general, such trenches must not be sheeted since, with the laying depths used, the trench bottoms will be less than five (5) feet below the ground surface. However, removal of existing pipe, or connections to existing pipe may, in some instances result in trench depths of five (5) feet or greater. In such cases, at a minimum, sheeting will be required. If sheeting is required, it must be of sufficient length so that all ingress and egress is within the sheeted area, and must extend at least 2 feet beyond all work locations and access points. If workmen are required to transit between sheeted areas, they must exit the trench.

If, in the opinion of the Engineer or the Engineer's inspector at the work site, sheeting is required, for whatever reason, in any trench or other excavation, the Contractor must install it.

(b) Trenches For Water Main Pipe 16-Inch and 20-Inch In Diameter

All such trenches must be sheeted, regardless of the depth of the trench.

(c) Trenches For Water Main Pipe Larger Than 20-Inch In Diameter; And Excavations For Chambers And Manholes

All such trenches must be sheeted, regardless of the depth of the trench.

(d) Detailed Requirements As To Type And Size Of Sheeting

Unless specifically noted otherwise on the contract drawings or in these specifications, the sheeting required in paragraphs (a), (b), and (c) above, above, must be furnished and installed in full compliance with the requirements of Section 1926.652 of the OSHA Regulations.

The size and spacing of sheeting, stringers, and cross bracing required for various soil conditions must meet the latest OSHA Regulation requirements.

(B) SUBSTITUTION FOR TIMBER SHEETING

Any substitution for timber sheeting and bracing such as a self-supporting movable shield of timber or metal, etc., must be designed by and stamped with the seal of a Professional Engineer, licensed to practice in the State of New York, and must be approved by the Engineer in writing prior to its being used on the job. Submittal of proposed substitutions must be made by the Contractor at least four (4) weeks prior to their scheduled use to allow for proper review and approval of it by the Engineer.

(C) SHEETING LEFT IN PLACE

Where the sheeting is ordered to be left in place, the full amount of the lumber so left in place will be paid for at fifty percent (50%) of the market value thereof, without any allowance for the cost of delivery or placing in the work. Sheeting left in place must be cut off in accordance with **Subsection 40.05.2**.

When sheeting is ordered to be left in place, the cost of all work required for the cutting, removal and disposal of the cut sheeting must be included in the fifty percent (50%) compensation paid above.

70.91.4 MEASUREMENT

The quantity of sheeting incorporated into the work, complete, as shown, specified or required must be computed as twice the depth of trench times the length of the sheeted trench. The depth of trench or excavation to be sheeted must be from the ground surface to the bottom of the pipe. In those cases where a special foundation, such as a broken stone bed or a concrete cradle or mat is required, the depth of trench or excavation to be sheeted must be from the ground surface to the bottom of such special foundation.

70.91.5 PRICE TO COVER

Payment for sheeting of trenches for water main pipe 12-inch in diameter and less must be made per square foot under bid Item No. 70.91SW12 - FURNISHING AND PLACING SHEETING AND BRACING IN TRENCH FOR WATER MAIN PIPE 12-INCH IN DIAMETER AND LESS contained in the bid schedule.

Payment for sheeting of trenches for water main pipe 16-Inch and 20-inch in diameter must be made per square foot under bid Item No. 70.91SW20 - FURNISHING AND PLACING SHEETING AND BRACING IN TRENCH FOR WATER MAIN PIPE 20-INCH IN DIAMETER contained in the bid schedule. Where there is no bid item for such sheeting, because the quantities of such pipe to be installed are very small, or the work involves connecting smaller size pipe to 16-Inch and 20-inch mains or larger, payment for such sheeting will be made at the unit price bid for Item No. 70.91SW12 - FURNISHING AND PLACING SHEETING AND BRACING IN TRENCH FOR WATER MAIN PIPE 12-INCH IN DIAMETER AND LESS.

The Contractor's attention is directed to the fact that the Contractor’s bid price for sheeting covers the cost of extra earth excavation and other extra costs involved in laying the pipe, such as but not limited to, lesser pipe footage being installed per day, etc.

All of the above provisions are intended to apply to those instances where sheeting is required in a trench in order to lay pipe. In such instances a wider trench is required (to accommodate the sheeting) than when pipe is laid in unsheeted trenches.

When sheeting is provided in portions of a trench (to protect men inserting taps, etc.) that was originally excavated for laying a water main, and when such trench was not sheeted at the time the water main was laid, payment must be made only for the amount of sheeting actually placed. In all such cases the payment lines for pavement excavation, pavement restoration, and satisfactory backfill must be those specified for unsheeted trenches.

Where the OSHA Regulations do not require sheeting, but where the Contractor, for the Contractor’s own convenience, installs a more limited type of trench support (stay bracing, etc.) such limited type of trench support will not be paid for. The cost of such limited trench support must be included in the various unit prices bid.

All sheeting that is to be paid for must meet all requirements of the OSHA Regulations.

70.91.6 NO SEPARATE PAYMENT

No separate payment will be made for the sheeting of water main trenches for water mains larger than 20-inches in diameter, the costs thereof must be included in the prices bid for laying these mains. No payment will be made for sheeting at chambers and manholes, but payment thereof will be deemed to be included in the various items bid for constructing the chambers and manholes.

Payment for Furnishing And Placing Sheeting And Bracing In Trench For Water Main Pipe will be made under the Item Number as calculated below:

The Item Numbers for Furnishing And Placing Sheeting And Bracing In Trench For Water Main Pipe have nine characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Furnishing And Placing Sheeting And Bracing In Trench For Water Main Pipe:

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(2) The sixth and seventh characters must define Furnishing And Placing Sheeting And Bracing In Trench For Water Main Pipe:

SW - Furnishing And Placing Sheeting And Bracing In Trench For Water Main Pipe

(3) The eighth and ninth characters must define the Size of Water Main Pipe That Trench Sheeting will be provided for:

12 - 12-Inch In Diameter And Less
20 16-Inch and 20-Inch In Diameter

(4) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	**Description**	**Pay Unit**
70.91SW12	FURNISHING AND PLACING SHEETING AND BRACING IN TRENCH FOR WATER MAIN PIPE 12-INCH IN DIAMETER AND LESS	S.F.
70.91SW20	FURNISHING AND PLACING SHEETING AND BRACING IN TRENCH FOR WATER MAIN PIPE 16-INCH AND 20-INCH IN DIAMETER	S.F.

SECTION 71.11 – SAW CUTTING PAVEMENT

71.11.1 DESCRIPTION

This section describes Saw Cutting Pavement.

71.11.2 CONSTRUCTION METHODS

(1) The Contractor will be required to cut all asphaltic pavement; concrete pavement; asphaltic top course on concrete base pavement; and all other roadway pavements specified or ordered; as follows:

(A) WATER MAIN TRENCHES AND EXCAVATIONS

(a) full-depth saw cuts of pavement along the initial opening limits of all water main trenches and excavations. (Cuts labeled “CUTS NO. 1” in Section A of **Standard Drawings No. WM0401, WM0402 and WM0403**);

(b) full-depth saw cuts of pavement along the edges of all trenches and excavations for cutbacks of trenches and excavations required for water mains 24-inches and larger in diameter and appurtenant structures. (Cuts labeled “CUTS NO. 2” in Section C of **Standard Drawing No. WM0403**);

(c) full-depth saw cuts of pavement along the edges of all trenches and excavations for cutbacks of trenches and excavations required in streets protected by New York City Administrative Code §19-144 (Local Law No. 14) for water mains 20-inches and less in diameter. (Cuts labeled “CUTS NO. 2” in Section C of **Standard Drawing No. WM0402**);

(d) full-depth saw cuts of asphaltic top course along the edges of all water main trenches and excavations for cutbacks of asphaltic top course. (Cuts labeled “SAW-CUTS NO. 2” in Section E of **Standard Drawing No. WM0401**; and, Cuts labeled “SAW-CUTS NO. 3” in Section E of **Standard Drawings No. WM0402 and WM0403**); and;

(e) full-depth saw cuts of pavement across the widths of all water main trenches, excavations and cutbacks.

(B) SEWER TRENCHES AND EXCAVATIONS

(a) full-depth saw cuts of pavement along the initial opening limits of all sewer trenches and excavations. (Same as cuts labeled “CUTS NO. 1” in Section A of **Standard Drawing No. WM0403**);

(b) full-depth saw cuts of pavement along the edges of all trenches and excavations for cutbacks of trenches and excavations required for sewer conduits and appurtenant structures. (Same as cuts labeled “CUTS NO. 2” in Section C of **Standard Drawing No. WM0403**);

(c) full-depth saw cuts of asphaltic top course along the edges of all sewer trenches and excavations for cutbacks of asphaltic top course. (Same as cuts labeled “SAW-CUTS NO. 3” in Section E of **Standard Drawing No. WM0403**); and;

(d) full-depth saw cuts of pavement across the widths of all sewer trenches, excavations and cutbacks.

(C) ALL TRENCHES AND EXCAVATIONS, AND OTHER PAVEMENT AREAS

(a) The Contractor will be required to full-depth saw cut all sidewalks and curbs along the limits of all sewer and water main trenches and excavations or as directed by the Engineer.

(b) The Contractor will be required to full-depth saw cut and/or partial-depth saw cut all pavement keys, and pavement adjustment and transition sections as shown, specified or ordered.

NOTE: A “SAW CUT” is defined as the cutting of pavement by the use of a dust controlling rotary blade concrete and pavement saw cutting machine. (Vermeer type cutting machines will not be permitted for use in order to make saw cuts.)

(2) All saw cutting must be done with approved power tool equipment.

71.11.3 PAYMENT

(A) WATER MAIN TRENCHES AND EXCAVATIONS

(1) Full-Depth Saw Cutting Of Pavements Along The Initial Opening Limits Of All Water Main Trenches And Excavations - No separate payment will be made for any required full-depth saw cutting of pavements along the initial opening limits of all water main trenches and excavations. (Cuts labeled "CUTS NO. 1" in Section A of **Standard Drawings No. WM0401, WM0402 and WM0403**).

(2) Full-Depth Saw Cutting Of Pavements Along The Edges Of All Trenches And Excavations For Cutbacks Of Trenches and Excavations Required For Water Mains 24-Inches And Larger In Diameter And Appurtenant Structures - No separate payment will be made for any required full-depth saw cutting of pavements along the edges of all trenches and excavations for cutbacks of trenches and excavations required for water mains 24-inches and larger in diameter and appurtenant structures. (Cuts labeled "CUTS NO. 2" in Section C of **Standard Drawing No. WM0403**).

(3) Full-Depth Saw Cutting Of Pavements Along The Edges Of All Trenches And Excavations For Cutbacks Of Trenches and Excavations Required In Streets Protected By New York City Administrative Code §19-144 (Local Law No. 14) For Water Mains 20-Inches And Less In Diameter - Separate payment will be made for any required full-depth saw cutting of pavements along the edges of all trenches and excavations for cutbacks of trenches and excavations required in streets protected by New York City Administrative Code §19-144 (Local Law No. 14) for water mains 20-inches and less in diameter. (Cuts labeled "CUTS NO. 2" in Section C of **Standard Drawing No. WM0402**).

(4) Full-Depth Saw Cutting Of Asphaltic Top Course Along The Edges Of All Water Main Trenches And Excavations For Cutbacks Of Asphaltic Top Course - No separate payment will be made for any required full-depth saw cutting of asphaltic top course along the edges of all water main trenches and excavations for cutbacks of asphaltic top course. (Cuts labeled "SAW-CUTS NO. 2" in Section E of **Standard Drawing No. WM0401**; and, Cuts labeled "SAW-CUTS NO. 3" in Section E of **Standard Drawings No. WM0402 and WM0403**).

(5) Full-Depth Saw Cutting Of Pavements Across The Widths Of All Water Main Trenches, Excavations And Cutbacks - No separate payment will be made for any required full-depth saw cutting of pavements across the widths of all water main trenches, excavations and cutbacks.

(B) SEWER TRENCHES AND EXCAVATIONS

(1) Full-Depth Saw Cutting Of Pavements Along The Initial Opening Limits Of All Sewer Trenches And Excavations - No separate payment will be made for any required full-depth saw cutting of pavements along the initial opening limits of all sewer trenches and excavations. (Same as cuts labeled "CUTS NO. 1" in Section A of **Standard Drawing No. WM0403**).

(2) Full-Depth Saw Cutting Of Pavements Along The Edges Of All Trenches And Excavations For Cutbacks Of Trenches and Excavations Required For Sewer Conduits And Appurtenant Structures - No separate payment will be made for any required full-depth saw cutting of pavements along the edges of all trenches and excavations for cutbacks of trenches and excavations required for sewer conduits and appurtenant structures. (Same as cuts labeled "CUTS NO. 2" in Section C of **Standard Drawing No. WM0403**).

(3) Full-Depth Saw Cutting Of Asphaltic Top Course Along The Edges Of All Sewer Trenches And Excavations For Cutbacks Of Asphaltic Top Course - No separate payment will be made for any required full-depth saw cutting of asphaltic top course along the edges of all sewer trenches and excavations for cutbacks of asphaltic top course. (Same as cuts labeled "SAW-CUTS NO. 3" in Section E of **Standard Drawing No. WM0403**).

(4) Full-Depth Saw Cutting Of Pavements Across The Widths Of All Sewer Trenches, Excavations And Cutbacks - No separate payment will be made for any required full-depth saw cutting of pavements across the widths of all sewer trenches, excavations and cutbacks.

(C) ALL TRENCHES AND EXCAVATIONS, AND OTHER PAVEMENT AREAS

(1) Full-Depth Saw Cutting Of All Sidewalks And Curbs Along The Limits Of All Sewer And Water Main Trenches And Excavations - No separate payment will be made for any required full-depth saw cutting of all sidewalks and curbs along the limits of all sewer and water main trenches and excavations or as directed by the Engineer.

(2) Full-Depth Saw Cutting And/Or Partial-Depth Saw Cutting Of All Pavement Keys, And Pavement Adjustment And Transition Sections - No separate payment will be made for any required full-depth saw cutting and/or partial-depth saw cutting of all pavement keys, and pavement adjustment and transition sections as shown, specified or ordered.

71.11.4 MEASUREMENT

Measurement for payment will be made **ONLY** for full-depth saw cutting of pavements along the edges of all trenches and excavations for cutbacks of trenches and excavations required in streets protected by New York City Administrative Code §19-144 (Local Law No. 14) for water mains 20-inches and less in diameter, as follows:

The quantity of saw cutting to be measured for payment must be the number of linear feet of actual saw cutting performed to the full depth required along each edge of the trenches and excavations for the cutbacks of trenches and excavations required in streets protected by New York City Administrative Code §19-144 (Local Law No. 14) for water mains 20-inches and less in diameter.

71.11.5 PRICE TO COVER

Payment will be made **ONLY** for full-depth saw cutting of pavements along the edges of all trenches and excavations for cutbacks of trenches and excavations required in streets protected by New York City Administrative Code §19-144 (Local Law No. 14) for water mains 20-inches and less in diameter, as follows:

Payment for full-depth saw cutting of pavements along the edges of all trenches and excavations for cutbacks of trenches and excavations required in streets protected by New York City Administrative Code §19-144 (Local Law No. 14) for water mains 20-inches and less in diameter must be made under the unit price bid for the NYCDOT Highway Item No. 6.55 - SAWCUTTING EXISTING PAVEMENT. The contract price for NYCDOT Highway Item No. 6.55 - SAWCUTTING EXISTING PAVEMENT must be the unit price bid per linear foot for full-depth saw cutting of pavement performed and must cover the cost of all labor, materials, plant, equipment and insurance required and necessary to saw cut pavements along the edges of all trenches and excavations for cutbacks of trenches and excavations required in streets protected by New York City Administrative Code §19-144 (Local Law No. 14) for water mains 20-inches and less in diameter, and to perform all incidental work necessary thereto, all in accordance with the plans, specifications and standards, and as directed by the Engineer.

71.11.6 NO SEPARATE PAYMENT

No separate or additional payment will be made for the following saw cutting work. The costs of these saw cutting work must be included in the prices bid for all items of the contract.

(1) Full-Depth Saw Cutting Of Pavements Along The Initial Opening Limits Of All Sewer And Water Main Trenches And Excavations;

(2) Full-Depth Saw Cutting Of Pavements Along The Edges Of All Trenches And Excavations For Cutbacks Of Trenches and Excavations Required For Sewer Conduits And Appurtenant Structures And Water Mains 24-Inches And Larger In Diameter And Appurtenant Structures;

(3) Full-Depth Saw Cutting Of Asphaltic Top Course Along The Edges Of All Sewer And Water Main Trenches For Cutbacks Of Asphaltic Top Course;

(4) Full-Depth Saw Cutting Of Pavements Across The Widths Of All Sewer And Water Main Trenches, Excavations And Cutbacks;

(5) Full-Depth Saw Cutting Of All Sidewalks And Curbs Along The Limits Of All Sewer And Water Main Trenches And Excavations Or As Directed By The Engineer;

(6) Full-Depth Saw Cutting And/Or Partial-Depth Saw Cutting Of All Pavement Keys, And Pavement Adjustment And Transition Sections As Shown, Specified Or Ordered; and,

(7) Partial-Depth Precutting Or Scoring Of Existing Pavement.

Payment for Sawcutting Existing Pavement will be made under the NYCDOT Item Number listed below:

Item No.	Description	Pay Unit
6.55	SAWCUTTING EXISTING PAVEMENT	L.F.

SECTION 71.21 – PAVEMENT EXCAVATION

71.21.1 DESCRIPTION

This section describes the removal of pavements.

71.21.2 CONSTRUCTION METHODS

(A) OPENING OF PAVEMENTS

(1) All pavements must be initially opened as specified in **Subsection 71.11.2 paragraphs (1)(A)(a), (1)(B)(a) and (1)(C)(a)**.

(B) BREAKING EXISTING PAVEMENT

Unless otherwise specified, the remainder of the pavements between cuts may be opened with hand-held "Jack" Hammers, Hoe-Rams, or Truck-Mounted Pavement Breakers. Hoe-Rams will be permitted to crack the pavements between longitudinal cuts just prior (same day) to the excavation (where surrounding pavement is to remain). This applies to all streets at all times. The area under construction must be kept as clean and neat as possible and material must not restrict water flow in gutter areas. These requirements are the responsibility of the Contractor.

In order to minimize future settlements, cuts in recently constructed pavements still under guarantee by the Contractor; in which subgrade material is removed along with the pavement excavated; must be backfilled to subgrade of pavement with clean sand or run-of-bank gravel, except where subsurface conditions preclude select granular fill, as determined by the Engineer.

(C) REMOVAL OF PAVEMENTS

All pavement removal must be done in such a manner so as not to disturb the existing pavements outside the specified and ordered area of removal and restoration.

For pavement removal and replacement refer to **Standard Drawing Nos. WM0401, WM0402 and WM0403** and as specified herein.

For the removal and restoration of brick or block pavements the edges of the pavement must be toothed or racked back.

71.21.3 PAYMENT

The Contractor will be compensated for breaking, removal and disposal of excavated pavement, provided that the pavement removed meets the following conditions:

(1) Pavement excavated is:

- (a) within the ordered trench and excavation and cutback limits, or
- (b) outside the ordered trench and excavation and cutback limits and has been specifically shown on the plans, specified in the contract documents, or ordered and approved in writing to be removed by the Engineer, or
- (c) within the ordered test pit excavation limits.

and

(2) Pavement must consist of:

- (a) asphaltic concrete top course on a cement concrete base course, or
- (b) one and one-half (1-1/2) inches or two (2) inches (as specified) of asphaltic concrete top course on an asphaltic concrete base course, or
- (c) cement concrete (sidewalks and curbs must not be included), or
- (d) brick or block pavers top course on asphaltic concrete base course or cement concrete base course (sidewalks and curbs must not be included).

71.21.4 MEASUREMENT

(A) WATER MAIN TRENCHES AND EXCAVATIONS

(1) Within Ordered Trench And Cutback Limits In Non-Protected Streets For Water Mains 20-Inches And Less In Diameter - When water main work is required in non-protected streets for water mains 20-inches and less in diameter, the payment limits (unless otherwise approved in writing by the Engineer) for the volume of pavement excavated, (i.e., broken, removed and disposed of, irrespective of the actual pavement material encountered), must be computed as follows:

(A) Unsheeted Trenches:

(a) For existing pavement consisting of asphaltic concrete top course on a cement concrete base course, or brick or block pavers top course on asphaltic concrete base course or cement concrete base course:

The product of the average depth of the base course, by the actual length of trench, by the width of the base course two (2) feet wider than the nominal diameter of the pipe installed; plus, the product of the average depth of the top course, by the actual length of trench plus one and one-half (1-1/2) feet, by the width of the top course three and one-half (3-1/2) feet wider than the nominal diameter of the pipe installed.

(b) For existing pavement consisting of one and one-half (1-1/2) inches or two (2) inches (as specified) of asphaltic concrete top course on an asphaltic concrete base course:

The product of the average depth of the base course, by the actual length of trench, by the width of the base course two (2) feet wider than the nominal diameter of the pipe installed; plus, the product of the one and one-half (1-1/2) inch or two (2) inch depth of the top course, by the actual length of trench plus one and one-half (1-1/2) feet, by the width of the top course three and one-half (3-1/2) feet wider than the nominal diameter of the pipe installed.

(c) For existing pavement consisting of cement concrete:

The product of the average depth of the full pavement, by the actual length of trench plus one and one-half (1-1/2) feet, by the width of the full pavement three and one-half (3-1/2) feet wider than the nominal diameter of the pipe installed.

(B) Sheeted Trenches:

(a) For existing pavement consisting of asphaltic concrete top course on a cement concrete base course, or brick or block pavers top course on asphaltic concrete base course or cement concrete base course:

The product of the average depth of the base course, by the actual length of trench, by the width of the base course four (4) feet wider than the nominal diameter of the pipe installed; plus, the product of the average depth of the top course, by the actual length of trench plus one and one-half (1-1/2) feet, by the width of the top course five and one-half (5-1/2) feet wider than the nominal diameter of the pipe installed.

(b) For existing pavement consisting of one and one-half (1-1/2) inches or two (2) inches (as specified) of asphaltic concrete top course on an asphaltic concrete base course:

The product of the average depth of the base course, by the actual length of trench, by the width of the base course four (4) feet wider than the nominal diameter of the pipe installed; plus, the product of the one and one-half (1-1/2) inch or two (2) inch depth of the top course, by the actual length of trench plus one and one-half (1-1/2) feet, by the width of the top course five and one-half (5-1/2) feet wider than the nominal diameter of the pipe installed.

(c) For existing pavement consisting of cement concrete:

The product of the average depth of the full pavement, by the actual length of trench plus one and one-half (1-1/2) feet, by the width of the full pavement five and one-half (5-1/2) feet wider than the nominal diameter of the pipe installed.

(C) These Payment Limits Must Be Maximums: The width of pavement components to be excavated is based on the trench width, as specified. If actual trench widths are less than those maximums, the smaller widths must become the basis for calculating payment limits. When, due to unforeseen or special field conditions changing the trench width from that specified becomes necessary, and the change is approved by the Engineer, the width of the pavement components' excavation to be used for payment must be increased or decreased by the dimension equal to that of the change in the trench width.

(2) Within Ordered Trench And Cutback Limits In Streets Protected By NYC Administrative Code §19-144 (Local Law No. 14.) For Water Mains 20-Inches And Less In Diameter - When water main work is required in streets protected by NYC Administrative Code §19-144 (Local Law No. 14) for water mains 20-inches and less in diameter, the payment limits (unless otherwise approved in writing by the Engineer) for the volume of pavement excavated, (i.e., broken, removed and disposed of, irrespective of the actual pavement material encountered), must be computed as follows:

(A) Unsheeted Trenches:

(a) For existing pavement consisting of asphaltic concrete top course on a cement concrete base course, or brick or block pavers top course on asphaltic concrete base course or cement concrete base course:

The product of the average depth of the base course, by the actual length of trench plus one (1) foot, by the width of the base course three (3) feet wider than the nominal diameter of the pipe installed; plus, the product of the average depth of the top course, by the actual length of trench plus two and one-half (2-1/2) feet, by the width of the top course four and one-half (4-1/2) feet wider than the nominal diameter of the pipe installed.

(b) For existing pavement consisting of one and one-half (1-1/2) inches or two (2) inches (as specified) of asphaltic concrete top course on an asphaltic concrete base course:

The product of the average depth of the base course, by the actual length of trench plus one (1) foot, by the width of the base course three (3) feet wider than the nominal diameter of the pipe installed; plus, the product of the one and one-half (1-1/2) inch or two (2) inch depth of the top course, by the actual length of trench plus two and one-half (2-1/2) feet, by the width of the top course four and one-half (4-1/2) feet wider than the nominal diameter of the pipe installed.

(c) For existing pavement consisting of cement concrete:

The product of the average depth of the full pavement, by the actual length of trench plus two (2) feet, by the width of the full pavement four (4) feet wider than the nominal diameter of the pipe installed.

(B) Sheeted Trenches:

(a) For existing pavement consisting of asphaltic concrete top course on a cement concrete base course, or brick or block pavers top course on asphaltic concrete base course or cement concrete base course:

The product of the average depth of the base course, by the actual length of trench plus one (1) foot, by the width of the base course five (5) feet wider than the nominal diameter of the pipe installed; plus, the product of the average depth of the top course, by the actual length of trench plus two and one-half (2-1/2) feet, by the width of the top course

six and one-half (6-1/2) feet wider than the nominal diameter of the pipe installed.

(b) For existing pavement consisting of one and one-half (1-1/2) inches or two (2) inches (as specified) of asphaltic concrete top course on an asphaltic concrete base course:

The product of the average depth of the base course, by the actual length of trench plus one (1) foot, by the width of the base course five (5) feet wider than the nominal diameter of the pipe installed; plus, the product of the one and one-half (1-1/2) inch or two (2) inch depth of the top course, by the actual length of trench plus two and one-half (2-1/2) feet, by the width of the top course six and one-half (6-1/2) feet wider than the nominal diameter of the pipe installed.

(c) For existing pavement consisting of cement concrete:

The product of the average depth of the full pavement, by the actual length of trench plus two (2) feet, by the width of the full pavement six (6) feet wider than the nominal diameter of the pipe installed.

(C) These Payment Limits Must Be Maximums: The width of pavement components to be excavated is based on the trench width, as specified. If actual trench widths are less than those maximums, the smaller widths must become the basis for calculating payment limits. When, due to unforeseen or special field conditions changing the trench width from that specified becomes necessary, and the change is approved by the Engineer, the width of the pavement components' excavation to be used for payment must be increased or decreased by the dimension equal to that of the change in the trench width.

(3) Within Ordered Trench And Cutback Limits In All Streets For Water Mains 24-Inches And Larger In Diameter - When water main work is required in streets for water mains 24-inches and larger in diameter, the payment limits (unless otherwise approved in writing by the Engineer) for the volume of pavement excavated, (i.e., broken, removed and disposed of, irrespective of the actual pavement material encountered), must be computed as follows:

(A) All Trenches:

(a) For existing pavement consisting of asphaltic concrete top course on a cement concrete base course, or brick or block pavers top course on asphaltic concrete base course or cement concrete base course:

The product of the average depth of the base course, by the actual length of trench plus two (2) feet, by the width of the base course six (6) feet wider than the nominal diameter of the pipe installed; plus, the product of the average depth of the top course, by the actual length of trench plus four (4) feet, by the width of the top course eight (8) feet wider than the nominal diameter of the pipe installed.

(b) For existing pavement consisting of one and one-half (1-1/2) inches or two (2) inches (as specified) of asphaltic concrete top course on an asphaltic concrete base course:

The product of the average depth of the base course, by the actual length of trench plus two (2) feet, by the width of the base course six (6) feet wider than the nominal diameter of the pipe installed; plus, the product of the one and one-half (1-1/2) inch or two (2) inch depth of the top course, by the actual length of trench plus four (4) feet, by the width of the top course eight (8) feet wider than the nominal diameter of the pipe installed.

(c) For existing pavement consisting of cement concrete:

The product of the average depth of the full pavement, by the actual length of trench plus two (2) feet, by the width of the full pavement six (6) feet wider than the nominal diameter of the pipe installed.

(B) These Payment Limits Must Be Maximums: The width of pavement components to be excavated is based on the trench width, as specified. If actual trench widths are less than

those maximums, the smaller widths must become the basis for calculating payment limits. When, due to unforeseen or special field conditions changing the trench width from that specified becomes necessary, and the change is approved by the Engineer, the width of the pavement components' excavation to be used for payment must be increased or decreased by the dimension equal to that of the change in the trench width.

(4) Within Ordered Excavation and Cutback Limits For Construction Of Valve Chambers, Etc. - When construction of valve chambers and other structures are required, the payment limits (unless otherwise approved in writing by the Engineer) for the volume of pavement excavated (i.e., broken, removed and disposed of, irrespective of the actual pavement material encountered), must be computed as follows:

(A) All Excavations:

(a) For existing pavement consisting of asphaltic concrete top course on a cement concrete base course, or brick or block pavers top course on asphaltic concrete base course or cement concrete base course:

The product of the average depth of the base course, by the length of the base course six (6) feet wider than the length of the chamber or structure (measured between outside faces of walls), by the width of the base course six (6) feet wider than the width of the chamber or structure (measured between outside faces of walls); plus, the product of the average depth of the top course, by the length of the top course eight (8) feet wider than the length of the chamber or structure (measured between outside faces of walls), by the width of the top course eight (8) feet wider than the width of the chamber or structure (measured between outside faces of walls).

(b) For existing pavement consisting of one and one-half (1-1/2) inches or two (2) inches (as specified) of asphaltic concrete top course on an asphaltic concrete base course:

The product of the average depth of the base course, by the length of the base course six (6) feet wider than the length of the chamber or structure (measured between outside faces of walls), by the width of the base course six (6) feet wider than the width of the chamber or structure (measured between outside faces of walls); plus, the product of the one and one-half (1-1/2) inch or two (2) inch depth of the top course, by the length of the top course eight (8) feet wider than the length of the chamber or structure (measured between outside faces of walls), by the width of the top course eight (8) feet wider than the width of the chamber or structure (measured between outside faces of walls).

(c) For existing pavement consisting of cement concrete:

The product of the average depth of the full pavement, by the length of the full pavement six (6) feet wider than the length of the chamber or structure (measured between outside faces of walls), by the width of the full pavement six (6) feet wider than the width of the chamber or structure (measured between outside faces of walls).

(B) Pavement excavation volumes coming within the limits of the water main pipe trench will not be allowed for measurement twice and must be deducted from the above calculated volumes.

(C) These Payment Limits Must Be Maximums: The length and width of pavement components to be excavated is based on the excavation length and width, as specified. If actual excavation lengths and widths are less than those maximums, the smaller lengths and widths must become the basis for calculating payment limits. When, due to unforeseen or special field conditions changing the excavation length and width from that specified becomes necessary, and the change is approved by the Engineer, the length and width of the pavement components' excavation to be used for payment must be increased or decreased by the dimension equal to that of the change in the excavation length and width.

(5) Pavement Excavation In Connection With Various Construction Operations - Payment limits for pavement excavation in connection with various construction operations are as follows:

(A) For Removing Existing Main: Where the existing main to be removed is in the same trench and alongside the new main an additional allowance equal to the nominal diameter of the existing pipe to be removed will be added to the width of the base course, the width of the top course, and the width of the full pavement as allowed for the laying of new mains specified in **Subsections 71.21.4(A)(1), 71.21.4(A)(2), and 71.21.4(A)(3)**. The volume of the pavement excavation must then be calculated as specified in **Subsections 71.21.4(A)(1), 71.21.4(A)(2), and 71.21.4(A)(3)** with the widths as modified.

Where the existing main to be removed does not come within the limits of the trench excavated for laying the new main an amount of one-half (1/2) foot must be deducted from the width of the base course, the width of the top course, and the width of the full pavement as allowed for the laying of new mains specified in **Subsections 71.21.4(A)(1), 71.21.4(A)(2), and 71.21.4(A)(3)**. The volume of the pavement excavation must then be calculated as specified in **Subsections 71.21.4(A)(1), 71.21.4(A)(2), and 71.21.4(A)(3)** with the widths as modified.

(B) For Setting Valve And Valve Boxes: No additional pavement excavation over the regular pipe trench will be allowed for setting valve and valve boxes.

(C) For Making Connections To Or Setting Valves Upon Existing Mains: Payment limits for pavement excavation for making connections to existing mains or for setting valves upon existing mains will be based upon the limits of excavation specified in **Subsection 40.02.4(B)(3)(b)**. In all kinds of pavement, cutback limits at all edges of excavation must be as determined by the Engineer.

(D) For Making Wet Connections: Payment limits for pavement excavation for the making of wet connections will be based upon the limits of excavation specified in **Subsection 40.02.4(B)(3)(e)**. In all kinds of pavement, cutback limits at all edges of excavation must be as determined by the Engineer.

(E) For Removing Valve Boxes - Payment limits for pavement excavation, in all kinds of pavement, for removing valve boxes from abandoned mains that are left in place will be six (6) feet square for large boxes and four (4) feet square for hydrant boxes.

(F) For Extending House Service Connections - Payment limits for pavement excavation for extending house service connections will be based upon the limits of excavation specified in **Subsection 40.02.4(B)(3)(g)**. In all kinds of pavement, cutback limits at all edges of excavation must be as determined by the Engineer.

(G) For Locating Taps - Payment limits for pavement excavation for locating existing taps on existing mains to be abandoned will be based upon the limits of excavation specified in **Subsection 40.02.4(B)(3)(h)**. In all kinds of pavement, cutback limits at all edges of excavation must be as determined by the Engineer.

Payment limits for pavement excavation for making taps on an existing main which is to be retained in service will be based upon the limits of excavation specified in **Subsection 40.02.4(B)(3)(h)**. In all kinds of pavement, cutback limits at all edges of excavation must be as determined by the Engineer.

Payment limits for pavement excavation for locating taps (single taps, or two or more taps) where an existing main to be abandoned lies sufficiently close to a parallel main, so that they can both be exposed in the same trench will be based upon the limits of excavation specified in **Subsection 40.02.4(B)(3)(h)**. In all kinds of pavement, cutback limits at all edges of excavation must be as determined by the Engineer.

(B) SEWER TRENCHES AND EXCAVATIONS

(1) Within Ordered Trench And Cutback Limits In All Streets For Sewers - When sewer work is required in streets, the payment limits (unless otherwise approved in writing by the Engineer) for the volume of pavement excavated, (i.e., broken, removed and disposed of, irrespective of the actual pavement material encountered), must be computed as follows:

(A) Sheeted Trenches:

(a) For existing pavement consisting of asphaltic concrete top course on a cement concrete base course, or brick or block pavers top course on asphaltic concrete base course or cement concrete base course:

The product of the average depth of the base course, by the actual length of trench plus two (2) feet, by the maximum width as specified in **Subsection 40.02.4(A)(2)** plus two (2) feet; plus, the product of the average depth of the top course, by the actual length of trench plus four (4) feet, by the maximum width as specified in **Subsection 40.02.4(A)(2)** plus four (4) feet.

(b) For existing pavement consisting of one and one-half (1-1/2) inches or two (2) inches (as specified) of asphaltic concrete top course on an asphaltic concrete base course:

The product of the average depth of the base course, by the actual length of trench plus two (2) feet, by the maximum width as specified in **Subsection 40.02.4(A)(2)** plus two (2) feet; plus, the product of the one and one-half (1-1/2) inch or two (2) inch depth of the top course, by the actual length of trench plus four (4) feet, by the maximum width as specified in **Subsection 40.02.4(A)(2)** plus four (4) feet.

(c) For existing pavement consisting of cement concrete:

The product of the average depth of the full pavement, by the actual length of trench plus two (2) feet, by the maximum width as specified in **Subsection 40.02.4(A)(2)** plus two (2) feet.

(B) These Payment Limits Must Be Maximums: The width of pavement components to be excavated is based on the maximum trench width, as specified in **Subsection 40.02.4(A)(2)**. If actual trench widths are less than those maximums, the smaller widths must become the basis for calculating payment limits. When, due to unforeseen or special field conditions changing the trench width from that specified becomes necessary, and the change is approved by the Engineer, the width of the pavement components' excavation to be used for payment must be increased or decreased by the dimension equal to that of the change in the trench width.

(2) Within Ordered Excavation And Cutback Limits For Construction Of Manholes, Chambers, Etc. - When construction of manholes, chambers and other structures are required, the payment limits (unless otherwise approved in writing by the Engineer) for the volume of pavement excavated, (i.e., broken, removed and disposed of, irrespective of the actual pavement material encountered), must be computed as follows:

(A) All Excavations:

(a) For existing pavement consisting of asphaltic concrete top course on a cement concrete base course, or brick or block pavers top course on asphaltic concrete base course or cement concrete base course:

The product of the average depth of the base course, by the length of the base course five (5) feet wider than the length of the manhole, chamber or structure (measured between outside faces of walls), by the width of the base course five (5) feet wider than the width of the manhole, chamber or structure (measured between outside faces of walls); plus, the product of the average depth of the top course, by the length of the top course seven (7) feet wider than the length of the manhole, chamber or structure (measured between outside faces of walls), by the width of the top course seven (7) feet wider than the width of the manhole, chamber or structure (measured between outside faces of walls).

(b) For existing pavement consisting of one and one-half (1-1/2) inches or two (2) inches (as specified) of asphaltic concrete top course on an asphaltic concrete base course:

The product of the average depth of the base course, by the length of the base course five (5) feet wider than the length of the manhole, chamber or structure (measured between outside faces of walls), by the width of the base course five (5) feet wider than the width of the manhole, chamber or structure (measured between outside faces of walls); plus, the product of the one and one-half (1-1/2) inch or two (2) inch depth of the top course, by the length of the top course seven (7) feet wider than the length of the manhole, chamber or structure (measured between outside faces of walls), by the width of the top course seven (7) feet wider than the width of the manhole, chamber or structure (measured between outside faces of walls).

(c) For existing pavement consisting of cement concrete:

The product of the average depth of the full pavement, by the length of the full pavement five (5) feet wider than the length of the manhole, chamber or structure (measured between outside faces of walls), by the width of the full pavement five (5) feet wider than the width of the manhole, chamber or structure (measured between outside faces of walls).

(B) Pavement excavation volumes coming within the limits of the sewer trench will not be allowed for measurement twice and must be deducted from the above calculated volumes.

(C) Payment limits for the volume of pavement excavation for odd shaped excavations must be as defined by the Engineer. In all kinds of pavement, cutback limits at all edges of excavation must be as determined by the Engineer.

(D) These Payment Limits Must Be Maximums: The length and width of pavement components to be excavated is based on the excavation length and width, as specified. If actual excavation lengths and widths are less than those maximums, the smaller lengths and widths must become the basis for calculating payment limits. When, due to unforeseen or special field conditions changing the excavation length and width from that specified becomes necessary, and the change is approved by the Engineer, the length and width of the pavement components' excavation to be used for payment must be increased or decreased by the dimension equal to that of the change in the excavation length and width.

(3) Within Ordered Unsheeted Basin Connection Trench And Cutback Limits - When pavement excavation is within the ordered unsheeted basin connection trench and cutback limits and has been specifically shown on the plans, specified in the contract documents, or ordered and approved in writing to be removed by the Engineer, the maximum payment limits for the volume of pavement excavated, (i.e., broken, removed and disposed of, irrespective of the actual pavement material encountered), must be the product of the average depth of the full pavement, by the actual length of the trench (measured outside and between the pavement excavation payment limits of the sewer trench and catch basin excavation), by the maximum width as specified in **Subsection 40.02.4(A)(2)** plus two (2) feet. If actual unsheeted trench widths are less than those maximums, the smaller widths must become the basis for calculating payment limits.

(C) ALL TRENCHES AND EXCAVATIONS, AND OTHER PAVEMENT AREAS

(1) Outside The Ordered Trench And Excavation And Cutback Limits - When pavement excavation is outside the ordered trench and excavation and cutback limits and has been specifically shown on the plans, specified in the contract documents, or ordered and approved in writing to be removed by the Engineer, the maximum payment limits for the volume of pavement components' excavation, (i.e., broken, removed and disposed of, irrespective of the actual pavement material encountered), must be as defined and approved in writing by the Engineer.

(2) Within The Ordered Test Pit Excavation Limits - When pavement excavation is within the ordered test pit excavation limits and has been specifically shown on the plans, specified in the contract documents, or ordered and approved in writing to be removed by the Engineer, the maximum payment limits for the volume of pavement excavated, (i.e., broken, removed and disposed of, irrespective of the actual pavement material encountered), must be the product of the average depth of the full pavement, by the actual length of the excavation plus one (1) foot, by the actual width of the excavation

plus one (1) foot. However, the pavement excavation volume coming within the limits of the sewer or water main trench or excavation will not be allowed for measurement twice unless such pavement area is ordered permanently restored and is completed before the sewer or water main trench or excavation is excavated.

(3) The method of measurement for computing the average depths specified herein must be as ordered by the Engineer and must be taken in the Engineer's or the Engineer's representative's presence. The Engineer must verify all measurements. No quantities for volume of pavement excavated will be accepted unless approved in writing by the Engineer.

71.21.5 PRICE TO COVER

Payment for the volume of pavement excavated must be made under the unit price bid for the NYCDOT Highway item(s) labeled "UNCLASSIFIED EXCAVATION". The contract price for NYCDOT Highway item(s) labeled "UNCLASSIFIED EXCAVATION" must be the unit price bid per cubic yard for excavation of pavement and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to break, remove and dispose of excavated pavement, irrespective of the pavement material encountered, and to do all work incidental thereto all in accordance with the plans and specifications, and as ordered by the Engineer.

71.21.6 NO SEPARATE PAYMENT

(A) Sidewalk and driveway pavements must be removed in whole flags, squares or sections, or as directed by the Engineer. Curb removal must be as ordered or approved in writing by the Engineer.

The Contractor is notified that the cost for all labor, materials, equipment and insurance required and necessary to break, remove and dispose of sidewalk and driveway pavements and curbs, irrespective of sidewalk, driveway and curb material encountered, must be included in the prices bid for all contract items of work. No separate or additional payment will be made for this work.

(B) No separate or additional payment will be made for saw cutting work specified in **Subsection 71.11.6**. The costs of these saw cutting work must be included in the prices bid for all items of the contract.

Payment for Pavement Excavation will be made under the NYCDOT Item Number listed below:

Item No.	Description	Pay Unit
6.02 AAN	UNCLASSIFIED EXCAVATION	C.Y.
6.02 AAD	UNCLASSIFIED EXCAVATION	C.Y.

SECTION 71.31 – TEMPORARY RESTORATION OF PAVEMENTS

71.31.1 DESCRIPTION

Street surfaces must be temporarily restored as specified in **Section 40.08** and as directed by the Engineer.

71.31.2 MATERIALS

(A) The material for temporary pavement must be either Binder Mixture or Asphaltic Concrete Mixture, as applicable, and as determined by the Engineer.

Binder Mixture and Asphaltic Concrete Mixture must be in conformance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 3.01 - Asphalt Paving Mixtures (Binder, Asphaltic Concrete)**.

(B) The material for subbase required under temporary pavement on all projects within the Borough of Staten Island must be Recycled Portland Cement Concrete (Material D).

Recycled Portland Cement Concrete (Material D) must be in conformance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 6.67 - Subbase Course, Select Granular Material**.

71.31.3 CONSTRUCTION METHODS

Temporary restoration of pavements must be done according to the requirements of **Section 40.08** of these specifications, and **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 4.02 - Asphaltic Concrete Wearing Course**.

71.31.5 PAYMENT AND MEASUREMENT

Payment for the temporary restoration of pavements must be made under either the NYCDOT Highway Item No. 4.02 CA - BINDER MIXTURE, or the NYCDOT Highway Item No. 4.02CB - ASPHALTIC CONCRETE MIXTURE, as applicable, and as determined by the Engineer.

The quantities of NYCDOT Highway Item No. 4.02CA - BINDER MIXTURE or NYCDOT Highway Item No. 4.02CB - ASPHALTIC CONCRETE MIXTURE to be measured for payment must be the number of tons of binder mixture or asphaltic concrete mixture incorporated into the work as temporary pavement, complete, as shown, specified or required, and in accordance with the requirements of **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 4.02 - Asphaltic Concrete Wearing Course**.

71.31.6 PRICE TO COVER

(A) The contract price for NYCDOT Highway Item No. 4.02CA - BINDER MIXTURE must be the unit price bid per ton and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to furnish, deliver, lay and remove when directed the binder mixture temporary pavement, complete, and do all work incidental thereto, all in accordance with the Standard Highway Specifications of the New York City Department of Transportation, and as shown on the plans, specified within these specifications, and as directed by the Engineer.

(B) The contract price for NYCDOT Highway Item No. 4.02CB - ASPHALTIC CONCRETE MIXTURE must be the unit price bid per ton and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to furnish, deliver, lay and remove when directed the asphaltic concrete mixture temporary pavement, complete, and do all work incidental thereto, all in accordance with the Standard Highway Specifications of the New York City Department of Transportation, and as shown on the plans, specified within these specifications, and as directed by the Engineer.

71.31.7 NO SEPARATE PAYMENT

No separate or additional payment will be made for furnishing, delivering, laying and removing the subbase required under temporary pavement on all projects within the Borough of Staten Island. The cost of this subbase work must be deemed included in the prices bid for all items of the contract.

Payment for Temporary Restoration Of Pavements will be made under the NYCDOT Item Numbers listed below:

Item No.	Description	Pay Unit
4.02 CA	BINDER MIXTURE	TONS
4.02 CB	ASPHALTIC CONCRETE MIXTURE	TONS

SECTION 71.41 – FINAL RESTORATION OF PAVEMENTS

71.41.1 DESCRIPTION

Restoration of permanent roadway pavement must include the restoration of each kind of roadway pavement shown, specified or ordered.

71.41.2 MATERIALS

The materials for roadway pavement to be restored must conform in all respects to the requirements set forth in the Standard Details of Construction and the Standard Highway Specifications of the New York City Department of Transportation.

71.41.3 CONSTRUCTION METHODS

The Contractor will be required to replace all permanent pavement disturbed in the course of the work, in accordance with the requirements of the Standard Details of Construction and the Standard Highway Specifications of the New York City Department of Transportation.

When performing final restoration work no more than six hundred (600) linear feet of trench must be excavated and pending installation of concrete or asphaltic concrete base at any time.

Unless otherwise specified, final restoration must commence upon completion of two thousand (2,000) linear feet of water main installation. Except for water mains installed during the period of December 1 to April 30 there must be no more than three thousand (3,000) linear feet of water main trench pending final restoration. If, on May 1, there are more than three thousand (3,000) linear feet pending final restoration then no new excavations for pipe installation may be made until this requirement is met.

All trenches and excavations must be backfilled and compacted to the underside of the pavement in accordance with **Section 40.06**.

All manhole covers and other street hardware must be adjusted or raised to final grade, prior to the final restoration of pavements. All loose, slippery or broken city-owned manhole covers and other city-owned street hardware must be replaced. No separate or additional payment will be made for the work of adjusting or raising to final grade all city-owned manhole covers and other city-owned street hardware; and for replacing loose, slippery or broken city-owned manhole covers and other city-owned street hardware, the cost must be included in the prices bid for all items of the contract.

Immediately after any street opening has been backfilled and the compaction completed, the Contractor must install the permanent or temporary pavement as directed by the Engineer. All pavement materials and methods of restoration must comply with the Standard Details of Construction and the Standard Highway Specifications of the New York City Department of Transportation. The temporary pavement must consist of binder mixture or asphaltic concrete mixture (as applicable, and as determined by the Engineer) as specified in **Section 40.08**, flush with the adjacent roadway surfaces. Immediately upon completion of the installation of the temporary pavement, all equipment construction materials and debris must be removed from the site.

Final restoration of pavements must conform to the requirements of **Section 40.09**.

Whenever a permanent pavement is to be installed and a temporary restoration has been used all of the temporary pavement must be removed and the new roadway must be installed.

All concrete used for base must be Class B-32 (3,200-psi) Type 1A. For bus stops or reinforced pavements, Class A-40 (4,000-psi) Type 11A must be used.

When a permanent full depth concrete pavement is to be installed as the final pavement, all work must be done in accordance with **Department of Transportation Standard Detail of Construction No. H-1042B**.

When existing granite block pavements are encountered the Contractor must reinstall the granite block on a new six (6) inch concrete base, unless more than fifty (50) percent of the adjacent street is already patched with asphalt. In that case, the Contractor must replace the granite block with a three (3) inch asphaltic concrete top course on a six (6) inch to nine (9) inch concrete base. Unless otherwise directed by the Borough Administrative Superintendent of Street Maintenance, all granite block must be cleaned and delivered to the Borough Highway Yard of the Department of Transportation. The Contractor must coordinate delivery with the Borough's Administrative Superintendent of Street Maintenance. In the restoration of block pavements the edges of the pavement must be toothed or racked back.

All roadway markings including crosswalks and thermoplastic lane dividers removed as a result of construction must be replaced in kind to the Standard Details of Construction and the Standard Highway Specifications of the New York City Department of Transportation.

All sidewalks, curbs, and concrete bus stops disturbed as a result of construction must be restored in strict accordance with the Standard Details of Construction and the Standard Highway Specifications of the New York City Department of Transportation.

All restorations must conform to the standards and specifications of the Standard Details of Construction and the Standard Highway Specifications of the New York City Department of Transportation.

The Contractor will be required to construct pavement keys and apply tack coat in accordance with the Standard Details of Construction and the Standard Highway Specifications of the New York City Department of Transportation. Unless otherwise provided for in the Bid Schedule, the stripping or milling of all pavement keys and application of tack coat must be included in the price bid for all pavement restoration items, and no separate or additional payment must be made for this work.

Roadways, driveways and sidewalk pavements, crosswalks, curbs, etc., must be satisfactorily restored and adjusted by the Contractor at such times as may be directed by the Department of Design and Construction. Sidewalk and driveway pavements must be restored in whole flags, squares or sections, and in general, must be restored with concrete laid on six (6) inch thick foundation materials unless otherwise specified. All work and materials used in such restoration and adjustment must conform in all respects to the standards and specifications of the Department of Transportation for similar work and materials. The cost for these restorations must be included and payment must be made under the appropriate bid items. Unless otherwise specified, the cost for any grading work and for supplying and placing of any foundation materials must be deemed included in the prices bid for all items of work.

If roadway pavements, driveway and sidewalk pavements, crosswalks, curbs, etc., are specified in the contract documents to be laid where none existed at the time the bids for this contract were opened, the Contractor must excavate, remove and grade such portions of the areas where the new roadways, driveways, sidewalks, crosswalks, curbs, etc., and their foundations are to be placed upon and are necessary for the prosecution of the work and the Contractor will be required to make a permanent restoration of them. Payment for the work performed will be made under the appropriate bid items.

Where roadway pavements, driveway and sidewalk pavements, crosswalks, curbs, etc., are not specified in the contract documents to be laid where none existed at the time the bids for this contract were opened; however, the Engineer orders such work done, payment must be made for the work performed in accordance with **Articles 25 and 26** of the Contract.

The Contractor must install new curb and concrete sidewalk within the project limit at the locations where required due to missing or defective curb and/or sidewalk as directed by the Engineer. New curbs and sidewalks must be constructed in compliance with NYCDOT's requirements and specifications. Payment for this work must be made under the appropriate curb and sidewalk items. (This does not include damage to curbs and sidewalks caused by the Contractor's construction operation; such damage must be repaired at the sole expense of the Contractor. Nor does it include curb and sidewalk work required for house service connections and catch basin installation. Such work must be included in the prices bid for house service connections and catch basins.)

The Contractor is required to install pedestrian ramps within the project limit at those corners where back to back catch basin connections are called for and at all corners where there are no existing pedestrian ramps or where there are existing pedestrian ramps that do not comply with the current NYCDOT Highway Standards and Specifications, as directed by the Engineer. All pedestrian ramps must comply with Highway Standard Drawing No. H1011 (latest revision), with a detectable warning surface installed in the ramp, within two (2) feet of the curb. Payment for this work must be made under the appropriate curb and sidewalk items.

Prior to the start of final restoration the Contractor will be required to submit to the Engineer, for approval, a layout of the proposed final restoration.

71.41.4 SPECIFIC PAVEMENT RESTORATION PROVISIONS

(A) The permanent restoration requirements must be as specified in the Addenda to the specifications. Where restoration is required to satisfactorily complete the contract, but permanent restoration

requirements are not specified in the Addenda, the Contractor must restore the pavements as encountered and as directed by the Engineer.

(B) All roadway markings including thermoplastic reflectorized pavement markings (crosswalks and lane dividers) removed as a result of the construction operations, must be replaced in kind to the Department of Transportation specifications.

(C) The Contractor must restore all existing sidewalk and curb structures that are disturbed due to the construction operations.

(D) The Department of Design and Construction will make all necessary inspections of restoration.

71.41.5 MEASUREMENT

(A) WATER MAIN TRENCHES AND EXCAVATIONS

(1) Within Ordered Trench And Cutback Limits In Non-Protected Streets For Water Mains 20-Inches And Less In Diameter - When water main work is required in non-protected streets for water mains 20-inches and less in diameter, the quantity of pavement restoration for each kind of roadway pavement required must be based on the following pay limits:

(A) Unsheeted Trenches:

(a) Pay limits for laying pavement consisting of asphaltic concrete top course on a cement concrete base course, or brick or block pavers top course on asphaltic concrete base course or cement concrete base course must be:

(1) For The Base Course - the actual length of trench; and the width of the base course two (2) feet wider than the nominal diameter of the pipe installed.

(2) For The Top Course - the actual length of trench plus one and one-half (1-1/2) feet; and the width of the top course three and one-half (3-1/2) feet wider than the nominal diameter of the pipe installed.

(b) Pay limits for laying pavement consisting of one and one-half (1-1/2) inches or two (2) inches (as specified) of asphaltic concrete top course on an asphaltic concrete base course must be:

(1) For The Base Course - the actual length of trench; and the width of the base course two (2) feet wider than the nominal diameter of the pipe installed.

(2) For The Top Course - the actual length of trench plus one and one-half (1-1/2) feet; and the width of the top course three and one-half (3-1/2) feet wider than the nominal diameter of the pipe installed.

(c) Pay limits for laying pavement consisting of cement concrete must be:

For The Full Pavement - the actual length of trench plus one and one-half (1-1/2) feet; and the width of the full pavement three and one-half (3-1/2) feet wider than the nominal diameter of the pipe installed.

(B) Sheeted Trenches:

(a) Pay limits for laying pavement consisting of asphaltic concrete top course on a cement concrete base course, or brick or block pavers top course on asphaltic concrete base course or cement concrete base course must be:

(1) For The Base Course - the actual length of trench; and the width of the base course four (4) feet wider than the nominal diameter of the pipe installed.

(2) For The Top Course - the actual length of trench plus one and one-half (1-1/2) feet; and the width of the top course five and one-half (5-1/2) feet wider than the nominal diameter of the pipe installed.

(b) Pay limits for laying pavement consisting of one and one-half (1-1/2) inches or two (2) inches (as specified) of asphaltic concrete top course on an asphaltic concrete base course must be:

(1) For The Base Course - the actual length of trench; and the width of the base course four (4) feet wider than the nominal diameter of the pipe installed.

(2) For the Top Course - the actual length of trench plus one and one-half (1-1/2) feet: and the width of the top course five and one-half (5-1/2) feet wider than the nominal diameter of the pipe installed.

(c) Pay limits for laying pavement consisting of cement concrete must be:

For The Full Pavement - the actual length of trench plus one and one-half (1-1/2) feet; and the width of the full pavement five and one-half (5-1/2) feet wider than the nominal diameter of the pipe installed.

(C) These Payment Limits Must Be Maximums: The width of pavement components to be restored is based on the trench width, as specified. If actual trench widths are less than those maximums, the smaller widths must become the basis for calculating payment limits. When, due to unforeseen or special field conditions changing the trench width from that specified becomes necessary, and the change is approved by the Engineer, the width of the pavement components' restoration to be used for payment must be increased or decreased by the dimension equal to that of the change in the trench width.

(2) Within Ordered Trench And Cutback Limits In Streets Protected By NYC Administrative Code §19-144 (Local Law No. 14.) For Water Mains 20-Inches And Less In Diameter - When water main work is required in streets protected by NYC Administrative Code §19-144 (Local Law No. 14) for water mains 20-inches and less in diameter, the quantity of pavement restoration for each kind of roadway pavement required must be based on the following pay limits:

(A) Unsheeted Trenches:

(a) Pay limits for laying pavement consisting of asphaltic concrete top course on a cement concrete base course, or brick or block pavers top course on asphaltic concrete base course or cement concrete base course must be:

(1) For The Base Course - the actual length of trench plus one (1) foot; and the width of the base course three (3) feet wider than the nominal diameter of the pipe installed.

(2) For The Top Course - the actual length of trench plus two and one-half (2-1/2) feet; and the width of the top course four and one-half (4-1/2) feet wider than the nominal diameter of the pipe installed.

(b) Pay limits for laying pavement consisting of one and one-half (1-1/2) inches or two (2) inches (as specified) of asphaltic concrete top course on an asphaltic concrete base course must be:

(1) For The Base Course - the actual length of trench plus one (1) foot; and the width of the base course three (3) feet wider than the nominal diameter of the pipe installed.

(2) For The Top Course - the actual length of trench plus two and one-half (2-1/2) feet; and the width of the top course four and one-half (4-1/2) feet wider than the nominal diameter of the pipe installed.

(c) Pay limits for laying pavement consisting of cement concrete must be:

For The Full Pavement - the actual length of trench plus two (2) feet; and the width of the full pavement four (4) feet wider than the nominal diameter of the pipe installed.

(B) Sheeted Trenches:

(a) Pay limits for laying pavement consisting of asphaltic concrete top course on a cement concrete base course, or brick or block pavers top course on asphaltic concrete base course or cement concrete base course must be:

(1) For The Base Course - the actual length of trench plus one (1) foot; and the width of the base course five (5) feet wider than the nominal diameter of the pipe installed.

(2) For The Top Course - the actual length of trench plus two and one-half (2-1/2) feet; and the width of the top course six and one-half (6-1/2) feet wider than the nominal diameter of the pipe installed.

(b) Pay limits for laying pavement consisting of one and one-half (1-1/2) inches or two (2) inches (as specified) of asphaltic concrete top course on an asphaltic concrete base course must be:

(1) For The Base Course - the actual length of trench plus one (1) foot; and the width of the base course five (5) feet wider than the nominal diameter of the pipe installed.

(2) For The Top Course - the actual length of trench plus two and one-half (2-1/2) feet; and the width of the top course six and one-half (6-1/2) feet wider than the nominal diameter of the pipe installed.

(c) Pay limits for laying pavement consisting of cement concrete must be:

For The Full Pavement - the actual length of trench plus two (2) feet; and the width of the full pavement six (6) feet wider than the nominal diameter of the pipe installed.

(C) These Payment Limits Must Be Maximums: The width of pavement components to be restored is based on the trench width, as specified. If actual trench widths are less than those maximums, the smaller widths must become the basis for calculating payment limits. When, due to unforeseen or special field conditions changing the trench width from that specified becomes necessary, and the change is approved by the Engineer, the width of the pavement components' restoration to be used for payment must be increased or decreased by the dimension equal to that of the change in the trench width.

(3) Within Ordered Trench And Cutback Limits In All Streets For Water Mains 24-Inches And Larger In Diameter - When water main work is required in streets for water mains 24-inches and larger in diameter, the quantity of pavement restoration for each kind of roadway pavement required must be based on the following pay limits:

(A) All Trenches:

(a) Pay limits for laying pavement consisting of asphaltic concrete top course on a cement concrete base course, or brick or block pavers top course on asphaltic concrete base course or cement concrete base course must be:

(1) For The Base Course - the actual length of trench plus two (2) feet; and the width of the base course six (6) feet wider than the nominal diameter of the pipe installed.

(2) For The Top Course - the actual length of trench plus four (4) feet; and the width of the top course eight (8) feet wider than the nominal diameter of the pipe installed.

(b) Pay limits for laying pavement consisting of one and one-half (1-1/2) inches or two (2) inches (as specified) of asphaltic concrete top course on an asphaltic concrete base course must be:

(1) For The Base Course - the actual length of trench plus two (2) feet; and the width of the base course six (6) feet wider than the nominal diameter of the pipe installed.

(2) For The Top Course - the actual length of trench plus four (4) feet; and the width of the top course eight (8) feet wider than the nominal diameter of the pipe installed.

(c) Pay limits for laying pavement consisting of cement concrete must be:

For The Full Pavement - the actual length of trench plus two (2) feet; and the width of the full pavement six (6) feet wider than the nominal diameter of the pipe installed.

(B) These Payment Limits Must Be Maximums: The width of pavement components to be restored is based on the trench width, as specified. If actual trench widths are less than those maximums, the smaller widths must become the basis for calculating payment limits. When, due to unforeseen or special field conditions changing the trench width from that specified becomes necessary, and the change is approved by the Engineer, the width of the pavement components' restoration to be used for payment must be increased or decreased by the dimension equal to that of the change in the trench width.

(4) Within Ordered Excavation and Cutback Limits For Construction Of Valve Chambers, Etc. - When construction of valve chambers and other structures are required, the quantity of pavement restoration for each kind of roadway pavement required must be based on the following pay limits:

(A) All Excavations:

(a) Pay limits for laying pavement consisting of asphaltic concrete top course on a cement concrete base course, or brick or block pavers top course on asphaltic concrete base course or cement concrete base course must be:

(1) For The Base Course - the length of the base course six (6) feet wider than the length of the chamber or structure (measured between outside faces of walls); and the width of the base course six (6) feet wider than the width of the chamber or structure (measured between outside faces of walls).

(2) For The Top Course - the length of the top course eight (8) feet wider than the length of the chamber or structure (measured between outside faces of walls); and the width of the top course eight (8) feet wider than the width of the chamber or structure (measured between outside faces of walls).

(b) Pay limits for laying pavement consisting of one and one-half (1-1/2) inches or two (2) inches (as specified) of asphaltic concrete top course on an asphaltic concrete base course must be:

(1) For The Base Course - the length of the base course six (6) feet wider than the length of the chamber or structure (measured between outside faces of walls); and the width of the base course six (6) feet wider than the width of the chamber or structure (measured between outside faces of walls).

(2) For The Top Course - the length of the top course eight (8) feet wider than the length of the chamber or structure (measured between outside faces of walls); and the width of the top course eight (8) feet wider than the width of the chamber or structure (measured between outside faces of walls).

(c) Pay limits for laying pavement consisting of cement concrete must be:

For The Full Pavement - the length of the pavement six (6) feet wider than the length of the chamber or structure (measured between outside faces of walls); and the width of the full pavement six (6) feet wider than the width of the chamber or structure (measured between outside faces of walls).

(B) Pavement restoration coming within the limits of the water main pipe trench will not be allowed for measurement twice and must be deducted from the above pavement components' restoration quantities.

(C) These Payment Limits Must Be Maximums: The length and width of pavement components to be restored is based on the excavation length and width, as specified. If actual excavation lengths and widths are less than those maximums, the smaller lengths and widths must become the basis for calculating payment limits. When, due to unforeseen or special field conditions changing the excavation length and width from that specified becomes necessary, and the change is approved by the Engineer, the length and width of the pavement components' restoration to be used for payment must be increased or decreased by the dimension equal to that of the change in the excavation length and width.

(5) Pavement Restoration In Connection With Various Construction Operations - Pay limits for pavement restoration in connection with various construction operations are as follows:

(A) For Removing Existing Main: Where the existing main to be removed is in the same trench and alongside the new main an additional allowance equal to the nominal diameter of the existing pipe to be removed will be added to the width of the base course, the width of the top course, and the width of the full pavement as allowed for the laying of new mains specified in **Subsections 71.41.5(A)(1), 71.41.5(A)(2), and 71.41.5(A)(3)**. The quantities of the pavement components' restoration must then be calculated using the widths as modified.

Where the existing main to be removed does not come within the limits of the trench excavated for laying the new main an amount of one-half (1/2) foot must be deducted from the width of the base course, the width of the top course, and the width of the full pavement as allowed for the laying of new mains specified in **Subsections 71.41.5(A)(1), 71.41.5(A)(2), and 71.41.5(A)(3)**. The quantities of the pavement component's restoration must then be calculated using the widths as modified.

(B) For Setting Valve And Valve Boxes: No additional pavement restoration over the regular pipe trench will be allowed for setting valve and valve boxes.

(C) For Making Connections To Or Setting Valves Upon Existing Mains: Payment limits for pavement components' restoration for making connections to existing mains or for setting valves upon existing mains will be based upon the limits of excavation specified in **Subsection 40.02.4(B)(3)(b)**. In all kinds of pavement, cutback limits at all edges of excavation must be as determined by the Engineer.

(D) For Making Wet Connections: Payment limits for pavement components' restoration for the making of wet connections will be based upon the limits of excavation specified in **Subsection 40.02.4(B)(3)(e)**. In all kinds of pavement, cutback limits at all edges of excavation must be as determined by the Engineer.

(E) For Removing Valve Boxes - Payment limits for pavement components' restoration, in all kinds of pavement, for removing valve boxes from abandoned mains that are left in place will be six (6) feet square for large boxes and four (4) feet square for hydrant boxes.

(F) For Extending House Service Connections - Payment limits for pavement components' restoration for extending house service connections will be based upon the limits of excavation specified in **Subsection 40.02.4(B)(3)(g)**. In all kinds of pavement, cutback limits at all edges of excavation must be as determined by the Engineer.

(G) For Locating Taps - Payment limits for pavement components' restoration for locating existing taps on existing mains to be abandoned will be based upon the limits of excavation specified in **Subsection 40.02.4(B)(3)(h)**. In all kinds of pavement, cutback limits at all edges of excavation must be as determined by the Engineer.

Payment limits for pavement components' restoration for making taps on an existing main which is to be retained in service will be based upon the limits of excavation specified in **Subsection 40.02.4(B)(3)(h)**. In all kinds of pavement, cutback limits at all edges of excavation must be as determined by the Engineer.

Payment limits for pavement components' restoration for locating taps (single taps, or two or more taps) where an existing main to be abandoned lies sufficiently close to a parallel main, so that they can both be exposed in the same trench will be based upon the limits of excavation specified in **Subsection 40.02.4(B)(3)(h)**. In all kinds of pavement, cutback limits at all edges of excavation must be as determined by the Engineer.

(B) SEWER TRENCHES AND EXCAVATIONS

(1) Within Ordered Trench And Cutback Limits In All Streets For Sewers - When sewer work is required in streets, the quantity of pavement restoration for each kind of roadway pavement required must be based on the following pay limits:

(A) Sheeted Trenches:

(a) Pay limits for laying pavement consisting of asphaltic concrete top course on a cement concrete base course, or brick or block pavers top course on asphaltic concrete base course or cement concrete base course is:

(1) For The Base Course - the actual length of the trench plus two (2) feet; and the maximum width as specified in **Subsection 40.02.4(A)(2)** plus two (2) feet.

(2) For The Top Course - the actual length of trench plus four (4) feet; and the maximum width as specified in **Subsection 40.02.4(A)(2)** plus four (4) feet.

(b) Pay limits for laying pavement consisting of one and one-half (1-1/2) inches or two (2) inches (as specified) of asphaltic concrete top course on an asphaltic concrete base course is:

(1) For The Base Course - the actual length of trench plus two (2) feet; and the maximum width as specified in **Subsection 40.02.4(A)(2)** plus two (2) feet.

(2) For The Top Course - the actual length of trench plus four (4) feet; and the maximum width as specified in **Subsection 40.02.4(A)(2)** plus four (4) feet.

(c) Pay limits for laying pavement consisting of cement concrete is:

For The Full Pavement - the actual length of trench plus two (2) feet; and the maximum width as specified in **Subsection 40.02.4(A)(2)** plus two (2) feet.

(B) These Payment Limits Must Be Maximums: The width of pavement components to be restored is based on the maximum trench width, as specified in **Subsection 40.02.4(A)(2)**. If actual trench widths are less than those maximums, the smaller widths must become the basis for calculating payment limits. When, due to unforeseen or special field conditions changing the trench width from that specified becomes necessary, and the change is approved by the Engineer, the width of the pavement components' restoration to be used for payment must be increased or decreased by the dimension equal to that of the change in the trench width.

(2) Within Ordered Excavation And Cutback Limits For Construction Of Manholes, Chambers, Etc. - When construction of manholes, chambers and other structures are required, the quantity of pavement restoration for each kind of roadway pavement required is based on the following pay limits:

(A) All Excavations:

(a) Pay limits for laying pavement consisting of asphaltic concrete top course on a cement concrete base course, or brick or block pavers top course on asphaltic concrete base course or cement concrete base course is:

(1) For The Base Course - the length of the base course five (5) feet wider than the length of the manhole, chamber or structure (measured between outside faces of walls); and the width of the base course five

(5) feet wider than the width of the manhole, chamber or structure (measured between outside faces of walls).

(2) For The Top Course - the length of the top course seven (7) feet wider than the length of the manhole, chamber or structure (measured between outside faces of walls); and the width of the top course seven (7) feet wider than the width of the manhole, chamber or structure (measured between outside faces of walls).

(b) Pay limits for laying pavement consisting of one and one-half (1-1/2) inches or two (2) inches (as specified) of asphaltic concrete top course on an asphaltic concrete base course is:

(1) For The Base Course - the length of the base course five (5) feet wider than the length of the manhole, chamber or structure (measured between outside faces of walls); and the width of the base course five (5) feet wider than the width of the manhole, chamber or structure (measured between outside faces of walls).

(2) For The Top Course - the length of the top course seven (7) feet wider than the length of the manhole, chamber or structure (measured between outside faces of walls); and the width of the top course seven (7) feet wider than the width of the manhole, chamber or structure (measured between outside faces of walls).

(c) Pay limits for laying pavement consisting of cement concrete is:

For The Full Pavement - the length of the full pavement five (5) feet wider than the length of the manhole, chamber or structure (measured between outside faces of walls); and the width of the full pavement five (5) feet wider than the width of the manhole, chamber or structure (measured between outside faces of walls).

(B) Pavement restoration coming within the limits of the sewer trench will not be allowed for measurement twice and will be deducted from the above pavement components' restoration quantities.

(C) Payment limits for the quantities of pavement components' restoration for odd shaped excavations will be as defined by the Engineer. In all kinds of pavement, cutback limits at all edges of excavation must be as determined by the Engineer.

(D) These Payment Limits Must Be Maximums: The length and width of pavement components to be restored is based on the excavation length and width, as specified. If actual excavation lengths and widths are less than those maximums, the smaller lengths and widths must become the basis for calculating payment limits. When, due to unforeseen or special field conditions changing the excavation length and width from that specified becomes necessary, and the change is approved by the Engineer, the length and width of the pavement components' restoration to be used for payment must be increased or decreased by the dimension equal to that of the change in the excavation length and width.

(3) Within Ordered Unsheeted Basin Connection Trench And Cutback Limits - When roadway pavement restoration is within the ordered unsheeted basin connection trench and cutback limits and has been specifically shown on the plans, specified in the contract documents, or ordered and approved in writing to be restored by the Engineer, the payment limits for the roadway pavement restoration, for all kinds of pavements, must be the actual length of the trench (measured outside and between the roadway pavement restoration payment limits of the sewer trench and catch basin excavation), and the maximum width as specified in **Subsection 40.02.4(A)(2)** plus two (2) feet. If actual unsheeted trench widths are less than those maximums, the smaller widths must become the basis for calculating payment limits.

(C) ALL TRENCHES AND EXCAVATIONS, AND OTHER PAVEMENT AREAS

(1) Outside The Ordered Trench And Excavation And Cutback Limits - When roadway pavement restoration is required outside the ordered trench and excavation and cutback limits and has been specifically shown on the plans, specified in the contract documents, or ordered and approved in

writing to be restored by the Engineer, the payment limits for the roadway pavement components' restoration, must be as defined and approved in writing by the Engineer.

(2) Within The Ordered Test Pit Excavation Limits - When roadway pavement restoration is required within the ordered test pit excavation limits and has been specifically shown on the plans, specified in the contract documents, or ordered and approved in writing to be restored by the Engineer, the payment limits for the roadway pavement components' restoration, must be the actual length of the excavation plus one (1) foot, and the actual width of the excavation plus one (1) foot. However, the roadway pavement restoration coming within the limits of the sewer or water main trench or excavation will not be allowed for measurement twice unless such roadway pavement restoration is ordered restored and is completed before the sewer or water main trench or excavation is excavated.

(3) Sidewalk And Driveway Pavement And Curb Restoration - When sidewalk and driveway pavement restoration is required whether due to water main and/or sewer conduit work in the sidewalk area or when shown on the plans, specified in the contract documents, or ordered and approved in writing to be restored by the Engineer, the payment limits for the sidewalk and driveway pavement restoration must be measured in whole flags, squares or sections, or as directed by the Engineer.

When curb restoration is required whether due to water main and/or sewer conduit work or when shown on the plans, specified in the contract documents, or ordered and approved in writing to be restored by the Engineer, the payment limits for the curb restoration, must be as ordered or approved in writing by the Engineer.

71.41.6 PRICE TO COVER

Payment for furnishing, delivering and placing of all pavement restoration of each kind of roadway pavement required must be made under the appropriate bid items, as shown, specified or ordered, contained in the bid schedule and within the pay limits described herein.

Payment for reinstalling granite block must be made under the appropriate bid items.

The cost for cleaning and delivery of granite block as specified herein must be included in prices bid for all items of work.

Grass or Lawn areas that are injured or defaced as a result of the Contractor's construction operations must be replaced with Sod, unless otherwise directed by the Engineer, in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 4.19 - Sodding**. Unless otherwise provided for in the Bid Schedule, payment for the replacing of injured or defaced Grass or Lawn areas due to the Contractor's construction operations or due to the installation of items under this contract must be included in the unit prices bid for all items of the contract.

Payment for installing pedestrian ramps must be made under the appropriate bid items.

The cost of all labor and materials required to restore all pavements, sidewalks, curbs, etc. all in accordance with the highway standards and specifications of the Department of Transportation and as directed by the Engineer, must be included in the prices bid for the appropriate roadway pavement, sidewalk pavement and curb items. Where there are no specific classified bid item(s) of work for roadway pavement, sidewalk pavement and curb, payment must be made in accordance with **Articles 25 and 26** of the Contract, unless otherwise specified for such restoration work to be included in the price bid for a specific item or in the prices bid for all items of the contract.

71.41.7 NO SEPARATE PAYMENT

There will be no separate payment for the excavation, removal and disposal of the temporary pavement and portion of the backfill prior to placing the concrete or asphaltic concrete base, payment therefore must be included in the unit prices bid for all items of the contract.

No separate payment will be made for the restoration of existing sidewalks, curbs and concrete bus stops that are to remain undisturbed but are damaged as a result of the Contractor's operations. All such restoration must be performed in accordance with the Standard Details of Construction and the Standard Highway Specifications of the New York City Department of Transportation at the sole expense of the Contractor unless otherwise indicated on the plans or in the specifications.

If, when the pavement is to be replaced, it is found that additional area must be replaced due to undermining caused by the work performed under the contract, the Contractor at the Contractor's own cost and expense must restore such additional pavement.

Should a settlement occur, or other defect develop in restored pavement, sidewalk and curb or in pavement, sidewalk and curbs adjacent thereto within the period of maintenance which, in the opinion of the Engineer is due to improper workmanship or to materials furnished or installed under this contract, such defective pavement and/or sidewalk and curbing must be replaced and/or restored by the Contractor to the satisfaction of the Engineer, at the Contractor's expense.

Unless otherwise specified, no separate payments will be made for the removal of pavement markings and replacement with thermoplastic reflectorized pavement markings (crosswalks and lane dividers), and for the placement and eradication of temporary roadway markings, payment therefore must be included in the unit prices bid for all items of the contract.

Payment for Final Restoration Of Pavements will be made under various NYCDOT Item Numbers. Examples of these NYCDOT Item Numbers are listed below:

Item No.	Description	Pay Unit
4.01 RAG	ASPHALT MACADAM PAVEMENT, 6" THICK	S.Y.
4.02 AB-R	ASPHALTIC CONCRETE WEARING COURSE, 1-1/2" THICK	S.Y.
4.02 AF-R	ASPHALTIC CONCRETE WEARING COURSE, 2" THICK	S.Y.
4.02 AG	ASPHALTIC CONCRETE WEARING COURSE, 3" THICK	S.Y.
4.02 CA	BINDER MIXTURE	TONS
4.02 CB	ASPHALTIC CONCRETE MIXTURE	TONS
4.04 AC	CONCRETE BASE FOR PAVEMENT, 6" THICK, CLASS B-32	C.Y.
4.04 B	CONCRETE BASE FOR PAVEMENT, VARIABLE THICKNESS FOR TRENCH RESTORATION, CLASS B-32	C.Y.
4.04 DC	CONCRETE BASE FOR PAVEMENT, 9" THICK, CLASS B-32	C.Y.
4.04 H	CONCRETE BASE FOR PAVEMENT, VARIABLE THICKNESS FOR TRENCH RESTORATION, (HIGH-EARLY STRENGTH)	C.Y.
4.05 AC	REINFORCED CONCRETE PAVEMENT (BUS STOPS)	C.Y.
4.05 AX	HIGH-EARLY STRENGTH REINFORCED CONCRETE PAVEMENT (BUS STOPS)	C.Y.
4.05 B	REINFORCED CONCRETE PAVEMENT (FULL WIDTH PAVEMENT)	C.Y.
4.05 BX	HIGH-EARLY STRENGTH REINFORCED CONCRETE PAVEMENT (FULL WIDTH PAVEMENT)	C.Y.
4.07 AB	RESET BLUESTONE CURB	L.F.
4.07 BA	RESET GRANITE CURB	L.F.
4.07 CB	NEW GRANITE CURB, STRAIGHT	L.F.
4.07 CC	NEW GRANITE CURB, CORNER	L.F.
4.07.CD	NEW STRAIGHT GRANITE CURB, DEPRESSED AND TRANSITION	L.F.
4.08 AA	CONCRETE CURB (18" DEEP)	L.F.
4.08 AE	CONCRETE CURB (22" DEEP)	L.F.
4.08 BA	CONCRETE CURB (21" DEEP)	L.F.
4.09 AD	STRAIGHT STEEL FACED CONCRETE CURB (18" DEEP)	L.F.
4.09 AE	STRAIGHT STEEL FACED CONCRETE CURB (21" DEEP)	L.F.
4.09 BD	DEPRESSED STEEL FACED CONCRETE CURB (18" DEEP)	L.F.
4.09 BE	DEPRESSED STEEL FACED CONCRETE CURB (21" DEEP)	L.F.
4.09 CD	CORNER STEEL FACED CONCRETE CURB (18" DEEP)	L.F.
4.09 CE	CORNER STEEL FACED CONCRETE CURB (21" DEEP)	L.F.
4.11 CA	FILL, PLACE MEASUREMENT	C.Y.
4.13 AAS	4" CONCRETE SIDEWALK (UNPIGMENTED)	S.F.
4.13 ABS	4" CONCRETE SIDEWALK (PIGMENTED)	S.F.
4.13 BAS	7" CONCRETE SIDEWALK (UNPIGMENTED)	S.F.
4.13 BBS	7" CONCRETE SIDEWALK (PIGMENTED)	S.F.
4.13 BR	7" REINFORCED CONCRETE SIDEWALK (UNPIGMENTED)	S.F.
4.13 DE	EMBEDDED PREFORMED DETECTABLE WARNING UNITS	S.F.
4.19	SODDING	S.Y.
6.04 BB	FURNISH NEW GRANITE BLOCK PAVERS	EACH
6.04 BC	INSTALL GRANITE BLOCK PAVEMENT (NEW OR EXISTING)	S.Y.
6.68	PLASTIC FILTER FABRIC	S.Y.

SECTION 72.11 – HYDRAULIC FILL FOR ABANDONED SEWERS AND WATER MAINS

72.11.1 INTENT

This section describes the provision and placement of Hydraulic Fill For Abandoned Sewers And Water Mains.

72.11.2 DESCRIPTION

The Contractor must hydraulically fill all sewers 12-inches and larger in their least dimension and all water mains 24-inches and larger in diameter that are to be abandoned within the limits of this contract as shown or specified with an excavatable flowable fill.

72.11.3 MATERIALS

(A) Cement must be Type-I or Type-II Portland Cement that conforms to the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**. Each bag of cement must be one (1) cubic foot.

(B) Fine Aggregate - Sand must be Concrete Sand or Natural Sand and must conform to the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

(C) Fly Ash must conform to the chemical and physical requirements for Mineral Admixture, Class F listed in ASTM C618 including Table 1A (except for Footnote A). Loss on ignition must not exceed four percent (4%).

(D) Water must be fresh, clean and free from oils, acids, alkali or organic matter.

(E) Admixtures may be used in the Hydraulic Fill Mix to enhance certain properties. (Air entraining or water reducing admixtures must not be used.) No admixtures may be used without the prior approval of the Engineer. Laboratory test results or Manufacturer's data must be submitted by the Contractor to the Engineer proving that the admixture will not detract from the specified twenty-eight (28) day compressive strength.

All admixtures considered for inclusion in the Hydraulic Fill Mix must comply with the State of New York, Department of Transportation, Standard Specifications, Section 711-08 "Admixtures". The name of the admixture must be found on the "Approval List" issued by the NYS DOT Materials Bureau. The brand name of the approved admixture must be plainly marked on the admixture container.

72.11.4 METHODS

(A) Mix Design

HYDRAULIC FILL MIX (EXCAVATABLE FLOWABLE FILL) - The Contractor must prepare a design mix and produce a trial batch to show compliance with the specifications and submit design mix and test results to the Engineer for approval prior to construction. The approved Hydraulic Fill Mix must not be altered unless otherwise directed by the Engineer. The mix design proportion parameters per cubic yard must be as follows:

MIX DESIGN PROPORTION PARAMETERS
PER CUBIC YARD

Cement (lbs.)	30 - 70
Fly Ash (lbs.)	250 - 600
Fine Aggregate (lbs.)	2500 - 3000
Water (lbs.) (gal.)	350 (41.9) - 500 (59.9)
Slump (in.)	8 - 10
28-Day Comp. Strength (psi)	50 - 100

The hydraulic fill must be thoroughly mixed, in a mechanical mixer, to the desired consistency and in accordance with ACI 506R-90 before being placed in a calibrated hopper for discharge into the abandoned sewer and/or water main through nozzles and or other suitable apparatus. Calibration of the hopper must be subject to inspection, verification and approval of the Engineer.

Hydraulic fill may be supplied from an established concrete plant that has been approved by the Engineer.

The hydraulic fill mix that has gone for a period of forty-five (45) minutes or longer from the time of mixing without being incorporated into the work must be discarded. Remixing or tempering must not be permitted.

(B) Application

The hydraulic fill mix must not be placed during freezing weather at the site of application. The hydraulic fill mix must not be placed when it is anticipated that the temperature during the following twenty-four (24) hours will drop below forty (40) degrees Fahrenheit at the site of application.

The proposed method of application must be submitted to the Engineer for prior approval and must be in a manner that will thoroughly hydraulically fill the abandoned sewer and water main from bottom to top of existing sewer and water main and from bulkhead to bulkhead, complete, as directed by the Engineer. Included in this submittal must be the recommended maximum distances for hydraulically filling the abandoned sewer and water main, together with drawings showing the locations of any sections of abandoned sewer and water main that require removal in order to facilitate the hydraulic filling operation.

72.11.5 MEASUREMENT

The quantity of Hydraulic Fill For Abandoned Sewers And Water Mains to be paid for must be the number of cubic yards of hydraulic fill furnished and placed in the work, complete, as determined by (a) truck delivery tickets from an approved concrete batching plant, or (b) the volume of hydraulic fill batched, mixed on the site, and dispensed from calibrated discharge hoppers, all as shown on the contract drawings, specified and as required and approved by the Engineer.

72.11.6 PRICE TO COVER

The contract price for Item No. 72.11HF - HYDRAULIC FILL FOR ABANDONED SEWERS AND WATER MAINS must be the unit price bid per cubic yard for hydraulic fill for abandoned sewers and water mains and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to hydraulically fill the abandoned sewers and water mains, including the removal of sections of sewer and water main pipe if required to facilitate the hydraulic filling operation, the construction of brick bulkheads at each end of the fill, submittals and do all work incidental thereto, all in accordance with the contract drawings and specification, and as directed by the Engineer.

Payment for Hydraulic Fill For Abandoned Sewers And Water Mains will be made under the Item Number as calculated below:

The Item Number for Hydraulic Fill For Abandoned Sewers And Water Mains has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Hydraulic Fill For Abandoned Sewers And Water Mains:

72.11

(2) The sixth and seventh characters must define Hydraulic Fill For Abandoned Sewers And Water Mains:

HF - Hydraulic Fill For Abandoned Sewers And Water Mains

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
72.11HF	HYDRAULIC FILL FOR ABANDONED SEWERS AND WATER MAINS	C.Y.

SECTION 73.11 – ADDITIONAL BRICK MASONRY

73.11.1 DESCRIPTION

Additional brick masonry must be the brick masonry ordered in writing by the Engineer to be incorporated in the work exclusive of brick masonry for which payment is provided for under separate items. Additional brick masonry must also be the brick masonry shown, specified or ordered placed in water main structures in accordance with water main standard drawings.

73.11.2 MATERIALS

Brick masonry must be in accordance with **Section 23.02**.

Cement mortar must be in accordance with **Section 23.03**.

73.11.3 CONSTRUCTION METHODS

(1) The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

(2) Brick Masonry must comply with the provisions of **Subsection 23.02.9**.

(3) Brick must be laid to a line and with close joints, and all joints exposed to view must be pointed and must be left in a neat condition.

(4) All unfinished work must be racked back, or toothed, as directed, and before new work is joined to its surface, the bricks must be scraped, thoroughly cleaned and scrubbed with a stiff brush and well moistened.

73.11.4 MEASUREMENT

The quantity of brick masonry to be measured for payment must be the number of cubic yards of brick masonry furnished and incorporated into the work, complete, as shown, specified or required.

73.11.5 PRICE TO COVER

The contract price for Item No. 73.11AB - ADDITIONAL BRICK MASONRY must be the unit price bid per cubic yard for brick masonry and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to furnish, deliver and place the brick masonry and do all work incidental thereto, all in accordance with the plans, specifications and standards, and as directed by the Engineer.

Payment for Additional Brick Masonry will be made under the Item Number as calculated below:

The Item Number for Additional Brick Masonry has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Additional Brick Masonry:

73.11

(2) The sixth and seventh characters must define Additional Brick Masonry:

AB - Additional Brick Masonry (Not Less Than Item)

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
73.11AB	ADDITIONAL BRICK MASONRY (NOT LESS THAN $XX.XX/C.Y.)	C.Y.

SECTION 73.21 – ADDITIONAL CONCRETE

73.21.1 DESCRIPTION

Additional concrete must be the concrete masonry ordered in writing by the Engineer to be incorporated in the work exclusive of concrete masonry for which payment is provided under separate items.

Included therein must be all the concrete masonry:

(a) Ordered placed in the work outside the limits of the structures as shown on the contract plans or otherwise provided.

(b) For cradles and encasement under pipe sewers and drains except when the cradles and encasements are paid for under the prices bid for precast reinforced concrete pipe sewers, vitrified pipe sewers, ductile iron pipe sewers, cast iron pipe sewers, house connection drains or catch basin connection drains.

(c) For pile caps of sewers and structures on piles as shown on the Sewer Design Standards.

73.21.2 MATERIALS

Concrete must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

73.21.3 MEASUREMENT

The quantity of additional concrete to be measured for payment must be the number of cubic yards of additional concrete incorporated into the work, complete, as shown, specified or ordered.

73.21.4 PRICE TO COVER

The contract price for Item No. 73.21AC - ADDITIONAL CONCRETE must be the unit price bid per cubic yard for additional concrete and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to furnish, deliver and place the additional concrete, including form work and pumping, and do all work incidental thereto, all in accordance with the plans, specifications and standards, and as directed by the Engineer.

Where additional excavation is required or approved in writing by the Engineer below the subgrade of sewers or associated structures for placement of additional concrete, payment for this additional excavation must be paid for at the price bid for item(s) labeled "ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS".

No separate or additional payment will be made for any additional sheeting required due to the additional excavation, the cost of the additional sheeting must be included in the price bid for item(s) labeled "ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS".

Payment for Additional Concrete will be made under the Item Number as calculated below:

The Item Number for Additional Concrete has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Additional Concrete:

73.21

(2) The sixth and seventh characters must define Additional Concrete:

AC - Additional Concrete (Not Less Than Item)

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
73.21AC	ADDITIONAL CONCRETE (NOT LESS THAN $XX.XX/C.Y.)	C.Y.

SECTION 73.31 – ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS

73.31.1 DESCRIPTION

This section describes earth excavations other than normal trench excavations required and approved in writing by the Engineer.

73.31.2 CONSTRUCTION METHODS

During the course of work the Contractor may be required or ordered to perform additional earth excavation outside of or within the specified trenches or excavation. These additional earth excavations include, but are not limited to the following purposes:

(a) For the enlargement of trenches and excavations due to changes in the design of standard or special structures.

(b) For the removal of obstructions or unsuitable material below the subgrade of trenches and excavations, and for the placing of additional bedding or concrete below the standard subgrade of trenches and excavations.

(c) For the construction of additional structures, and for grading and for compacting.

(d) For test pits, exploratory borings and other excavations ordered made and not subsequently included within the limits of the trench in which the pipes, mains, structures and appurtenances are installed, or where such test pits, exploratory borings and other excavations are ordered backfilled prior to excavating the trench. Information regarding the types and strata of underlying material obtained by the subsurface exploration provide the basis for estimating the need for furnishing satisfactory backfill material; the findings must be properly logged and submitted to the Engineer for the Engineer's evaluation and records.

(e) To locate the ends of existing pipes, mains, or structures to which new pipes, mains or structures are to be connected and where such excavation is not part of the trench or excavations in which said new pipes, mains or structures are laid, or where such excavation is ordered backfilled prior to excavating the trench or excavation.

The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

73.31.3 MEASUREMENT

The quantity of additional earth excavation to be measured for payment is the number of cubic yards of material actually excavated, as ordered in writing by the Engineer, and as measured in its original position. No measurement for payment will be made for excavation beyond the limits ordered.

73.31.4 PRICE TO COVER

The contract price for "ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS" is the unit price bid per cubic yard for additional earth excavation (within limits specified) and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to excavate all materials of whatever nature encountered (See **Section 40.03 - Earth Excavation**) as specified or ordered, including the providing of all sheeting and bracing; modifications of sheeting systems; pumping; bridging; decking; cleaning up; disposal of surplus and rejected excavated material; grading and compacting of subgrades; and do all work incidental thereto, all in accordance with the plans, specifications and standards, and as directed by the Engineer.

In addition, included in the price hereunder must be the cost of all labor and materials necessary to remove all specified or ordered existing sewers, water mains, manholes and appurtenances, that may be in the line of the work and do all work incidental thereto, all in accordance with **Subsections 10.13 and 10.28** of the specifications and as directed by the Engineer.

Where the Engineer orders the area excavated under this item to be backfilled, the work must be done in accordance with **Section 40.06** and payment will be made as per **Section 70.81 - Clean Backfill and Section 73.41 - Additional Select Granular Backfill**.

All pavement disturbed, either within or outside the limits of the trench and excavation, must be replaced by the Contractor and payment will be made under the applicable items contained in the Bid Schedule.

Payment for Additional Earth Excavation Including Test Pits will be made under the Item Number as calculated below:

The Item Numbers for Additional Earth Excavation Including Test Pits have eight characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Additional Earth Excavation Including Test Pits:

73.31

(2) The sixth and seventh characters must define Additional Earth Excavation Including Test Pits:

AE - Additional Earth Excavation Including Test Pits (Not Less Than Item)

(3) The eighth characters must define the Depth Limits Below Existing Street Surface at which and to which additional earth excavation is performed:

0 - No Depth Limits (All Depths)
1 - 0' to 12'
2 - Over 12' to 16'
3 - Over 16' to 20'
4 - Over 20' to 24'
5 - Over 24'

(4) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	**Description**	**Pay Unit**
73.31AE0	ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS (ALL DEPTHS) (NOT LESS THAN $XX.XX/C.Y.)	C.Y.
73.31AE1	ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS (0' TO 12' DEPTH) (NOT LESS THAN $XX.XX/C.Y.)	C.Y.
73.31AE2	ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS (OVER 12' TO 16' DEPTH) (NOT LESS THAN $XX.XX/C.Y.)	C.Y.
73.31AE3	ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS (OVER 16' TO 20' DEPTH) (NOT LESS THAN $XX.XX/C.Y.)	C.Y.
73.31AE4	ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS (OVER 20' TO 24' DEPTH) (NOT LESS THAN $XX.XX/C.Y.)	C.Y.
73.31AE5	ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS (OVER 24' DEPTH) (NOT LESS THAN $XX.XX/C.Y.)	C.Y.

SECTION 73.41 – ADDITIONAL SELECT GRANULAR BACKFILL

73.41.1 DESCRIPTION

Additional select granular backfill must be the select granular fill ordered in writing by the Engineer to fill voids outside or within the limits of the ordered trenches and excavations. This backfill material must be exclusive of the normal backfill requirements as specified in **Subsection 40.06.2**.

73.41.2 MATERIALS

Select Granular Backfill must comply with the requirements of **Subsection 26.01.2(B)**.

If approved in writing by the Engineer, excavated material determined to be unsuitable, in accordance with **Subsection 40.06.2**, may be processed (i.e. screened and/or crushed) to produce select granular fill as specified herein. In such case, the material furnished in accordance with these specifications, to be used as specified in **Subsection 73.41.1** must be accepted for payment under the contract Item No. 73.41AG - ADDITIONAL SELECT GRANULAR BACKFILL computed in accordance with **Subsection 73.41.4**.

73.41.3 CONSTRUCTION METHODS

The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** must apply to the work to be done hereunder.

73.41.4 MEASUREMENT

The quantity of additional select granular backfill to be measured for payment must be the number of cubic yards of additional select granular backfill, as ordered in writing by the Engineer, in place after compaction and limited to the conditions specified in **Subsection 73.41.1**.

Where additional select granular backfill is ordered by the Engineer to be placed within the limits of the ordered trenches, the following must apply:

> If actual trench widths are less than either payment maximums stated in **Subsections 40.02.4(A)(2) and 40.02.4(B)(1)**, those smaller widths must serve as the basis upon which the actual volume of substituted select granular backfill is measured for purposes of determining additional compensation. If, however, actual trench widths exceed those maximums, no payment will be made for select granular backfill placed outside these established limits. The cost of such excess backfill must be borne solely and exclusively by the Contractor.

Where impracticable to measure additional select granular backfill in place, measurements may be made in scows and vehicles, and the quantity to be paid for will be eight-tenths (8/10) of the yardage determined by such measurements.

73.41.5 PRICE TO COVER

The contract price for Item No. 73.41AG - ADDITIONAL SELECT GRANULAR BACKFILL must be the unit price bid per cubic yard for additional select granular backfill and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to furnish, deliver, place, compact, sample and test the additional select granular backfill material and to do all work incidental thereto, all in accordance with the plans and specifications, and as directed by the Engineer.

73.41.6 NO SEPARATE PAYMENT

No separate or additional payment will be made under this item for the furnishing, delivering, placing and compacting of Select Granular Fill material within the areas as described under **Subsections 40.06.2(B)(2), 40.06.2(B)(3) and 40.06.2(B)(4)**, the cost of which is deemed included in the prices bid for all contract items of work.

Payment for Additional Select Granular Backfill will be made under the Item Number as calculated below:

> The Item Number for Additional Select Granular Backfill has seven characters. (The decimal point is considered a character, the third character.)
>
> (1) The first five characters must define Additional Select Granular Backfill:

73.41

(2) The sixth and seventh characters must define Additional Select Granular Backfill:

AG - Additional Select Granular Backfill (Not Less Than Item)

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
73.41AG	ADDITIONAL SELECT GRANULAR BACKFILL (NOT LESS THAN $XX.XX/C.Y.)	C.Y.

SECTION 73.51 – ADDITIONAL STEEL REINFORCING BARS

73.51.1 DESCRIPTION

Additional steel reinforcing bars must be the steel reinforcing bars ordered in writing by the Engineer to be incorporated in the work exclusive of steel reinforcing bars for which payment is provided under separate items.

Included therein must be all the steel reinforcing bars placed in pile caps of sewers and structures on piles as shown on the Sewer Design Standards.

73.51.2 MATERIALS

Reinforcement must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

73.51.3 CONSTRUCTION METHODS

Construction methods for fabricating, protecting, bending, splicing, lapping, supporting and placing steel reinforcing bars must comply with the requirements of **General Specification 11 - Concrete, as modified in Section 23.01**.

73.51.4 MEASUREMENT

The quantity of additional steel reinforcing bars to be measured for payment is the number of pounds of steel reinforcing bars incorporated into the work, complete, as shown, specified or required.

73.51.5 PRICE TO COVER

The contract price for Item No. 73.51AS - ADDITIONAL STEEL REINFORCING BARS is the unit price bid per pound for additional steel reinforcing bars and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to furnish, deliver and place the additional steel reinforcing bars and do all work incidental thereto, all in accordance with the plans, specifications and standards, and as directed by the Engineer.

Payment for Additional Steel Reinforcing Bars will be made under the Item Number as calculated below:

The Item Number for Additional Steel Reinforcing Bars has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Additional Steel Reinforcing Bars:

73.51

(2) The sixth and seventh characters must define Additional Steel Reinforcing Bars:

AS - Additional Steel Reinforcing Bars (Not Less Than Item)

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
73.51AS	ADDITIONAL STEEL REINFORCING BARS (NOT LESS THAN LBS. $XX.XX/LB.)	

SECTION 73.61 – ADDITIONAL STONE BALLAST

73.61.1 DESCRIPTION

Additional stone ballast must be the stone ballast ordered in writing by the Engineer to fill voids outside the limits of the ordered trenches and excavations. This stone ballast material must be exclusive of the stone ballast requirements as shown on the plans, specified in specifications and standards, ordered by the Engineer to be used within the limits of the ordered trenches and excavations, and to fill voids in the subgrade of trenches caused by the removal of boulders, rock, unsuitable subgrade material, existing sewers and associated structures.

Where the Engineer deems it necessary to order the smaller coarse aggregate material broken stone to fill voids outside the limits of the ordered trenches and excavations, payment must be made under **Subsection 73.61.5**.

73.61.2 MATERIALS

Stone ballast or broken stone must be in accordance with **Section 26.02**.

73.61.3 CONSTRUCTION METHODS

The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** apply to the work to be done hereunder.

Stone ballast or broken stone must be deposited in such a manner as to form a compact mass.

73.61.4 MEASUREMENTS

The quantity of additional stone ballast to be measured for payment must be the number of cubic yards of additional stone ballast or broken stone, as ordered in writing by the Engineer, incorporated into the work and limited to the conditions specified in **Subsection 73.61.1** of the specifications.

73.61.5 PRICE TO COVER

The contract price for Item No. 73.61AT - ADDITIONAL STONE BALLAST must be the unit price bid per cubic yard for additional stone ballast and must cover the cost of all labor, materials, plant, equipment, samples, tests and insurance required and necessary to furnish, deliver and place the additional stone ballast material and to do all work incidental thereto, all in accordance with the plans and specifications, and as directed by the Engineer. Included in the price hereunder must be the cost for broken stone when ordered by the Engineer in writing as a substitute for stone ballast under this additional stone ballast item.

Payment for Additional Stone Ballast will be made under the Item Number as calculated below:

The Item Number for Additional Stone Ballast has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Additional Stone Ballast:

73.61

(2) The sixth and seventh characters must define Additional Stone Ballast:

AT - Additional Stone Ballast (Not Less Than Item)

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
73.61AT	ADDITIONAL STONE BALLAST (NOT LESS THAN $XX.XX/LB.)	C.Y.

SECTION 74.11 – MAINTENANCE AND PROTECTION OF TRAFFIC

74.11.1 DESCRIPTION

Maintenance And Protection Of Traffic must be done in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 6.70 - Maintenance And Protection Of Traffic**.

Payment for Maintenance And Protection Of Traffic will be made under various NYCDOT Item Numbers. Examples of these NYCDOT Item Numbers are listed below:

Item No.	Description	Pay Unit
6.70	MAINTENANCE AND PROTECTION OF TRAFFIC (NOT LESS THAN $XX.XX/L.S.)	L.S.
6.25 RS	TEMPORARY SIGNS	S.F.
6.26	TIMBER CURB	L.F.
6.28 AA	LIGHTED TIMBER BARRICADES	L.F.
6.28 AB	UNLIGHTED TIMBER BARRICADES	L.F.
6.28 BA	LIGHTED TYPE III BREAKAWAY BARRICADES	L.F.
6.28 BB	UNLIGHTED TYPE III BREAKAWAY BARRICADES	L.F.
6.49	TEMPORARY PAVEMENT MARKINGS (4” WIDE)	L.F.
6.52	UNIFORMED FULL-TIME FLAGPERSON	P/HR
6.53	REMOVE EXISTING LANE MARKINGS (4” WIDE)	L.F.
6.59 P	TEMPORARY CONCRETE BARRIER	L.F.
6.59 PH	TEMPORARY CONCRETE BARRIER, HALF SECTION	L.F.
6.85 A	TRAFFIC ENFORCEMENT AGENTS	F.S.
6.87	PLASTIC BARRELS	EACH
7.36	PEDESTRIAN STEEL BARRICADES	L.F.
8.07	TEMPORARY ALUMINUM PEDESTRIAN BRIDGE	EACH
8.08	VARIABLE MESSAGE BOARD	EACH
9.99	FLASHING ARROW BOARD	EACH
9.99 A	FLASHING ARROW BOARD WITH IMPACT ATTENUATOR	EACH
9.99 D	FLASHING ARROW BOARD	DAY
9.99 AD	FLASHING ARROW BOARD WITH IMPACT ATTENUATOR	DAY
9.99 M	FLASHING ARROW BOARD	MONTH
9.99 AM	FLASHING ARROW BOARD WITH IMPACT ATTENUATOR	MONTH

SECTION 74.21 – MAINTENANCE OF SITE

74.21.1 DESCRIPTION

Maintenance Of Site must be done in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 7.13 - Maintenance Of Site**.

Payment for Maintenance Of Site will be made under the NYCDOT Item Numbers listed below:

Item No.	Description	Pay Unit
7.13 A	MAINTENANCE OF SITE (NOT LESS THAN $XX.XX/L.S.)	L.S.
7.13 B	MAINTENANCE OF SITE (NOT LESS THAN $XX.XX/MONTH)	MONTH

SECTION 75.11 – REMOVAL OF ABANDONED TRACKS

75.11.1 DESCRIPTION

Abandoned track system rails, ties, yokes, “I” beams, concrete ducts, main conduit, rail and yoke footings and foundations may be found buried beneath the existing pavement in the line of the work. Where such a condition is encountered, the Contractor must cut and remove the track system rails, ties, yokes, “I” beams, concrete ducts, main conduit, rail and yoke footings and foundations within the limits of the trench and in a manner as defined herein.

75.11.2 CONSTRUCTION METHODS

(A) Where both rails of the track system lie within the trench limit, all rails, ties, yokes, “I” beams, concrete ducts, main conduit, rail and yoke footings and foundations must be cut and removed from the site.

(B) Where only one (1) rail of the track system lies within the trench limit, all components within the trench limits and within a minimum distance of two (2) feet beyond the sheeting line must be cut and removed from the site.

(C) All material removed hereunder must become the property of the Contractor, unless otherwise provided, and must be disposed of away from the site by the Contractor.

75.11.3 MEASUREMENT

The quantity of removal of abandoned tracks to be measured for payment must be the number of linear feet of trench where removal of track system components in part or in full are removed, as shown, specified or required.

75.11.4 PRICE TO COVER

The contract price for Item No. 75.11RT - REMOVAL OF ABANDONED TRACKS must be the unit price bid per linear foot of trench where removal of track system components in part or in full are removed and must cover the cost of all labor, materials, plant, equipment and insurance required and necessary to cut, excavate and remove from the site of work the track system components, and do all work incidental thereto, all in accordance with the plans and specifications, and as directed by the Engineer.

Included in the price hereunder must be the cost of any additional excavation, backfilling, compacting, and temporary and permanent restoration of all disturbed sidewalk and pavement areas required in order to cut and remove that part of the track system and restore the area that is within a minimum distance of two (2) feet beyond the sheeting line as specified in **Subsection 75.11.2(B)** (unless items for temporary and permanent restoration are otherwise provided in the Bid Schedule).

Payment for Removal Of Abandoned Tracks will be made under the Item Number as calculated below:

The Item Number for Removal Of Abandoned Tracks has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Removal Of Abandoned Tracks:

75.11

(2) The sixth and seventh characters must define Removal Of Abandoned Tracks:

RT - Removal Of Abandoned Tracks

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
75.11RT	REMOVAL OF ABANDONED TRACKS	L.F.

SECTION 76.11 – CONSTRUCTION REPORT

76.11.1 INTENT

The intent of this section is to prepare a preconstruction report for work to be performed under the contract to ensure that the Contractor's proposed means and methods of construction do not create or aggravate any potentially dangerous conditions. In order to ascertain the effects of construction on structures, the Contractor will be required to retain the services of a qualified firm with experience in structural engineering, soil mechanics, foundations, installation of piles, evaluation of the effect of construction on buildings and structures, effects of tunneling operations and tunneling shaft construction on buildings and structures, effects of dewatering and the associated movement of soil due to dewatering and the effect of vibrations upon structures. All construction work (roadway, sidewalk, curb, sewer, water main, etc.) is subject to the preconstruction report.

76.11.2 SPECIAL EXPERIENCE REQUIREMENTS

Within thirty (30) days of the award of this contract, the Contractor must submit to the Commissioner qualifications of the firm it proposes to provide the engineering services described in this section. The proposed firm must meet the following special experience requirements.

(1) Such firm must, within the last three (3) consecutive years, have successfully provided engineering services similar to the services described in this section on a minimum of two (2) comparable projects.

(2) Such firm must carry professional liability insurance as specified in Schedule "A".

Compliance with such special experience requirements will be determined solely by the Commissioner. Once a firm is approved, no substitution will be permitted, unless the Commissioner has approved the qualifications of the proposed replacement in writing in advance. If the qualifications of the proposed firm are NOT ACCEPTABLE , the Contractor must submit the qualifications of another proposed firm within fifteen (15) days of notice to do so.

76.11.3 SUBMISSION OF PRECONSTRUCTION REPORT

Upon approval and prior to construction the chosen firm (hereinafter referred to as the firm) must submit six (6) copies of a report incorporating their findings and recommendations. The report must be prepared by or under the immediate direction of a New York State Licensed Professional Engineer as evidenced by the imprint of the Professional Engineer's seal and signature on the document. The report must include but not be limited to the following:

(A) a detailed description of the Contractor's proposed means and methods of construction including the installation of the sheeting system, pile system, tunneling system and dewatering system.

(B) an inspection of the interior and exterior (including photographs and digital audio-visual recordings as required) of all building and/or structures that may be affected by the proposed means and methods of construction and dewatering.

(C) a definition of the "radius of influence" that the proposed dewatering, pile installation and other construction activity will impart on the surrounding soil.

(D) a definition of the limits of horizontal and vertical movement each building and/or structure within the "radius of influence" can tolerate without damage to the structural integrity of that building and/or structure. Movements which must be considered include, but are not limited to, vibration-related settlements, differential settlements, settlements from dewatering, and building movement and/or rotation due to excavation or construction-related work.

(E) a complete study of the vibrations that each building can tolerate along with the anticipated vibrations promulgated by the means and methods of construction, taking into account the age and condition of the buildings.

(F) a statement that the limits of movement and vibrations as defined in (D) and (E) above will not be exceeded as a result of the proposed means and methods of construction, as well as means and methods the Contractor, at the Contractor's own expense, will employ should any limits be exceeded.

(G) a geological profile of the soils in the area. This profile must be based upon the boring logs taken for this project. The Contractor, at own discretion, may make additional borings to supplement the boring logs taken for the project. Supplemental borings made by the Contractor must be at no additional cost

to the City, the cost for these borings must be included in the price bid for Item No. 76.11CR - CONSTRUCTION REPORT.

(H) a geotechnical data summary including assumed values for the physical and strength characteristics of the soils shown on the Record(s) of Borings, developed from, but not limited to available soil and/or rock descriptions, blow counts, and available geotechnical laboratory testing. Such physical and strength characteristics include, but are not limited to, a soil's unit weight, friction angle, cohesion, consolidation properties, and permeability/drainage properties.

(I) engineering computations to substantiate any values stated, recommended, or defined in (C), (D) and (E), using the appropriate data from (G) and (H).

The report must include all field notes, measurements and photographs and digital audio-visual recordings, as required, of existing conditions which may be aggravated by the proposed construction work and must include a visual inspection of the interior and exterior of all buildings within the radius of influence of construction activity and dewatering. A view of each exterior face of the building and/or structure is required. Additional interior photographs must be taken to show any existing cosmetic or structural damage on buildings.

Applications for consents to enter buildings for the purpose of inspection must state that the inspection is necessary to ensure the structural integrity of the building. One counterpart of each consent, duly signed and acknowledged by the owner or one of the owners, executors or administrators for the owner and for the owner's agents, lessee and any other persons who must have a vested or contingent interest in the building, or notice of refusal if consent is not obtained must be filed with the Engineer at least ten (10) days before the commencement of work which affect the building or structure.

The report must also include recommendations or comments regarding any potentially dangerous and/or unsafe conditions uncovered along with all other additional information required pursuant to other sections of the specifications.

All results of the building or structure examinations must be incorporated into the preconstruction report.

No work may begin until the Department of Design and Construction has accepted the preconstruction report. This pertains to all contract work and no exceptions will be allowed unless otherwise stated in these specifications.

76.11.4 PRICE TO COVER

The contract price for Item No. 76.11CR - CONSTRUCTION REPORT must be a lump sum price and must include the cost of all labor, materials, plant, equipment and insurance necessary or required to prepare the preconstruction report, including building examinations and do all other work incidental thereto all in accordance with the specifications and as directed by the Engineer.

76.11.5 PAYMENT

No payment for the preconstruction report will be made until after the Department of Design and Construction has accepted the preconstruction report.

Payment for Construction Report will be made under the Item Number as calculated below:

The Item Number for Construction Report has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Construction Report:

76.11

(2) The sixth and seventh characters must define Construction Report:

CR - Construction Report

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
76.11CR	CONSTRUCTION REPORT	L.S.

SECTION 76.21 – MONITORING AND POST CONSTRUCTION REPORT

76.21.1 INTENT

The intent of this section is to monitor and summarize the effects of construction activities on structures located within the influence line of work to be performed under the contract to ensure that the Contractor's proposed means and methods of construction do not create or aggravate any potentially dangerous conditions.

The Contractor will be required to adhere to all criteria, requirements and recommendations of the preconstruction report.

76.21.2 SPECIAL EXPERIENCE REQUIREMENTS

Within thirty (30) days of the award of this contract, the Contractor must submit to the Commissioner qualifications of the firm it proposes to provide the engineering services described in this section. The proposed firm must meet the following special experience requirements.

(1) Such firm must, within the last three (3) consecutive years, have successfully provided engineering services similar to the services described in this section on a minimum of two (2) comparable projects.

(2) Such firm must carry professional liability insurance as specified in Schedule "A".

Compliance with such special experience requirements will be determined solely by the Commissioner. Once a firm is approved, no substitution will be permitted, unless the Commissioner has approved the qualifications of the proposed replacement in writing in advance. If the qualifications of the proposed firm are NOT ACCEPTABLE , the Contractor must submit the qualifications of another proposed firm within fifteen (15) days of notice to do so.

The firm approved for the preparation of the preconstruction report in accordance with **Section 76.11 - Construction Report**, may also be submitted for approval to perform the monitoring and post-construction report work.

76.21.3 SUBMISSIONS

(A) MONITORING REPORTS

The firm will be required to perform the monitoring during construction activity and submit reports to the Engineer on a weekly basis. These reports must include sketches noting the location of all monitoring points. Should any of the criteria set forth in the preconstruction report be exceeded, the Engineer must be notified immediately. Monitoring must include but not be limited to the following:

(1) Settlement Monitoring

(a) For Existing Structures And/Or Buildings:

(i) A series of reference points must be established outside of the "radius of influence" (as previously described in **Subsection 76.11.3, paragraph (C)**) for monitoring structural settlements. All initial and subsequent readings must be taken to the nearest one-hundredth (0.01) of a foot.

(ii) Structures and/or buildings must be monitored daily for vertical and horizontal movement with respect to the trench when work is being performed within the radius of influence. Upon completion of work within the radius of influence, buildings and/or structures must be monitored weekly for the first month then monthly for the next five (5) months. In the event of an unusual event (e.g. water main break or abnormal flooding) monitoring must be performed within twenty-four (24) hours of the event.

(iii) Should the limit of horizontal and/or vertical movement, as set forth in the preconstruction report, of any building and/or structure be exceeded, the Contractor must immediately and concurrently notify the Engineer and, at the Contractor's own expense, follow the steps included in the preconstruction report outlined in **Subsection 76.11.3, paragraph (F)** to rectify the situation and prevent any further settlement of such building and/or structure. The Contractor is fully responsible for any damages to any foundations, walls or other portions of buildings and/or structures that may result during the courses of this construction. Any damage done by the Contractor, whether it is accidental or due to negligence or

carelessness in performing the work included in this contract must be made good by the Contractor at the Contractor's own expense.

(b) For Columns And/Or Overhead Structures (When pile installation is being performed.):

(i) Settlement points must be installed at all columns of overhead structures adjacent to proposed sewer or water main construction work. A minimum of two (2) settlement points must be established at each column.

(ii) A minimum of two (2) benchmarks must be established for the settlement monitoring. The benchmark should be a minimum of fifty (50) feet distance from the columns and sewer or water main construction work alignment.

(iii) The initial survey of the settlement points must be done prior to pile installation within one hundred (100) feet of the columns.

(iv) A warning must be issued if settlement reaches 1/8-inch.

(v) All pile installation work within one hundred (100) feet of the columns must be stopped if settlement reaches 1/4-inch.

(vi) Frequency of settlement monitoring must be as follows:

(1) Pile installation between fifty (50) feet and one hundred (100) feet distance from the columns; once every four (4) days.

(2) Pile installation within fifty (50) feet of the columns; once every two (2) days.

(3) If the settlement reaches 1/8-inch; once a day.

(c) All survey readings must be done by or under the immediate supervision of a Licensed Land Surveyor, currently registered in the State of New York. All survey readings must include the imprint of the Surveyor's seal and signature.

(d) The Contractor must transmit a copy of all readings to the Engineer on the same day they are taken.

(2) Vibration Monitoring

(a) For Existing Structures And/Or Buildings:

(i) Should the Contractor employ means and methods of construction that will result in vibrations being imparted to the surrounding soil and/or buildings and/or structures, the Contractor must monitor and record particle velocity. Locations of the monitoring points must be placed in such a manner so as to ensure recordings that reveal any possibility of damage to existing structures and/or buildings.

(ii) These points must be monitored at all times when means and methods of construction resulting in vibrations are employed. The maximum permissible peak particle velocity must be that noted in the preconstruction report. Should particle velocities be exceeded the Contractor must immediately cease operations and resort to another method which will eliminate or minimize the effect of vibrations.

(iii) It is the Contractor's responsibility to restore any buildings or structures damaged as a result of the Contractor's operations to its original condition or better.

(b) For Columns And/Or Overhead Structures (When pile installation is being performed.):

(i) Vibrations at the columns must be monitored during the installation of piles that are between fifty (50) feet and one hundred (100) feet from the columns.

(ii) A total of two (2) seismographs must be used for the monitoring; one (1) at each of the closest two (2) columns from pile installation.

(iii) Check the ambient vibration prior to vibration monitoring.

(iv) The allowable limit of vibration during pile driving is 0.5-inch per second (in particle velocity) above the ambient vibration level. Stop pile driving if the vibration exceeds 0.5-inch per second above ambient.

(c) The results of the vibration monitoring must be submitted to the Engineer on the same day of monitoring.

(B) POST-CONSTRUCTION REPORT

Within thirty (30) days of the completion of all work that necessitated monitoring, the chosen firm must prepare and submit six (6) copies of a report detailing the results of the monitoring program. The report must include a comparison of all assumptions and field-measured values. Should there be excessive discrepancies between the assumptions and field-measured values, an explanation must be presented within the report. This report must include sketches of all monitoring points. Should this contract provide for the installation of piles the report must include the location and length of all piles driven superimposed on the geological profile. The Engineer must provide the location and lengths of piles. The post-construction report must be prepared by or under the immediate direction of a New York State Licensed Professional Engineer as evidenced by the imprint of the Professional Engineer's seal and signature on the document.

76.21.4 RESPONSIBILITIES OF THE CONTRACTOR

Prior to bidding the Contractor must examine the site and available subsurface inspection information and formulate means and methods of construction that will not result in any damage to existing structures. Should the Contractor lack the expertise in evaluating the effects of the Contractor's means and methods of construction, the Contractor should prepare the Contractor's bid in consultation with an experienced firm or authority. In any event, the Contractor will be held liable for any damage to any existing structures due to the Contractor's means and methods of construction.

In addition, should the results of the preconstruction report indicate that damage will result from the Contractor's proposed means and methods of construction, the Contractor will be required to amend the Contractor's means and methods of construction in accordance with the preconstruction report, at no additional cost to the City.

76.21.5 PRICE TO COVER

The contract price for Item No. 76.21MR - MONITORING AND POST-CONSTRUCTION REPORT must be a lump sum price and must include the cost of all labor, materials, plant, equipment and insurance necessary or required to prepare weekly reports, examine buildings and structures, perform the construction monitoring, prepare the post-construction report and do all other work incidental thereto all in accordance with the specifications, and as directed by the Engineer.

76.21.6 NO SEPARATE OR ADDITIONAL PAYMENT

No separate or additional payment will be made for compliance with the requirements of the preconstruction report including, but not limited to, any modification to the Contractor's means and methods of construction.

76.21.7 PAYMENT

Payment for this work must be made under Item No. 76.21MR - MONITORING AND POST-CONSTRUCTION REPORT and proportional to the work completed as follows:

Completion of Field Monitoring	60%
Acceptance of Post-Construction Report	40%

Payment for Monitoring And Post-Construction Report will be made under the Item Number as calculated below:

The Item Number for Monitoring And Post-Construction Report has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Monitoring And Post-Construction Report:

76.21

(2) The sixth and seventh characters must define Monitoring And Post-Construction Report:

MR - Monitoring And Post-Construction Report

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
76.21MR	MONITORING AND POST-CONSTRUCTION REPORT	L.S.

SECTION 76.31 – CONTINUOUS REAL TIME MONITORING FOR VIBRATIONS AND MOVEMENTS AND POST CONSTRUCTION REPORT

76.31.1 INTENT

The intent of this section is to continuously monitor building and/or structure movements and construction-related vibrations in real-time at the specified location(s) and summarize the effects of construction activities on buildings and/or structures at the specified location(s) to ensure that the Contractor's proposed construction methods do not create or aggravate any potentially dangerous conditions.

The Contractor will be required to perform real-time and continuous monitoring of building and/or structure movements and vibrations at the specified location(s) for a period of one (1) month prior to the start of construct activities at the specified location(s), to provide a baseline for subsequent data comparison during construction activities.

Then the Contractor must commence monitoring at the specified location(s) when any construction activity is performed within one hundred (100) feet of the specified location(s). Once construction starts within the area specified above, the Contractor must monitor the specified location(s) continuously and for a period up to three (3) weeks after completion of construction activities in this area. These construction activities include the construction of all sewers, water mains, appurtenances, final restoration of pavements and all other activities the Engineer determines impacts the specified location(s).

The Contractor will be required to adhere to all criteria, requirements and recommendations of the preconstruction report.

76.31.2 SPECIAL EXPERIENCE REQUIREMENTS

Within thirty (30) days of the award of this contract, the Contractor must submit to the Commissioner qualifications of the firm it proposes to provide the engineering services described in this section. The proposed firm must meet the following special experience requirements.

(1) Such firm must, within the last three (3) consecutive years, have successfully provided engineering services similar to the services described in this section on a minimum of two (2) comparable projects.

(2) Such firm must carry professional liability insurance as specified in Schedule "A".

Compliance with such special experience requirements will be determined solely by the Commissioner. Once a firm is approved, no substitution will be permitted, unless the Commissioner has approved the qualifications of the proposed replacement in writing in advance. If the qualifications of the proposed firm are NOT ACCEPTABLE , the Contractor must submit the qualifications of another proposed firm within fifteen (15) days of notice to do so.

The firm approved for the preparation of the preconstruction report in accordance with **Section 76.11 - Construction Report**, may also be submitted for approval to perform the continuous real-time monitoring for vibrations and movements and post-construction report work.

76.31.3 SUBMISSIONS

The firm will be required to perform the monitoring during construction activity and submit reports to the Engineer on a weekly basis. These reports must include sketches noting the location of all monitoring points. Should any of the criteria set forth in the preconstruction report be exceeded, the Engineer must be notified immediately. Monitoring must include but not be limited to the following:

(A) Monitoring Structural Movement (Horizontal And Vertical)

(1) The Contractor must provide high quality precision optical survey prism targets in conjunction with robotic total stations under computer control to provide real-time movement monitoring of points at location(s) specified. The system must provide the means for all parties involved in the project to be able to remotely monitor the three components of movement of the specified points in real-time.

(2) The monitoring system must provide three-dimensional displacement vectors for all the survey prisms with a measurement precision of plus or minus 1-millimeter for sight distances up to 100-meters.

(3) The monitoring system must have been proven to have the performance and precision specified herein for monitoring the deformation of structures at a minimum of ten (10) projects of similar magnitude.

(4) Each system must consist of:

(a) One robotic total station(s) including antitheft support and brackets.

(b) High quality precision optical survey prism targets.

(c) On-site equipment to operate the total station and communicate with the main computer. This equipment must be secured in a NEMA 4 (IP56) enclosure and must include the appropriate power supply, connections, backup battery, transceiver modem, and associated cabling.

(d) The site to designated office data transmission link must be designed so that the digital transmission of data between the total station controller and the Central Monitoring Location is done safely and without disturbing the ongoing work at any time. A wireless solution may be used when appropriate.

(5) The total station(s) must be installed on sturdy structures. The location(s) must be approved by the Engineer.

(6) The monitoring system must include a weather station and be capable of computing real-time ambient temperature, pressure, and humidity data to compensate for the effect of refraction on optical readings of the total station(s).

(7) The monitoring system must include statistical analyses to be made at the end of each cycle of readings, in order to maximize the precision of the measurements in real-time.

(8) The monitoring system must include a programmable limited search window and search time for any prism target so that, if the search is unsuccessful because of prism damage or other causes, the system will pass to the next target in the cycle. In such case, the system must not report any data and indicate that the target cannot be seen. Should the system still not be able to find and read this target during the following cycle, the system must broadcast an alarm message, indicating that the prism is missing.

(9) The monitoring system must include an alarm system featuring at least six (6) fully programmable threshold limits for each and every acquisition point. Each one of the six (6) limits must be able to trigger an email, a text message or an automated phone call to a predefined list of recipients.

(10) The monitoring system must be capable of providing real-time three-directional online information for as much as one hundred (100) prism targets per total station and per hour.

(11) The monitoring system must be able to provide real-time differential calculations between designated prism targets.

(12) A minimum of eight (8) reference targets, per total station, must be set up at sturdy structures that are outside the zone of construction influence. The reference targets must be read by the total stations during each cycle and the data collected for these reference targets must be used to automatically compensate for any movement of the total stations.

(13) The monitoring system must be designed to never lose setup information and acquired data. It must also be capable of still acquiring data for a minimum of seventy-two (72) hours in case of a loss of power.

(14) The monitoring system must have the ability of processing, in real-time, a global least squares adjustment of data that are acquired by a specific group of total stations so that if one or more total stations in the group require the use of a reference target associated with a different total station, a global monitoring network can be set up to relate to the total amount of reference targets available in the group.

(15) In order to provide a manual check of the continuous monitoring system, the Contractor must also engage a licensed surveyor to measure movements at the beginning and end of each work day, at the location(s) where work was done during that particular work day. Readings must be referenced and compared to the optical prisms used for continuous monitoring. The manual readings must be done by or under the immediate supervision of a Licensed Land Surveyor,

currently registered in the State of New York as evidenced by the imprint of the Surveyor's seal and signature.

(16) The Contractor must transmit a copy of all readings to the Engineer on the same day they are taken.

(17) Should the limit of horizontal and/or vertical movement exceed one-quarter (1/4) inch in any direction, as stipulated in the New York City Department of Building's Technical Policy and Procedure Notice No. 10/88, the Contractor must immediately notify the Engineer. The Contractor at the Contractor's own expense must take steps to rectify the situation and prevent any further settlement or movement of such building and/or structure. The Contractor must be fully responsible for any damages to any foundations, walls or other portions of buildings and/or structures that may result during the courses of this construction. Any damage caused by the Contractor, whether it is accidental or due to negligence or carelessness in performing the work included in this contract, must be made good by the Contractor at the Contractor's own expense.

(B) Monitoring Construction Vibrations

(1) The Contractor must provide equipment to continuously monitor and record particle velocities and frequencies resulting from construction activities, and provide real-time monitoring. The equipment must be able to monitor the particle velocities and frequency ranges listed below. The equipment must be linked with the equipment for monitoring structural movements, providing the means for all parties involved in the project to remotely monitor real-time vibrations.

(2) Unless otherwise stated in the preconstruction report for the project, vibrations from construction activities must not exceed the following maximum limits:

(a) 0.3-inches per second (ips) when frequencies are less than or equal to 20-Hertz (Hz), and

(b) 0.5-ips when frequencies are greater than 20-Hz.

(3) The Contractor must install no less than twelve (12) vibration monitors, equally spaced, directly in front of the specified location(s).

(4) The vibration monitors must be linked to the same Central Monitoring Location as the monitors for structural movement. The collected data must be sent to the Central Monitoring Location via wired or wireless transmission. The method used for data transmission must neither disturb nor interfere with ongoing work at any time.

(5) The Contractor must provide adequate means to protect the vibration monitors, cables, terminals, and any related appurtenances from damage. Should a vibration monitor become damaged during the course of work, the Contractor must notify the Engineer and provide an equal replacement as soon as possible.

(6) The Contractor must provide power (electric or batteries) to the vibration monitors. If battery-operated equipment is used, the Contractor must change/replace/recharge the batteries as needed, according to the monitoring equipment manufacturer's recommendations.

(7) In order to provide a manual check of the continuous vibration monitoring, the Contractor must provide a traditional vibration monitoring point at the location(s) where work is performed each work day. The vibration equipment should be capable of measuring the peak particle velocities indicated in **Subsection 76.31.3(B)(2)**, and be able to provide a printout (either directly at the equipment's terminal or downloadable to a computer). The Contractor must transmit a copy of these reading to the Engineer on the same day they are recorded.

(8) In the event the vibration limits are exceeded, the Contractor must cease operations and immediately notify the Engineer. The Contractor and Engineer must discuss the work being performed at the time the vibration limit was exceeded, as well as methods to eliminate or reduce the magnitude of subsequent vibrations. No additional payment to the Contractor will be made for using equipment and methods needed to reduce construction activity vibrations.

(9) It is the Contractor's responsibility to repair any damage caused as a result of vibrations exceeding the maximum limits listed in **Subsection 76.31.3(B)(2)**.

(C) Post-Construction Report

Within thirty (30) days of the completion of the monitoring at the specified location(s) the chosen firm must prepare and submit six (6) copies of a report detailing the results of the monitoring program. The report must include a comparison of all assumptions and all automated and field-measured values. Should there be excessive discrepancies between the assumptions and automated and field-measured values, an explanation must be presented within the report. This report must include sketches of all monitoring points. Should this contract provide for the installation of piles the report must include the location and length of all piles driven superimposed on the geological profile. The Engineer must provide the location and lengths of piles. The post-construction report must be prepared by or under the immediate direction of a New York State Licensed Professional Engineer as evidenced by the imprint of the Professional Engineer's seal and signature on the document.

76.31.4 RESPONSIBILITIES OF THE CONTRACTOR

Prior to bidding the Contractor must examine the site and available subsurface inspection information and formulate means and methods of construction that will not result in any damage to the existing buildings and/or structures. Should the Contractor lack the expertise in evaluating the effects of the Contractor's means and methods of construction, the Contractor should prepare the Contractor's bid in consultation with an experienced firm or authority. In any event, the Contractor will be held liable for any damage to any existing building and/or structure due to the Contractor's means and methods of construction.

In addition, should the findings of the preconstruction report indicate that damage will result from the Contractor's proposed means and methods of construction, the Contractor will be required to amend the Contractor's means and methods of construction in accordance with the preconstruction report, at no additional cost to the City.

76.31.5 PRICE TO COVER

The contract price for Item No. 76.31CM - CONTINUOUS REAL-TIME MONITORING FOR VIBRATIONS AND MOVEMENTS AND POST-CONSTRUCTION REPORT must be the unit price bid per month and must include the cost of all labor, materials, plant, equipment and insurance necessary or required to prepare weekly reports, examine buildings and/or structures, perform the construction monitoring, prepare the post-construction report and do all other work incidental thereto all in accordance with the specifications, and as directed by the Engineer.

76.31.6 NO SEPARATE OR ADDITIONAL PAYMENT

No separate or additional payment will be made for compliance with the requirements of the preconstruction report including, but not limited to, any modification to the Contractor's means and methods of construction.

76.31.7 PAYMENT

Payment for the final month of Item No. 76.31CM - CONTINUOUS REAL-TIME MONITORING FOR VIBRATIONS AND MOVEMENTS AND POST-CONSTRUCTION REPORT will be withheld and will not be made until after the New York City Department of Design and Construction has accepted the Post-Construction Report.

Payment for Continuous Real-Time Monitoring For Vibrations And Movements And Post-Construction Report will be made under the Item Number as calculated below:

The Item Number for Continuous Real-Time Monitoring For Vibrations And Movements And Post-Construction Report has seven characters. (The decimal point is considered a character, the third character.)

(1) The first five characters must define Continuous Real-Time Monitoring For Vibrations And Movements And Post-Construction Report:

76.31

(2) The sixth and seventh characters must define Continuous Real-Time Monitoring For Vibrations And Movements And Post-Construction Report:

CM - Continuous Real-Time Monitoring For Vibrations
And Movements And Post-Construction Report

(3) The Item Number together with Description and Pay Unit as provided in the Bid Schedule is provided below:

Item No.	Description	Pay Unit
76.31CM	CONTINUOUS REAL-TIME MONITORING FOR VIBRATIONS AND MONTH MOVEMENTS AND POST-CONSTRUCTION REPORT	

SECTION 77.11 – TREES (PROTECTION, PRUNING, REMOVAL, TRANSPLANTING, AND PLANTING)

77.11.1 DESCRIPTION

Trees (Removal, Transplanting And Planting) must be done in accordance with **Subsection 10.06 and New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 4.16 - Trees (Removal, Transplanting, Planting)**.

Tree Pruning must be done in accordance with **Subsection 10.06 and New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 4.18 - Tree Pruning**.

Protective Tree Barrier must be done in accordance with **Subsection 10.06 and New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 4.22 - Protective Tree Barrier**.

Payment for Trees (Protection, Pruning, Removal, Transplanting, And Planting) will be made under various NYCDOT Item Numbers. Examples of these NYCDOT Item Numbers are listed below:

Item No.	Description	Pay Unit
4.16 AA	TREES REMOVED (4” TO UNDER 12” CALIPER)	EACH
4.16 AB	TREES REMOVED (12” TO UNDER 18” CALIPER)	EACH
4.16 AC	TREES REMOVED (18” TO UNDER 24” CALIPER)	EACH
4.16 AD	TREES REMOVED (24” CALIPER AND OVER)	EACH
4.16 ADE	TREES REMOVED (24” TO UNDER 48” CALIPER)	EACH
4.16 AE	TREES REMOVED (48” CALIPER AND OVER)	EACH
4.16 BA405	TREES PLANTED, 2-1/2” TO 3” CALIPER, ALL TYPES, IN 4’ X 5’ TREE PITS	EACH
4.16 BA505	TREES PLANTED, 2-1/2” TO 3” CALIPER, ALL TYPES, IN 5’ X 5’ TREE PITS	EACH
4.16 BA510	TREES PLANTED, 2-1/2” TO 3” CALIPER, ALL TYPES, IN 5’ X 10’ TREE PITS	EACH
4.16 CA405	TREES PLANTED, 3” TO 3-1/2” CALIPER, ALL TYPES, IN 4’ X 5’ TREE PITS	EACH
4.16 CA505	TREES PLANTED, 3” TO 3-1/2” CALIPER, ALL TYPES, IN 5’ X 5’ TREE PITS	EACH
4.16 CA510	TREES PLANTED, 3” TO 3-1/2” CALIPER, ALL TYPES, IN 5’ X 10’ TREE PITS	EACH
4.16 DA405	TREES PLANTED, 3-1/2” TO 4” CALIPER, ALL TYPES, IN 4’ X 5’ TREE PITS	EACH
4.16 DA505	TREES PLANTED, 3-1/2” TO 4” CALIPER, ALL TYPES, IN 5’ X 5’ TREE PITS	EACH
4.16 DA510	TREES PLANTED, 3-1/2” TO 4” CALIPER, ALL TYPES, IN 5’ X 10’ TREE PITS	EACH
4.16 EA405	TREES PLANTED, 4” TO 4-1/2” CALIPER, ALL TYPES, IN 4’ X 5’ TREE PITS	EACH
4.16 EA505	TREES PLANTED, 4” TO 4-1/2” CALIPER, ALL TYPES, IN 5’ X 5’ TREE PITS	EACH
4.16 EA510	TREES PLANTED, 4” TO 4-1/2” CALIPER, ALL TYPES, IN 5’ X 10’ TREE PITS	EACH
4.16 CAT405	TREES TRANSPLANTED, 3” TO 3-1/2” CALIPER, ALL TYPES, IN 4’ X 5’ TREE PITS	EACH
4.16 CAT505	TREES TRANSPLANTED, 3” TO 3-1/2” CALIPER, ALL TYPES, IN 5’ X 5’ TREE PITS	EACH
4.16 CAT510	TREES TRANSPLANTED, 3” TO 3-1/2” CALIPER, ALL TYPES, IN 5’ X 10’ TREE PITS	EACH
4.16 DAT405	TREES TRANSPLANTED, 3-1/2” TO 4” CALIPER, ALL TYPES, IN 4’ X 5’ TREE PITS	EACH
4.16 DAT505	TREES TRANSPLANTED, 3-1/2” TO 4” CALIPER, ALL TYPES, IN 5’ X 5’ TREE PITS	EACH

Item No.	Description	Pay Unit
4.16 DAT510	TREES TRANSPLANTED, 3-1/2” TO 4” CALIPER, ALL TYPES, IN 5’ X 10’ TREE PITS	EACH
4.16 STUMP	STUMP REMOVAL	UNIT
4.18 A	MAINTENANCE TREE PRUNING (UNDER 12” CAL.)	EACH
4.18 B	MAINTENANCE TREE PRUNING (12” TO UNDER 18” CAL.)	EACH
4.18 C	MAINTENANCE TREE PRUNING (18” TO UNDER 24” CAL.)	EACH
4.18 D	MAINTENANCE TREE PRUNING (24” CAL. AND OVER)	EACH
4.22 A	PROTECTIVE TREE BARRIER, TYPE A	EACH
4.22 B	PROTECTIVE TREE BARRIER, TYPE B	EACH
8.02 A	SPECIAL CARE EXCAVATION AND RESTORATION FOR SIDEWALK WORK	S.F.
8.02 B	SPECIAL CARE EXCAVATION AND RESTORATION FOR CURB WORK	L.F.

SECTION 77.21 – SODDING, SEEDING, AND TOPSOIL

77.21.1 DESCRIPTION

Topsoil must be done in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 4.15 - Topsoil**.

Sodding must be done in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 4.19 - Sodding**.

Seeding must be done in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 4.20 - Seeding**.

Payment for Sodding, Seeding And Topsoil will be made under the NYCDOT Item Numbers listed below:

Item No.	Description	Pay Unit
4.15	TOPSOIL	C.Y.
4.19	SODDING	S.Y.
4.20	SEEDING	S.Y.

SECTION 77.31 – TREE CONSULTANT

77.31.1 DESCRIPTION

Tree Consultant must be done in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 4.21 - Tree Consultant**.

Payment for Tree Consultant will be made under the NYCDOT Item Number listed below:

Item No.	Description	Pay Unit
4.21	TREE CONSULTANT	P/HR

SECTION 78.11 – REPLACEMENT OF FIRE COMMUNICATION SYSTEM

78.11.1 DESCRIPTION

Replacement Of Fire Communication System must be done in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 6.23 - Fire Department Facilities**.

Payment for Replacement Of Fire Communication System will be made under various NYCDOT Item Numbers. Examples of these NYCDOT Item Numbers are listed below:

Item No.	Description	Pay Unit
6.23 AA	FURNISH AND INSTALL FIRE ALARM POST IN ACCORDANCE WITH F.D. STD. DWG. #141	EACH
6.23 AB	REMOVE EXISTING FIRE ALARM POST	EACH
6.23 BA	FURNISH AND INSTALL FIRE ALARM POST AND SUBBASE IN ACCORDANCE WITH F.D. STD. DWG. #141	EACH
6.23 BBSE	FURNISH AND INSTALL 3” 90-DEGREE P.V.C. WIDE BEND, SCHEDULE 40, U.L. 651 (WITH PAVEMENT EXCAVATION) IN ACCORDANCE WITH F.D. STD. DWG. #141	EACH
6.23 BCSE	FURNISH AND INSTALL 3” P.V.C. CONDUIT, SCHEDULE 40, U.L. 651 (WITH PAVEMENT EXCAVATION)	L.F.
6.23 BD	FURNISH AND INSTALL 4-PAIR FIRE ALARM CABLE	L.F.
6.23 BE	FURNISH AND INSTALL FIRE DEPARTMENT MANHOLE TYPE “A” WITH FRAME AND COVER IN ACCORDANCE WITH F.D. STD. DWG. #140, #144 & #144E	EACH
6.23 BES	FURNISH AND INSTALL FIRE DEPARTMENT SLOTTED MANHOLE TYPE “A” WITH FRAME AND COVER IN ACCORDANCE WITH F.D. STD. DWG. #140, #144S & #144E	EACH
6.23 BF	FURNISH AND INSTALL FIRE DEPARTMENT POLE TERMINAL (HOFFMAN) BOX IN ACCORDANCE WITH FIRE DEPARTMENT STANDARD DRAWING #146	EACH
6.23 BFB	FURNISH AND INSTALL FIRE DEPARTMENT 24 WIRE TERMINAL BOX AND TERMINATE FIRE ALARM CABLES	EACH
6.23 BGR	FURNISH AND INSTALL 4” P.V.C. CONDUIT TO 2” GALVANIZED STEEL REDUCER BUSHING AS SHOWN IN F.D. STD. DWG. #145AA	EACH
6.23 BGSE	FURNISH AND INSTALL 4” P.V.C. CONDUIT, SCHEDULE 40, U.L. 651 (WITH PAVEMENT EXCAVATION)	L.F.
6.23 BGTE	FURNISH AND INSTALL 2 - 4” P.V.C. CONDUITS, SCHEDULE 40, U.L. 651 IN ONE TRENCH (WITH PAVEMENT EXCAVATION, ONE ON TOP OF THE OTHER)	L.F.
6.23 BHE	FURNISH AND INSTALL 4” 90-DEGREE P.V.C. WIDE BEND, SCHEDULE 40, U.L. 651 (WITH PAVEMENT EXCAVATION) IN ACCORDANCE WITH F.D. STD. DWG. #141 OR #145AA	EACH
6.23 BP	FURNISH AND INSTALL FIRE ALARM PEDESTAL BUMPERS (2 REQUIRED PER SET) IN ACCORDANCE WITH F.D. STD. DWG. #168	SETS
6.23 CBE	FURNISH AND INSTALL 2 - 3” 90-DEGREE P.V.C. WIDE BENDS, SCHEDULE 40, U.L. 651 IN ONE TRENCH (WITH PAVEMENT EXCAVATION) IN ACCORDANCE WITH F.D. STD. DWG. #141	EACH
6.23 CCE	FURNISH AND INSTALL 2 - 3” P.V.C. CONDUITS, SCHEDULE 40, U.L. 651 IN ONE TRENCH (WITH PAVEMENT EXCAVATION, ONE ON TOP OF THE OTHER)	L.F.
6.23 DC	FURNISH AND INSTALL 10 PAIR FIRE ALARM CABLE	L.F.
6.23 DDA	FURNISH AND INSTALL 15 PAIR FIRE ALARM CABLE	L.F.
6.23 DDD	FURNISH AND INSTALL 30 PAIR FIRE ALARM CABLE	L.F.
6.23 DJ	FURNISH AND INSTALL 60 PAIR FIRE ALARM CABLE	L.F.
6.23 EB	FURNISH AND INSTALL FIRE DEPARTMENT MANHOLE TYPE “B” WITH FRAME AND COVER IN ACCORDANCE WITH F.D. STD. DWG. #140, #144, #144C, #144CC & #144E	EACH

6.23 FCA	FURNISH AND INSTALL F.D.N.Y. MANHOLE FRAME & COVER IN ACCORDANCE WITH F.D. STD. DWG. #140	EACH
6.23 HFCA	FURNISH AND INSTALL F.D.N.Y. SIDEWALK HANDHOLE FRAME AND COVER IN ACCORDANCE WITH F.D. STD. DWG. #143 & #144B	EACH
6.23 HH	FURNISH AND INSTALL F.D.N.Y. SIDEWALK HANDHOLE WITH FRAME AND COVER IN ACCORDANCE WITH F.D. STD. DWG. #143, #144B & #144E	EACH
6.23 PP	PAINT EXISTING FIRE ALARM POSTS AND/OR BOX	EACH
6.23 RH	REMOVE EXISTING F.D.N.Y. SIDEWALK HANDHOLE	EACH
6.23 RM	REMOVE EXISTING F.D.N.Y. MANHOLE	EACH
6.23 RR	ROD AND ROPE EXISTING CONDUIT	L.F.
6.23 XAPE	FURNISH AND INSTALL 1/2” GALVANIZED STEEL CONDUIT POLE RISER IN ACCORDANCE WITH FIRE DEPARTMENT STANDARD DRAWING #145AA	EACH
6.23 XBBE	FURNISH AND INSTALL 2” GALVANIZED STEEL 90-DEGREE BEND (WITH PAVEMENT EXCAVATION) IN ACCORDANCE WITH F.D. STD. DWG. #145BB	EACH
6.23 XBE	FURNISH AND INSTALL 2” GALVANIZED STEEL CONDUIT (WITH PAVEMENT EXCAVATION)	L.F.
6.23 XBPE	FURNISH AND INSTALL 2” GALVANIZED STEEL CONDUIT POLE RISER IN ACCORDANCE WITH FIRE DEPARTMENT STANDARD DRAWING #145AA	EACH
6.23 XCE	FURNISH AND INSTALL 3” GALVANIZED STEEL CONDUIT (WITH PAVEMENT EXCAVATION)	L.F.
6.23 XY	FURNISH AND INSTALL POLYPROPYLENE DRAG ROPE	L.F.

SECTION 78.21 – STORM WATER POLLUTION PREVENTION

78.21.1 DESCRIPTION

Storm Water Pollution Prevention must be done in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 9.30 - Storm Water Pollution Prevention**.

Payment for Storm Water Pollution Prevention will be made under the NYCDOT Item Number listed below:

Item No.	Description	Pay Unit
9.30	STORM WATER POLLUTION PREVENTION	L.S.

SECTION 78.31 – RODENT AND WATERBUG PEST CONTROL

78.31.1 DESCRIPTION

Rodent And Waterbug Pest Control must be done in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 7.88 - Rodent And Waterbug Pest Control**.

Payment for Rodent And Waterbug Pest Control will be made under the NYCDOT Item Numbers listed below:

Item No.	Description	Pay Unit
7.88 AA	RODENT INFESTATION SURVEY AND MONITORING (NOT LESS THAN $XX.XX/L.S.)	L.S.
7.88 AB	RODENT BAIT STATIONS (NOT LESS THAN $XX.XX/EACH)	EACH
7.88 AC	BAITING OF RODENT BAIT STATIONS (NOT LESS THAN $XX.XX/EACH)	EACH
7.88 AD	WATERBUG BAIT APPLICATION (NOT LESS THAN $XX.XX/BLOCK)	BLOCK

SECTION 79.11 – ENGINEER'S FIELD OFFICE (TYPE A, B, C, CU, D, OR DU)

79.11.1 DESCRIPTION

Engineer's Field Office (Type A, B, C, CU, D or DU) must be done in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 6.40 - Engineer's Field Office**.

*Payment for Engineer's Field Office (Type A, B, C, CU, D, or DU**)** will be made under the NYCDOT Item Numbers listed below:*

Item No.	Description	Pay Unit
6.40 A	ENGINEER'S FIELD OFFICE (TYPE A)	MONTH
6.40 B	ENGINEER'S FIELD OFFICE (TYPE B)	MONTH
6.40 C	ENGINEER'S FIELD OFFICE (TYPE C)	MONTH
6.40 CU	ENGINEER'S FIELD OFFICE (JOINT USE) (TYPE CU)	MONTH
6.40 D	ENGINEER'S FIELD OFFICE (TYPE D)	MONTH
6.40 DC	ENGINEER'S FIELD OFFICE WITH CONFERENCE ROOM	MONTH
6.40 DU	ENGINEER'S FIELD OFFICE (JOINT USE) (TYPE DU)	MONTH

SECTION 79.91 -- MOBILIZATION

79.91.1 DESCRIPTION

Mobilization must be done in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 6.39 - Mobilization**.

Payment for Mobilization will be made under the NYCDOT Item Numbers listed below:

Item No.	Description	Pay Unit
6.39 B	MOBILIZATION	L.S.

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