INFRASTRUCTURE DESIGN STANDARDS

STANDARD SEWER SPECIFICATIONS

August 1, 2009

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

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THE CITY OF NEW YORK

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF WATER AND SEWER OPERATIONS

DIVISION I

GENERAL PROVISIONS

SECTIONS 1.06 TO 1.08

NO TEXT ON THIS PAGE

SECTION 1.06
DEFINITIONS AND GENERAL PROVISIONS

1.06.1 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 shall 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 shall 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 shall mean, "specified in the contract".

Whenever the word "Addenda" is used, it shall 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 shall 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 shall 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 shall 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 shall 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.

1.06.2 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 1.07.6**.

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 shall 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.

1.06.2a MEANS AND METHODS OF CONSTRUCTION

Unless otherwise expressly provided in the contract drawings, specifications and addenda, the Contractor shall 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 shall be determined by the Engineer and approved by the Department of Environmental Protection, agency borough distribution engineer. The means and methods of construction shall 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, shall not relieve the Contractor of the Contractor's obligation to complete the work of the contract; nor shall the exercise of such right to reject create a cause of action for damages.

1.06.3 HOURS OF WORK

Working hours shall be as stipulated by the Department of Transportation's Office of Construction Mitigation and Coordination (OCMC). Generally, no work shall be done on the job before 7:00 A.M. nor after 6:00 P.M., excepting that water mains shall not be shut down before 8:30 A.M. nor after 4:30 P.M., nor shall any work be done on Saturdays, Sundays, or the following holidays, as celebrated in New York City, unless the Contractor shall have given the Engineer at least seven (7) calendar days advance notice in writing, and the Engineer shall, 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 shall 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 shall cease construction operations and shall 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 shall be on weekdays from 7:00 A.M. to 6:00 P.M., unless a variance therefrom is provided in the contract.

1.06.4 ADJUSTING EXISTING PAVEMENTS, SIDEWALKS, ETC.

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

1.06.5 TREE PRESERVATION, PROTECTION, REMOVAL AND REPLACEMENT

(A) Tree Preservation, Protection, Removal and Replacement shall be done in accordance with the following **New York City Department of Transportation (NYCDOT) Standard Highway Specifications:**

Subsection 1.06.48(I) - 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 shall be required to modify work methods of installing new curbs and sidewalks. This special modification of work shall be done in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 8.02 - Special Modification Of Work For Installation Of New Curb And Sidewalks**. Payment for this special modification work shall be made under following 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 shall employ all means and methods necessary to avoid removal of existing trees. If it is determined by the Engineer to be absolutely necessary that existing healthy trees within the contract area be removed due to the installation of new sewers, water mains or pavements, replacement trees shall be planted within the project limits wherever possible but the number planted shall not exceed that required by the equal caliper replacement rule. Replacement trees shall 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 shall be deemed included in the prices bid for the respective Tree Planting items of the contract. In no case shall any tree be planted less than five (5) feet from a utility pole or in front of bus stops.

(2) The Contractor shall 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 shall 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 shall be bark traced within three (3) days.

(5) New house connections shall 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 shall be made for the hereinabove work described in this **Subsection 1.06.5(C)**. The costs thereof shall be deemed included in the prices bid for all items of the contract.

1.06.6 ENCUMBRANCES

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, shall be removed by the Contractor to the extent directed by the Engineer, and shall be replaced and/or rebuilt to the satisfaction of the Engineer and the property owner.

The Contractor shall take preconstruction photographs of all affected encumbrances as specified in **Subsection 1.06.31**. The Contractor shall 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 shall 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 shall be deemed included in the prices bid for all items of work.

1.06.7 DISPOSAL OF EXCESS EXCAVATED MATERIAL

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

1.06.8 LINES AND GRADES (CONTRACTOR'S SURVEY PARTY)

(1) A bench mark and the control lines for the alignment and levels necessary for the prosecution of the sewer and water main work, where required, shall be established by a Licensed Professional Land Surveyor retained by the Contractor. When necessary, the Land Surveyor shall 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 shall also provide the alignment, elevation and position for all construction work between the controls. Chiefs of Party employed by the Contractor, for establishing alignment and levels between controls, shall hold a license issued by the State of New York as either a Professional Engineer or Land Surveyor.

The aforementioned shall be subject to check and correction by the Engineer. The Contractor shall 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, shall, 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 shall 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 shall 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-Built Elevations of the completed work. Elevations shall be taken and furnished to the Engineer whenever a five hundred (500) linear foot section of sewer is completed and at every manhole.

(2) CONTRACTOR TO PROVIDE ASSISTANCE - The Contractor shall 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 refer to the respective Borough Sewer Datum specified below in feet above mean sea level as established by the U.S.C.G.S. at Sandy Hook, New Jersey.

The Bronx	2.608	Brooklyn	1.72	Manhattan	2.75
Queens	2.725	Staten Island	3.192		

1.06.9 PRESERVATION OF POINTS, STAKES, ETC.

The Contractor shall 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.

1.06.10 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 shall be given to the Engineer.

Based upon these locations the Contractor shall 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 shall take up 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 shall perform all work regarding the resetting of monuments. The costs thereof shall be deemed included in the prices bid for all items of work.

1.06.11 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 shall 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 shall not be considered as an acceptance by the City of the part of the sewer into which such connections empty or flow, nor shall 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 shall be shown in all cases to the Engineer.

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

(1) The Contractor shall provide at the Contractor’s own cost for the flow of the sewers, drains and watercourses interrupted during the progress of the work, and shall immediately remove and dispose of all offensive matter. The flow throughout the entire length of such sewers and appurtenances as are to be replaced by the work to be done under this contract shall be maintained by the Contractor. The Contractor, as may be directed, shall, 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 shall 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 shall 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 shall 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 shall be deemed 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 shall 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 shall 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 shall submit the Contractor's method of fluming to the Engineer. The Contractor shall 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 shall be deemed 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 shall be kept thoroughly clean throughout, and shall be left clean. They shall 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, shall be cleaned and connections flushed. Cleaning shall 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 shall 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 shall submit to the Borough Engineer a typical fluming and/or bypass-pumping diagram. This diagram shall 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 shall 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 shall be deemed included in the prices bid for all items of this contract.

(2) The above referenced fluming diagram shall detail the Contractor's method to prevent debris, silt, and grease from migrating downstream during any cleaning or construction operations. The Contractor shall be required to 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 shall 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 shall be deemed included in the prices bid for the various contract items. No separate or additional payment will be made for this work.

(C) The Contractor shall 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 shall 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 shall be removed and all others shall 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 shall be at the expense of the Contractor and shall be deemed 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, shall bulkhead all pipe connection openings to existing structures, shall remove all castings off existing structures, shall break down existing structures to a depth four (4) feet below final grade, shall break up the existing structures' bottom slab in such a manner as to prevent water from being trapped, and shall fill in and compact the existing structures' entire openings in accordance with **Subsection 4.06.3** and as directed by the Engineer. Unless specific items are provided for in the Bid Schedule, the cost of this work shall 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, shall remove all valves, hydrants, valve boxes and covers off mains, and shall seal all ends of mains. In addition valve chambers shall have their heads and covers removed, shall be broken down to a depth four (4) feet below final grade, shall have bottom slab broken up in such a manner as to prevent water from being trapped, and shall have the entire opening filled in and compacted in accordance with **Subsection 4.06.3** and as directed by the Engineer. Unless specific items are provided for in the Bid Schedule, the cost of this work shall 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 shall be completely filled hydraulically with an excavatable flowable fill in accordance with **Section 5.33 - 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 shall be made under the item labeled "HYDRAULIC FILL FOR ABANDONED SEWERS AND WATER MAINS".

1.06.13 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 shall be constructed so as to meet existing sewers at outlet and inlet conditions and as directed by the Engineer.

The proposed water mains shall 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 shall 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 shall 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 shall be done in accordance with the Specifications and Sewer and Water Main Standards.

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

The Contractor shall, except as otherwise provided for in **Subsections 1.06.18 and 1.06.24**, 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 shall 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 shall 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 shall fail to remove their structures, the Contractor shall, upon the written approval of the Commissioner, remove the same, it being expressly understood that the cost thereof shall not be a charge against the City, but shall be a matter for adjustment between the Contractor and the company or companies or individuals concerned.

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

The Contractor shall, except as otherwise provided for in **Subsections 1.06.18 and 1.06.24**, 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 shall 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 shall 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 shall 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 shall 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 shall 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 shall be the Contractor's responsibility to determine the location of the City owned underground distribution systems. The Contractor shall make own field observations and research the City's records to determine the location of such facilities before the commencement of excavation.

1.06.16 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 1.06.18 and 1.06.24**, 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 shall not be a charge against the City, but shall be a matter of adjustment between the Contractor and the company or companies or individuals concerned.

1.06.17 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 shall result to said structure through or

by reason of any negligence, wilfulness, 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 shall be sufficient to cover the expenses and damages occasioned thereby, and that such amount shall be charged against the Contractor; and the Commissioner is hereby authorized to deduct and retain from any moneys which may be due, or which shall 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.

1.06.18 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 shall 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 shall not seek additional compensation from gas companies except as specifically set forth in its contract. **(See Addenda to the Specifications.)**

1.06.19 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 shall be done in the course of construction to any such structures or property through or by reason of the prosecution of the work.

1.06.20 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 shall 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 shall 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 shall 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 shall 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 shall 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.

1.06.21 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 shall be included in the prices bid for all the items for which there are contract prices, unless otherwise specified.

1.06.22 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 shall be and 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 shall 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 shall 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 shall 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 shall provide temporary signals and streetlighting. Upon completion of the work, traffic signals, lamps, lampposts, and accessory equipment shall be restored and temporary facilities shall be removed. Such work shall 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 shall 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 shall be immediately repaired with the knowledge of and to the satisfaction of the City. The cost of such work shall be at the sole expense of the Contractor, unless otherwise specified.

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

All water service pipes damaged, cut or otherwise interrupted in the performance of the work under this contract shall 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 shall obtain all no-fee permits for water service repair.

All water service pipes damaged during construction and requiring repair shall 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.

1.06.24 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.

1.06.25 MATERIALS ON PRIVATE PROPERTY

The Contractor hereby agrees that no excavated material or materials of construction shall 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 shall 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 shall be given to the Engineer prior to the placement of any material on private property.

1.06.26 SAFE AND HEALTHFUL WORKING CONDITIONS

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

The Contractor shall 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 shall be provided at all times in all places underground. Provisions shall 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 shall 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 shall be deemed included in the prices bid for all items of the contract.

1.06.27 SALVAGEABLE MATERIALS

No salvageable material shall be returned to the Department of Environmental Protection regardless of condition. It shall become the property of the Contractor for removal and disposal, by the Contractor, away from the site.

1.06.28 MATERIAL ON PUBLIC PROPERTY

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

1.06.29 CONTRACTOR TO PROVIDE FOR TRAFFIC

The Contractor shall 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**.

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

The Contractor shall 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 shall cooperate with the City Departments and Agencies and utility companies affected by the work of this contract.

1.06.31 PHOTOGRAPHS

(1) The Contractor shall employ and pay for the services of a competent professional photographer who, at the direction of the Commissioner or the Commissioner's authorized representative, shall take Preconstruction Photographs and Construction Progress Photographs and such other photographs that may be required during the period of this contract.

(2) The photographs will generally represent views of the original surface conditions of streets, curbs and walks, buildings that show evidence of damage or disrepair, emergency situations, and views of the work under construction. All photographic prints shall be 8" x 10" in size, single weight, of glossy finish and in color. The Contractor shall furnish to the Commissioner, for each view taken, two (2) - 8" x 10" color prints and one (1) negative, minimum size 2-1/4" x 2-1/4" in color. Prints shall be inserted in standard weight Archival Quality clear poly sheet protectors and submitted in a hard cover three (3) ring binder. The following information shall be imprinted, or indelibly printed, on a white border measuring no more than one and one-half (1-1/2) inch at the bottom of the front of the photograph:

(A) Contract Number and Job Location
(B) Photograph Number
(C) View and Description - (Indicating the location of the camera, a general description of what the photograph represents, and whether it is a Preconstruction Photograph or a Construction Progress Photograph.)
(D) Date - (The date the photograph was taken.)
(E) Name of Photographer
(F) Department of Design and Construction Witness

Each negative shall be numbered accordingly to correspond to the photograph and shall be inserted in Archival Negative Preservers.

Photographs showing the original condition of all encumbrances and/or encroachments that may be affected by the construction of the proposed sewer, water main and related work shall be taken prior to the start of construction. These photographs shall be in addition to those required in paragraph (6) below.

(3) All photographs and negatives shall become the property of the Commissioner. All completed photographs shall be delivered to the Borough Engineer, Department of Design and Construction, within one (1) week after the photographs have been taken.

(4) The Photographer shall be available for taking the required photographs within forty-eight (48) hours after receiving notification from the Commissioner or the Commissioner's authorized representative.

(5) A minimum of four (4) views for every one hundred (100) linear feet of estimated sewer or water main length will be taken for Construction Progress Photographs.

(6) It is estimated; unless otherwise directed by the Engineer due to job size, conditions and complexity; that the average number of Preconstruction Photographs will approximate two (2) views (one (1) each side of street) for each twenty-five (25) linear feet of estimated sewer or water main length.

(7) No separate payment will be made for the expense of the Photographer or for the taking and providing of all required photographs, negatives, etc.; the cost thereof shall be deemed included in the prices bid for the various contract items.

(8) No separate payment will be made for the expense of furnishing the required binders; the cost thereof shall be deemed included in the prices bid for the various contract items.

(9) The Engineer reserves the right to reject any and all views that are not reasonably clear and definitive. No separate or additional payment will be made for any additional photographs that are required as a result of the rejecting of views. The cost shall be deemed included in the prices bid for the various contract items.

1.06.32 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.

1.06.33 USE OF WATER MAINS AND APPURTENANCES

The City shall 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 shall not be considered as an acceptance of the work or any part thereof, nor shall it affect the maintenance period as described.

1.06.34 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 shall 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 shall 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, shall 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 shall be made upon that basis. Should any conflict occur in or between the drawings and specifications, the Contractor shall be deemed to have estimated on the most expensive way of doing the work unless the Contractor shall have asked for and obtained a decision in writing from the Commissioner before the submission of the Contractor's bid, as to what shall 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 shall 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 shall 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 shall be made as specified, unless otherwise approved. The following statement shall appear on the face of every purchase order issued by the Contractor for work to be incorporated in this contract and the Contractor shall 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 shall 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 shall be used as is customary in first class work of the nature for which the material is employed.

The Contractor shall 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 shall be the product of one manufacturer, except as otherwise approved by the Engineer.

1.06.35 URGENT REPAIRS

The Contractor shall 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 shall have the right to have the work done by others in the same manner as provided for under **Article 51** of the Contract.

SECTION 1.07
SURFACE RESTORATION UNDER MAINTENANCE GUARANTEE

1.07.1 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 shall 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 shall 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.

1.07.2 CONTRACTOR TO MAKE REPAIRS

The Contractor shall 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 shall 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 shall 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 shall, 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 shall bring the fill to the grade of the adjoining roadway.

1.07.3 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.

1.07.4 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 shall 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, shall be construed as accepting defective work or material or condoning any negligence or omission.

1.07.5 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.

1.07.6 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	$125.00 per Ton
Binder Mixture	100.00 per Ton
2" Asphaltic Concrete Wearing Course	18.00 per Sq. Yd.
3" Asphaltic Concrete Wearing Course	24.00 per Sq. Yd.
Asphalt Macadam Pavement 4" Thick	27.00 per Sq. Yd.
Asphalt Macadam Pavement 5" Thick	30.00 per Sq. Yd.
Asphalt Macadam Pavement 6" Thick	33.00 per Sq. Yd.
Asphalt Macadam Pavement 7" Thick	36.00 per Sq. Yd.
Asphalt Macadam Pavement 8" Thick	39.00 per Sq. Yd.
Asphalt Macadam Pavement 9" Thick	42.00 per Sq. Yd.
Concrete Base For Pavement	200.00 per Cu. Yd.
Subbase Course, Select Granular Material (Material D)	47.00 per Cu. Yd.
Dense Graded Stone Base	55.00 per Cu. Yd.
Reinforced Concrete Pavement	300.00 per Cu. Yd.
Granite Block Pavement	200.00 per Sq. Yd.
Granite Block Sidewalk	200.00 per Sq. Yd.
4" Concrete Sidewalk	7.00 per Sq. Ft.
7" Concrete Sidewalk in Driveways	10.00 per Sq. Ft.
2" Asphaltic Concrete Sidewalk on 3" Screenings	4.00 per Sq. Ft.

Seeding	7.00 per Sq. Yd.
Concrete Curb (18” Deep)	25.00 per Lin. Ft.
Concrete Header	20.00 per Lin. Ft.
Granite Curb Straight on Concrete Cradle	75.00 per Lin. Ft.
Granite Curb at Corner on Concrete Cradle	200.00 per Lin. Ft.
Granite Curb in Driveway on Concrete Cradle	200.00 per Lin. Ft.
Sodding	27.00 per Sq. Yd.
Straight Steel Faced Concrete Curb (18” Deep)	45.00 per Lin. Ft.
Corner Steel Faced Concrete Curb (18” Deep)	70.00 per Lin. Ft.
Chain Link Fence 4’-0” High	40.00 per Lin. Ft.
Chain Link Gate for 4’-0” High Fence	50.00 per Lin. Ft.

1.07.7 UNDERGROUND FACILITIES

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

1.07.8 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 1.08
MISCELLANEOUS PROVISIONS

1.08.1 LABOR

(1) The Contractor shall 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 shall 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 shall 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.

1.08.2 VENDORS

A list of approved vendors and manufacturers is available from:

Department of Design and Construction
Division of Infrastructure
30-30 Thomson Avenue, 3rd Floor
Long Island City, New York 11101

Prior to starting work, the Contractor will submit in writing the names of all vendors and manufacturers the Contractor intends to use. The Contractor shall 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. If a vendor or manufacturer is not on the approved list, the Contractor will submit same for approval.

1.08.3 PERMITS

The Contractor shall, 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 shall 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.

1.08.4 TEMPORARY USE OF CITY WATER ON CONSTRUCTION PROJECTS

(1) It shall 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 shall be used as directed by the Engineer so that unnecessary waste may be avoided.

1.08.5 ROADWAY OPENINGS, USE, STORAGE, ETC.

The Contractor shall 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.

1.08.6 PROCESSING OF SUBSTANTIAL OR FINAL PAYMENT

At the time of completion of all contract work, the Contractor shall obtain a letter from the Director of Contract Compliance Programs evaluating the Contractor's Compliance with Part C, Section 9 of Local Law 49 (LBE requirements) or applicable MBE/WBE requirements. The Department of Design and Construction cannot process a final payment until the above is complied with.

THE CITY OF NEW YORK

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF WATER AND SEWER OPERATIONS

DIVISION II

MATERIALS OF CONSTRUCTION

SECTIONS 2.01 TO 2.26

NO TEXT ON THIS PAGE

SECTION 2.01
DEFINITIONS

2.01.1 DEFINITIONAL

All definitions of materials shall be in accordance with the Specifications on Nomenclature of the American Society for Testing and Materials, Designations C125, C150, E6, A81 and E44, unless otherwise specified herein.

2.01.2 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.

2.01.3 ASPHALT

Any solid natural bitumen or a residue from the distillation of an asphaltic petroleum.

2.01.4 AASHTO

American Association of State, Highway and Transportation Officials.

2.01.5 ANSI

American National Standards Institute.

2.01.6 ASTM

American Society for Testing and Materials.

2.01.7 AWPA

American Wood Preservers Association, Chicago.

2.01.8 AWWA

American Water Works Association.

2.01.9 BITUMEN

Any natural or pyrogenous hydrocarbons soluble in chloroform.

2.01.10 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.

2.01.11 CENTRAL PLANT MIX CONCRETE

Concrete produced at an approved plant, ready for use prior to discharge into a transporting vehicle.

2.01.12 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.

2.01.13 CONCRETE

A homogeneous mixture consisting essentially of cement, fine aggregate, coarse aggregate and water.

2.01.14 CONSISTENCY

The degree of workability of freshly mixed concrete as indicated by the slump test.

2.01.15 DEPARTMENT OF ENVIRONMENTAL PROTECTION (NYCDEP)

Department of Environmental Protection of the City of New York.

2.01.16 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.

2.01.17 FIRE CLAY

Sedimentary clay of low flux content.

2.01.18 GRAVEL

The coarse granular material, larger than sand grains, resulting from the natural erosion of rock.

2.01.19 ISO

International Standards Organization.

2.01.20 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.

2.01.21 NAAMM

National Association of Architectural Metal Manufacturers.

2.01.22 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.

2.01.23 SHALE

A thinly stratified, consolidated sedimentary clay with well-marked cleavage parallel to the bedding.

2.01.24 SIEVE

An apparatus, in which the apertures are square, for separating sizes of material.

2.01.25 SIEVE ANALYSIS

Analysis of aggregate by sieves in accordance with "Sieve Analysis of Fine and Coarse Aggregates", ASTM C136.

2.01.26 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.

2.01.27 SPIB

Southern Pine Inspecting Bureau.

2.01.28 SURFACE CLAY

An unconsolidated, unstratified clay, occurring on the surface.

2.01.29 SURFACE MOISTURE

All water carried by the aggregate other than that absorbed by the aggregate particles.

2.01.30 TRUCK MIXED CONCRETE

Concrete whose constituent materials are proportioned at a central plant and mixed with water in a transporting vehicle.

2.01.31 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.

2.01.32 WCLIB

West Coast Lumber Inspection Bureau, Seattle, Washington.

2.01.33 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 shall mean the latest edition or revision in effect at the time of invitation to bid.

SECTION 2.02
VITRIFIED CLAY PIPE

2.02.1 INTENT

This section describes hub and spigot vitrified clay pipe and fittings for sewers and appurtenances.

2.02.2 KIND

Vitrified clay pipe and fittings shall be Full Inside Diameter Extra Strength. Socket sizes shall be standard or deep and wide as specified.

2.02.3 SIZE

(A) Vitrified clay pipe shall be of the sizes shown in the following table:

FULL INSIDE DIAMETER EXTRA STRENGTH PIPE TABLE
(Extra Strength Pipe shall conform to ASTM Specification C700, except as modified herein.)

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 shall be as specified.

2.02.4 BRAND

Each pipe shall 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.

2.02.5 MATERIAL, WORKMANSHIP AND FINISH

(A) Vitrified pipe shall be manufactured from surface clay, fire clay, or shale, or a combination of these materials.

(B) Vitrified pipe shall be thoroughly and perfectly burned without warps, cracks, or other imperfections, and shall be unglazed fully. Only fully unglazed pipe shall be acceptable.

2.02.6 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) GENERAL REQUIREMENTS - Pipe and fittings shall comply with the requirements of ASTM Specification for Extra Strength Clay Pipe - Designation C700 except as modified herein.

(B) DIMENSIONS - Dimensions shall be in accordance with the Full Inside Diameter Extra Strength Pipe Table in **Subsection 2.02.3(A)**.

(C) SHAPE - All pipe shall be circular with hubs true and concentric with the barrel of the pipe.

(D) STRAIGHTNESS - Pipe intended to be straight shall 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 shall be furnished in one-eighth (1/8) and one-quarter (1/4) bends as shown, specified or required. Slants, branches and split pipe shall 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 shall be in accordance with ASTM C700.

(G) SOUNDNESS - When it is broken, vitrified pipe shall show dense and solid material, without serious cracks or laminations. It shall be of such toughness that it can be worked with a chisel and hammer, and when struck with a hammer, it shall have a metallic ring.

2.02.7 JOINTS

Joint material shall conform to the requirements of **Section 2.07**, and unless otherwise shown, specified or ordered shall be Type 3 - Elastomeric Pipe Joint.

2.02.8 VISUAL INSPECTION

Vitrified pipe and fittings shall 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 2.02.3(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 2.02.6(D)**.

(G) SPURS - Insecure attachment of spurs on branches.

SECTION 2.03
CAST IRON PIPE

2.03.1 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.

2.03.2 KIND

(A) Cast iron pipe and fittings shall be of the following classes:

BELL AND SPIGOT CAST IRON PIPE AND FITTING CLASS TABLE

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 shall be used unless otherwise specified.

2.03.3 SIZE

(A) Cast Iron pipe shall be of the sizes shown in the Reference Specifications.

(B) Size of pipe and fittings shall be as specified.

(C) Special castings shall be of the sizes and dimensions as shown, specified, or required.

2.03.4 BRAND

(A) Every pipe and fitting shall have distinctly cast upon it the initials of the manufacturer's name for identification.

(B) The weight and class letter shall be conspicuously painted by the manufacturer, with white oil paint, on the inside of each pipe and fitting after the coating has become hard.

2.03.5 MATERIAL AND WORKMANSHIP

(A) Pipe, fittings and special castings shall be made of cast iron of good quality, and of such character as shall make the metal of the castings strong, tough and of even grain, and soft enough to satisfactorily allow for drilling and cutting. The metal shall be made without any admixture of cinder iron or other inferior metal, and shall be remelted in a cupola or air furnace.

(B) Pipe, fittings and special castings shall 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.

2.03.6 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) Pipe shall comply with the requirements of the Standard Specifications of the American Standards Association for Cast Iron Pit Cast Pipe, Designation A21.2 or for Cast Iron Centrifugally Cast Pipe, Designations A21.6 and A21.8.

Fittings shall comply with the requirements of the Standard Specifications of the American Water Works Association for Cast Iron Fittings, Designation C100.

(B) Dimension, weight and allowable variations of pipe and fittings shall be in accordance with the Reference Specifications.

(C) Special castings shall comply with the requirements stipulated herein for pipe and fittings.

2.03.7 COATING

Every pipe, fitting and special casting shall be thoroughly and evenly coated inside and outside with an approved coal tar pitch varnish. The coating shall be smooth, tough and tenacious when cold and shall not be brittle or have any tendency to scale off.

2.03.8 JOINTS

Joints shall comply with the requirements of **Subsection 2.06.5** as defined for ductile iron pipe.

SECTION 2.04
CAST IRON SOIL PIPE

2.04.1 INTENT

This section describes hub and spigot cast iron soil pipe and fittings for sewers and appurtenances.

2.04.2 KIND

Cast iron soil pipe and fittings shall be extra-heavy cast iron and shall be uniformly coated with coal tar pitch inside and outside and shall conform to ASTM A74 and ANSI A112.51.

2.04.3 JOINTS

Joints for hub and spigot cast iron soil pipe and fittings shall be made with positive double seal compression type rubber gaskets conforming to ASTM C564.

2.04.4 SIZE

(A) Cast iron soil pipe shall be of the sizes shown in the following table:

HUB AND SPIGOT CAST IRON SOIL PIPE TABLE

NOMINAL INSIDE DIAMETER (Inches)	THICKNESS OF BARREL (EXTRA-HEAVY) (Inch)	TOLERANCE FOR THICKNESS OF BARREL (Inch)
6	0.25	+0.06 to -0.03
8	0.31	+0.09 to -0.06
10	0.37	+0.09 to -0.06
12	0.37	+0.09 to -0.06
15	0.44	+0.09 to -0.06

(B) Size of pipe and fittings shall be as specified.

2.04.5 MATERIALS AND MANUFACTURE

(A) The pipe and fittings shall be iron castings suitable for installation and service in sewer lines, and shall meet all applicable requirements and tests.

(B) The castings shall be made of gray cast iron, produced by an established commercial method that provides adequate control over chemical and physical properties. The castings shall be sound, true to pattern, and of compact close grain that permits drilling and cutting by ordinary methods. The interior surface shall be reasonably smooth and free from defects that would make the castings unfit for the use for which they are intended.

2.04.6 COATING

The pipe and fittings shall 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 shall be evenly and smoothly applied to all surfaces.

2.04.7 MARKING

Each length of pipe and each fitting shall 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 shall be cast on fittings and shall be located away from the spigot end so as not to interfere with proper joining upon installation.

2.04.8 CERTIFICATION

The Contractor shall 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.

2.04.9 INSPECTION

Pipe and fittings shall 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 2.05
PRECAST REINFORCED CONCRETE PIPE

2.05.1 INTENT

This section describes unlined precast reinforced concrete pipe for sewers and appurtenances.

2.05.2 KIND

(A) Precast reinforced concrete pipe shall be of the kinds and classes prescribed in ASTM C76, except as otherwise noted.

(B) Kind and class of pipe shall be as specified.

2.05.3 SIZE

(A) Precast reinforced concrete pipe shall be of the sizes prescribed in ASTM C76.

(B) Size of pipe shall be as specified.

2.05.4 MATERIALS, WORKMANSHIP AND FINISH

(A) CONCRETE - The Concrete shall be a homogeneous mixture of such proportions and quality that the pipe will conform to the design and test requirements of these specifications. In no case, however, shall the proportions of Portland Cement in the mixture be less than six (6) bags per cubic yard of concrete. Each bag shall be ninety-four (94) pounds.

(B) CEMENT - Cement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**, and shall be Portland Cement (Type II - Moderate Sulfate Resistant).

(C) AGGREGATES - Fine aggregate and coarse aggregate shall conform to the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(D) CONCRETE REINFORCEMENT - Reinforcing steel shall be steel bars or steel wire fabric conforming to the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**. Steel reinforcing shall be circular. Elliptical or Quadrant reinforcing will not be permitted for Class III, IV or V pipe.

(E) FORMS - Pipe shall 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 shall be perfectly uniform. The inner and outer castings shall be sheet steel fitted to the top and bottom rings. Shell casings shall be accurately formed to true concentric cylinders with tight joints. Approved sockets for spurs shall be cast or cut to the sizes specified and approved with approved covers. The bells of the pipe shall 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 shall be made by a manufacturer who has previous experience in the manufacture of reinforced concrete pipe.

(G) FINISH - Inside surface of pipe shall be smooth.

(H) Holes drilled or cast into pipe for lifting bolts shall be adequately plugged with a suitable precast concrete plug that shall be properly grouted and sealed before backfill is placed.

2.05.5 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) All requirements of ASTM C76 shall 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 shall be in accordance with the following table and notes: No individual length of pipe shall be less than four (4) feet.

MINIMUM SHELL THICKNESS TABLE

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: (1) Variation in shell thickness of minus five (5) percent at any point will be permitted.

(2) Variations of the internal diameter shall not exceed the following:

SIZE OF PIPE	CULVERT PIPE (C76)
36 Inch and Smaller	1.00%
Over 36 Inch	0.75%

(3) For intermediate sizes interpolate from ASTM tables.

(4) Mating pipe sections whose dimensions, although they lie within the tolerances hereinbefore specified, result in joints which are not smooth, or which prevent easy and proper assembly and close jointing, will not be accepted.

(5) Mating pipe sections shall 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 shall be circular. The planes of the ends of the pipe shall be perpendicular to the longitudinal axis.

All steel reinforcing shall 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 shall be increased, or elliptical steel reinforcement may be added to the circular steel reinforcement, all as approved by the Engineer.

(D) JOINTS - Pipe shall be constructed with approved lap or bell and spigot joints that will permit watertight, smooth, and permanent joints. The joint shall 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 shall 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 shall 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 shall be equal and shall 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 shall be parallel and the angle of taper on these conic surfaces with respect to the longitudinal axis

of the pipe shall not exceed two (2) degrees. The spigot end of the pipe shall 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 shall be such that the area of the groove plus the annular space immediately adjacent to the groove shall 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 shall be in accordance with ASTM C76, except as otherwise noted.

2.05.6 VISUAL INSPECTION

Precast reinforced concrete pipe shall 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 shall 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 shall 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 pipe shall 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.

2.05.7 MARKING

Each length of pipe shall 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 2.06
DUCTILE IRON PIPE

2.06.1 INTENT

This section describes ductile iron pipe for sewers and appurtenances.

2.06.2 KIND

Pipe shall be centrifugally cast Ductile Iron Pipe, 60-42-10 grade and shall be ceramic epoxy lined. Ductile Iron Pipe shall be Class 56 unless otherwise indicated.

2.06.3 BRAND

The weight, class or nominal thickness, and casting period shall be shown on each pipe. The manufacturer's mark, the year of manufacture and the letters "DI" or "DUCTILE" shall be cast or stamped.

All markings shall 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 shall be in accordance with ANSI Specification A21.51.

2.06.4 MATERIAL

Pipe shall be centrifugally cast Ductile Iron Pipe, 60-42-10 grade and Class 56, unless otherwise indicated.

All inside surfaces of ductile iron pipes and fittings shall be ceramic epoxy lined (Amine Cured Novalac 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 shall be coated with an asphaltic coating in conformance with ANSI/AWWA C151/A21.51.

Laying lengths shall not exceed twenty (20) feet.

2.06.5 JOINTS

Unless otherwise specified all joints for Ductile Iron Pipe shall be Push-On Joints.

The following type joints shall be used as specified:

(A) PUSH-ON JOINTS - Push-on joints shall be the Super Bell-Tite Joint of Amstead Industries, 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 shall be furnished a rubber gasket. All of the above shall conform to the applicable provisions of ANSI Specification A21.11.

Unless otherwise specified, push-on joints shall be used for catch basin connections.

(B) MECHANICAL JOINTS - The joint material shall conform to requirements of ANSI Specification A21.11. The mechanical joint installation shall conform to ANSI Specifications. Surface of joint in contact with rubber gasket seal shall be brushed thoroughly with a wire brush just prior to assembly and all loose rust or foreign material shall be removed. The cleaned surface shall be brushed with soapy water just prior to slipping with torque indicating wrenches. The applied torque shall 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 shall 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 shall be disassembled, thoroughly cleaned and reassembled.

(C) FIELD LOK GASKET SYSTEM - Field Lok Gasket Systems shall be as manufactured by the U.S. Pipe and Foundry Company or approved equal.

These gaskets shall 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 shall be as manufactured by the U.S. Pipe and Foundry Company or approved equal.

These joints shall be employed where specified in the contract documents.

TR Flex Pipe shall conform to applicable requirements of ANSI/AWWA C151/A21.51. TR Flex Fittings shall conform to applicable requirements of ANSI/AWWA C110/A21.10.

2.06.6 LINING

All ductile iron pipe sewers shall be ceramic epoxy lined. Ceramic epoxy lining shall be applied in accordance with the pipe manufacturer's recommendations and procedures. The thickness of the lining shall be a minimum of forty (40) mils thick.

2.06.7 INSPECTION AND ACCEPTANCE

Final acceptance shall be based on tests and values conforming to Section 51-12 and 51-13 of the ANSI Standard. Paragraph 51-12.3 shall be modified to read: "At least one (1) tensile sample and six (6) impact samples shall 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) impact samples shall 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 shall 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 shall be the source of the sample, as closely located as possible to the above criteria of time or ladle.

Rejected New York City pipe shall 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 shall be cut from the spigot end. A ring section from such ring, at least one (1) inch wide, shall 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 shall be cut and tested. If both rings fail, either all pieces of pipe from that ladle shall be rejected by the manufacturer; or each New York City pipe from that ladle successively preceding that pipe during manufacture shall 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 shall be considered acceptable, subject to final acceptance tests.

Pipe failing the deflection test shall 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 shall 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 shall 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 shall in no way be construed as relieving the Contractor of responsibility for compliance with the requirements of the above specification.

2.06.8 FIELD CUTTING

Ductile Iron Pipe shall 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 2.07
JOINT MATERIALS FOR PIPE

2.07.1 INTENT

This section describes materials for jointing vitrified clay pipe, concrete pipe, and cast iron pipe for sewers and appurtenances.

2.07.2 KIND

(A) Joints shall 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 shall be as specified.

2.07.3 MATERIAL

(A) TYPE 1 - Gasket and Mortar Joint shall consist of a caulked jute or oakum gasket and cement mortar packing.

(B) TYPE 2 - Premoulded Bituminous Compound Joint shall consist of collars of bituminous compound cast in the bell and on the spigot ends of the pipe. Each of the collars shall have a minimum thickness of one-quarter (1/4) inch and their surfaces shall be concentric with the pipe. Immediately prior to joining the pipes, the collars shall be suitably treated.

(C) TYPE 3 - The design of the joint shall conform to ASTM C425, Type I, II or III.

The elastomeric material in the joint shall conform to the gasket specified in ASTM C361, except that for Type I and Type II joints the tensile strength shall be not less than six hundred (600) pounds per square inch and the elongation at break shall be not less than three hundred (300) percent.

The semiflexible material used in the Type II or Type III joint shall be a polyester resin.

(D) TYPE 4 - The ring rubber gasket shall conform to the requirements of ASTM C443. The outer diameter of the spigot surface shall be grooved. The inner diameter of the bell surface shall be such that when a round rubber gasket is snapped into the spigot groove and the two (2) pipes drawn together, the gasket shall completely fill the annular space at the groove between the bell and spigot.

(E) TYPE 5 - The flexible butyl gasket joint material shall conform to Federal Specification SS-S-210A and AASHTO M-198, and be of either rectangular or circular shape with a minimum cross-sectional area of 0.78-square inches. The pipe joint material shall 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

shall be hand cleaned of all foreign material prior to placing the joint material and primer. The joint material shall be overlapped (not butted) to assure a complete seal.

2.07.4 CHEMICAL AND PHYSICAL REQUIREMENTS, INGREDIENT MATERIALS

(A) PREMOULDED BITUMINOUS COMPOUND - The compound shall 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 shall be slate, limestone or dolomite or the mineral matter contained in natural asphalt.

(1) The compound shall contain not less than thirty-five (35) or more than fifty-five (55) percent by weight of mineral flour. The mineral flour shall be free from lumps and foreign material, and shall be thoroughly dry when used. It shall pass the following sieve analysis:

Pass No. 200 Sieve - 99% to 100%
Pass No. 325 Sieve - 95% to 100%

(2) The compound shall 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 shall be Non-Air Entrained Portland Cement Mortar (Maximum 4% entrapped air) for spaces less than one (1) inch and shall comply with the requirements of **Section 2.17**.

SECTION 2.08
IRON CASTINGS, GRAY AND MALLEABLE

2.08.1 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 pipe or castings subject to high temperatures.

2.08.2 KIND

(A) Iron castings shall be of the following types:

Type 1 - Gray Iron Castings
Type 2 - Malleable Iron Castings

(B) Gray iron castings shall 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 shall be Grade 32510, ASTM A47.

2.08.3 SIZE, WEIGHT AND LOT NUMBER

(A) Castings shall conform to either the drawings or patterns or both as specified.

(B) The weight of each casting shall be conspicuously painted thereon in white oil paint.

(C) Each casting shall 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.

2.08.4 MATERIALS, WORKMANSHIP AND FINISH

(A) The iron shall be such as will make castings, which are of close and even grain and easily machined.

(B) Casting shall be true to pattern, free from cracks, gas holes, flaws and excessive shrinkage. Surfaces of castings shall be free from burnt on sand and shall be reasonably smooth after cleaning. Runners, risers, fins and other cast on pieces shall be removed. Plugging and filling will not be allowed.

(C) When "machining" is specified or shown on the drawings, it shall 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 shall be machined. The upper side of the cover seating rims of manhole heads shall also be machined.

2.08.5 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) Gray iron castings shall comply with the requirements of ASTM A48.

(B) Malleable iron castings shall comply with the requirements of ASTM A47.

(C) When a particular chemical composition is required in gray iron castings, it shall be as specified.

SECTION 2.09
WROUGHT IRON

2.09.1 INTENT

This section describes Wrought Iron for sewers and appurtenances.

2.09.2 KIND

Wrought iron shall be of one kind.

2.09.3 MATERIAL

Wrought iron shall be tough, fibrous, uniform in quality, ductile and malleable, thoroughly welded in rolling and free from surface defects.

2.09.4 CHEMICAL AND PHYSICAL REQUIREMENTS

Wrought iron shall comply with the requirements of ASTM A207.

SECTION 2.10
GALVANIZING

2.10.1 INTENT

This section describes Galvanizing.

2.10.2 KIND

All galvanizing shall be done by the hot-dip process, or, the electrolytic process.

2.10.3 MATERIAL AND WORKMANSHIP

(A) Zinc coating shall be adherent, smooth, continuous and thorough. It shall be free from such imperfections as lumps, blisters, gritty areas, uncoated spots, acid and black spots, dross and flux.

(B) Metal to be galvanized shall be thoroughly cleaned and pickled.

(C) Threading shall be done before galvanizing. The coating shall not interfere with the intended use of the material.

2.10.4 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) GENERAL REQUIREMENTS - Galvanizing shall comply with the requirements of ASTM A123.

(B) WEIGHT OF COATING - The weight of zinc coating per square foot of actual surface shall average not less than two (2.0) ounces and no individual specimen shall show less than one and eight-tenth (1.8) ounces as determined in accordance with ASTM A90.

(C) UNIFORMITY OF COATING - Coating shall be uniform as determined by visual inspection. If, in the opinion of the Engineer, visual examination is not conclusive, uniformity of coating shall be determined in accordance with ASTM A239. Galvanized articles, so tested, shall withstand seven (7) - one (1) minute dips without exposing base metal or showing adherent copper deposit.

(D) ADHERENCE - The coating shall adhere so as not to be removable by any reasonable handling and erection. Light blows with a one-half (1/2) pound hammer shall not cause peeling of the coating adjacent to the area deformed by the hammer blows.

SECTION 2.11
GRANITE SLABS

2.11.1 INTENT

This section describes granite slabs to be used in drop-pipe manholes and junction chambers for sewers and appurtenances.

2.11.2 MATERIAL AND WORKMANSHIP

Granite slabs shall be sound, durable, fine grained and free from rifts and laminations. Granite slabs shall be saw cut to the required dimensions and continuous dovetail groves shall be cut into the back faces of the slabs to receive the silicone bronze bolt heads.

2.11.3 SETTING

The granite slabs shall be set in a full bed of fresh mortar, in compliance with the requirements of **Section 2.17**.

SECTION 2.12
STEEL CASTINGS

2.12.1 INTENT

This section describes Steel Castings for sewers and appurtenances.

2.12.2 KIND

(A) Steel castings shall be of one (1) type.

(B) Steel shall be Grade B-1, Full Annealed.

2.12.3 SIZE, WEIGHT AND LOT NUMBER

(A) Castings shall conform to either the drawings or patterns or both, as specified.

(B) The weight of each casting shall be conspicuously painted thereon in white oil paint.

(C) Each casting shall have a lot number integrally cast on it at time of manufacture.

2.12.4 MATERIAL, WORKMANSHIP AND FINISH

(A) The steel shall be such as will make castings that are of close and even grain and easily machined.

(B) Casting shall be true to pattern, free from cracks, gas holes, flaws and excessive shrinkage. Surfaces of castings shall be free from burnt on sand and shall be reasonably smooth after cleaning. Runners, risers, fins and other cast on pieces shall be removed. Plugging and filling will not be allowed.

(C) When "machining" is specified or shown on the drawings, it shall 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.

2.12.5 CHEMICAL AND PHYSICAL REQUIREMENTS

Steel castings shall comply with the requirements of ASTM A27.

SECTION 2.13
WATERSTOPS

2.13.1 DESCRIPTION

Waterstops shall 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.

2.13.2 MATERIAL

Waterstops for construction joints shall be polyvinyl chloride (PVC).

Waterstops in expansion joints shall be PVC and shall be installed where shown on the contract drawings or as determined by the Engineer.

The polyvinyl chloride shall be extruded from an elastomeric plastic compound of which the basic resin shall be polyvinyl chloride (PVC). The compound shall 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 shall be used for the manufacturing of the waterstops.

The Contractor shall furnish certification that the Contractor's proposed waterstops meet the above requirements.

Waterstops for construction joints shall be flat ribbed type, six (6) inches wide with a minimum thickness at any point of three-eighth (3/8) inches.

2.13.3 PLACEMENT

Waterstops shall be carefully positioned so that they are embedded to an equal depth in concrete on both sides of the joint. They shall be kept free from oil, grease, mortar and other foreign matter. Where necessary, PVC waterstops shall be braced or supported. Such method shall be submitted to the Engineer for review.

Splices in PVC waterstops shall be made with a thermostatically controlled heating element. Splices shall be made in strict accordance with the manufacturer's recommended instructions and procedures. At least three (3) satisfactory sample splices shall be made on the site. The Engineer may require tests on these splices by an approved laboratory. The splices shall exhibit not less than eighty percent (80%) of the strength of the unspliced material.

2.13.4 PAYMENT

Payment for furnishing and installing the waterstops shall be deemed included in the prices bid for all items of work. No separate or additional payment will be made for waterstops.

SECTION 2.14
ALUMINUM GRATING

2.14.1 DESCRIPTION

This section describes Aluminum Gratings.

2.14.2 TYPE OF GRATING

(1) IN WATER MAIN STRUCTURES

Only riveted type gratings shall be installed by the Contractor in water main structures. Grating designs shall 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 shall 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.

One type of aluminum grating shall be used exclusively throughout the project.

(A) TYPE A - Extruded shape assembly shall 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 shall be in continuous line for the full width of the grating.

(B) TYPE B - Pressure locked assembly shall 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 shall be slotted for joining. Slots in bearing bars shall terminate with dovetail recesses above the neutral axis. Slots in cross bars shall terminate below the neutral axis. Cross bars shall be forced down into the slots of the bearing bars and their bottoms spread into the dovetail recesses to make tight rigid joints.

2.14.3 MATERIAL AND CONSTRUCTION

(1) IN WATER MAIN STRUCTURES

(A) ALUMINUM GRATING - The riveted type grating assembly shall 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 shall be mill finish as fabricated. The minimum allowable main or bearing bar size shall be 2" x 3/16".

Aluminum gratings shall 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 shall conform to **Section 2.19**.

(2) IN SEWER STRUCTURES

Aluminum gratings, anchored frames and accessories shall 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

2.14.4 GENERAL

The Contractor shall 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 shall be made where required.

2.14.5 CONTRACTOR'S WORKING DRAWINGS

Gratings that are specified in the Water Main Standard Drawings and Sewer Design Standards shall 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, shall be submitted by the Contractor for approval of the Engineer in accordance with the specifications. These gratings shall not be manufactured until the Contractor's working drawings have been approved.

2.14.6 WORKMANSHIP

Gratings shall 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 shall be in the same plane.

Gratings shall be installed with each section readily removable and replaceable. Adjacent units shall be neatly fitted together. The clearance at the ends and between sections of grating shall be a maximum of one-quarter (1/4) inch. Gratings shall be set with a full and uniform end bearing on the supports to preclude rocking movement. Wedges or similar shimming devices shall not be used. Edges of gratings shall be neatly banded with bearing bars.

2.14.7 FASTENING DEVICES

Approved aluminum fastening devices shall be installed to hold the gratings rigidly to the supports with means for easy removal. Fastening devices shall not protrude above the walking surface of the grating. Fasteners shall be installed in accordance with the manufacturer's directions.

2.14.8 CUTOUTS

Cutouts shall 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 shall be provided around the opening and welded or electric forged to the component parts of the grating.

2.14.9 CONTACT SURFACES - COATING

Aluminum surfaces in contact with concrete or dissimilar metals shall be thoroughly protected with a heavy coating of bituminous paint or other approved insulating material.

2.14.10 PAYMENT

(1) IN WATER MAIN STRUCTURES

Payment for furnishing and installing the aluminum grating in water main structures shall be deemed included in the price bid for the item labeled “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 shall be deemed 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.

2.14.11 SEPARATE PAYMENT

IN WATER MAIN STRUCTURES - Separate payment shall be made for furnishing and installing the anchored steel frame for the aluminum grating under the price bid for the item labeled “FURNISHING, DELIVERING AND PLACING STRUCTURAL, REINFORCING AND MISCELLANEOUS STEEL”.

SECTION 2.15
CONCRETE

2.15.1 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.

2.15.2 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 shall 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 shall govern.

2.15.3 MODIFICATIONS

D 1.4.1.6 For purposes of this section the Supervising Engineer for Concrete Construction shall 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, shall 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" shall 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 shall be well graded in accordance with 2.6.1.1. Size of Coarse Aggregate shall 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:

The Contractor may submit for approval concrete mixes that (within two (2) years 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 shall contain evidence that the concrete mix was approved within two (2) years of this contract and shall 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. Average gradation of aggregates intended for use shall be shown and computations included showing that the requirements for yield and percent (%) mortar be met. Except for high range water reducers, other liquid admixture may be omitted from computations of water/cement ratio, yield or percent (%) mortar.

If the Contractor elects to submit a concrete mix that was not previously approved, the Contractor shall submit the new concrete mix in accordance with Chapters 2 and 3 of General Specification 11 as modified herein.

D 3.3 ADD the following:

Unless otherwise shown, specified or required by the Engineer, all concrete shall be Class 40, 4,000-psi, non-air entrained concrete. The concrete mix for all structures, except for concrete cradles and encasements, shall contain six hundred sixty (660) pounds per cubic yard of cementitious material of which eighty-five percent (85%) shall 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 shall contain six

hundred sixty (660) pounds per cubic yard of cementitious material of which one hundred percent (100%) shall be cement (Type 2, ASTM C150); no Fly Ash will be permitted in concrete used for cradles and encasements. The concrete mix shall 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 shall be proportioned using a maximum water/cement ratio of 0.42. Design slump shall be in accordance with 3.6 of GS11. Coarse and Fine Aggregates shall 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 shall 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 shall 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 shall be submitted to the Engineer for review.

D 4.7 Removal of Forms - ADD the following:

4.7.7 - Forms shall not be removed without the permission of the Engineer. In general, forms shall 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 shall be left in place the minimum length of time specified below, from the date of placing concrete. The Contractor shall be fully responsible for the concrete at all times, and any damage to the work, including any caused by premature removal of forms, shall 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 shall 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 shall 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 shall 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 shall 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 shall 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 shall be taken at that location. For monolithic structures with a minimum clear height of five (5) feet or more, tests shall be taken on the underside of the roof surface. All other structures shall be tested on the top surface of the roof. When tests are taken on the top surface of the structure the results shall 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 shall 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 shall be removed from the concrete immediately after removing the forms.

Care shall 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, shall 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 shall 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 shall 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 shall 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 shall:

(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 shall also be included.

(d) A copy of the computer tape recording the batched weights shall also be included.

D 8.2 DELETE 8.2 of GS11.

D 8.5 Depositing - ADD the following:

8.5.7 - All concrete shall be poured against forms unless otherwise specified in the contract documents or approved by the Engineer.

Sheeting used as forms shall 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 shall be added to all surfaces of structures in contact with the sheeting. The cost for this additional concrete and protection shall be deemed 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 shall retain the services of an independent testing laboratory to provide for all 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.

D 16.3.1.5-(a)-3.1.2 The Engineer shall be 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 Department of Design and Construction Laboratory. The Department of Design and Construction testing laboratory will provide the services for the curing and breaking of the test cylinders.

The Contractor shall provide empty cylinder molds and facilities for the proper care of these cylinders while on the site, and shall 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 shall be transported to the testing laboratory when directed by the Engineer.

The Contractor shall 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 shall obtain a receipt for delivered cylinders, which shall be submitted to the Engineer.

D 18.1.2 At the end of 18.1.2 of GS11, ADD the following:

Class 40 concrete shall 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 shall be permanently retained from the payment due the Contractor. Whenever Class 40 concrete tests less than 3,200-psi it shall be rejected and removed. All other concrete shall 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 shall 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 shall 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 shall 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) shall be built in accordance with the Sewer Design Standards, Water Main Standard Drawings and Standard Sewer and Water Main Specifications.

SECTION 2.16
BRICK

2.16.1 INTENT

This section describes brick for use in water main installation, sewer construction, appurtenances, and for lining of sewers.

2.16.2 KIND

(A) Brick shall 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 shall be used and shall be either solid or cored, as directed by the Engineer.

2.16.3 SIZE

Brick shall be of standard size as approved.

2.16.4 BRAND

Brick need not be branded.

2.16.5 MATERIAL AND MANUFACTURE

Brick shall be made from clay or shale and burned so that they are free from cracks, warpage and exposed stones, pebbles or particles of lime.

2.16.6 CHEMICAL AND PHYSICAL REQUIREMENTS

Except as otherwise provided herein, brick shall comply with the following requirements:

Type 1 Brick, ASTM C32, Grade MS
Type 2 Brick, ASTM C32, Grade SS

2.16.7 VISUAL INSPECTION

Brick shall 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 shall vary from the standard of comparison as established from the approved samples.

2.16.8 REJECTION

(A) Approximately one (1) percent of each type of brick shall 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 shall 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.

2.16.9 CONSTRUCTION METHODS, BRICK MASONRY

(A) The bricks shall be wet when laid and each brick shall be laid in cement mortar so as to form full bed, end and side joints at one operation. The joints shall 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 shall not exceed one-quarter (1/4) inch. Brickwork shall be smoothly coated both inside and outside with a layer of cement mortar one-half (1/2) inch thick. Brickwork shall be laid with a satisfactory bond, and as it progresses shall be racked back in courses, unless otherwise permitted.

(B) All fresh brickwork shall be carefully protected from freezing and from the drying effects of the sun and wind, and if required, it shall be sprinkled with water at such intervals and for such time as may be directed. Brickwork shall be protected from injuries of all sorts, and all portions that may become damaged or may be found defective shall be repaired or if directed, be removed and rebuilt. In freezing weather bricks shall be heated sufficiently to remove all ice and frost before lying.

SECTION 2.17
MORTAR, PORTLAND CEMENT

2.17.1 INTENT

This section describes Portland Cement Mortar.

2.17.2 KIND

(A) Mortar shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(B) Unless otherwise specified, mortar shall 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 2.15**.)

2.17.3 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) Mortar shall consist of sand mixed with Portland Cement, water and additives when required in definite proportions so as to produce a stiff mixture. Proportions shall be in accordance with **General Specification 11 - Concrete, as modified in Section 2.15**.

(B) Portland Cement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**. Type II cement shall be used unless otherwise specified.

(C) Sand for mortar shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(D) Water shall be drawn from mains owned by or supplying water to the City of New York.

2.17.4 MANUFACTURE

(A) PROPORTIONING INGREDIENTS - The materials shall be measured in accordance with **General Specification 11 - Concrete, as modified in Section 2.15**.

(B) MIXING INGREDIENTS - Mortar shall be mixed in a suitable box or on a tight platform, and never upon pavement or ground. Cement and Sand shall be thoroughly mixed dry, until the mixture has a uniform color. Clean, fresh water shall then be added and the mass worked until a mortar, which is uniform and of the required consistency, is produced. Mortar shall be mixed in no greater quantity than is required for the work in hand. Mortar that has set sufficiently to require retempering shall not be used.

When required by the Engineer, ingredient materials, after measuring, shall be mixed in an approved rotating drum type batch mixer. Mixing shall 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 shall be continued until a homogeneous mixture is produced. The mortar shall be kept constantly agitated until used.

2.17.5 FREEZING WEATHER

The mixing and use of mortar in freezing weather shall be subject to the same requirements as herein specified for mixing and placing concrete under similar conditions.

SECTION 2.18
GROUT, PORTLAND CEMENT

2.18.1 INTENT

This section describes Portland Cement Grout.

2.18.2 KIND

(A) Grout shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(B) Unless otherwise specified grout shall be Cement Grout composed of neat cement and water.

2.18.3 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) Cement Grout shall consist of neat cement and water mixed to a consistency suitable for the work on hand.

(B) Cement and Sand Grout shall 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 shall be in accordance with **General Specification 11 - Concrete, as modified in Section 2.15**.

(C) Portland Cement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**. Type II cement shall be used, unless otherwise specified.

Cement for dilute grout shall be screeded, if so directed, to remove the coarser particles.

(D) Sand for grout shall comply with the requirement of **General Specification 11 - Concrete, as modified in Section 2.15**.

(E) Water shall be drawn from mains owned by or supplying water to the City of New York.

2.18.4 MANUFACTURE

(A) PROPORTIONING INGREDIENTS - The materials shall be measured in accordance with **General Specification 11 - Concrete, as modified in Section 2.15**.

(B) MIXING INGREDIENTS - Grout shall be mixed in a suitable box or on a tight platform, and never upon pavement or ground. Cement and Sand Grout shall be thoroughly mixed dry, until the mixture has a uniform color. Clean, fresh water shall then be added and the mass worked until a mixture, which is uniform and of the required consistency, is produced. Grout shall be mixed in no greater quantity than is required for the work in hand. Grout that has set sufficiently to require retempering shall not be used.

When required by the Engineer, ingredient materials, after measuring, shall be mixed in an approved rotating drum type batch mixer. Mixing shall 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 shall be continued until a homogeneous mixture is produced. The grout shall be kept constantly agitated until used.

2.18.5 FREEZING WEATHER

The mixing and use of grout in freezing weather shall be subject to the same requirements as herein specified for mixing and placing concrete under similar conditions.

SECTION 2.19
STRUCTURAL, REINFORCING AND MISCELLANEOUS STEEL

2.19.1 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.

2.19.2 STRUCTURAL STEEL

2.19.2.1 KIND

Structural steel shall be of one kind, and unless otherwise specified, shall have minimum yield strength (Fy) of thirty-six thousand (36,000) pounds per square inch.

2.19.2.2 SIZE AND SHAPE

Structural steel sizes and shapes shall be as shown, specified or required.

2.19.2.3 BRAND

Test specimens and every finished piece of steel shall 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.

2.19.2.4 MATERIAL AND WORKMANSHIP

The requirements of ASTM A6 shall apply.

All delivered material shall be new, unused and not part of previously fabricated structures.

2.19.2.5 CHEMICAL AND PHYSICAL PROPERTIES

Structural steel shall conform to the requirements of ASTM A36. Steel for structural rivets shall comply with the requirements of ASTM A141.

2.19.2.6 IDENTIFICATION

Markings shall be in accordance with the requirements of ASTM A36.

2.19.2.7 METHODS OF TEST

Structural steel plates, shapes and bars shall 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.

2.19.3 REINFORCING STEEL FOR CONCRETE REINFORCEMENT

Reinforcement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

2.19.4 MISCELLANEOUS STEELS

Steel for round stock for connecting lugs and bands shall conform to ASTM A36, Standard Specification for Carbon Structural Steel.

Unless otherwise specified, bolts and studs shall conform to ASTM A307, Grade B, and nuts shall be A563, Grade B.

2.19.5 PAINTING

Steel surfaces shall be satisfactorily cleaned and painted as follows:

(1) PRIOR TO ERECTION - All steel work (except reinforcing bars and fasteners) shall 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) shall 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 shall be recleaned and receive a base coat prior to receiving this second coat.)

2.19.6 PACKING

Packing of all steels shall be in accordance with the best commercial practice.

SECTION 2.20
TIMBER AND LUMBER

2.20.1 INTENT

This section describes timber and lumber.

2.20.2 KIND

All timber and lumber shall be yellow pine or Douglas fir.

2.20.3 SIZE

Timber and lumber shall be of the sizes shown, specified or required. Sizes given are nominal sizes.

2.20.4 BRAND

Each piece of wood shall be stamped with standard grade marks.

2.20.5 MATERIAL, WORKMANSHIP AND FINISH

(A) YELLOW PINE - Yellow pine timber and lumber shall 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 shall be Select Structural grade.

2.20.6 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) YELLOW PINE - Yellow pine timber and lumber shall conform to the requirements of the Southern Pine Association Standard Specifications.

(B) DOUGLAS FIR - Douglas fir timber and lumber shall conform to the requirements of the West Coast Lumberman's Association Standard Grading and Dressing Rules.

SECTION 2.21
STEEL SHEETING

2.21.1 INTENT

This section describes Steel Sheet Piling.

2.21.2 KIND

Steel sheet piling shall be the continuous interlock type and of an approved type and shape.

2.21.3 SIZE

(A) Sections of piling shall be of the shapes and sizes shown, specified or required.

(B) Piles shall be in single lengths as required in the work.

(C) At changes in direction and at closures, special fabricated or rolled steel sheet piles shall be furnished as shown, specified or required.

2.21.4 BRAND

Each length of steel sheet piling shall be stamped with a steel die or rolled with the following information: Manufacturer's Name or Mark, Date of Manufacture and Inspector's Mark.

2.21.5 CHEMICAL AND PHYSICAL REQUIREMENTS

Steel sheet piling shall comply with the requirements of ASTM A328.

SECTION 2.22
TIMBER PILES

2.22.1 INTENT

This section describes timber piles to be used, treated in accordance with **Section 2.23**.

2.22.2 KIND

Piles shall be treated yellow pine or Douglas fir.

2.22.3 SIZE

(A) DIAMETERS - Diameters of piles, measured under the bark, shall conform to the minimum diameters specified in the following table:

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 shall 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 shall be not less than ten (10) inches in diameter.

2.22.4 MATERIAL AND WORKMANSHIP

(A) MATERIAL, GENERAL - Piles shall 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 shall have a gradual taper from the place of butt measurement to the point and shall be cut above the ground swell.

(B) WORKMANSHIP, GENERAL - Knots and limbs shall be trimmed or cut smoothly, flush with the surface, and butt and point shall 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 shall be free from splits and shall 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, shall be removed as soon as practicable after piles are cut. Care shall 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 shall be more than three-quarter (3/4) inch wide or eight (8) inches long, and there shall be not less than one (1) inch of clean wood surface between strips.

(D) DRIVING SHOES - When driving shoes are required, they shall be of an approved design and securely fastened to the piles whose end shall be suitably pointed.

2.22.5 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) GENERAL - Timber piles shall comply with the requirements of ASTM D25 for Round Timber Piles, Class B, except as otherwise specified herein. Driving shoes shall be malleable iron or cast steel conforming to the requirements of **Section 2.08** and **Section 2.12**, respectively.

(B) SOUNDNESS - Piles shall be straight and sound. They shall 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 midlengths and the butts of piles more than fifty (50) feet in length, sound knots shall be not 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 shall exceed four (4) inches in diameter. In the sections between midlengths and the points of piles more than fifty (50) feet in length, sound knots shall 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 shall exceed five (5) inches in diameter.

(D) STRAIGHTNESS - A straight line joining the centers of the butt and point shall lie within the body of the pile.

(E) SHORT BENDS - Short bends shall 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 shall not exceed four (4) percent of the length of the bend nor two and one-half (2-1/2) inches.

SECTION 2.23
WOOD PRESERVATIVE AND TREATMENT

2.23.1 INTENT

This section describes wood preservative and treatment of timber, lumber and timber piles.

2.23.2 KIND

(A) Wood preservative shall be CCA for yellow pine and ACZA for Douglas fir.

(B) Treatment of timber, lumber and timber piles shall be the impregnation of these materials with CCA or ACZA by the pressure process.

2.23.3 MATERIALS AND WORKMANSHIP

(A) CCA - CCA shall be Chromated Copper Arsenate Type C.

(B) ACZA - ACZA shall be Ammoniacal Copper Zinc Arsenate.

(C) PEELING PILES - Bark, including not less than eighty (80) percent of the inner skin, shall be removed as soon as practicable after piles are cut. Care shall 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 shall be more than three-quarter (3/4) inch wide or eight (8) inches long and there shall be not less than one (1) inch of clean wood surface between strips.

(D) CUTTING AND DRILLING - Insofar as practicable, all cutting and drilling shall 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 shall 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 shall be incised in an approved manner, except when incising will unfit lumber for the use intended.

2.23.4 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) GENERAL REQUIREMENTS - The wood preservative shall conform to AWPA Standard P5 for waterborne preservatives.

(B) TREATMENT - The treatment of timber, lumber and timber piles shall be in accordance with the AWPA specifications for the various materials as listed in the following table:

A.W.P.A. 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 shall be as specified.

(D) WOOD - Timber and lumber shall conform to the requirements of **Section 2.20**. Timber piles shall conform to the requirements of **Section 2.22**.

SECTION 2.24
BACKFILL MATERIAL

2.24.1 DESCRIPTION

This section describes the material required to backfill sewer and water main trenches and excavations.

2.24.2 MATERIAL

(A) GENERAL - All material for backfilling shall have a moisture content and gradation suitable for attaining the required density.

All material for backfilling shall be free from frost at the time of placement.

Miscellaneous fill material removed from the trenches and excavations shall 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 shall 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 shall not contain particles larger than one-quarter (1/4) inch in diameter. For the purpose of this contract, this backfill material shall be called Select Granular Fill.

(C) APPROVED EXCAVATED SUITABLE FILL - All approved excavated suitable fill material within the project limits shall be utilized for backfill as specified in **Subsection 4.06.2(C)**. Approved excavated suitable fill material shall 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 shall not contain stones larger than six (6) inches in their largest dimension. Stones shall 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 shall not exceed the limits stipulated below. For the purpose of this contract, this backfill material shall 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) shall 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 shall 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 shall be discarded.

(D) CLEAN FILL - Clean fill material shall 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 shall not contain stones larger than six (6) inches in their largest dimension. Stones shall be so distributed that all interstices are filled with fine material. For the purpose of this contract, this backfill material shall 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 2.24.2(B) - Select Granular Fill** and in **Subsection 2.24.2(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 2.25
RIPRAP; STONE BALLAST; SCREENED GRAVEL AND SCREENED BROKEN STONE; BROKEN STONE; SLOPE PAVEMENT; AND CRUSHED STONE

2.25.1 INTENT

This section describes riprap; stone ballast; screened gravel and screened broken stone; broken stone; slope pavement; and crushed stone.

2.25.2 MATERIALS

(A) RIPRAP - Riprap shall consist of stones of acceptable size and quality, placed in embankments or to form foundations. All riprap shall be granite, dolomite, gneiss, traprock or other approved hard and durable stone. No riprap stone shall be smaller than the commercial two and one-half (2-1/2) inch stone. In general, riprap stone shall be graded from two and one-half (2-1/2) inches to eighteen (18) inches so that the smaller stones shall 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 shall 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 shall be clean, well-graded, sound, hard, roughly cubical in shape and free from organic and other deleterious materials. They shall 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 shall 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 shall be not less than eighteen (18) inches in depth, normal to the slope and shall be composed of sound, hard and durable quarried or split stones. Except when used for pinning or wedging, the stones shall be not less than six (6) inches thick and from twelve (12) to eighteen (18) inches long.

(F) CRUSHED STONE - Crushed stone shall be broken stone, sound, hard and roughly cubical in shape and shall comply with ASTM C33, Size No. 67. Crushed stone shall 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
20-50% passing the 3/8-inch sieve
0-10% passing the No. 4 sieve
0-5% passing the No. 8 sieve

SECTION 2.26
POLYMER CONCRETE PIPE

2.26.1 INTENT

This section describes polymer concrete pipe for use in microtunneling/pipe jacking installation operations of sewers and appurtenances. Polymer concrete pipe shall be manufactured in accordance with ASTM D6783. Where requirements herein specified are more stringent than ASTM requirements, the more stringent specification shall apply.

2.26.2 KIND

(A) Polymer concrete pipe shall be a very dense, nonporous, corrosion-resistant and homogeneous composite structure of the classes prescribed in ASTM D6783.

(B) Unless otherwise specified, pipe shall be Class V.

2.26.3 SIZE

(A) Polymer concrete pipe shall be of the sizes prescribed in ASTM D6783.

(B) Size of pipe shall be as specified.

2.26.4 MATERIALS, MANUFACTURE AND PRODUCT CONSTRUCTION

(A) POLYMER CONCRETE: The Polymer Concrete shall 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 shall comply with the requirements of ASTM D6783. Unless otherwise approved prior to manufacture, only polyester or vinyl-ester resin systems shall be used. Pipe shall not contain Portland cement or other corrodible elements.

(C) FILLER: Kiln-dried silicate aggregates, sand and quartz powder shall 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, shall not be detrimental to the pipe.

(E) FORMS: Pipe shall 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 shall be perfectly uniform. The inner and outer castings shall be sheet steel fitted to the top and bottom rings. Shell casings shall be accurately formed to true concentric cylinders with tight joints. Approved sockets for spurs shall be cast or cut to the sizes specified and approved with approved covers.

(F) CASTING PIPE: Pipe shall be manufactured by the vibratory vertical casting process resulting in a dense, nonporous, corrosion-resistant, and homogeneous material.

(G) ELASTOMERIC GASKETS: All Gaskets shall meet the requirements of ASTM F477. Gaskets shall 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 shall meet the requirements of ASTM A276.

(I) JOINTS: Joints shall meet the requirements of ASTM D4161. The pipe shall be connected with a stainless steel sleeve coupling. This coupling shall either be mounted integral to the pipe at one end and utilize an elastomeric sealing gasket at the other end or shall utilize elastomeric sealing gaskets at both ends as the means to maintain water-tightness. The joints shall have an outside diameter equal to or slightly less than the outside diameter of the pipe. When the pipe is assembled, the joints shall be essentially flush with the outside diameter of the pipe. Joints at tie-ins shall be as approved in writing by the Engineer.

(J) FITTINGS: Fittings shall be of the same structural design and materials as adjoining pipe. Fittings shall be manufactured with mitered sections of pipe and joined by epoxy bonding.

(K) SPECIAL REQUIREMENTS: When specifically required by the contract polymer concrete pipe shall 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 shall be smooth.

(M) LIFTING BOLT HOLES: Holes drilled or cast into pipe for lifting bolts shall be adequately plugged with a suitable polymer concrete plug that shall be properly glued and sealed before backfill is placed.

(N) MANUFACTURER'S EXPERIENCE: The pipe manufacturer shall have employed manufacturing methods and material formulations in the manufacture of polymer concrete pipe for a minimum of five (5) years. The manufacturer shall 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 shall submit such references, which shall 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.

2.26.5 CHEMICAL AND PHYSICAL REQUIREMENTS

(A) The polymer concrete pipe shall 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 shall 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 shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

(2) The inside surface of the pipe shall 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 shall be free of dents, gouges, and other surface irregularities that will affect the integrity of the joint.

(C) DIMENSIONS AND TOLERANCES: All pipes shall be circular.

(1) Inside Diameters - Inside Diameters and tolerances on inside diameters for pipe shall be in accordance with ASTM D6783.

(2) Lengths - Pipe shall be supplied in nominal lengths of eight (8) or ten (10) feet. Tolerance on nominal length for pipe shall be ±1-inch.

(3) Wall Thickness - Wall thicknesses and tolerances on wall thicknesses for polymer concrete pipe shall be in accordance with ASTM D6783. The minimum wall thickness, measured at the narrowest point along the pipe, shall provide sufficient axial compression strength to withstand anticipated loads. Unless otherwise specified, the minimum factor of safety against ultimate jacking load shall be 3:1.

(4) End Squareness - The planes of the ends of the pipe shall 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 shall 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 shall not vary from true circle by more than one percent (1.0%) when measured in accordance with ASTM D6783.

2.26.6 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) shall be done in accordance with ASTM D6783.

2.26.7 INSPECTION

(A) PLANT INSPECTION: The City and/or the City's designated representative shall be entitled to inspect and witness the manufacturing process of the pipe.

(B) VISUAL INSPECTION: Polymer concrete pipe shall 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 2.26.5**. 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 shall be rejected.

2.26.8 MARKING

Each length of pipe shall 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.

2.26.9 PACKAGING, HANDLING AND SHIPPING

Packaging, handling and shipping shall be performed in accordance with the Manufacturer's instructions or ASTM D6783; whichever is more stringent.

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 3.01 TO 3.03

NO TEXT ON THIS PAGE

SECTION 3.01
INSPECTION OF MATERIALS

3.01.1 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 shall 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 shall be borne by the Contractor and the costs thereof shall be deemed included in the prices bid for all items of work.

All materials, as well as the plant and methods of manufacture, shall 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 shall give the Engineer sufficient advance notice prior to starting the manufacture of the materials. The Engineer shall 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 shall 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 shall be furnished on all deliveries, unless otherwise permitted. The Contractor shall 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 shall be subject to inspection at all times. The Contractor shall 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, shall be provided at the plant by the Contractor. All testing apparatus and equipment shall be of standard and approved type.

(D) TREATED WOOD - Timber, lumber and timber piles to be treated shall be inspected and tested before and after treatment at the plant. No shipment of treated material shall be made unless it has been accepted by the Engineer as satisfactory under the Inspector's report. The Inspector shall seal or stamp accepted treated material prior to shipment.

(E) TREATED TIMBER PILES - Before delivery on the site of the work, all piles shall be inspected. An independent Testing Laboratory approved by the Commissioner shall do the inspection. The expense for the inspection shall 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 shall 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.

3.01.2 IDENTIFICATION

Each delivery shall 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 shall be plainly marked with the name and brand of the manufacturer. The type shall 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 shall contain information that will permit positive identification of the material delivered.

3.01.3 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 shall 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.

3.01.4 MATERIALS TO BE EQUAL TO SAMPLES

Samples taken from the various deliveries during the progress of the work, when tested and analyzed, shall conform to the requirements of the specifications and shall have qualities equal to those of the approved samples submitted. No material other than that equal to the approved samples shall be used without the written permission of the Engineer.

SECTION 3.02
SAMPLING

3.02.1 SAMPLES AND AFFIDAVITS

The Contractor shall 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; 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 shall 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 shall 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 shall 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.

3.02.2 METHODS

(A) The Engineer shall select all samples of materials for testing. Except as herein otherwise specified, sampling of materials shall be in accordance with the methods prescribed by the following and other applicable requirements of the American Society for Testing and Materials:

	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 shall 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 shall be consolidated into one (1) sample for test purposes.

(2) TRUCK LOAD PILE - A gross sample shall 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 shall be consolidated into one (1) sample for test purposes.

(3) SIZE OF SAMPLE - The gross sample shall be not less than twice the weight of the laboratory sample, and it shall 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 shall be taken from each size as representing the delivery thereof.

(C) CONCRETE TEST CYLINDERS - All work related to Concrete Test Cylinders shall be in accordance with **General Specification 11 - Concrete, as modified in Section 2.15**.

(D) STEEL BARS FOR CONCRETE REINFORCEMENT - Three (3) pieces at least twenty-four (24) inches in length shall be taken from each size and heat number delivered.

SECTION 3.03
METHODS OF TEST

3.03.1 METHODS OF TEST

Except as herein otherwise specified, methods of test shall be as prescribed under the various sections of Division II and by the following and other applicable requirements of the American Society for Testing and Materials:

	TITLE	DESIGNATION
(1)	Brick	C279, C32
(2)	Compressive Strength (Mortars)	C109
(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

3.03.2 VITRIFIED CLAY PIPE

(A) INSPECTION - All pipe shall be inspected at the manufacturer's yard for compliance with the requirements of ASTM C700. An independent Testing Laboratory retained by the manufacturer shall perform this inspection. The Testing Laboratory shall be licensed in both the State wherein the inspection and testing is to be performed and also in the State of New York.

(B) TESTING - The Testing Laboratory shall assign an identifying number for each lot of one hundred (100) lengths of pipe for every size manufactured for the project and shall also affix said lot number to each pipe length.

For crushing strength tests, the Testing Laboratory shall 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 shall be tested for crushing strength by the three-edge bearing method in accordance with ASTM C301, Standard Methods of Testing Clay Pipe. This test shall 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 shall 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 shall have all New York City identifying cast on or painted on markings removed as soon as possible after rejection.

The Testing Laboratory shall submit a report in quadruplicate that shall bear the name of the Laboratory and the seal and signature of an authorized representative of the Laboratory and shall included 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 shall include the specification requirements for the above items, where applicable. The reports shall be submitted to the Engineer within three (3) days after testing, and no pipe shall be incorporated into the work until these reports have been received and accepted by the Engineer.

The cost of all of the above shall be deemed included in the prices bid for all items of work.

3.03.3 PRECAST REINFORCED CONCRETE PIPE

All requirements of ASTM C76, shall be conformed to in the manufacture of precast reinforced concrete pipe including ASTM C497 regarding Standard Methods of Testing.

(A) INSPECTION - All pipe shall be inspected at the manufacturer's yard for compliance with the requirements of ASTM C76. An independent Testing Laboratory retained by the manufacturer shall perform the inspection. The Testing Laboratory shall be licensed in both the State wherein the inspection and testing is 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 shall 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 (1) or both of these lengths of pipe prove unsatisfactory, no further tests on any lengths of pipe from this lot shall be made, and all the pipe in this particular lot will be rejected. Pipe shall not 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 shall provide an approved and certified testing machine with a hydraulically operated jack and direct reading gauges requiring no calibration.

Rejected New York City pipe shall 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 shall perform hydrostatic tests on pipe and rubber gasket joints in accordance with ASTM C361, Section 8. - Hydrostatic Tests. Hydrostatic tests shall be for a hydrostatic head of twenty-five (25) feet or as otherwise specified. The hydrostatic pressure tests on joints shall 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 shall 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 shall 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 shall 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 shall, 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 shall 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 shall 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 shall include date of test and copy of Certification.

(2) All shop drawings submitted shall 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 shall 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.

CITY OF NEW YORK

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF WATER AND SEWER OPERATIONS

DIVISION IV

GENERAL CONSTRUCTION PROVISIONS

SECTIONS 4.01 TO 4.13

NO TEXT ON THIS PAGE

SECTION 4.01
SCOPE OF WORK

4.01.1 DESCRIPTION

The description and location of the work for this contract are specified on Attachment 1 (Bid Information).

4.01.2 PROSECUTION OF WORK AND STAGING OPERATIONS

The Contractor shall 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 shall be as directed by the Engineer. Only as much of the roadway as the Engineer shall designate, may be closed to traffic and only for as long as the Engineer may prescribe. The work shall be prosecuted simultaneously at one or more places as ordered by the Engineer.

SECTION 4.02
TRENCHES - GENERAL

4.02.1 OPEN CUT, NO TUNNELING

All work shall be done in open trenches or excavations except where construction by tunneling methods is specifically provided for in the contract documents.

4.02.2 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, shall 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.

4.02.3 TRENCHES

(A) All trenches in earth shall be excavated with vertical sides, and shall be supported by close sheeting, properly braced, unless otherwise permitted. Sheeting and bracing shall 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 shall 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 shall be sloped to elevations approved by the Engineer. Side slopes must be stable and shall 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 shall 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 shall be in conformity with **Subsection 4.02.4**.

4.02.4 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 shall 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 shall not be less than the standard width of the cradle plus six (6) inches minimum each side. This minimum shall 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 shall 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.), shall 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 shall 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 shall 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.), shall 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 non pipe 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 shall 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.) shall 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 shall 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 shall 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. No rock shall 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 shall 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 shall 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 shall, 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 shall 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 shall backfill the trench to the required subgrade with concrete or stone ballast as directed by the Engineer. No separate or additional payment shall be made for such backfilling where required, nor for any additional excavation and sheeting, the cost thereof shall be deemed included in the prices bid for all contract items of work.

(B) 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 shall 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 shall be deemed included in the prices bid for all contract items of work.

4.02.5 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.

4.02.6 SHEETING AND BRACING AND FORMWORK

Sheeting and Bracing of the trenches shall be done in accordance with **Section 4.05 - Sheeting And Bracing**.

Unless otherwise specified in the plans or these specifications or specifically permitted in writing by the Engineer, the Contractor shall remove all sheeting and bracing throughout this project as per **Subsection 4.05.7**.

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 shall be done in accordance with **Subsection 4.05.2**.

Prior to the backfilling of trenches and excavations all formwork shall be removed.

4.02.7 LENGTH OF TRENCH

Unless otherwise specified in the contract documents or ordered in writing by the Engineer, there shall 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 shall 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 shall not be less than fifty (50) feet. The only exception to this is at its upper end or ends, where rock shall 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 5.27**.)

Trenches for basin connections and house services shall 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 shall be fully excavated for its entire length before any pipe is laid therein.

4.02.8 TREES AND STUMPS

The Contractor shall 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 shall be done in accordance with **Subsection 1.06.5** of the specifications and as specified by the Department of Parks and Recreation permits.

4.02.9 MATERIALS TO BE DISINFECTED

If required, any or all of the excavated material shall be satisfactorily disinfected or deodorized prior to removal from the site of work.

4.02.10 ROADWAY, SIDEWALKS, ETC. TO BE KEPT CLEAR

Materials of construction shall be so deposited, and the work shall 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 shall be provided for the free passage of vehicles, unless otherwise specified in **Subsection 1.06.29** or permitted in writing by the Engineer. Street hydrants, water gates, fire alarm boxes and letter boxes shall be kept accessible for use at all times. Not more than two hundred (200) feet of available sidewalk shall be used at any time for storage of materials of construction. During the progress of the work the Contractor shall maintain all crosswalks, sidewalk, driveways and roadways in a safe, neat, clean and satisfactory condition. The work shall 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 shall be done in accordance with **Subsection 1.06.29** and Department of Transportation permits.

4.02.11 NO EXCAVATED MATERIAL STORED ALONG THE LINE OF THE WORK

Excavated material shall 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 shall be carted away by the Contractor as soon as excavated. The material subsequently excavated, if suitable for backfill in accordance with **Section 4.06**, 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 shall be brought to the work and used to backfill the trench.

(3) All excess excavated material shall be removed from the site of work immediately upon excavation. Work shall be done in accordance with **Subsection 1.06.7**.

4.02.12 SUBGRADE OF TRENCHES

The subgrade of all trenches and excavations shall 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 shall take in-place soil density tests of the subgrade (the number and locations of these tests shall be as directed by the Engineer), and shall 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 shall be done in accordance with **Subsection 4.06.4 - Soil Density Testing**.

4.02.13 FENCE

The Contractor shall 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 shall be constructed, placed, maintained, measured and payment made for in accordance with **Section 5.24** of the specifications.

4.02.14 TEMPORARY WALKS AND BRIDGES

Where specified or required, the Contractor shall 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 shall be installed across trenches in order to provide vehicles access to driveways. Where specified or required, street intersections and/or sidewalk areas shall be temporarily bridged or decked over and kept open to vehicular and pedestrian traffic.

The Contractor shall work one-half (1/2) of an intersection at a time and shall keep the other one-half (1/2) of the intersection open to vehicular traffic at all times, unless otherwise specified.

The Contractor shall, 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 shall 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 shall 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 shall be constructed with temporary fence attached to timber curbs on both sides of the walk or bridge. Such crossings shall have a clear distance between timber curbs with fencing of not less than three (3) feet in width.

All temporary walks, crosswalks and bridges shall be maintained in a safe, neat, clean and satisfactory condition and shall be suitably lighted at night. All walks, bridging and decking shall 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 shall 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 shall be submitted for approval prior to commencement of construction operations in accordance with **Subsection 4.05.5** and **Subsection 4.05.6** and shall be constructed in accordance with the approved drawings on file with the Engineer.

All work shall be done in accordance with **Subsection 1.06.29**, Department of Transportation Permits and as directed by the Engineer.

4.02.15 DISPOSAL OF WATER FROM TRENCHES

The Contractor shall at all times during the progress of the work keep the trenches and excavations free from water. The water from the trenches and excavations shall 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 shall 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 shall, as directed by the Engineer, provide either pipe of additional strength or concrete encasement at no additional cost to the City.

The Contractor shall, 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 shall be deemed included in the prices bid for all items of the contract.

All dewatering and discharge pipes and hoses which cross traveled roadways shall be placed in such a manner so as to eliminate any disruption of traffic flow. If so ordered by the Engineer, the Contractor shall place the pipes and hoses in shallow trenches that will then be plated over. All header pipes shall be buried below existing roadway grade at driveways in order to maintain access to driveways.

All plates shall be firmly secured so as to eliminate any possible shift or movement.

All pumps used in the dewatering operation shall be electric and shall 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 4.03
EARTH EXCAVATION

4.03.1 DEFINITION, EARTH EXCAVATION

(A) Earth Excavation shall 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 shall 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 shall not include the following:

(1) boulders in open cut as defined in **Subsection 4.04.1**;
(2) rock as defined in **Subsection 5.27.2**;
(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 5.30**);
(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 shall be paid for as Extra Work.

4.03.2 WIDTHS OF TRENCHES

The widths of trenches in earth and the dimensions of excavations in earth shall be in accordance with **Section 4.02** of the specifications.

4.03.3 DEPTH OF TRENCHES

(A) The trenches in open cut shall be excavated to the depth required for the foundations of the 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 4.03.3(B)** below) separate payment shall be made under the item(s) labeled "ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS", and as described in **Section 5.36 - Additional Earth Excavation Including Test Pits**.

All irregularities in the bottom of the sewer trenches and excavations shall be filled to the required subgrade with Stone Ballast as directed by the Engineer.

Backfill of the sewer trench to subgrade, shall be as described in **Section 5.28 - Riprap, Stone Ballast, Broken Stone And Slope Pavement** for sewer trenches and excavations and payment shall be made under the item labeled "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 shall 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 shall 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 4.04
EXCAVATION OF BOULDERS IN OPEN CUT

4.04.1 DEFINITION

Excavation of boulders in open cut shall 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 shall include riprap, rock fill, thrust blocks and loose masonry.

4.04.2 REMOVAL

The Contractor may elect to remove an entire boulder when partly extending into the trench. Boulders shall be removed from the site of the work immediately after being excavated and measurements taken by the Engineer. Excavated boulders shall become the Contractor's property and shall be properly disposed of at the Contractor's expense.

4.04.3 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 shall be deemed 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 4.05
SHEETING AND BRACING

4.05.1 SHEETING AND BRACING

(A) The sides of the trenches and excavations shall 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 shall comply with these specifications and must receive the approvals stated herein. Timber sheeting and bracing shall be vertical sheeting with ranges 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 shall 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 4.05.4(E)**.))

(E) In general, sheeting and bracing in trenches and excavations shall be designed and installed so that the sheeting shall 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 shall be 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 shall remove all sheeting and bracing throughout this project as per **Subsection 4.05.7**.

4.05.2 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 shall 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 shall be rebraced in a manner approved by the Engineer; however, in no case shall 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 shall also be left in place. Where steel sheeting is used, the rangers and braces shall also be left in place.

When sheeting is to be left in place, the Contractor shall cut sheeting at the elevations ordered in writing by the Engineer; however, in general such cutoffs shall not be less than four (4) feet below the final grade. Timber sheeting shall be cut off by sawing. Steel sheeting or soldier beams shall be cut off by burning. Breaking off of sheeting will not be permitted. The Contractor shall 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 shall be placed prior to cutting at a level below the ordered elevation of cut and left in place.

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 shall 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 shall 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 shall be determine in accordance with **Articles 25 and 26** of the Contract.

If sheeting is specifically shown on the plans or specifically described in the specification to be left in place in sewer trenches and excavations and the Contractor requests permission to remove the sheeting and bracing in place or requests that the sides of the trenches be sloped, and such procedures are approved in writing by the Engineer, an acceptable credit shall accrue to the City for the portion of the sheeting and bracing removed or omitted.

4.05.3 MATERIALS

(A) Timber sheeting and bracing shall be of new or acceptable used timber free from injurious defects.

(B) Steel soldier beams shall comply with the requirements of **Section 2.19 - Structural, Reinforcing And Miscellaneous Steel**, except that approved used material will be permitted. Steel sheet piling shall

comply with the requirements of **Section 2.21 - Steel Sheeting**, except that approved used materials will be permitted. Timber and lumber for bracing, shoring, fencing, bridging, and decking shall conform to the requirements of **Section 2.20 - Timber And Lumber**. Steel used for sheeting systems or for any other purposes herein shall 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 can not be considered as steel bracing frames).

(D) Steel Sheeting shall conform to the requirements of **Section 2.21** and shall be installed with continuous interlock.

4.05.4 CONSTRUCTION METHODS

(A) GENERAL - Timber sheeting and bracing and other sheeting systems shall be of sufficient dimensions and strength, and steel sheeting shall 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 shall be installed in accordance with the approved sheeting details. The Contractor shall be solely responsible for the adequacy and sufficiency of all sheeting and bracing used.

(B) SHEETING - Unless otherwise specified, timber sheeting and bracing shall 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 shall be driven to adequate depth below subgrade. As the work progresses, any voids back of the sheeting shall be filled and compacted in accordance with **Section 4.06** 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 shall 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 shall be increased be three (3) inches beyond the original neat line of such structure or portion thereof. In no case shall the sheeting, soldier beams or other bracing 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 shall 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 shall be removed.

(D) All open cuts shall be excavated with vertical sides and properly supported with close sheeting and bracing in conformity with the requirements of **Section 4.03 - Earth Excavation** and with Industrial Code Rule 23 - "Protection of Persons Employed in Construction and Demolition Work" and 16NYCRR Part 753 of the Industrial Code - "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 shall 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 shall show the trench box extending to subgrade.

(F) Sloped sides will not be permitted, unless shown, specified or permitted in writing by the Engineer.

(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

4.05.5 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 shall 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 shall 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 and allow a minimum of two (2) weeks to review same. This time requirement is to be considered in forming a work schedule.

(C) The Contractor shall have these drawings prepared by a Licensed Professional Engineer, currently registered in the State of New York. Such drawings shall be submitted together with design calculations, references, tables and charts. Both drawings and design calculations shall bear the imprint of the Licensed Professional Engineer's seal and signature.

(D) In designing the sheeting stated above, the Contractor's Engineer shall take note of the standard minimum load diagram requirements for Watertight and Non-Watertight sheeting structures. (See Sewer Design Standards.)

(E) The following notes shall 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 shall adequately reinforce the sheeting and bracing as required at no additional cost to the City.

(2) Maximum pilot cut shall be five (5) feet.

The sheeting and bracing drawings shall 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 shall be signed by and carry the seal of a Professional Engineer licensed in the State of New York. These drawings shall be submitted together with proper design computations bearing the same seal and signature. Shop drawings

shall 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 shall be numbered consecutively and shall 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 shall 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 shall 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 shall 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 shall 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.

4.05.6 DESIGN CRITERIA

The following criteria shall be used in calculating the required sheeting, bracing and/or decking systems.

(A) All compression members (struts) shall be designed with a factor of safety of two (2.0). The factor of safety of two (2.0) shall be a value above and beyond the allowable value for compressive stresses for steel as designated in the "Manual of Steel Construction" (AISC), 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 shall be used to determine the minimum embedment for sheeting as follows:

Vertical Timber - 15%
Soldier Beams - 20%
Steel Sheeting - 30%

(C) Embedment shall be calculated in accordance with the procedures and standard minimum load diagrams specified herein. The maximum allowable embedment for vertical timber sheeting shall not exceed three feet six inches (3'-6"). The minimum embedment shall be two (2) feet.

(D) The Contractor is advised that the maximum allowable bending stress (F_b) for all timber members shall 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 shall 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 shall be increased accordingly.

(F) The Contractor shall 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 shall 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 shall 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 shall be used for sheeting below decking.

(H) Maximum trench widths shown on sheeting details shall not exceed those allowed by the standards or specifications.

(I) The Contractor shall 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 shall include the effect of hydrostatic loading in calculations for both watertight and non-watertight sheeting.

(K) Sheeting details shall accurately depict actual field operations. The Contractor shall 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 shall not assume that additional pilot cut depths will be allowed.

4.05.7 REMOVAL OF SHEETING

All sheeting design and requirements shall 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 shall remove all sheeting and bracing throughout this project.

(A) The sheeting shall 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 shall be accomplished in conjunction with the removal of wales and braces. In no case shall the lifts for sheeting exceed the specified or otherwise approved depth of compaction layer.

(B) The Contractor shall 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 shall also specify if there are any location(s) where sheeting cannot be removed and detail the reasons why the sheeting cannot be removed. The submission shall 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 shall 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 4.05.2**.

(E) This section shall 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 shall perform such maintenance, protection and support.

(F) The cost of maintenance, protection and support (temporarily and permanently) of City owned utilities shall 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 shall 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 4.05.7(E)** above.

4.05.8 COST INCLUDED

There shall be no separate payment 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, shall be deemed included in the prices bid for the respective contract items.

SECTION 4.06
BACKFILLING

4.06.1 BACKFILLING

All trenches and excavations shall be backfilled immediately after the structures are built and inspected, and the Engineer has given permission to backfill.

4.06.2 MATERIAL FOR BACKFILLING

(A) GENERAL - All material for backfilling shall have a moisture content and gradation suitable for attaining the required density.

In general, it is expected that material excavated from a trench shall 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 shall be deemed included in the prices bid for all contract items of work.

The Contractor shall 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 allowed 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 shall be deemed included in the prices bid for all contract items of work.

All material for backfilling shall be free from frost at the time of placement.

Miscellaneous fill material removed from the trenches and excavations shall 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 shall meet the requirements of **Subsection 2.24.2(B)**.

(2) For Sewer Trenches And Excavations - Select Granular Fill material shall 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 shall also be placed around all catch basins.

(3) For All Trenches And Excavations - Select Granular Fill material shall 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.)

(4) 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, shall be deemed included in the prices bid for all contract items of work. Also included in the prices bid for all contract items of work shall be the cost of removing and disposing of that portion of the excavated material that cannot be reused. No separate or additional payment shall be made for this work.

(C) APPROVED EXCAVATED SUITABLE FILL

(1) Approved Excavated Suitable Fill material shall meet the requirements of **Subsection 2.24.2(C).**

(2) All approved excavated suitable fill material within the project limits shall 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:

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.

(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, shall be deemed included in the prices bid for all contract items of work. No separate or additional payment shall be made for this work.

(D) CLEAN FILL

(1) Clean Fill material shall meet the requirements of **Subsection 2.24.2(D).**

(2) Clean fill material shall be fill ordered in writing by the Engineer where there is a deficiency of acceptable backfill. Clean fill material shall 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:

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.

(3) This backfill shall 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 shall be made in accordance with **Subsection 4.06.6**.

(E) PROCESSED FILL

(1) Processed fill material shall meet the requirements of **Subsection 2.24.2(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 shall be in accordance with **Subsection 4.06.6**. (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; shall not be considered as processed material but shall 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 shall be deemed included in the prices bid for all contract items of work.)

4.06.3 METHOD OF DEPOSITING ALL BACKFILL

Sewer conduits for which permission to backfill has been given shall be covered before the completion of each day's work to the following depths:

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.).

Unless otherwise approved in writing by the Engineer, this backfill shall be progressively deposited to equal depths on all sides of the 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 shall be solidly compacted by mechanical tamping or other approved means in such a manner as to avoid injury to the 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 shall be progressively deposited in uniform and successive horizontal layers not exceeding twenty-four (24) inches in depth for the entire width of the trench or excavation and each successive layer shall be solidly compacted by mechanical tamping or other approved means so as to achieve the required density.

The use of backhoe buckets for the compaction of backfill material in all trenches and excavations will not be permitted.

All backfill shall be carefully deposited and spread by approved methods.

Backfill shall proceed simultaneously with the withdrawal of sheeting. 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 shall retain the services of a testing laboratory, in accordance with **Subsection 4.06.4 - Soil Density Testing,** to make all compaction tests of backfill materials used and placed. All compaction tests shall be witnessed and verified by the Engineer.

The Contractor shall furnish to the Engineer, copies of in-process compaction reports certified by an Independent Testing Laboratory. These certified compaction reports shall be submitted as directed by the Engineer.

Compaction to a minimum of ninety-five (95) percent of Standard Proctor Maximum Dry Density shall be attained by the use of impact rammers, plate or small drum vibrators, or pneumatic button head compaction equipment. The equipment shall 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 shall not be permitted except in the immediate area of underground facilities. The backfill within the immediate area of underground facilities shall 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 shall be the area within eighteen (18) inches around all underground facilities.

The Contractor shall be responsible for the proper compaction of all backfill in accordance with the specifications. The Contractor shall also be responsible for determining and maintaining the proper moisture content of the backfill material at all times during the compaction process.

The Contractor shall 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 shall be added, as required, and shall be thoroughly incorporated into the soil. Manipulation shall 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 shall be deferred until the required optimum moisture content is achieved or, if directed by the Engineer, a more suitable material shall be substituted. No separate or additional payment shall 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 shall be deemed included in the prices bid for all items of work.

In-place soil density tests shall be required to ensure that the soil compaction requirements of the specifications are met. In-place soil density tests shall 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 shall 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 shall 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, shall 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 shall be as directed by the Engineer.

Proctor analyses and in-place soil density tests shall be performed in accordance with **Subsection 4.06.4 - Soil Density Testing**.

No separate or additional payment shall be made for the depositing, compacting and sampling of backfill or for the services of the approved testing laboratory, the costs thereof, shall be deemed included in the prices bid for all items of work.

Where sheeting has been used for the excavation, it shall 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 shall apply.

Select granular fill material, approved excavated suitable fill material and clean fill material shall not be used to fill voids in the subgrade of the trenches and excavations for proposed sewer conduits and associated structures unless otherwise specified on the plans or in the contract documents, or as ordered in writing by the Engineer.

4.06.4 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 shall 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 shall 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 shall be completely independent from the Contractor or any subsidiary thereof.

(3) All proposed testing laboratories shall be duly licensed by the New York City Department of Buildings, 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 shall 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 shall 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 shall undergo a Proctor analysis in order 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 shall be as specified and as directed by the Engineer.

Each soil sample designated for Proctor analysis shall 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 shall 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 shall 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 shall 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 shall 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 shall 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 shall be deemed 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 shall 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 shall be deemed 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 shall 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 shall 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 shall be as directed by the Engineer.

(D) EVALUATION OF SOIL TEST RESULTS - All natural earth subgrade, fill and backfill material under this contract shall 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, shall be deemed included in the prices bid for all contract items of work. No separate or additional payment shall 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, shall be deemed included in the prices bid for all contract items of work. No separate or additional payment shall be made for any costs associated with the performing of all In-Place Soil Density Tests.

4.06.5 BACKFILLING AROUND SHEETING

When sheeting is withdrawn all cavities remaining in or adjoining the trench and excavation shall be filled and meet all the requirements of **Subsections 4.06.2 and 4.06.3**. When sheeting is left in place all cavities behind such sheeting shall be filled as directed and in such a manner so as to ensure compliance with all the requirements of **Subsections 4.06.2 and 4.06.3**.

4.06.6 DEFICIENCY OF BACKFILL MATERIAL

Unless otherwise shown on or specified in the contract documents, the Contractor shall backfill and compact all trenches and excavations to the underside of the pavement. Where deficiency of acceptable backfill material occurs, the trenches and excavations shall be backfilled with the acceptable backfill materials as specified in **Subsection 4.06.2**. 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, shall be made as follows:

(A) For providing acceptable select granular fill material (whether natural or processed) to satisfy the requirements of **Subsection 4.06.2(B)** payment for the cost shall be deemed 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 5.37** of the specifications.

(B) For providing acceptable clean fill material (whether natural or processed) to satisfy the requirements of **Subsection 4.06.2(D)** to fill voids left by the removal of ledge rock payment shall be deemed included in the price bid under the contract item labeled "ROCK EXCAVATION". The Contractor's attention is directed to **Section 5.27 - Rock Excavation** of the specifications.

(C) For providing acceptable clean fill material (whether natural or processed) to satisfy the requirements of **Subsection 4.06.2(D)** payment shall be made under the contract item labeled "CLEAN BACKFILL". The Contractor's attention is directed to **Section 5.29 - Clean Backfill** of the specifications.

The cost of rehandling and acceptably disposing of excavated material deemed not suitable for backfill and which requires replacement with clean backfill (with the exception of excavated material that is classified as hazardous material) shall be deemed included in the price bid for the contract item labeled "CLEAN BACKFILL".

The cost for all labor, materials, equipment and insurance necessary and required to place, compact, sample and test provided acceptable backfill material shall be deemed included in the prices bid for all contract items of work. No separate or additional payment will be made for this work.

4.06.7 TEMPORARY BULKHEADS

For retaining compacted backfill, only temporary bulkheads will be allowed over sewer conduits, basin connection pipes, etc. Such temporary bulkheads shall not be constructed of stone, and they shall be removed as the adjacent trenches and excavations are backfilled. This removal of temporary bulkheads along with the backfilling of adjacent trenches and excavations shall proceed simultaneously and shall be accomplished in strict accordance with **Subsections 4.06.2 and 4.06.3**.

4.06.8 REMOVAL OF SURPLUS MATERIAL

As the trenches are backfilled, the Contractor shall 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 shall 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 shall 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 shall be performed in such a manner so as to leave the surfaces of the backfill compact and even with the adjoining surfaces, and shall be done in accordance with **Subsection 4.06.3**.

SECTION 4.07
CONSTRUCTION OF ADJACENT CONDUITS AND/OR PIPES IN THE SAME TRENCH

4.07.1 DESCRIPTION

The criteria for construction of adjacent conduits and/or pipes in the same trench shall 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 shall 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 shall not be considered as eligible for construction as adjacent conduits and/or pipes in the same trench.

The conduits and/or pipes to be constructed under this section shall 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 shall be paid for under the contract item bid for each of the respective conduits and/or pipes.

4.07.2 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 shall 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 shall 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 shall replace the disturbed or over excavated subgrade with well-compacted crushed stone complying with **Subsection 2.25.2(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.

4.07.3 PRICE INCLUDED

The contract price for construction of adjacent conduits and/or pipes in the same trench shall 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 shall 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 4.03 - 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 shall be deemed included in the prices bid for all items of the contract.

SECTION 4.08
TEMPORARY RESTORATION AND CLEANING UP

4.08.1 RESTORATION OF PAVEMENT SURFACE

Unless otherwise specified or directed, in all areas (except projects within the Borough of Staten Island) 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 shall temporarily restore the surface of roadway pavements where disturbed with not less than four (4)

inches of binder mixture or asphaltic concrete mixture (as applicable, and as determined by the Engineer) on dirt immediately after completion of backfilling and compactions.

Unless otherwise specified or directed, in all areas where an existing sidewalk 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 shall temporarily restore the surface of sidewalk pavements where disturbed with not less than two (2) inches of binder mixture or asphaltic concrete mixture (as applicable, and as determined by the Engineer) on dirt immediately after completion of backfilling and compactions.

On all projects within the Borough of Staten Island 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 shall temporarily restore the surface of roadway pavements where disturbed with not less than four (4) inches of binder mixture or asphaltic concrete mixture (as applicable, and as determined by the Engineer) on six (6) inches of subbase immediately after completion of backfilling and compactions. The subbase shall be Recycled Portland Cement Concrete (Material D, only) in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 6.67 - Subbase Course, Select Granular Material**.

All temporary pavement shall be thoroughly compacted and laid flush with the surrounding pavement.

Such temporary restoration shall be maintained in acceptable condition until replaced by final restoration. Unless otherwise specified or directed, the temporary surfacing shall not be replaced with the permanent restoration for a period of not less than six (6) weeks, after it has been laid to the satisfaction of the Department of Design and Construction.

4.08.2 TEMPORARY RESTORATIONS

All temporary pavement restoration shall be done in conformance with **Section 5.31**.

4.08.3 MAINTENANCE OF TEMPORARY RESTORATIONS

The Contractor shall 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 shall immediately restore such pavement to proper grade or otherwise repair the defects.

4.08.4 CLEANING UP

At such times as may be directed, the Contractor shall 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 shall be left clean and in a satisfactory condition. Payment for clean up shall be deemed included in the price bid under the contract item labeled “MAINTENANCE OF SITE”. No separate or additional payment will be made for any required clean up work.

4.08.5 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 shall be placed six (6) inches adjacent to the curbside of the trench upon placing temporary restoration. Spacing shall 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 shall be placed approximately one-

third (1/3) the length apart. A minimum of two (2) markers shall 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 shall be required.

Markers shall be painted in the shape and size of a three (3) inch diameter solid circle.

Marker colors shall correspond to Federal Specification #TT-P-115D and Federal Standard Booklet #595.

Traffic Base White shall be stained or tinted to match the assigned colors as per Federal Standard #595 (color standards).

Material Requirements shall be satisfied under Section 3.1 through 3.3 of the Federal Specification #TT-P-115D.

Qualitative Requirements shall be satisfied under Section 3.4 through 3.5.10 of the Federal Specification #TT-P-115D.

SECTION 4.09
FINAL RESTORATION OF PAVEMENTS

4.09.1 DESCRIPTION

Restoration of permanent roadway pavement shall include the restoration of each kind of roadway pavement shown, specified or required. The Contractor shall obtain the Standard Details of Construction and the Standard Highway Specifications of the New York City Department of Transportation.

4.09.2 MATERIALS

The materials for roadway pavement to be restored shall 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.

4.09.3 CONSTRUCTION METHODS

(A) SAWCUTTING - All saw cutting of pavements shall be done in conformance with **Subsection 5.30.2(A) and Subsection 5.30.6(B)**.

(B) REMOVAL OF EXISTING PAVEMENT - All pavement excavation shall be done in conformance with **Section 5.30**.

(C) FINAL RESTORATION - All Final Restoration shall be done in conformance with **Section 5.32**.

4.09.4 NOTIFICATION OF RESTORATION

At least forty-eight (48) hours before making any restoration of pavements destroyed during the construction of the sewers in this contract the Contractor shall notify the Department of Transportation that the Contractor intends to make such restoration so that the necessary inspection can be provided.

4.09.5 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 shall 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 shall be deemed included in the prices bid for all items of work. No separate or additional payment will be made for any restoration of unpaved areas.

4.09.6 TRENCHES AND EXCAVATIONS

Before laying any final pavements, sidewalks, crosswalks, curbs, etc., the trenches and excavations shall have been filled and compacted all in accordance with **Section 4.06**.

4.09.7 CLEANING UP

At such times as may be directed, the Contractor shall 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 shall be left in a satisfactory condition. The sidewalks and crosswalks shall be swept clean of all material that may have come thereon by reason of the work under this contract, and if required, they shall be sprinkled with water during the sweeping. Payment for clean up shall be deemed included in the price bid under the contract item labeled “MAINTENANCE OF SITE”. No separate or additional payment will be made for any required clean up work.

4.09.8 BROOM CLEANING

The Contractor shall broom clean all streets after final restoration has been made.

4.09.9 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 shall 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 shall be in accordance with the requirements of the Department of Transportation. The results of all measurements and tests shall be certified by the Testing Laboratory and shall be submitted to the Department of Design and Construction.

One (1) core shall 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 shall be taken for each three hundred (300) feet of trench, except that not less than three (3) cores shall 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 shall be transferred to the Department of Transportation in order to provide for the cost of repairs.

4.09.10 GUARANTEE AND MAINTENANCE PERIOD

The guarantee and maintenance period shall be eighteen (18) months after the date of substantial completion of the work as certified by the Department of Design and Construction. The guarantee shall 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 shall be determined at the sole discretion of the Department of Transportation.

4.09.11 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.

4.09.12 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 shall be placed in the center line of the trench upon placing permanent restoration. Spacing shall 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 shall be placed approximately one-third (1/3) the length apart. A minimum of two (2) markers shall 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 shall be required.

Markers shall be painted in the shape and size of a three (3) inch diameter solid circle.

Marker colors shall correspond to Federal Specification #TT-P-115D and Federal Standard Booklet #595.

Traffic Base White shall be stained or tinted to match the assigned colors as per Federal Standard #595 (color standards).

Material Requirements shall be satisfied under Section 3.1 through 3.3 of the Federal Specification #TT-P-115D.

Qualitative Requirements shall be satisfied under Section 3.4 through 3.5.10 of the Federal Specification #TT-P-115D.

SECTION 4.10
PROJECT SIGN, PROJECT RENDERING SIGN AND TEMPORARY NOTIFICATION SIGNS

4.10.1 DESCRIPTION

The Contractor shall be 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 And Rendering**.

The Contractor (when directed in an Addendum to this project) shall be 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 And Rendering**.

The Contractor shall be 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 4.11
LEAKAGE AND LEAKAGE TESTS FOR SEWER LINES

4.11.1 WHEN TESTS ARE REQUIRED

Sewers shall be tested for leakage when specified, required or ordered by the Engineer. When sewers are to be tested for leakage, the methods of testing shall be in accordance with the requirements herein.

4.11.2 ALLOWABLE LEAKAGE

All sewers whether tested or not shall be constructed so the quality of leakage or infiltration shall 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 shall 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 shall 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 shall leak an amount in excess of one-eighth (1/8) gallon per hour per inch of inner diameter.

Outfall sewers shall be classed as pressure sewer lines.

Leakage in sewers of other than circular section shall not exceed an amount based on a circular section having an equivalent inner perimeter.

4.11.3 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 shall be made by the internal pressure test method. The Contractor shall make them as the construction progresses, before any backfilling material is placed, unless otherwise directed by the Engineer. All joints of pipe under test shall be entirely free from earth or other foreign material. The trench shall 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 shall be plugged and bulkheaded at both heads. The sewer section and the manhole or a riser not less than six (6) inches in diameter shall 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 shall be maintained for the duration of the test by adding water.

Leakage by the internal pressure test method shall 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 shall be made by the infiltration test method in accordance with **Subsection 4.11.4** except where sewers are constructed above the ground water level. In this case leakage tests shall be made by the internal pressure test method.

4.11.4 GRAVITY MONOLITHIC SEWERS - SPECIFIC REQUIREMENTS

Leakage tests on monolithic sewers shall 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 shall 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 shall be made by the internal pressure test method in accordance with **Subsection 4.11.3**.

4.11.5 PRESSURE SEWERS - SPECIFIC REQUIREMENTS

Leakage tests for all pressure sewers, including outfall sewers, but excluding tunnel sewers, shall be made by the internal pressure test method as specified for gravity pipe sewers under thirty-six (36) inches in diameter in **Subsection 4.11.3** except that the Contractor shall 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.

4.11.6 TUNNEL SEWERS - SPECIFIC REQUIREMENTS

Leakage tests for sewers constructed in tunnel shall be made by the infiltration method in accordance with **Subsection 4.11.4**.

4.11.7 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.

4.11.8 EQUIPMENT FOR TESTS

The Contractor shall 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 shall be made promptly and as often as necessary to expedite backfilling and completion of sections of the work.

4.11.9 REPAIRING LEAKS

Leakage or infiltration in excess of the specified amount shall be located and stopped and all visible leaks shall be stopped to the satisfaction of the Engineer. When this work is completed the structure shall again be tested. These procedures shall 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, shall remove, take out and reconstruct as much of the original work as the Engineer may direct.

4.11.10 WAIVER OF LEAKAGE TEST

The Engineer may waive leakage tests by the infiltration method. Such waiver shall 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.

4.11.11 NO SEPARATE PAYMENT

No separate or additional payment will be made for fulfilling the requirements specified above and the costs thereof shall be deemed included in the prices bid for all items of work.

SECTION 4.12
CRUSHED STONE BEDDING FOR SEWERS

4.12.1 DESCRIPTION

Where shown, specified or approved, sewers shall be laid on crushed stone bedding or completely encased in crushed stone.

4.12.2 MATERIALS

Crushed stone shall comply with **Subsection 2.25.2(F)**.

Truck receipts showing the size of the stone shall accompany all stone delivered on the project. The Contractor will be responsible for and shall bear the cost of periodic testing of the stone by sieve analysis. An approved independent testing laboratory that is approved by the City shall 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 shall be excavated and replaced at no additional cost to the City.

4.12.3 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 shall extend from manhole walls or other wall faces.

(5) The bedding shall 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 shall 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.

4.12.4 WIDTH OF TRENCH

(A) MINIMUM WIDTH - As per Sewers Design Standards and Specifications.

(B) MAXIMUM WIDTH - As per Sewers Design Standards and Specifications.

4.12.5 REQUIREMENTS

The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** shall apply to the work, except where otherwise described in this section.

The requirements of **Sections 5.03, 5.04, 5.05, 5.13 and 5.16** shall also apply with the exception of references to concrete cradle and concrete encasement.

As per the specifications the Contractor shall 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 shall be done at the Contractor's expense.

SECTION 4.13
PRICES TO COVER

4.13.1 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 4.02 to 4.12, inclusively**, shall be deemed included in the prices bid for all contract items of work.

4.13.2 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 4.02 thru 4.12, 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 WORK

SECTIONS 5.01 TO 5.49

NO TEXT ON THIS PAGE

SECTION 5.01
REINFORCED CONCRETE SEWERS

5.01.1 DESCRIPTION

Reinforced concrete sewers shall be constructed of the sizes and shapes shown.

5.01.2 MATERIALS

(A) Concrete shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(B) Reinforcement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(C) Pipe for spurs and risers shall comply with the requirements of **Section 2.02** for vitrified clay pipe, or **Section 2.04** for cast iron soil pipe, or **Section 2.06** for ductile iron pipe.

(D) Cement mortar shall comply with the requirements of **Section 2.17**.

5.01.3 CONSTRUCTION METHODS

(A) GENERAL - Reinforced concrete sewers shall 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 shall be located where approved by the Engineer.

(B) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** shall apply to the work to be done hereunder.

(C) INVERTS - Inverts of reinforced concrete sewers shall be formed between transverse templates and shall be screeded. Where the radii of inverts are too small to permit screeding between templates, the inverts shall be shaped by means of interior forms. The concrete for inverts shall be deposited continuously for the entire cross section and for such longitudinal distances as approved. Inverts shall be carefully protected from all injury during the progress of the work. The inverts of reinforced concrete sewers shall be troweled smooth. Unless otherwise permitted or ordered, not less than twelve (12) feet of invert for reinforced concrete sewer shall be built at one operation.

(D) SIDE WALLS - Concrete in the sidewalls of sewers shall be deposited continuously to the height, to the thickness and for such longitudinal distances as approved.

(E) ROOFS - Concrete in the roofs of sewers shall 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 shall be finished true and smooth.

(F) BULKHEADS - Approved construction joint bulkheads with provisions for keying and doweling adjoining sections shall be provided, where required.

(G) REINFORCEMENT AND STRUCTURAL STEEL - The steel reinforcement shall be of the dimensions and shapes shown, and installed in the manner specified in **General Specification 11 - Concrete, as modified in Section 2.15**. Structural steel shall be of the shapes and sizes shown, and installed as directed.

(H) CONNECTIONS - Connections and branches shall be built where shown on the plans or where directed. All unconnected branches shall 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 shall 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 shall be closed with approved tile or precast concrete plugs or with hand tightening (wing nut type) expandable plugs as manufactured by O.R.H.A. Industries or Jones Manufacturing Co., or approved equal, so as 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 shall be removed in accordance with **General Specification 11 - Concrete, as modified in Section 2.15**.

(K) WATERSTOPS - Waterstops shall be provided between each successive pour in accordance with **Section 2.13**. Details shall be submitted for waterstops as part of the shop drawings.

5.01.4 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 shall be a four (4) sided box section with open ends to be monolithically cast of reinforced concrete. All inside surfaces shall be smooth so as not to restrict flow. All curves and bends must be poured in place.

(B) MATERIALS

(1) Concrete shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15** except that the concrete shall 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 shall not exceed one-tenth (1/10) of one percent by weight of cement. The maximum water/cement ratio shall not exceed forty-seven (47) percent by weight.

(2) Portland Cement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**, and shall be Type II unless otherwise specified. Coarse and Fine Aggregate for concrete shall be well graded in accordance with **Subsection 2.6.1.1 of General Specification 11 - Concrete, as modified in Section 2.15**. Size of Coarse Aggregate shall be three-quarter (3/4) inch unless smaller size aggregate is required due to nature of work.

(3) Reinforcement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(4) Welded Steel Wire Fabric shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15** and shall 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 shall 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 shall be in general conformance with ASTM C789 or C850 (as required) and ACI Specification. The following design parameters shall be used:

(1) Unit Weight of Soil - 120 lbs./cu. ft (minimum)
(2) Minimum Live Load - AASHTO HS 20-44
(3) Impact Loading (Dependent upon depth)
(4) Exterior Groundwater Elevation

A design shall 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 shall have an approved lap and spigot joint that will permit water tight smooth and permanent joints. The minimum lap shall 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 shall be manufactured with a groove or step to accept a gasket. The gasket shall be a one (1) inch diameter neoprene ring gasket and shall 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 shall be tested in conformance with **General Specification 11 - Concrete, as modified in Section 2.15**, with the exception that the concrete, steel reinforcement, fabrication and manufacture shall 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, shall be performed and must be satisfactorily completed prior to acceptance. The gasket shall conform to ASTM C443 and must be tested for a joint deflection of one (1) inch.

Testing shall 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 shall 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 shall be deemed included in the price bid per linear foot of "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 shall be provided integral with the precast sections at the time of manufacture, and shall 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 shall 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 shall be maintained between the edge of the opening and the end of the section.

Openings in roofs required for risers shall be provided at time of manufacture and shall 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 shall provide openings as required by the field conditions and as directed by the Engineer.

Lateral pipes (i.e. spurs, risers, drains) shall be installed flush with the inside face of the box section and all annular spaces shall be filled with nonshrink grout that shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(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 shall be provided with a keyway and a four (4) inch waterstop. In general, the location of this connection shall be at least eighteen (18) inches from the poured-in-place structure. Threaded inserts shall be provided in the

precast section at twelve (12) inches on center located in the center of the walls, roof and invert. These inserts shall be nine (9) inches in depth and provided with eighteen (18) inch long No. 6 reinforcement bars which shall 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, shall be included in the shop drawings.

(H) INSTALLATION - All precast box sections shall be laid on a well-compacted six (6) inch thick layer of crushed stone, the material shall be in conformance with **Section 4.12** of these specifications. In addition, two (2) rows of 2" x 8" pressure treated wood planks shall be laid parallel and continuous along the entire length of the trench. The planks shall be laid so that their outer edges align with the inside walls of the precast section. The planks shall 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 shall be placed on the prepared base. Coil inserts and lifting slings or their equivalent shall be used in the placing of all sections. After the initial section is in place, successive precast sections shall be lowered into position and slid upon the planks as close as possible to the previous section. Pipe pullers or their equivalent shall 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 shall 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 shall show dimensions, reinforcement details, connection details, design parameters and construction procedures.

All shop drawings and calculations shall bear the seal and signature of a New York State Licensed Professional Engineer. Shop drawings shall show the Contractor's name, the manufacturer's name, the project number and title, drawing description, drawing number and date.

(J) MARKINGS - The manufacturer shall mark each individual piece with permanent markings on the inside of the box section. The following minimum information shall be listed:

(1) Date of Manufacture
(2) Manufacturer's Logo
(3) Individual Piece Identification
(4) ASTM Designation

(K) DELIVERY OF SECTIONS - No sections shall 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 shall be built in conformance with approved drawings and shall be cast in steel forms.

Devices used to position reinforcement shall 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 shall 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 shall be thoroughly consolidated by internal or external vibration or a combination of both.

(M) CURING - All precast sections shall 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 shall 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 shall 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 shall 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 shall 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 shall not be subjected to freezing temperatures until the required twenty-eight (28) day compressive strength is achieved.

5.01.5 MEASUREMENT

The quantities of reinforced concrete sewers to be measured for payment shall 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 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.

5.01.6 PRICE TO COVER

The contract price for “REINFORCED CONCRETE SEWERS” shall be the unit price bid per linear foot for each size and type of sewer and shall 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 4.03 - 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 shall be deemed included in the contract price bid for “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 shall 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 shall 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 1.06.12 and 1.06.27** 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 shall define Flat Top Reinforced Concrete Sewers:

50.11

(2) The sixth character shall define the Type of Sewer Effluent:

S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer

(3) The seventh character shall define the Number Of Barrels of the Sewer:

S - Single Barrel
D - Double Barrel
T - Triple Barrel

(4) The eighth, ninth and tenth characters shall 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 shall 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 5.02
PRECAST REINFORCED CONCRETE PIPE SEWERS

5.02.1 DESCRIPTION

Precast reinforced concrete pipe sewers shall be constructed of the sizes and classes shown.

5.02.2 MATERIALS

(A) Precast reinforced concrete pipe shall comply with the requirements of **Section 2.05**. Kind, class and size of pipe shall be as shown or specified.

Approved openings with covers for spurs or risers shall be provided where shown or required.

(B) Cement mortar shall comply with the requirements of **Section 2.17**.

(C) Ring rubber gasket and grooved spigot joint shall comply with the requirements of **Section 2.07**, Type 4, and as specified herein.

(D) Flexible butyl gasket shall comply with the requirements of **Section 2.07**, Type 5, and as specified herein.

(E) Concrete for cradle and encasement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

5.02.3 CONSTRUCTION METHODS

(A) GENERAL - Precast reinforced concrete pipe sewers shall 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** shall apply to the work to be done hereunder.

(C) JOINTS - All pipe forty-eight (48) inches and larger in its least dimension shall have all interior and exposed exterior joints completely filled with cement mortar. Joints must be watertight. They shall be troweled or otherwise finished to make them smooth and flush with the interior surface of the pipe.

The following type joints shall be acceptable:

(1) Type 4 - Ring Rubber Gasket of Circular Cross Section and Grooved Spigot Joint shall be used for Circular Reinforced Concrete Pipe joints. Pipe for which these types of joints are specified shall 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 shall be perfectly uniform.

The design of the joint shall conform to the requirements of ASTM C361.

Rubber Gaskets shall 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 shall be submitted for approval before pipe laying begins.

For Type 4 - Ring Rubber Gasket and Grooved Spigot Joints, the following shall apply:

(a) Immediately before laying the pipe a round rubber gasket shall be snapped into the spigot groove and shall be completely covered with soap or wax compound or other approved lubricant.

(b) The pipe shall be properly aligned in the trench to avoid any possibility of fouling the gasket.
(c) The spigot with gasket attached shall be entered into the heel of the previously laid pipe and forced home. Approved tackle and apparatus shall be used to draw the joints home. When the pipe is laid the shoulders of the bell and spigot shall touch.
(d) Rubber gaskets shall not be exposed to the sun either before or after placing on the pipe spigots.

(2) Elliptical Reinforced Concrete Pipe Joint Material shall be Type 5 - Flexible Butyl Gasket, conforming to Federal Specification SS-S-210A and ASSHTO M-198. The pipe joint material shall be of either rectangular or circular shape with a minimum cross-sectional area of 0.78-square inches. The joint material shall 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 shall be hand cleaned of all foreign material prior to placing the joint material and primer. The joint material shall be overlapped (not butted) to assure a complete seal.

(3) Inspection - Unless otherwise directed by the Engineer, the finished joint shall be left exposed for inspection and approval by the Engineer. A suitable ladder affording easy access for such inspection shall be provided.

(D) LAYING - The pipe shall be laid with the male ends toward the outlet. The pipes shall 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 shall be laid in one operation.

During the progress of the work the exposed ends of pipe sewers shall 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 shall be cut to fit the inner face of the masonry. Unless otherwise directed, such cutting shall be done before the pipes are built in.

(E) CRADLES - Precast reinforced concrete pipe sewers shall be laid in continuous concrete cradles. Concrete cradles for pipe shall be cast in one (1) pour and shall be of the dimensions shown on the Sewer Design Standards and as directed by the Engineer.

Concrete sills of approved shapes and dimensions shall be used for the temporary support of pipes that are to be permanently supported on concrete cradles. Such sills shall be completely embedded in the concrete cradle. Working drawings of these sills shall be submitted to the Engineer for approval before pipe laying begins. The use of wood blocks or fieldstones will not be permitted.

Forms shall be removed in accordance with **General Specification 11 - Concrete, as modified in Section 2.15**.

(F) CONCRETE ENCASEMENT - Where shown, specified or required, precast reinforced concrete pipe sewers shall be fully encased in concrete.

(G) DAMAGED PIPE - Pipe damaged from handling or any cause whatsoever, whether in or out of the trench shall 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 shall 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 shall be such as to provide a continuous and smooth inside surface with the branch pipe. A socket shall 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 nonshrink and watertight compound. The depth of the socket shall at least be two (2) inches. Unconnected openings for spurs and risers, or dead ends of spurs and risers shall be closed with approved tile or precast concrete plugs or with hand tightening (wing nut type) expandable plugs as manufactured by O.R.H.A. Industries or Jones Manufacturing Co., or approved equal, so as 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. Need for and location of openings for spurs and risers, and height of risers will be determined by the Engineer at time of construction. The Contractor shall provide openings as required by the field conditions and as directed by the Engineer.

(I) FIELD CUTTING - Precast reinforced concrete pipe shall 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 shall be removed and be replaced with a pipe of suitable size in the proper position. The ends of pipe that enter masonry shall be neatly cut to fit the inner face of the masonry. Unless otherwise directed, such cutting shall be done before the pipes are built in. Inverts of existing manholes shall 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 shall be deemed included in the prices bid per linear foot of the respective sewer items.

5.02.4 MEASUREMENT

The quantities of precast reinforced concrete pipe sewers to be measured for payment shall 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 shall 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.

5.02.5 PRICE TO COVER

The contract price for “PRECAST REINFORCED CONCRETE PIPE SEWERS” shall be the unit price bid per linear foot for each size, kind and class of sewer and shall 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 4.03 - 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 shall 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 shall 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 1.06.12 and 1.06.27** 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 shall define Precast Reinforced Concrete Pipe Sewers:

(2) The sixth character shall define the Type of Sewer Effluent:

S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer

(3) The seventh character shall 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 shall define the Kind of Bedding for Sewer Pipe:

C - On Concrete Cradle
E - Encased In Concrete

(5) The ninth, tenth and eleventh characters shall 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 shall 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 5.03
VITRIFIED PIPE SEWERS

5.03.1 DESCRIPTION

Vitrified pipe sewers shall be constructed of the sizes and kinds shown.

5.03.2 MATERIALS

(A) Vitrified pipe shall comply with the requirements of **Section 2.02**. Kind, class and size of pipe shall be as shown or specified.

(B) Cement mortar shall comply with the requirements of **Section 2.17**.

(C) Cement grout shall comply with the requirements of **Section 2.18**.

(D) Gasket and mortar joint shall comply with the requirements of **Section 2.07**, Type 1, and as specified herein.

(E) Premoulded bituminous compound joint shall comply with the requirements of **Section 2.07**, Type 2, and as specified herein.

(F) Elastomeric pipe joint shall comply with the requirements of **Section 2.07**, Type 3, and as specified herein.

(G) Ring rubber gasket and grooved spigot joint shall comply with the requirements of **Section 2.07**, Type 4, and as specified herein.

(H) Concrete for cradle and encasement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

5.03.3 CONSTRUCTION METHODS

(A) GENERAL - Vitrified pipe sewers shall be constructed of the sizes and kinds and to the lines and grades shown on the plans or as ordered.

The Contractor shall 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** shall 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 shall be either Type 3 - Elastomeric Pipe Joint, or Type 4 - Ring Rubber Gasket of Circular Cross Section and Grooved Spigot Joint, or shall be a Compression Ring of a Resilient Material and Grooved Spigot Joint, and the following shall apply:

(a) Vitrified pipe joints of elastomeric material shall be factory applied. The method employed to mould the joint shall be such as to insure even distribution of material, smooth contact surfaces and tight joints when the pipe is laid. Care shall 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 shall be cleaned by effective means and then coated with a lubricating agent recommended by the manufacturer of the joint material being used.

The pipe shall then be drawn up home so that the inner edge of the jointing material on the spigot edge shall be approximately flush with the outer edge of the jointing material in the bell and the joint material shall remain in continuous compression around the full circumference of the pipe. None of the jointing material on the spigot end shall 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 shall 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 shall also be coated with the same lubricating agent. The pipe shall 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 shall apply:

(a) Type 1 - Gasket and Mortar Joint shall 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 shall be solidly rammed into the annular space between the pipes with a suitable caulking tool. Before being placed, the gasket shall be saturated with neat cement grout. The remainder of the space shall then be completely filled with mortar and the joint wiped inside and finished to a smooth bevel outside.

(b) Type 2 - Premoulded Bituminous Compound may be made at the site or in the yard of the pipe supplier. The methods employed to mould the joint shall be such as to ensure even distribution of material, smooth contact surfaces and tight joints when the pipe is laid. Care shall be taken in transporting and handling pipe to prevent deformation or damage to the premoulded bituminous joint material.

The bell and spigot of the pipe shall be cleaned by effective means and then coated with an approved primer. The joint material shall be cast on the pipe using approved metal forms.

Before inserting spigot into pipe previously laid, contact surfaces shall be cleaned and coated with an approved solvent or adhesive on both surfaces. An approved mechanical device shall 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 shall be left exposed for inspection and approval by the Engineer. A suitable ladder affording easy access for such inspection shall be provided.

(D) LAYING - The pipe shall be laid with the male ends toward the outlet. The pipes shall 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 shall be laid in one operation.

During the progress of the work the exposed ends of pipe sewers shall 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 shall be cut to fit the inner face of the masonry. Unless otherwise directed, such cutting shall be done before the pipes are built in.

(E) CRADLES - Vitrified pipe sewers shall be laid in continuous concrete cradles. Concrete cradles for pipe shall be cast in one (1) pour and shall be of the dimensions shown on the Sewer Design Standards, and as directed by the Engineer.

Concrete sills of approved shapes and dimensions shall be used for the temporary support of pipes that are to be permanently supported on concrete cradles. Such sills shall be completely embedded in the concrete cradle. Working drawings of these sills shall 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 shall be removed in accordance with **General Specification 11 - Concrete, as modified in Section 2.15**.

(F) CONCRETE ENCASEMENT - Where shown, specified or required, vitrified pipe sewers shall be fully encased in concrete.

(G) DAMAGED PIPE - Pipe damaged from handling or any cause whatsoever, whether in or out of the trench, shall be replaced and removed from the site of the work by and at the sole expense of the Contractor.

(H) SPURS AND RISERS - 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 shall provide vitrified pipe Wye or Tee branches for spurs as required by the field conditions and as directed by the Engineer.

Unconnected dead ends of spurs and risers shall be closed with approved tile or precast concrete plugs or with hand tightening (wing nut type) expandable plugs as manufactured by O.R.H.A. Industries or Jones Manufacturing Co., or approved equal, so as 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 shall 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 shall be removed and be replaced with a pipe of suitable size in the proper position. The ends of pipe that enter masonry shall be neatly cut to fit the inner face of the masonry. Unless otherwise directed, such cutting shall be done before the pipes are built in. Inverts of existing manholes shall 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 shall be deemed included in the prices bid per linear foot of the respective sewer items.

5.03.4 MEASUREMENT

The quantities of vitrified pipe sewers to be measured for payment shall 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 shall 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.

5.03.5 PRICE TO COVER

The contract price for "VITRIFIED PIPE SEWERS" shall be the unit price bid per linear foot for each size, kind and class of sewer and shall 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 4.03 - 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 shall 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 1.06.12 and 1.06.27** 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 shall define Vitrified Pipe Sewers:

50.31

(2) The sixth character shall define the Type of Sewer Effluent:

S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer

(3) The seventh character shall 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 shall 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.
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 5.04
DUCTILE IRON PIPE SEWERS

5.04.1 DESCRIPTION

Ductile iron pipe sewers shall be constructed of the sizes and classes shown.

5.04.2 MATERIALS

(A) Ductile iron pipe shall comply with the requirements of **Section 2.06** and shall be Class 56 unless otherwise specified.

(B) Joints shall comply with the requirements of **Subsection 2.06.5**.

(C) Concrete for cradle and encasement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(D) All fittings required shall 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 shall comply with the requirements of **Section 4.12**.

5.04.3 CONSTRUCTION METHODS

(A) GENERAL - Ductile iron pipe sewers shall 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** shall apply to the work to be done hereunder.

(C) JOINTS

(1) Joints shall be made in accordance with the requirements of **Subsection 2.06.5**. Unless otherwise specified in the specifications and standards, or ordered by the Engineer, all joints for ductile iron pipe sewers shall be "push-on" joint type.

(2) Inspection - Unless otherwise directed by the Engineer, the finished joint shall be left exposed for inspection and approval by the Engineer. A suitable ladder affording easy access for such inspection shall be provided.

(D) LAYING - The pipe shall be laid with the male ends toward the outlet. The pipes shall 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 shall be laid in one operation.

During the progress of the work the exposed ends of pipe sewers shall 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 shall be cut to fit the inner face of the masonry. Unless otherwise directed, such cutting shall be done before the pipes are built in.

(E) STONE CRADLE AND ENCASEMENT - Ductile iron pipe sewers shall 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 4.12** shall apply to the work done hereunder.

(F) CONCRETE CRADLE AND ENCASEMENT - When specifically shown, specified or required, ductile iron pipe sewer shall be laid in a continuous concrete cradle or fully encased in concrete. Concrete cradles for pipe shall be cast in one (1) pour and shall be of the dimensions shown, specified or directed.

Concrete sills of approved shapes and dimensions shall be used for the temporary support of pipes that are to be permanently supported on concrete cradles. Such sills shall be completely embedded in the concrete cradle. Working drawings of these sills shall be submitted to the Engineer for approval before pipe laying begins. The use of wood blocks or fieldstones will not be permitted.

Forms shall be removed in accordance with **General Specification 11 - Concrete, as modified in Section 2.15**.

(G) DAMAGED PIPE - Pipe damaged from handling or any cause whatsoever, whether in or out of the trench, shall be replaced and removed from the site of the work by and at the sole expense of the Contractor.

(H) SPURS AND RISERS - 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 shall provide ductile iron pipe Wye or Tee branches for spurs as required by the field conditions and as directed by the Engineer.

Unconnected dead ends of spurs and risers shall be closed with approved tile or precast concrete plugs or with hand tightening (wing nut type) expandable plugs as manufactured by O.R.H.A. Industries or Jones Manufacturing Co., or approved equal, so as 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 shall 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 shall 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 shall be removed and be replaced with a pipe of suitable size in the proper position. The ends of pipe that enter masonry shall be neatly cut to fit the inner face of the masonry. Unless otherwise directed, such cutting shall be done before the pipes are built in. Inverts of existing manholes shall 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 shall be deemed included in the prices bid per linear foot of the respective sewer items.

5.04.4 MEASUREMENT

The quantities of ductile iron pipe sewers to be measured for payment shall 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 form 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 shall 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.

5.04.5 PRICE TO COVER

The contract price for “DUCTILE IRON PIPE SEWERS” shall be the unit price bid per linear foot for each size, kind and class of sewer and shall 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 4.03 - 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 shall 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 1.06.12 and 1.06.27** 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 shall define Ductile Iron Pipe Sewers:

50.41

(2) The sixth character shall define the Type of Sewer Effluent:

S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer

(3) The seventh character shall 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 shall 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 shall 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.
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.
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 5.05
CAST IRON PIPE SEWERS

5.05.1 DESCRIPTION

Cast iron pipe sewers shall be constructed of the sizes and classes shown.

5.05.2 MATERIALS

(A) Cast iron pipe shall comply with the requirements of **Section 2.03**. Kind, class and size of pipe shall be as shown or specified.

(B) Joints shall comply with the requirements of **Subsection 2.06.5** as defined for ductile iron pipe.

(C) Concrete for cradle and encasement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(D) All fittings required shall 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 shall comply with the requirements of **Section 4.12**.

5.05.3 CONSTRUCTION METHODS

(A) GENERAL - Cast iron pipe sewers shall 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** shall apply to the work to be done hereunder.

(C) JOINTS

(1) Joints shall be made in accordance with the requirements of **Subsection 2.06.5** 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 shall be "push-on" joint type.

(2) Inspection - Unless otherwise directed by the Engineer, the finished joint shall be left exposed for inspection and approval by the Engineer. A suitable ladder affording easy access for such inspection shall be provided.

(D) LAYING - The pipe shall be laid with the male ends toward the outlet. The pipes shall 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 shall be laid in one operation.

During the progress of the work the exposed ends of pipe sewers shall 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 shall be cut to fit the inner face of the masonry. Unless otherwise directed, such cutting shall be done before the pipes are built in.

(E) STONE CRADLE AND ENCASEMENT - Cast iron pipe sewers shall 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 4.12** shall apply to the work done hereunder.

(F) CONCRETE CRADLE AND ENCASEMENT - When specifically shown, specified or required, cast iron pipe sewer shall be laid in a continuous concrete cradle or fully encased in concrete. Concrete cradles for pipe shall be cast in one (1) pour and shall be of the dimensions shown, specified or directed.

Concrete sills of approved shapes and dimensions shall be used for the temporary support of pipes that are to be permanently supported on concrete cradles. Such sills shall be completely embedded in the concrete cradle. Working drawings of these sills shall be submitted to the Engineer for approval before pipe laying begins. The use of wood blocks or fieldstones will not be permitted.

Forms shall be removed in accordance with **General Specification 11 - Concrete, as modified in Section 2.15**.

(G) DAMAGED PIPE - Pipe damaged from handling or any cause whatsoever, whether in or out of the trench, shall be replaced and removed from the site of the work by and at the sole expense of the Contractor.

(H) SPURS AND RISERS - 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 shall provide cast iron pipe Wye or Tee branches for spurs as required by the field conditions and as directed by the Engineer.

Unconnected dead ends of spurs and risers shall be closed with approved tile or precast concrete plugs or with hand tightening (wing nut type) expandable plugs as manufactured by O.R.H.A. Industries or Jones Manufacturing Co., or approved equal, so as 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 shall 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 shall 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 shall be removed and be replaced with a pipe of suitable size in the proper position. The ends of pipe that enter masonry shall be neatly cut to fit the inner face of the masonry. Unless otherwise directed, such cutting shall be done before the pipes are built in. Inverts of existing manholes shall 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 shall be deemed included in the prices bid per linear foot of the respective sewer items.

5.05.4 MEASUREMENT

The quantities of cast iron pipe sewers to be measured for payment shall 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 form 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 shall 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.

5.05.5 PRICE TO COVER

The contract price for “CAST IRON PIPE SEWERS” shall be the unit price bid per linear foot for each size, kind and class of sewer and shall 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 4.03 - 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 shall 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 1.06.12 and 1.06.27** 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 shall define Cast Iron Pipe Sewers:

50.51

(2) The sixth character shall define the Type of Sewer Effluent:

S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer

(3) The seventh character shall 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 shall 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 shall 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.

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 5.05A
SEWERS IN JACKED STEEL SLEEVES

5.05A.1 INTENT

This section describes construction of sewers in jacked steel sleeves.

5.05A.2 DESCRIPTION

Sewers in jacked steel sleeves shall be constructed to the sizes, kinds and classes of pipe specified and in accordance with the details shown on the contract drawings. The construction of sewers herein shall be by means of the jacking of a steel sleeve with the use of microtunneling techniques and the insertion of a carrier pipe.

Microtunneling shall be defined as the trenchless installation of the pipe by jacking the pipe behind a remotely controlled tunnel-boring machine. The microtunnel machine shall be capable of adequately and safely counter-balancing prevailing hydrostatic conditions and shall be a slurry shield or an earth pressure-balanced shield or an approved equal. The microtunnel machine shall be capable of performing in the "Hydroshield" mode with the opportunity to support the face with Bentonite slurry. In addition it shall be equipped with the following:

(1) an air lock
(2) mixed face cutting wheel with cutter discs as well as ripper teeth
(3) a cone crusher

The microtunnel-boring machine shall be capable of tunneling both rock and boulders of all sizes.

5.05A.3 SUBMITTALS

(1) Before commencing any operations associated with the construction of sewers in jacked steel sleeves the Contractor shall submit a detailed description of the proposed method of installation including locations and dimensions of jacking/receiving pits, insertion procedures and all shop drawings required for review and approval by the Engineer. These submittals shall 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.

(2) Shop drawings shall be submitted in accordance with all applicable provisions of **Subsection 4.05.5 - Shop Drawings**, as required. Design criteria shall be submitted in accordance with all applicable requirements of **Subsection 4.05.6 - Design Criteria**, as required.

(3) The Contractor shall allow a minimum of four (4) weeks for review.

(4) No work associated with the construction of sewers in jacked steel sleeves shall commence until the Contractor receives all required approved shop drawing from the Department of Design and Construction, Division of Infrastructure.

5.05A.4 MATERIALS

(A) Precast reinforced concrete pipe shall comply with the requirements of **Section 2.05**. The minimum class and thickness of pipe shall be Class V, Wall B. Size of pipe shall be as shown or specified. Precast reinforced concrete pipe shall be protectively coated in accordance with **Subsection 5.05A.10**.

(B) Vitrified pipe shall comply with the requirements of **Section 2.02**. Kind, class and size of pipe shall be as shown or specified.

(C) Ductile iron pipe shall comply with the requirements of **Section 2.06** and shall be Class 56 unless otherwise specified.

(D) Steel Sleeves shall have an outer diameter (O.D.) as shown or specified and shall have a minimum sleeve thickness as specified in table below. The steel shall conform to ASTM A134 (plates: ASTM A283, Grade C) API std. 5L, Grade B. The jacked sleeve shall be designed to withstand jacking thrust as well as external loads. A factor of safety of 2.5 shall 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”	0.875”

(E) Cement mortar for joints shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(F) Ring rubber gasket and grooved spigot joint shall comply with the requirements of **Section 2.07**, Type 4, and for precast reinforced concrete pipe with **Subsection 5.02.3(C)**, and for vitrified pipe with **Subsection 5.03.3(C)**.

(G) Elastomeric pipe joint shall comply with the requirements of **Section 2.07**, Type 3, and for vitrified pipe with **Subsection 5.03.3(C)**.

(H) Joints for ductile iron pipe shall comply with the requirements of **Subsection 2.06.5**.

(I) Grout utilized to fill the voids between the steel sleeve and the sewer carrier pipe shall be Low Weight Cement Grout - Mearlcrete Cellular Concrete manufactured by the Mearl Corporation or approved equal.

Low Weight Cement Grout:

(a) Grout shall consist of neat Portland cement, water, Mearlcrete Foam Liquid concentrate and other materials as recommended by the Mearl Corporation or approved equal.
(b) Portland cement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**, and shall be Type II.
(c) Mixing water shall 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 shall be 95-lb/ft^3 maximum.
Dry Density shall be 90-lb/ft^3 maximum.
Compressive Strength shall be 1,000-psi minimum.

(J) Grout utilized to fill the voids between the outside of the jacked sleeve and the soil shall be Pressure Grout.

Pressure Grout:

(a) Pressure grout shall consist of neat Portland cement or it shall be mixed in a proportion by volume of one (1) part Portland cement and one (1) part sand or it shall 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 shall be mixed with clean fresh water to the desired consistency. In no case shall more than eight (8) gallons of water be mixed per bag of cement.

5.05A.5 METHODS

(A) GENERAL

The Contractor shall install jacking and receiving pits properly braced to withstand both external loads (soil, water, etc.), and internal jacking loads. The Contractor shall 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 shall be used in the pit for placement and alignment of each piece of sleeve during installation procedures.

The steel sleeve shall be jacked into position by the use of jacks of sufficient capacity to push the pipe and microtunneling machine through the soil. Upon completion of each jacked section (jacking pit to receiving pit) the Contractor shall immediately pressure grout from the interior of the steel sleeve in conformance with **Subsection 5.05A.9**.

The Contractor shall follow the recommendations of the pipe manufacturer regarding the installation of the carrier pipe. The recommended installation method used by the Contractor shall be such that no damage will occur to the carrier pipe when it is inserted.

The Contractor shall install the sewer carrier pipe to the line and grade required within the steel sleeve. Carrier pipe shall be properly braced and supported with spacers that are electrically insulated from the steel sleeve. The braces/supports/spacers shall be installed and positioned in accordance with the manufacturer's recommendations and shall not inhibit the flow of grout. The Contractor shall submit design and method of bracing prior to installation of carrier pipe for approval by the Engineer. Proper precautions shall be taken by the Contractor to prevent floatation or motion of the water main during the grouting operation.

The excavated pits shall be dewatered wherever required due to groundwater conditions. The Contractor shall 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 pit.

(B) CONTROL OF LINE AND GRADE

(1) Lines and grades shall conform to the requirements of **Subsection 1.06.8** and as amended herein. The Contractor shall establish the baselines and benchmarks in accordance with this contract.

(2) The Contractor shall 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.

(3) If there is any movement during construction, it shall be the Contractor's responsibility to detect and correct it as required.

(4) The microtunnel excavation and run of jacked pipe shall 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 shall make note of all possible encumbrances and structures in the line of work that may restrict clearances.

(C) EQUIPMENT

(1) The microtunnel boring machine shall be capable of controlling the volume of excavated material removed from the excavation face at all times.

(2) The microtunnel-boring machine shall be fully steerable both horizontally and vertically.

(3) Guidance of the microtunnel-boring machine shall be through a remote console, in or adjacent to the jacking pit or shaft. At a minimum, the thrust force, rate of advance, distance along heading, deviation from line and deviation from grade shall be monitored and displayed on the remote console.

(D) SAFETY

The Contractor shall carry out the Contractor's operations in strict accordance with OSHA and the Manufacturer's safety requirements.

(E) INSTALLATION OF CASING PIPE FOR INSERTION OF GROUT

After the steel sleeve has been installed the Contractor shall drill 4-inch casing pipes from the ground surface down to the top centerline of the steel sleeve. The number of casing pipes placed shall be at a minimum, one at each end of the steel sleeve. The Engineer may order the drilling of additional casing pipes for grouting along the length of the steel sleeve. Payment for all work required for the drilling of additional casing pipe together with fittings, excavation requirements, removal of casing pipe, etc. ordered by the Engineer, shall be made under **Articles 25 and 26** of the Contract.

The Contactor shall wash out the material inside the 4-inch casing pipes, then drill holes in the top of the steel sleeve and install fittings to the ends of the casing pipe that will produce a sealed connection to both the casing pipe and the steel sleeve. These fittings shall provide a sealed connection so that the insertion of grout between the steel sleeve and the carrier pipe can proceed with no leakage of grout to the outside soil area of the steel sleeve.

The Contactor shall remove any debris due to the installation of the casing pipe from the inside of the steel sleeve to the satisfaction of the Engineer.

5.05A.6 QUALIFICATIONS

The microtunneling/pipe jacking subcontractor utilized to perform the work required under this contract must be experienced in work of this nature and must have successfully completed tunneling project(s) in the last five (5) years using pressurized face microtunneling/pipe jacking equipment with a closed face tunnel shield and positive controlled face pressure. The Contractor shall submit a description of such project(s), which shall include at a minimum, a listing of the location(s), date of project(s), owner, pipe type and size, type of equipment utilized, maximum line and grade deviations and other information relevant to the issue of the successful completion of such project(s).

The microtunneling/pipe jacking machine operator(s) is required to have at least three (3) years of tunneling experience, and to have worked on at least two (2) microtunneling/pipe jacking projects 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. Submit the names, resumes and experience summaries of two (2) machine operators who will be available for this assignment, one (1) of which shall be assigned to this project.

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.

5.05A.7 SPECIFIC REQUIREMENTS FOR JACKING

All connections between successive steel pipe lengths shall be continuously butt-welded. Welds shall be made in conformance with AWS D1.1. Upon completion of a bore (jacking pit to receiving pit) the Contractor shall pressure grout all voids between the outside of the jacked sleeve and the soil and shall install the carrier pipe and completely fill all voids between the inside of the sleeve and the outside of the carrier pipe with low weight cement grout.

5.05A.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 shall furnish all water and pumping equipment necessary for the cleaning operation. After cleaning, the sleeve shall be clean and entirely free from projections that might interfere with the insertion of the carrier pipe through it.

As soon as possible after the completion of the cleaning operation, the Engineer will conduct a visual inspection of the pipe for any defect or leakage so those repairs, if necessary, can be made. No carrier pipe shall be installed until authorized by the Engineer.

5.05A.9 GROUTING

(A) GROUT FILL OUTSIDE JACKED SLEEVE

Upon completion of a jacked section (jacking pit to receiving pit) the Contractor shall immediately pressure grout from the interior of the steel sleeve. Pressure grout shall be placed under pressure to fill all annular voids between the outside of the jacked sleeve and the soil.

Systems of standard pipe, fittings, hose and special grouting outlets embedded in the sleeve shall be provided by the Contractor. Care shall be taken to insure that parts of the system are maintained free from dirt. Cement grout shall be forced under pressure into the grouting connections. Grouting shall start at the lowest connections and shall proceed until grout begins to flow from upper connections. Connections shall then be made to those holes and the operation continued to completion. During the grouting process, each grout plug shall be removed and the grout-mixing machine shall be connected to the hole by means of a hose and nipple cut to the same thread as the screw plug.

The sleeve shall have grout holes equipped with pipe half couplings. Three (3) grout holes spaced one hundred twenty (120) degrees on center shall be installed on each section of pipe. The two (2) inch standard pipe half couplings welded into the holes in the sleeve shall be provided with threaded cast iron plugs. Plugs shall be no less than five-eighths (5/8) inch in diameter.

Apparatus for mixing and placing grout shall 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 shall be screwed into the grout holes for their full length and tightened to provide a watertight seal.

The Contractor shall take all necessary precautions to prevent grout from escaping and setting on inner surface of steel sleeve. The Contractor shall remove such grout and restore the surface to its original condition.

The Contractor shall provide the Engineer all facilities necessary for the inspection of pressure grouting operation to ensure complete filling of the annular void. These facilities shall include removing of grout plugs as required for inspection behind the steel sleeve. Any voids found shall be grouted at once as directed by the Engineer.

The Contractor shall 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 shall 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 shall 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, the carrier pipe shall be secured to the steel sleeve at each end with a 12-inch long concrete plug. Unless otherwise shown on the contract drawings, the Contractor shall submit along with the required submittal in **Subsection 5.05A.3** the design of these concrete plugs. The design of these concrete plugs shall 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.

After approval by the Engineer the entire annular space between the inside of the steel sleeve and the outside of the sewer carrier pipe shall 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 shall be placed by pneumatic or pumping equipment under a pressure between 10 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 shall be monitored and recorded. A comparison between the theoretical volume and the actual volume of grout placed shall be done and any discrepancies shall be brought to the attention of the Engineer.

The Contractor shall also fill the holes used to place the grout.

5.05A.10 PROTECTIVE COATING

All concrete carrier pipes shall 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 approved equals.

Coating on the concrete carrier pipe shall be applied prior to its placement in the Steel Sleeve. Prior to coating the concrete carrier pipe the Contractor shall 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 shall be cleaned and/or treated as directed. Surfaces shall be brushed and thoroughly cleaned. Surfaces must then be permitted to dry thoroughly. All work shall 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**, shall be complied with.

Base and hardener shall be mixed in accordance with the manufacturers recommendations and after final mixing shall be applied in the presence of the Engineer within the time period stipulated by the manufacturer of the coating material. The Engineer shall certify to the adequacy of the coating work (i.e., mixing application). The coating shall be evenly applied in required number of coats by an airless spraying procedure approved by the Engineer.

Each protective coat shall be at least ten (10) mils minimum dry film thickness. The total thickness for all pipes of the finished protective coating shall be twenty (20) mils minimum dry film thickness.

The second protective coat shall 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 shall 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, shall be applied as recommended by the coating manufacturer and/or Engineer.

5.05A.11 MEASUREMENT

The quantity of sewers in jacked steel sleeves to be measured for payment shall be the number of linear feet of each size, kind and class of sewer together with jacked steel sleeve incorporated in the work, complete, as shown, specified or required, measured horizontally along the center lines of sewers.

5.05A.12 PRICE TO COVER

The contract price for "SEWERS IN JACKED STEEL SLEEVES" shall be the unit price bid per linear foot for each size, kind and class of sewer together with jacked steel sleeve and shall cover the cost of all labor, materials, plant, equipment, samples and tests 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 4.03 - Earth Excavation**); all sheeting and bracing; pumping; fluming; bridging; connections; maintaining flow in sewers; backfilling; jacking and receiving pits; installation of steel sleeves; grouting for soil stabilization; application of protective coating and top coating to interior surfaces of concrete carrier pipe; installation of carrier pipe sewers; grouting required to fill the voids between the inside of steel sleeves and the outside of carrier pipe sewers; preparation, submittal and approval of all required shop drawings and designs; obtaining of all necessary permits; 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 contract drawings, specifications and standards and as directed by the Engineer.

In addition, included in the price hereunder shall 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 jacking and receiving pits and in the line of the work and to do all the work incidental thereto, all in accordance with **Subsections 1.06.12 and 1.06.27** of the specifications and as directed by the Engineer.

Included in the price hereunder shall be the cost of all labor, materials and equipment required to install concrete plugs and for installing and removing 4-inch grouting casing pipes.

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 shall define Sewers In Jacked Steel Sleeves:

50.61

(2) The sixth character shall define the Type of Sewer Effluent:

S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer

(3) The seventh and eighth characters shall define the Diameter of the Carrier Sewer Pipe. (The seventh and eighth characters representing the unit of inches for the Diameter of the Carrier Sewer Pipe.) See examples below:

10 - 10"
16 - 16"
30 - 30"

(4) The ninth character shall define the Kind of Carrier Sewer 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 shall 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.
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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.
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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 5.05B
DIRECT JACKED PRECAST CONCRETE PIPE SEWERS

5.05B.1 INTENT

This section describes construction of precast polymer concrete pipe sewers and/or precast reinforced concrete pipe sewers by direct jacking.

5.05B.2 DESCRIPTION

Precast polymer concrete pipe sewers and/or precast reinforced concrete pipe sewers by direct jacking shall be constructed of the sizes, kinds and classes shown or specified. The construction of sewers herein shall be by means of the direct jacking of precast polymer concrete pipe sewers and\or precast reinforced concrete pipe sewers with the use of microtunneling techniques.

Microtunneling shall be defined as the trenchless installation of the pipe by jacking the pipe behind a remotely controlled tunnel-boring machine. The microtunnel machine shall be capable of adequately and safely counter-balancing prevailing hydrostatic conditions and shall be a slurry shield or an earth pressure-balanced shield or an approved equal. The microtunnel machine shall be capable of performing in the “Hydroshield” mode with the opportunity to support the face with Bentonite slurry. In addition it shall be equipped with the following:

(1) an air lock
(2) mixed face cutting wheel with cutter discs as well as ripper teeth
(3) a cone crusher

The microtunnel-boring machine shall be capable of tunneling both rock and boulders of all sizes.

5.05B.3 MATERIALS

(A) GENERAL:

(1) Precast Polymer Concrete Pipe - Precast polymer concrete pipe shall comply with the requirements of **Section 2.26**. The minimum class of pipe shall be Class V. Size of pipe shall be as shown or specified.

(2) Precast Reinforced Concrete Pipe - Precast reinforced concrete pipe shall comply with the requirements of **Section 2.05** and as amended herein. The minimum class and thickness of pipe shall be Class IV, Wall C. Size of pipe shall be as shown or specified. Precast reinforced concrete pipe shall be protectively coated in accordance with **Subsection 5.05B.9**.

(B) SUBMITTALS:

(1) Submit shop drawings to the Engineer for review showing all details of intermediate jacking stations, and concrete pipe including steel reinforcement, joint dimensions for all pipe and fittings, etc.

(2) (a) Precast Polymer Concrete Pipe - Design calculations demonstrating ASTM D6783 class and allowable axial jacking forces.

(b) Precast Reinforced Concrete Pipe - Design calculations demonstrating ASTM C76 class and allowable axial jacking forces.

(3) Test Reports.

(4) Certificate of Compliance.

(C) DESIGN:

(1) Dead and Live Loads:

(a) Precast Polymer Concrete Pipe - Pipe shall be designed for all superimposed dead loads due to weight of earth plus an allowance for HS20 live loading; or to the ASTM D6783 class; whichever is more stringent.

(b) Precast Reinforced Concrete Pipe - Pipe shall be designed for all superimposed dead loads due to weight of earth plus an allowance for HS20 live loading; or to the ASTM C76 class; whichever is more stringent.

(2) Allowable Jacking Forces:

Pipe shall be designed for the maximum anticipated jacking loads, distributed over the minimum cross sectional area of the pipe, using a safety factor of at least three (3). Designs shall consider bending and shear attributable to the eccentricity of the load on the jacking face.

(D) JOINTS:

(1) Precast Polymer Concrete Pipe - Joints shall comply with the requirements of **Section 2.26**.

(2) Precast Reinforced Concrete Pipe:

(a) Microtunneling precast reinforced concrete pipe joints shall be submitted to the Engineer for approval.

(b) The outer walls of pipe shall be straight and the joints flush or slightly recessed in relation with the pipe outer diameter.

(c) (1) Joints for pipe **48-inches in diameter and less** shall consist of a steel bell and concrete spigot. A solid rubber gasket shall be compressed between the bell and spigot and an additional 1-inch square rubber gasket shall be placed at the bell face. Surfaces of the bell ring that are exposed after manufacture shall be protected with a corrosion resistant coating.

(2) Joints for pipe **54-inches in diameter and greater** shall 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 shall 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 shall 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 shall 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.

(E) MANUFACTURE:

(1) Precast Polymer Concrete Pipe - Pipe shall be manufactured and supplied in accordance with **Section 2.26**.

(2) Precast Reinforced Concrete Pipe:

(a) Cement shall be Type II, in accordance with ASTM C150.

(b) Steel reinforcement shall consist of a minimum of two (2) cages of welded wire fabric conforming to ASTM A185.

(c) Pipe shall be supplied in ten (10) foot lengths, except where shorter lengths are required for proper stationing.

(d) Concrete shall have a minimum compressive strength of 6,000-psi at 28-days, as determined from standard test cylinders, in accordance with ASTM C31.

(e) The concrete pipe shall be cast vertically between inner and outer rigid steel forms. Mechanical vibrators shall be used to compact the concrete and ensure smooth concrete surfaces.

(f) After casting, the pipe in its forms shall be placed in a suitable enclosure and following a delay period of 1 to 4-hours, cured by the introduction of steam.

(3) All Precast Concrete Pipe - Each pipe shall have three (3) factory installed threaded injection ports and check valves with stainless steel threaded plugs to facilitate the Contractors lubricating operation and to grout the pipe in place upon completion of each bore. The injection ports (connections) shall be spaced one hundred twenty (120) degrees on center. Injection port fittings shall comply with ASTM A53, standard weight Schedule 40, black.

(F) QUALITY ASSURANCE AND TESTING:

(1) The pipe manufacturer shall have at their facility a fully equipped laboratory and staff to perform all testing on jacking pipe.

(2) Precast Polymer Concrete Pipe - Testing shall be done in accordance with **Section 2.26**.

(3) Precast Reinforced Concrete Pipe:

(a) Testing shall be done in accordance with ASTM C76. The manufacturer shall be required to perform the following additional tests and dimensional checks:

(1) Dimensional Inspection:

(A) The wall thickness in the joint and barrel shall not vary by more than (+/-) 3-percent of the nominal wall thickness.

(B) The outside diameter of pipe shall not vary from theoretical by more than +1/32, -1/16-inch per foot of inside diameter.

(C) Pipe squareness shall 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.

(D) The normality of the joint face shall have a maximum deviation of (+/-) 1-degree from perpendicular.

(2) Pipe (Concrete) Strength Confirmation:

The compressive strength of each pipe shall be determined by testing concrete cylinders from the same concrete as each jacking pipe. A minimum of four (4) test cylinders shall be taken for each pipe and tested at intervals up to 28-days.

(3) Airholes and Gate Seams:

The surfaces of each jacking pipe shall be examined for airholes and gate offsets. The maximum allowable airhole shall be 3/4-inch diameter and the maximum gate offset shall be 1/8-inch. Airholes exceeding this criterion shall be filled with neat cement and gate offsets greater than 1/8-inch shall be ground smooth.

(G) INSTALLATION:

Just prior to lowering the precast concrete pipe into the trench, the joint surfaces shall be wiped clean and lubricated with a manufacturer recommended lubricant. A pressure-distributing compression ring shall be placed between the mating vertical joint surfaces to evenly distribute the jacking load. Precast Concrete Pipe shall be installed in accordance with the manufacturer's recommendations and standard practices.

5.05B.4 METHODS

(A) GENERAL:

The Contractor shall install jacking and receiving pits properly braced to withstand both external loads (soil, water, etc.), and internal jacking loads. The Contractor shall 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 or steel rails or beams embedded in concrete shall be used in the pit for placement and alignment of each piece of precast concrete pipe during installation procedures.

The precast concrete pipe shall be jacked into position by the use of jacks of sufficient capacity to push the pipe and microtunneling machine through the soil. Upon completion of each jacked section (jacking pit to receiving pit) the Contractor shall immediately pressure grout from the interior of the precast concrete pipe in conformance with **Subsection 5.05B.7**.

Just prior to lowering the precast concrete pipe into the trench, the joints shall be wiped clean and lubricated with an approved lubricant. Upon completing the joint, the position of the gasket shall 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 shall be remade and the gasket(s) replaced. Joint openings shall not exceed the manufacturer's recommendations.

(B) CONTROL OF LINE AND GRADE:

(1) Lines and grades shall conform to the requirements of **Subsection 1.06.8** of the specifications and as amended herein. The Contractor shall establish the baselines and benchmarks in accordance with this contract.

(2) The Contractor shall 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 shall be performed under the direction of a New York State Licensed Surveyor and all submissions shall be sealed and signed by the Licensed Surveyor.

(3) If there is any movement during construction, it shall be the Contractor's responsibility to detect and correct it as required.

(4) The microtunnel excavation and run of jacked precast concrete pipe shall be controlled as such that the deviation from grade is not more than one (1) inch nor from line more than three (3) inches. The Contractor shall make note of all possible encumbrances and structures in the line of work that may restrict clearances.

(C) EQUIPMENT:

(1) The microtunnel-boring machine shall be capable of controlling the volume of excavated material removed from the excavation face at all times.

(2) The microtunnel-boring machine shall be fully steerable both horizontally and vertically.

(3) Guidance of the microtunnel-boring machine shall be through a remote console, in or adjacent to the jacking pit or shaft. At a minimum, the thrust force, rate of advance, distance along heading, deviation from line and deviation from grade shall be monitored and displayed on the remote console.

(D) SAFETY:

The Contractor shall carry out the Contractor's operations in strict accordance with OSHA and Manufacturer's safety requirements.

5.05B.5 QUALIFICATIONS

Microtunneling/pipe jacking subcontractor utilized to perform the work required under this contract must be experienced in work of this nature and must have successfully completed tunneling project(s) in the last five (5) years using pressurized face microtunneling/pipe jacking equipment with a closed face tunnel shield and positive controlled face pressure. The Contractor shall submit a description of such project(s), which shall include, at a minimum a listing of the location(s), date of project(s), owner, pipe type and size, type of equipment utilized, maximum line and grade deviations and other information relevant to the issue of the successful completion of such project(s).

The microtunneling/pipe jacking machine operator(s) is required to have at least three (3) years of tunneling experience, and to have worked on at least two (2) microtunneling/pipe jacking projects 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. Submit the names, resumes and experience summaries of two (2) machine operators who will be available for this assignment, one (1) of which shall be assigned to this project.

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.

5.05B.6 SPECIFIC REQUIREMENTS FOR JACKING

Upon completion of a bore (jacking pit to receiving pit) the Contractor shall grout all voids between the outside of the jacked precast concrete pipe and the soil.

5.05B.7 GROUT

(A) DESCRIPTION:

Pressure Grout - Pressure grout shall be placed under pressure to fill all voids between the outside of the jacked precast concrete pipe and the soil.

(B) MATERIAL:

Pressure Grout - Pressure grout shall consist of neat Portland cement or it shall be mixed in a proportion by volume of one (1) part Portland cement and one (1) part sand or it shall 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. All parts shall be mixed with clean fresh water to the desired consistency. In no case shall more than eight (8) gallons of water be mixed per bag of cement.

(C) GENERAL REQUIREMENTS:

Systems of standard pipe, fittings, hose and threaded injection ports and check valves with stainless steel threaded plugs (factory installed) embedded in the concrete pipe walls shall be provided by the Contractor. Care shall be taken to insure that parts of the system are maintained free from dirt. Cement grout shall be forced under pressure into the threaded injection ports. Grouting shall start at the lowest injection port and shall proceed until grout begins to flow from upper injection port. Connections shall then be made to those injection ports and the operation continued to completion. During the grouting process, each stainless steel plug shall be removed and the grout-mixing machine shall be connected to the injection port by means of a hose and nipple cut to the same thread as the injection port.

(D) JACKED PIPE:

Upon completion of bores (jacking pit to receiving pit) the Contractor shall pressure grout between the outside of the jacked concrete pipe and the soil.

The jacked precast concrete pipe shall 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 shall be flush with the inside face of the pipe. Factory installed threaded injection ports and check valves with stainless steel threaded plugs shall 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 shall be installed on each pipe.

Apparatus for mixing and placing grout shall 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 shall be installed into the injection ports so as to provide a watertight seal.

The Contractor shall take all necessary precautions to prevent grout that might escape from setting on exposed surface of the linings and shall remove such grout and restore the surface to their original condition.

The Contractor shall provide the Engineer all facilities necessary for the inspection of grouted jacked precast concrete pipe to ensure complete filling of the void. These facilities shall include removing of stainless steel plugs as required for inspection behind the jacked precast concrete pipe. Any voids found shall be grouted at once as directed by the Engineer.

The Contractor shall 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 shall be supplied by the Contractor to the Engineer or the Engineer's representative after each shift.

5.05B.8 SUBMISSION OF SHOP DRAWINGS AND REPORTS

(A) Before commencing any operations associated with the construction of direct jacking of precast concrete pipe sewers the Contractor shall have all required approved shop drawings and designs from the Department of Design and Construction, Division of Infrastructure, Design Section. These drawings shall include but not be limited to the following:

(1) Sheeting drawings for all Jacking and Receiving Pits
(2) Details of Thrust Blocks used in the Jacking Operation
(3) Layout Plan of the Entire Microtunneling Operation indicating the location of all support equipment
(4) Intermediate Jacking Stations
(5) Details of the Microtunneling Machine and Spoils Removal System
(6) Slurry Separation System
(7) Survey Control
(8) Lubrication Means and Methods
(9) Grouting Means and Methods
(10) Boulder Removal Means and Methods

(B) Shop drawing shall be submitted in accordance with all applicable provisions of **Subsection 4.05.5 - Shop Drawings**, as determined by the Design Section and as required herein. The design criteria shall be submitted in accordance with all applicable provisions of **Subsection 4.05.6 - Design Criteria**, as determined by the Design Section and as required herein.

(C) The Contractor shall allow a minimum of four (4) weeks for review.

(D) Reports - The Contractor shall maintain a Daily Log of all microtunneling activities. A copy of this log shall be submitted to the Engineer on a daily basis. The log, at a minimum, shall indicate the following in relationship to the advancement rate. The maximum advancement rate utilized shall be one (1) foot.

(1) Date and Time compared to the advancement rate
(2) Total Jacking Pressure compared to the advancement rate including all peak pressures
(3) Cutter Head Torque
(4) Position of the Machine with respect to the design line and grade
(5) Amounts, times and locations of lubrication
(6) Location, Pressure and Amounts of Grout placed upon completion of a Run

Upon the completion of Microtunneling 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 the microtunneling operation. In addition, all numerical data shall be entered into an Excel 2000 format. A copy of the Excel file shall also be submitted.

5.05B.9 PROTECTIVE COATING FOR PRECAST REINFORCED CONCRETE PIPE

All jacked precast reinforced concrete pipe shall 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 (Carbocrylic White S800) or approved equals.

Coating on the jacked precast reinforced concrete pipe shall be applied prior to its placement. Prior to coating the jacked precast reinforced concrete pipe the Contractor shall 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 shall be cleaned and/or treated as directed. Surfaces shall be brushed and thoroughly cleaned. Surfaces must then be permitted to dry thoroughly. All work shall be done 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**, shall be complied with.

Base and hardener shall be mixed in accordance with the manufacturers recommendations and after final mixing shall be applied in the presence of the Engineer within the time period stipulated by the manufacturer of the coating material. The Engineer shall certify to the adequacy of the coating work (i.e., mixing application). The coating shall be evenly applied in required number of coats by an airless spraying procedure approved by the Engineer.

Each protective coat shall be at least ten (10) mils minimum dry film thickness. The total thickness for all pipes of the finished protective coating shall be twenty (20) mils minimum dry film thickness.

The second protective coat shall 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 shall 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, shall be applied as recommended by the coating manufacturer and/or Engineer.

5.05B.10 MEASUREMENT

The quantity of direct jacked precast concrete pipe sewers to be measured for payment shall be the number of linear feet of each kind, type, size and class 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 shall be from inside face of manhole to inside face of manhole.

5.05B.11 PRICE TO COVER

The contract price for “DIRECT JACKED PRECAST CONCRETE PIPE SEWERS” shall be the unit price bid per linear foot for each kind, type, size and class of direct jacked precast concrete pipe sewer and shall cover the cost of all labor, materials, plant, equipment, samples and tests 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 4.03 - Earth Excavation**); all sheeting and bracing; pumping; fluming; bridging; connections; maintaining flow in sewers; backfilling; jacking and receiving pits; installation of precast concrete pipe sewers by direct jacking; grouting for soil stabilization; preparation, submittal and approval of all required shop drawings and designs; obtaining of all necessary permits; 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 shall 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 jacking and receiving pits and in the line of the work and to do all the work incidental thereto, all in accordance with **Subsections 1.06.12 and 1.06.27** 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 shall define Direct Jacked Precast Concrete Pipe Sewers:
50.62

(2) The sixth character shall define the Type of Sewer Effluent:
S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer

(3) The seventh and eighth characters shall 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 shall 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 shall 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.

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.
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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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50.62M60P5	DIRECT JACKED 60” P.C.P. CLASS V STORM SEWER	L.F.
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50.62M78P5	DIRECT JACKED 78” P.C.P. CLASS V STORM SEWER	L.F.
50.62M84P5	DIRECT JACKED 84” P.C.P. CLASS V STORM SEWER	L.F.
50.62M90P5	DIRECT JACKED 90” P.C.P. CLASS V STORM SEWER	L.F.
50.62M96P5	DIRECT JACKED 96” P.C.P. CLASS V STORM SEWER	L.F.
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.
50.62C78R4	DIRECT JACKED 78” 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.
50.62C30R5	DIRECT JACKED 30” R.C.P. CLASS V COMBINED SEWER	L.F.
50.62C36R5	DIRECT JACKED 36” 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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50.62C24P5	DIRECT JACKED 24” P.C.P. CLASS V COMBINED SEWER	L.F.

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50.62C36P5	DIRECT JACKED 36" P.C.P. CLASS V COMBINED SEWER	L.F.
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SECTION 5.05C
RECONSTRUCTION OF EXISTING SEWERS USING D.E.P. APPROVED CURED-IN-PLACE-PIPE (CIPP) LINING METHOD

5.05C.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.

5.05C.2 REQUIREMENTS

(A) DESCRIPTION OF WORK

Unless otherwise specified in the contract, the Contractor shall 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 shall 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 shall reconstruct existing sewers by the insertion of a flexible polyester felt fiber lining tube that has been saturated with a thermosetting resin. The liner shall 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 shall 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 Contractor shall make all investigations of the existing sewers to be reconstructed and shall determine and select the most effective approved lining method(s) appropriate for installation in the existing sewers to be reconstructed. The Contractor shall be 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 shall 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 shall be borne solely by the Contractor, and the Contractor shall not make any claim against the City for this additional required work.

Once installed, the liner shall 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 shall 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 D638, D790, D2990, F1216, F1743 and the manufacturer's standards are hereby made a part of this specification.

(C) LINER SIZE AND LENGTH

The liner shall be fabricated to a size that when installed will neatly fit the internal circumference of the sewer to be lined. The liner thickness shall be designed to adequately resist all external pressures and conditions (e.g. deflection, ring bending, buckling and minimum stiffness). The length of the liner shall 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 shall 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.

Allowance for circumferential and longitudinal stretching of the liner during installation shall be made as per the manufacturer's standards for the approved method of lining chosen. Under no circumstances shall the finished wall thickness of liner be less than six (6) millimeters in thickness.

(D) DESIGN PARAMETERS - The following design parameters shall 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 shall 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) 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 shall incorporate thermosetting materials that will withstand the corrosive effects of the normal existing effluents.

(F) SAFETY - The Contractor shall carry out the Contractor's operations in strict accordance with all OSHA and manufacturer's safety requirements. Emphasis shall be placed upon safety requirements for entering confined spaces and working with hot water and steam.

The Contractor shall erect such signs and other devices as are necessary for the safety of the work site and shall 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 shall be carried out in full compliance with all City, State, and Federal laws, rules, and regulations regarding Air Quality and Safety.

(H) 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 shall 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 shall immediately notify the Engineer.

For each section to be lined, the Contractor shall certify in writing that the DEP approved method the Contractor intends to use is suitable.

(I) CLEANING - The Contractor shall furnish all labor, materials and equipment and shall 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 shall immediately notify the Engineer if such debris, etc., cannot be removed by conventional non-excavation type pipe cleaning equipment.

Protruding service connections shall be removed and paid for consistent with **Section 5.16A**.

(J) FLOW BYPASSING - The Contractor shall 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 shall be of adequate capacity and size to handle the flow. The proposed bypassing system shall be submitted to the Engineer for approval and no work shall commence until such approval is granted.

(K) SERVICE CONNECTIONS - The Contractor shall be required to determine which service connections are active and shall 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 shall 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 shall 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 shall be of adequate capacity and size to handle the flow.

Prior to the commencement of any work, the Contractor shall 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 shall be submitted to the Engineer for approval and no work shall commence until such approval is granted.

(L) EQUIPMENT SPECIFICATION - The Contractor shall 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 shall be equipped with a tension gauge (Type-Martin Decker or Approved Equal) - smooth running and variable speed. The cutting device shall be a Gulectron type or approved equal remote monitored device when used inside the lined pipe.

The Contractor shall prepare and inspect all necessary tools and any spare parts that are required for equipment that suffer frequent breakdowns, and shall ensure that said tools and spare parts are available at the site. Supporting equipment, such as pumps and generators, shall be provided at the site in the event there is a fluid surge and pumping is required on an emergency basis. The Contractor shall 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 shall fully comply with **Subsections 5.05C.2(C) through 5.05C.2(L)**, inclusively, and with any additional requirements set forth in the specific provisions applicable to the respective lining methods. The Contractor shall not 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 shall be installed pursuant to the specific provisions set forth for the selected lining method. If any problem occurs during the installation operation the Contractor shall 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 shall be performed to determine if the liner is properly installed.

(O) SERVICE CONNECTIONS - After the liner has been installed, the Contractor shall re-open all existing active service connections and those inactive connections ordered by the Engineer. These service connections shall be re-opened and paid for consistent with **Section 5.16B**.

(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 shall 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 the item labeled “TELEVISION INSPECTION AND DIGITAL AUDIO-VISUAL RECORDING OF SEWERS”.

(Q) WORK SCHEDULE - The Contractor shall 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 shall be permitted.

5.05C.3 INSTALLATION

(1) PREPARING AND INSERTING THE LINER - The Contractor shall designate a location where the uncured resin in the original containers and the unimpregnated liner will be impregnated prior to installation. The Contractor shall 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 shall be used. The quantities of the liquid thermosetting materials inserted into the lining tube shall be as per manufacturer's standards so as to fully saturate the liner material and provide the lining thickness specified.

Prior to installation of liner, the downstream sewer manhole adjacent to the sewer section to be lined shall be plugged.

The chemical impregnated liner material shall 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 shall 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 shall be equipped with a tension gauge to measure tension during pull through.

Inflation of liners and heat source method used shall be accomplished in accordance with manufacturer’s standards and specifications.

Curing temperatures and pressures shall 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 shall 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 shall 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 shall supply a suitable heat source. The equipment shall 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 shall be determined by the resin/catalyst system employed. The heat source shall be fitted with suitable monitors to gauge the temperature and pressure of the incoming and outgoing heat exchanger circulating heating medium. Thermocouples shall 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 shall 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 shall be of a duration recommended by the resin manufacturer; modified for the site specific conditions at the time curing is effected. During this cure time, the temperature inside the liner will be continuously maintained in the range required.

Once the cure is complete, the Contractor shall cool the hardened liner to a temperature below one hundred degrees Fahrenheit (100ºF) before relieving the internal pressure. Cool down shall be accomplished as recommended by the manufacturer. Care shall be taken in the release of the internal pressure so that a vacuum will not develop that could damage the newly installed liner.

The finished lining shall be continuous over the entire length and be free from visual defects such as foreign inclusions, dry spots, pinholes and delamination. The lining shall 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 shall 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 shall be removed. This residual water shall 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 shall not be discharged into the downstream manhole or stream, but discharged into a nearby sanitary manhole.

5.05C.4 MEASUREMENT

The quantity to be measured for payment shall 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.

5.05C.5 PRICE TO COVER

The contract price for “RECONSTRUCTION OF EXISTING SEWERS, USING D.E.P. APPROVED CIPP LINING METHOD” shall be the unit price bid per linear foot for each size sewer reconstructed by a cured-in-place-pipe DEP approved lining method and shall cover the cost of all labor, materials, plant, equipment, samples and tests 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.

5.05C.6 SEPARATE PAYMENT

Payment for this final television inspection will be made under the item labeled "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 nine characters. (The decimal point is considered a character, the third character.)

(1) The first five characters shall define Reconstruction Of Existing Sewers Using D.E.P. Approved Cured-In-Place-Pipe (CIPP) Lining Method:

50.71

(2) The sixth character shall define the Type of Sewer Effluent:

S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer

(3) The seventh and eighth characters shall 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 shall 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 shall 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.

50.71S24D00	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.
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.

SECTION 5.05D
RECONSTRUCTION OF EXISTING SEWERS USING SHOTCRETE METHOD

5.05D.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.

5.05D.2 DESCRIPTION OF WORK

The reconstruction of existing sewers using shotcrete method shall be performed in strict accordance with **Subsections 5.05D.3 through 5.05D.7**, inclusively

5.05D.3 SEWER CLEANING

Prior to performing the work of repairing and reconstructing (shotcreting) the existing sewers and sewer portions through the manholes, the Contractor shall thoroughly clean the existing sewers and sewer portions through the manholes in accordance with **Section 5.18A**.

5.05D.4 SEWER REPAIR

Upon completion of the cleaning of the existing sewers and sewer portions through the manholes to be reconstructed (shotcreted) the Contractor shall inform the Engineer of such and shall 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 shall 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 shall perform the sewer repair work in accordance with **Section 5.20A - Portland Cement (Type V) - Injection Grouting** and **Section 5.20B - Shotcrete For Repair Work**.

5.05D.5 MATERIALS

(A) Cement shall be Type V Portland Cement which conforms to requirements of Specification C150 of the American Society for Testing Materials and to **General Specification 11 - Concrete, as modified in Section 2.15**. Each bag of cement shall be deemed to be one (1) cubic foot.

(B) Sand shall conform to the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**. The term "dry" as applied to sand, designates a normal moisture content of from three (3) percent to six (6) percent.

(C) Water shall be fresh, clean and free from oils, acids, alkali or organic matter.

(D) Reinforcement shall consist of 2x2-12-gauge or 3x3-10-gauge galvanized welded wire mesh. The wire mesh shall 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 shall have a minimum yield strength of thirty-five thousand (35,000) pounds per square inch.

5.05D.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 shall 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.

5.05D.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 shall 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 shall be used throughout the contract. The dry shotcrete mixture shall not be altered unless otherwise directed by the Engineer.

Dry-Mix Shotcrete shall 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 shall not be added to the mix after mixing or before using the cement gun. Sufficient water shall 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 shall be discarded. Remixing or tempering shall not be permitted.

(2) WET-MIX SHOTCRETE PROCESS - Wet-Mix Shotcrete shall 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 shall 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 shall be used throughout the contract. The wet shotcrete mixture shall not be altered unless otherwise directed by the Engineer.

Wet-Mix Shotcrete shall 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 shall be discarded. Remixing or tempering shall not be permitted.

(C) EQUIPMENT - Batching and mixing equipment shall be capable of thoroughly mixing the materials in sufficient quantity to maintain placing continuity. The pneumatic mixing and delivering equipment shall be of sufficient capacity.

For Dry-Mix Process the lower chamber shall deliver material to the delivery hose continuously during the upper chamber recharging period.

Gaskets in the equipment shall 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 shall be cleaned at regular intervals (at least once every shift).

For rough or heavy work, nozzle pressures of fifty (50) to sixty (60) pounds shall be maintained.

For high lifts or long hose lengths pressures of seventy (70) to seventy-five (75) pounds shall 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 shall include allowances for the air consumed in blowing rebound, cleaning reinforcement and other incidental uses. Compressor equipment shall be of such capacity as to insure air pressures, at the special mixer, nozzle, etc., capable of producing the required velocities.

Water pressure shall be maintained at a minimum of fifteen (15) pounds greater than the highest air pressure required for placing. Both air and water pressures shall be uniformly steady (nonpulsating).

Velocities of three hundred seventy-five (375) to five hundred (500) feet per second shall 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 shall be maintained using a one and one-half (1-1/2) inch nozzle.

Velocities other than specified shall be allowed only if approved in writing by the Engineer.

Nozzles for Dry-Mix Process shall 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 shall 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 shall submit, for the Engineer's review and approval, the resumes, with references, of the Shotcreting Contractor and the Contractor's onsite project management personnel. The Shotcrete Contractor or the Contractor's onsite project management personnel must have satisfactorily completed a minimum of three (3) similar or larger shotcreting projects elsewhere within the three (3) year period prior to the date of the opening of the bid. If the approved onsite project management personnel are removed from the project, the Shotcreting Contractor is required to replace that personnel immediately with qualified personnel and submit the replacement personnel experience resumes to the Engineer for approval.

(E) QUALIFICATIONS AND DUTIES OF WORKING PERSONNEL

(1) FOREMEN, NOZZLEMEN, GUNMEN AND REBOUNDMEN - Before employment on this project, each must have performed satisfactory work in similar capacities elsewhere, for a sufficient period of time in order to be fully qualified and approved by the Engineer to perform the work on this project all in accordance with the requirements of the specifications.

(2) FOREMEN shall each have had adequate experience as a Nozzleman and adequate experience on similar work.

(3) NOZZLEMEN shall be qualified workmen, each having had adequate experience in similar work. It shall be a 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 shall 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 shall 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 shall have sufficient 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) TEMPORARY LIGHTING

(1) WORK INCLUDED - The Contractor shall furnish all labor, materials, and equipment and do all work necessary to install, maintain, and eventually remove all temporary lighting.

(a) Temporary lighting shall consist of electric wire stringers attached to the crown of the sewer being worked on. The stringer shall not present a hazard to those workers inside the sewer. Lighting pigtails shall be attached to the stringer every twenty-five (25) linear feet. Bulb wattage shall be sufficient to adequately light the section of sewer being worked on. Bulbs shall be replaced in kind as needed.

(b) The Contractor shall 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.

(2) COST - All costs associated with Temporary Lighting shall be deemed to have been included in the unit price bid per linear foot of Sewer Reconstruction.

(G) CONNECTIONS TO HYDRANTS - The Contractor shall 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 shall 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 shall 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 shall inform the Engineer of such and shall 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 shall attach 2x2-12-gauge or 3x3-10-gauge galvanized welded wire mesh to the sewer. The wire mesh shall 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 shall 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 shall be lapped a minimum of six (6) inches and the lap shall be securely tied together. The mesh shall be cut properly and carefully bent to closely follow the contours of the area to be shotcreted. Galvanized anchors shall be spaced as needed to properly hold the mesh in place. The galvanized anchors shall be expansion anchor type bolts with a hook on the exposed end, or an approved equal. An expanding sleeve shall be on the embedded end and positively locked in a predrilled hole.

Four (4) small plastic depth gauges shall 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 shall show a depth of three (3) inches. The gauge rings shall be placed five (5) linear feet apart parallel to the center line of the sewer. The preset three (3) inch gauge guides shall 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 shall 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 shall inform the Engineer of such and shall 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 shall then be placed over the surface. (The tolerance for placement of three (3) inches of shotcrete shall be plus or minus one-quarter (1/4) inch.) The shotcreted area shall be given a final clean broom finish.

The Contractor shall furnish all labor, materials, and equipment and shall 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 shall 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 shall be installed around the entire inner face of the sewer. The sewer shall then be cleaned by water blasting. Shotcrete shall 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 shall be removed from the base coat by brooming, scraping, screeding or other approved methods. Also any surface deposits that take a final set shall be removed by sandblasting and the surface cleaned with an air-water blast. The surface of the base coat shall be thoroughly examined for hollow areas resulting from rebound pockets or lack of bond. Hollows, sags or other defects shall be cut out. The surface of the base coat to be shot shall be left open, rough and highly textured to improve bond, and shall be damp. Curing compounds or other bond breaking materials shall not be applied to the surface of the base coat. When the shotcreting of the invert and lower walls is complete the surface shall be finished in an approved manner, and then sufficient time shall 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 shall 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 shall 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 shall be removed from the base coat by brooming, scraping, screeding or other approved methods. Also the surface of the base coat shall be thoroughly examined for hollow areas resulting from rebound pockets or lack of bond. Hollows, sags or other defects shall be cut out. The surface of the base coat to be shot shall be left open, rough and highly textured to improve bond, and shall be damp. Prior to the application of the second layer the surface of the base coat shall be cleaned with an air-water blast. Curing compounds or other bond breaking material shall not be applied to the surface of the base coat. When the shotcreting of the crown and upper walls is complete the surface shall be finished in an approved manner and then sufficient time shall be given to allow the crown and upper walls to cure. The Engineer shall 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 shall be maintained until the crown and upper wall shotcrete work is accepted by the Engineer.

(J) APPLICATION - Shotcrete shall not be placed on a frozen surface nor during freezing weather at the site of application. Shotcrete shall 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 shall 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 shall 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 shall direct the nozzle away from the work until the faulty conditions are corrected. Such defects shall be replaced as the work progresses in accordance with the specifications and as directed by the Engineer.

Construction joints or day's work joints shall 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 shall be thoroughly cleaned as necessary and then moistened and scoured with an air jet.

(K) SUSPENSION - Shotcreting shall 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 shall 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 shall be trued with a thin edge screed to remove high areas and expose low areas. Low areas shall be properly filled with shotcrete to insure a true surface. After the surface of the shotcrete has been trued the entire surface shall be broom finished.

(M) CURING - All shotcrete shall be cured in accordance with ACI 506R-90 and as specified and as directed by the Engineer.

The freshly shotcreted invert shall not be disturbed until it has attained an initial set, as determined by the Engineer. All fluming and/or bypass pumping shall be maintained during the curing process.

(N) TESTING - TEST CUBES

Determination of the strength of the shotcrete will be based on the average strength of test cubes made in the manner hereinafter described. The test cubes shall be 4" x 4" x 4". A minimum of one (1) set of three (3) test cubes 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 cubes made to determine whether the shotcrete being produced complies with the contract requirements. Test cubes will be made and stored in accordance with ASTM C31 and tested in accordance with ASTM C39, except as otherwise modified by the Engineer. Each test will consist of three (3) cubes; one (1) to be tested at seven (7) days, the other two (2) at twenty-eight (28) days.

Test cubes shall be made at the point of shotcrete deposit and shall be representative of the batch from which they are taken. The Contractor under the Engineer’s supervision shall provide the necessary labor and facilities required to make, store and care for the test cubes. They shall be safeguarded against injury and protected from the elements.

The Engineer will be responsible for the preparation, documentation and labeling of the test cubes and for notifying the Contractor, at least twenty-four (24) hours in advance, when a shipment of test cubes is ready for delivery, so that cubes can be tested for the standard twenty-eight (28) day and/or seven (7) day tests. Test cubes shall be transported to the testing laboratory when directed by the Engineer.

The Contractor shall make arrangements to protect all cubes from damage during loading, transport to, and unloading at a Department of Design and Construction designated testing laboratory, and shall obtain a receipt for delivered test cubes, which shall be submitted to the Engineer.

The Total Minimum Number of Test Cube Sets to be taken by the Engineer shall be determined as follows:

(a) A minimum of One (1) Test cube set shall 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 cube set shall be taken for every additional Three Hundred (300) Linear Feet of Sewer Section Shotcreted.

Should the average strength of the seven (7) day test cubes 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 cubes 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 cubes taken for the Department of Design and Construction designated testing laboratory. The sampling shall be based on the quantities indicated hereinafter.

Shotcrete shall have a minimum compressive strength of four thousand (4,000) pounds per square inch at the end of twenty-eight (28) days. The Contractor shall 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 cubes 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 cubes taken for that section of sewer, determined in accordance with the following conditions: Test cubes 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 cubes 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 shall perform a television inspection and digital audio-visual recording of all sewers reconstructed in accordance with **Section 5.17** of the specifications. Payment for television inspection and digital audio-visual recording shall be made under the item labeled “TELEVISION INSPECTION AND DIGITAL AUDIO-VISUAL RECORDING OF SEWERS”.

5.05D.8 MEASUREMENT

The quantity of sewers reconstructed by shotcreting process to be measured for payment shall 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.

5.05D.9 PRICE TO COVER

The contract price for “RECONSTRUCTION OF EXISTING SEWERS USING SHOTCRETE METHOD” shall be the unit price bid per linear foot for each size and type of existing sewer and shall cover the cost of all labor, materials, plant, equipment, samples and tests required or necessary to reconstruct the existing sewer as specified herein, including the taking, storing and protecting of test cubes; 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.

5.05D.10 DETERMINATION OF PAYMENT

When the average strength of the test cubes 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 cubes 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 shall be deducted from the contract price bid. When the average strength of the test cubes 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 cubes 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 shall 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 cube 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 shall 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 shall define Reconstruction Of Existing Sewers Using Shotcrete Method:

50.72

(2) The sixth character shall define the Type of Sewer Effluent:

S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer

(3) The seventh, eighth, ninth and tenth characters shall 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 shall define the Shape of the Existing Sewer:

D - Circular (Diameter)
R - Rectangular
A - Arch-Shaped
V - Vertical Elliptical
E - Egg-Shaped Sewer

(5) The twelfth character shall define the Kind of Existing Sewer:

B - Brick
C - Concrete

(6) The thirteenth, fourteenth, fifteenth and sixteenth characters shall 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 DIAMETER 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 DIAMETER 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 DIAMETER RECTANGULAR CONCRETE COMBINED SEWER USING SHOTCRETE METHOD	L.F.
50.72C0706RC0500	RECONSTRUCTION OF EXISTING 7’-6”W X 5’-0”H DIAMETER 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.

SECTION 5.05E
RECONSTRUCTION OF EXISTING SEWERS USING CEMENT LINING METHOD

5.05E.1 INTENT

This section describes the reconstruction of existing ductile iron or cast iron sewers using a cement lining method.

5.05E.2 MATERIALS

Cement shall be Type V High Sulfate-Resistent Portland Cement conforming to the requirements of ASTM C150 and to **General Specification 11 - Concrete, as modified in Section 2.15**. Each bag of cement shall be deemed to be one (1) cubic foot.

Sand shall be silica-type conforming to the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**. The term "dry" as applied to sand, designates normal moisture content of from three (3) percent to six (6) percent.

Water shall be fresh, clean and free from oils, acids, alkali or organic matter.

5.05E.3 REQUIREMENTS

Cement-mortar mixture for cement lining shall consist of one (1) part Silica-type Sand and one (1) part Type V High Sulfate-Resistent Portland Cement.

The design of the cement-mortar mixture is to be corrosion proof and the thickness shall be consistent with ANSI/AWWA C104/A21.4, for Double Thickness.

Cement lining for ductile iron or cast iron pipe shall be in accordance with ANSI/AWWA C104/A21.4.

Cement-mortar for lining shall not be retamped and shall not be used after it has been mixed for more than one (1) hour.

Lining shall not be performed in freezing weather.

Surface crazing and cracks in the newly placed cement lining shall not exceed that specified in AWWA C104.

The Contractor shall 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 shall be of adequate capacity and size to handle the flow. The proposed bypassing system shall be submitted to the Engineer for approval and no work shall commence until such approval is granted.

The Contractor shall be required to determine which service connections are active and shall 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 shall 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 shall 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 shall be of adequate capacity and size to handle the flow.

Prior to the commencement of any work, the Contractor shall 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 shall be submitted to the Engineer for approval and no work shall commence until such approval is granted.

The Contractor shall 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.

5.05E.4 SEWER CLEANING

Prior to performing the work of cement lining the existing ductile iron or cast iron sewers, the Contractor shall thoroughly clean the existing sewers in accordance with **Section 5.19**.

5.05E.5 CONSTRUCTION METHODS

After the pipe is clean and dry, cement-mortar shall be applied to the walls of the pipe by the rotating head of an electric or air powered machine and the cement-mortar shall 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 shall leave a smooth, troweled (nonstructural) finish. The mortar shall be mixed on site in a mixing van or concrete batch plant located near the access manhole. The mortar shall then be transported from the mixing plant to the high-speed centrifugal sprayer through high-pressure hoses or shall be mechanically delivered. In pipes 24-inches and less in diameter, the sprayer and trowel shall 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 shall deliver and finish the mortar. Once the mortar has been applied the thickness of the liner shall 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 shall regulate the mortar application. Grinding of the lining will not be permitted.

After the cement liner has been accepted, the pipe shall 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 shall 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 shall perform a final television inspection and digital audio-visual recording of the rehabilitated pipe in accordance with the **Section 5.17** of the specifications.

5.05E.6 MEASUREMENT

The quantity of ductile iron or cast iron sewer cement lined to be measured for payment shall 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.

5.05E.7 PRICE TO COVER

The contract price for “RECONSTRUCTION OF EXISTING SEWERS USING CEMENT LINING METHOD” shall be the unit price bid per linear foot for each size and type of existing sewer reconstructed using cement lining method and shall cover the cost of all labor, materials, plant, equipment, samples and tests 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.

5.05E.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 the item labeled "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 shall define Reconstruction Of Existing Sewers Using Cement Lining Method:

50.73

(2) The sixth character shall define the Type of Sewer Effluent:

S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer

(3) The seventh and eighth characters shall 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 shall 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 5.06
CHAMBERS

5.06.1 DESCRIPTION

Chambers shall be constructed of the sizes and shapes shown complete with frames and covers.

5.06.2 MATERIALS

(A) Concrete shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(B) Brick and brick masonry shall comply with the requirements of **Section 2.16**.

(C) Frames and covers shall be of cast iron, unless otherwise shown on the contract plans, complying with the requirements of **Section 2.08**, Type 1. Malleable iron or cast steel covers, when required, shall comply with the requirements of **Section 2.08 and Section 2.12**.

(D) Steps shall be cast iron and shall comply with the requirements of **Section 2.08**, Type 1, or shall be copolymer polypropylene plastic manhole steps with one-half (1/2) inch Grade 60 steel reinforcement and shall comply with the Sewer Design Standards.

(E) Cement mortar shall comply with the requirements of **Section 2.17**.

(F) Reinforcement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(G) Structural steel shall comply with the requirements of **Section 2.19**.

(H) Cast iron pipe shall comply with the requirements of **Section 2.03**.

(I) Vitrified clay pipe shall comply with the requirements of **Section 2.02**.

(J) Ductile iron pipe shall comply with the requirements of **Section 2.06**.

(K) Bluestone shall be tough, sound, durable, fine graded sandstone or quartzite, free from injurious seams and other imperfections and saw cut to the required dimensions. It shall be set in a full bed of fresh mortar in compliance with the requirements of **Section 2.17**.

(L) Granite slabs shall comply with the requirements of **Section 2.11**.

(M) Aluminum floor gratings shall comply with the requirements of **Section 2.14**.

5.06.3 CONSTRUCTION METHODS

(A) GENERAL - Chambers shall 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** shall apply to the work to be done hereunder.

(C) INVERTS - Inverts of chambers shall be formed between transverse templates and shall be screeded. Where the radii of inverts are too small to permit screeding between templates, the inverts shall be shaped by means of interior forms. The concrete for inverts shall be deposited continuously for

their entire cross section and length. Inverts shall be carefully protected from all injury during the progress of the work. The inverts of chambers shall be troweled smooth.

(D) SIDE WALLS - Concrete in the side walls of chambers shall be deposited continuously to the height and to the thickness approved and for their entire length.

(E) ROOF - Concrete in the roofs of chambers shall be deposited continuously for the full depths, and for the entire widths and lengths of the roofs. The outer surfaces of roofs shall be finished true and smooth.

(F) STEPS AND LADDERS - The Contractor shall 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 shall be built to within such distance of the final grade as shown, specified or ordered. Frames and covers shall be as shown on the Sewer Design Standards. The frames shall be set on the masonry or concrete in a full bed of stiff fresh cement mortar.

(H) REINFORCEMENT AND STRUCTURAL STEEL - The steel reinforcement shall be of the dimensions and shapes shown, and installed in the manner specified in **General Specification 11 - Concrete, as modified in Section 2.15**. Structural steel shall be of the shapes and sizes shown, and installed as directed.

(I) PRECAST CHAMBERS - Chambers shall not be precast unless permission to do so is specified in the contract documents. Precast chambers when permitted in the contract documents shall comply with the requirements of **Subsections 5.07.4 and 5.08.4**.

(J) REMOVAL OF FORMS - Forms shall be removed in accordance with **General Specification 11 - Concrete, as modified in Section 2.15**.

(K) BULKHEADS - Approved construction joint bulkheads with provisions for keying and doweling for future sewers shall be provided, where shown or required.

(L) CONNECTIONS - All connections to chambers of existing, new or future sewers and catch basin connections shall be constructed as shown on the plans or as directed. All connections for future sewers shall be closed with bulkheads of brick masonry eight (8) inches thick, unless otherwise shown on the plans or specified.

(M) WATERSTOPS - Waterstops shall be provided between each successive pour in accordance with **Section 2.13**. Details shall be submitted for waterstops as part of the shop drawings.

5.06.4 MEASUREMENT

The quantities of chambers to be measured for payment shall be the number of chambers of each size and type, incorporated in the work, complete, as shown, specified or required.

5.06.5 PRICE TO COVER

The contract price for “CHAMBERS” shall be the unit price bid per each size and type chamber and shall 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 4.03 - 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 shall 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 shall 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, included in the price hereunder shall 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 1.06.12 and 1.06.27** of the specifications and as directed by the Engineer.

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 shall define Chambers:

51.11

(2) The sixth character shall define the Kind of Chamber:

C - Chamber
J - Junction Chamber
O - Overflow Chamber
T - Transition Chamber
E - Equalizer 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 shall 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
51.11J000	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
51.11P004	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 5.07
MANHOLES

5.07.1 DESCRIPTION

Manholes shall be constructed of the sizes and shapes shown and of the types specified complete with frames and covers.

5.07.2 MATERIALS

(A) Concrete shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(B) Brick and brick masonry shall comply with the requirements of **Section 2.16**.

(C) Frames and covers shall be of cast iron, unless otherwise shown on the contract plans, complying with the requirements of **Section 2.08**, Type 1. Malleable iron or cast steel covers, when required, shall comply with the requirements of **Section 2.08 and Section 2.12**.

(D) Steps shall be cast iron and shall comply with the requirements of **Section 2.08**, Type 1, or shall be copolymer polypropylene plastic manhole steps with one-half (1/2) inch Grade 60 steel reinforcement and shall comply with the Sewer Design Standards.

(E) Cement mortar shall comply with the requirements of **Section 2.17**.

(F) Reinforcement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(G) Structural steel shall comply with the requirements of **Section 2.19**.

(H) Cast iron pipe shall comply with the requirements of **Section 2.03**.

(I) Vitrified clay pipe shall comply with the requirements of **Section 2.02**.

(J) Ductile iron pipe shall comply with the requirements of **Section 2.06**.

(K) Bluestone shall be tough, sound, durable, fine graded sandstone or quartzite, free from injurious seams and other imperfections and saw cut to the required dimensions. It shall be set in a full bed of fresh mortar in compliance with the requirements of **Section 2.17**.

(L) Granite slabs shall comply with the requirements of **Section 2.11**.

(M) Aluminum floor gratings shall comply with the requirements of **Section 2.14**.

5.07.3 CONSTRUCTION METHODS

(A) GENERAL - Manholes shall 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** shall apply to the work to be done hereunder.

(C) CONCRETE MANHOLES - Concrete manholes shall 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 shall apply:

(1) Inverts of manholes shall be formed between transverse templates and shall be screeded. Where the radii of inverts are too small to permit screeding between templates, the inverts shall be shaped by means of interior forms. The concrete for inverts shall be deposited continuously for their entire cross section and length of manhole. Inverts shall be carefully protected from all injury during the progress of the work. The inverts of manholes shall be troweled smooth.

(2) Concrete in sidewalls of manholes shall be deposited continuously to the height and to the thickness approved and for their entire length.

(3) Concrete in roofs of manholes shall be deposited continuously for the full depths, and for the entire widths and lengths of the roofs. The outer surfaces of roofs shall be finished true and smooth.

(D) STEPS AND LADDERS - The Contractor shall 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 shall be placed integrally with the concrete or shall 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 shall be built to within such distance of the final grade as shown, specified or ordered. Frames and covers shall be as shown on the Sewer Design Standards. The frames shall be set on the masonry or concrete in a full bed of stiff fresh cement mortar.

(F) REMOVAL OF FORMS - Forms shall be removed in accordance with **General Specification 11 - Concrete, as modified in Section 2.15**.

(G) REINFORCEMENT AND STRUCTURAL STEEL - The steel reinforcement shall be of the dimensions and shapes shown, and installed in the manner specified in **General Specification 11 - Concrete, as modified in Section 2.15**. Structural steel shall 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 shall be provided, where shown or required.

(I) CONNECTIONS - All connections to manholes of existing, new or future sewers and catch basin connections shall be constructed as shown on the plans or as directed. All connections for future sewers shall be closed with bulkheads of brick masonry eight (8) inches thick, unless otherwise shown on the plans or specified.

(J) WATERSTOPS - Waterstops shall be provided between each successive pour in accordance with **Section 2.13**.

5.07.4 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 5.07** shall apply unless otherwise amended herein.

(B) MATERIALS

(1) Concrete shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**, except that the concrete shall 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 shall not exceed one-tenth (1/10) of one percent by weight of cement. The maximum water/cement ratio shall not exceed forty-seven (47) percent by weight.

(2) Portland Cement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**, and shall be Type II unless otherwise specified. Coarse and Fine Aggregate for concrete shall be well graded in accordance with **Subsection 2.6.1.1 of General Specification 11 - Concrete, as modified in Section 2.15**. Size of Coarse Aggregate shall be three-quarter (3/4) inch unless smaller size aggregate is required due to nature of work.

(3) Reinforcement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(4) Welded Steel Wire Fabric shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15** and shall 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 shall 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 shall be provided with lap and spigot joints that will permit water tight and permanent joints. The minimum lap shall be that shown on the standard details. Gaskets shall be provided at all joints and shall 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 shall be in conformance with **Subsection 2.05.5** of the specifications.

(E) TESTING - Concrete utilized in the construction of precast reinforced concrete manholes shall be tested in conformance with **General Specification 11 - Concrete, as modified in Section 2.15**, with the exception that the concrete, steel reinforcement, fabrication and manufacture shall 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 shall be performed and must be satisfactorily completed prior to acceptance.

Testing shall 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 shall 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 shall be deemed included in the price bid per manhole.

(F) OPENINGS FOR LATERAL CONNECTIONS - All sewer pipe openings shall conform to the sizes, dimensions and requirements specified on the Sewer Design Standards for Precast Manholes. All sewer pipe openings shall be provided with two (2) number four (4) reinforcement bar hoops around each opening and each opening shall 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 shall 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 shall 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 shall note all pipe entries, final grades, etc. The Engineer's review of such submissions shall 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 shall be built in conformance with the standard drawings and shall be cast in steel forms.

Devices used to position reinforcement shall be made of, or coated with, material so that corrosion of the device will not occur. Sufficient devices shall be provided to position the reinforcement for required concrete cover.

Concrete shall be thoroughly consolidated by internal or external vibration or a combination of both.

(I) CURING - All precast sections shall 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 shall 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 shall 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 shall 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 shall 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 shall not be subjected to freezing temperatures until the required twenty-eight (28) day compressive strength is achieved.

(J) INSTALLATION - All precast manholes shall be installed in accordance with the standards and specifications for Precast Manholes and as directed by the Engineer.

(K) MARKINGS - The manufacturer shall mark each individual piece with permanent markings on the inside of each section. The following minimum information shall be listed:

(1) Date of Manufacture
(2) Manufacturer's Logo
(3) Individual Piece Identification
(4) ASTM Designation

(L) DELIVERY OF SECTIONS - No sections shall 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.

5.07.5 MEASUREMENT

The quantities of manholes to be measured for payment shall be the number of manholes of each size and type, incorporated in the work, complete, as shown, specified or required.

5.07.6 PRICE TO COVER

The contract price for "MANHOLES" shall be the unit price bid per each size and type manhole and shall 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 4.03 - 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 shall 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 shall 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 shall 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 1.06.12 and 1.06.27** 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, shall 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 shall define Manholes:

51.21

(2) The sixth character shall 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 shall define either the Type of Manhole for Standard 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 shall 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 shall 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
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
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 5.07A
RECONSTRUCTION OF EXISTING MANHOLES

5.07A.1 INTENT

This section describes the reconstruction of existing manholes on existing sewers, lined sewers and shotcreted sewers.

5.07A.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 shall furnish all labor, materials, equipment, etc., necessary and required to reconstruct such manholes as specified herein and as ordered.

5.07A.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 shall be repaired and/or removed as directed by the Engineer; all debris, excess mortar, etc. shall be removed so that the faces of the manhole walls and the invert are left smooth and clean; and all surfaces shall 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 shall be removed and shall not be replaced. Finally the whole area shall be parged or flashed (Receive a one-half (1/2) inch minimum finishing coat of mortar with a float finish). (The invert dish finish coat shall 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 shall be repaired and/or removed as directed by the Engineer; all debris, excess mortar, etc. shall be removed so that the faces of the manhole walls and the invert are left smooth and clean; and all wall and invert surfaces shall 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 shall be removed and shall not be replaced. Finally the whole area shall be parged or flashed (Receive a one-half (1/2) inch minimum finishing coat of mortar with a float finish). (The invert dish shall 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 shall be repaired and/or removed as directed by the Engineer; all debris, excess mortar, etc. shall be removed so that the faces of the manhole walls are left smooth and clean; and all wall surfaces shall 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 shall be removed and shall not be replaced. Finally the whole area shall be parged or flashed (Receive 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.

5.07A.4 MEASUREMENT

The quantity to be measured for payment shall 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.

5.07A.5 PRICE TO COVER

(A) ON EXISTING SEWERS

The contract price for "RECONSTRUCTION OF EXISTING MANHOLE ON EXISTING SEWER" shall 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 shall 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 "RECONSTRUCTION OF EXISTING MANHOLE ON EXISTING LINED SEWER" shall 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 shall 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 "RECONSTRUCTION OF EXISTING MANHOLE ON EXISTING SHOTCRETED SEWER" shall 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 shall 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 shall define Reconstruction Of Existing Manholes:

51.22

(2) The sixth and seventh characters shall define the Kind of Sewer manhole reconstruction is to be on:

RM - Existing Sewer
RL - 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
51.21RS	RECONSTRUCTION OF EXISTING MANHOLE ON EXISTING SHOTCRETED SEWER	EACH

SECTION 5.07B
REPLACEMENT OF EXISTING MANHOLE FRAME AND COVER

5.07B.1 INTENT

This section describes the replacement of existing manhole frames and covers.

5.07B.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 shall 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.

5.07B.3 CONSTRUCTION METHODS

The Contractor shall be 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 shall be installed. All courses of brick damaged or removed during removal of existing castings shall be replaced. The new casting shall be properly set on a bed of mortar. Finally, the area of pavement damaged due to removal of castings shall 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 shall become the property of and be disposed of by the Contractor.

5.07B.4 MEASUREMENT

The quantity to be measured for payment shall be the number of sets of manhole frames and covers completely incorporated into the work as shown, specified or ordered.

5.07B.5 PRICE TO COVER

The contract price for “REPLACEMENT OF EXISTING MANHOLE FRAME AND COVER” shall be the unit price bid per each set of manhole frame and cover replaced and shall 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 shall define Replacement Of Existing Manhole Frame And Cover:
51.23

(2) The sixth and seventh characters shall 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 5.08
DROP-PIPE MANHOLES

5.08.1 DESCRIPTION

Drop-Pipe Manholes shall be constructed of the sizes and shapes shown and of the types specified complete with frames and covers.

5.08.2 MATERIALS

(A) Concrete shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(B) Brick and brick masonry shall comply with the requirements of **Section 2.16**.

(C) Frames and covers shall be of cast iron, unless otherwise shown on the contract plans, complying with the requirements of **Section 2.08**, Type 1. Malleable iron or cast steel covers, when required, shall comply with the requirements of **Section 2.08 and Section 2.12**.

(D) Steps shall be cast iron and shall comply with the requirements of **Section 2.08**, Type 1, or shall be copolymer polypropylene plastic manhole steps with one-half (1/2) inch Grade 60 steel reinforcement and shall comply with the Sewer Design Standards.

(E) Cement mortar shall comply with the requirements of **Section 2.17**.

(F) Reinforcement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(G) Structural steel shall comply with the requirements of **Section 2.19**.

(H) Cast iron pipe shall comply with the requirements of **Section 2.03**.

(I) Vitrified clay pipe shall comply with the requirements of **Section 2.02**.

(J) Ductile iron pipe shall comply with the requirements of **Section 2.06**.

(K) Bluestone shall be tough, sound, durable, fine graded sandstone or quartzite, free from injurious seams and other imperfections and saw cut to the required dimensions. It shall be set in a full bed of fresh mortar in compliance with the requirements of **Section 2.17**.

(L) Granite slabs shall comply with the requirements of **Section 2.11**.

(M) Aluminum floor gratings shall comply with the requirements of **Section 2.14**.

5.08.3 CONSTRUCTION METHODS

(A) GENERAL - Drop-Pipe Manholes shall 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** shall apply to the work to be done hereunder.

(C) CONCRETE DROP-PIPE MANHOLES - Concrete drop-pipe manholes shall 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 shall apply:

(1) Inverts of drop-pipe manholes shall be formed between transverse templates and shall be screeded. Where the radii of inverts are to small to permit screeding between templates, the inverts shall be shaped by means of interior forms. The concrete for inverts shall be deposited continuously for their entire cross section and length of drop-pipe manhole. Inverts shall be carefully protected from all injury during the progress of the work. The inverts of drop-pipe manholes shall be troweled smooth.

(2) Concrete in side walls of drop-pipe manholes shall be deposited continuously to the height and to the thickness approved and for their entire length.

(3) Concrete encasement for drop pipe shall be deposited continuously to the height and to the cross section approved. Concrete encasement for drop pipe shall be anchored to the side wall(s) as shown or specified, freestanding encasement for drop pipe shall not be 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 shall be deposited continuously for the full depths, and for the entire widths and lengths of the roofs. The outer surfaces of roofs shall be finished true and smooth.

(D) STEPS AND LADDERS - The Contractor shall 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 shall be placed integrally with the concrete or shall 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 shall be built to within such distance of the final grade as shown, specified or ordered. Frames and covers shall be as shown on the Sewer Design Standards. The frames shall be set on the masonry or concrete in a full bed of stiff fresh cement mortar.

(F) REMOVAL OF FORMS - Forms shall be removed in accordance with **General Specification 11 - Concrete, as modified in Section 2.15**.

(G) REINFORCEMENT AND STRUCTURAL STEEL - The steel reinforcement shall be of the dimensions and shapes shown, and installed in the manner specified in **General Specification 11 - Concrete, as modified in Section 2.15**. Structural steel shall 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 shall be provided, where shown or required.

(I) CONNECTIONS - All connections to drop-pipe manholes of existing, new or future sewers and catch basin connections shall be constructed as shown on the plans or as directed. All connections for future sewers shall be closed with bulkheads of brick masonry eight (8) inches thick, unless otherwise shown on the plans or specified.

5.08.4 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 5.08** shall apply unless otherwise amended herein.

(B) MATERIALS

(1) Concrete shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**, except that the concrete shall 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 shall not exceed one-tenth (1/10) of one percent by weight of cement. The maximum water/cement ratio shall not exceed forty-seven (47) percent by weight.

(2) Portland Cement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**, and shall be Type II unless otherwise specified. Coarse and Fine Aggregate for concrete shall be well graded in accordance with **Subsection 2.6.1.1 of General Specification 11 - Concrete, as modified in Section 2.15**. Size of Coarse Aggregate shall be three-quarter (3/4) inch unless smaller size aggregate is required due to nature of work.

(3) Reinforcement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(4) Welded Steel Wire Fabric shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15** and shall 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 shall 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 shall be provided with lap and spigot joints that will permit water tight and permanent joints. The minimum lap shall be that shown on the Standard Details. Gaskets shall be provided at all joints and shall 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 shall be in conformance with **Subsection 2.05.5** of the specifications.

(E) TESTING - Concrete utilized in the construction of precast reinforced concrete drop-pipe manholes shall be tested in conformance with **General Specification 11 - Concrete, as modified in Section 2.15**, with the exception that the concrete, steel reinforcement, fabrication and manufacture shall 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 shall be performed and must be satisfactorily completed prior to acceptance.

Testing shall 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 shall 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 shall be deemed included in the price bid per drop-pipe manhole.

(F) OPENINGS FOR LATERAL CONNECTIONS - All sewer pipe openings shall conform to the sizes, dimensions and requirements specified on the Sewer Design Standards for Precast Drop-Pipe Manholes. All sewer pipe openings shall be provided with two (2) number four (4) reinforcement bar hoops around each opening and each opening shall 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 shall 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 shall 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 shall note all pipe entries, final grades, etc. The Engineer's review of such submissions shall 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 shall be built in conformance with the standard drawings and shall be cast in steel forms.

Devices used to position reinforcement shall be made of, or coated with, material so that corrosion of the device will not occur. Sufficient devices shall be provided to position the reinforcement for required concrete cover.

Concrete shall be thoroughly consolidated by internal or external vibration or a combination of both.

(I) CURING - All precast sections shall 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 shall 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 shall 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 shall 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 shall 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 shall not be subjected to freezing temperatures until the required twenty-eight (28) day compressive strength is achieved.

(J) INSTALLATION - All precast drop-pipe manholes shall be installed in accordance with the standards and specifications for Precast Drop-Pipe Manholes and as directed by the Engineer.

(K) MARKINGS - The manufacturer shall mark each individual piece with permanent markings on the inside of each section. The following minimum information shall be listed:

(1) Date of Manufacture
(2) Manufacturer's Logo
(3) Individual Piece Identification
(4) ASTM Designation

(L) DELIVERY OF SECTIONS - No sections shall 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.

5.08.5 MEASUREMENT

The quantities of drop-pipe manholes to be measured for payment shall be the number of drop-pipe manholes of each size and type, incorporated in the work, complete, as shown, specified or required.

5.08.6 PRICE TO COVER

The contract price for “DROP-PIPE MANHOLES” shall be the unit price bid per each size and type drop-pipe manhole and shall 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 4.03 - 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 shall 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 shall 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, included in the price hereunder shall 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 1.06.12 and 1.06.27** 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, shall be deemed 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 shall define Drop-Pipe Manholes:

51.31

(2) The sixth character shall 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 shall 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 shall 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 shall 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
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 5.09
CATCH BASINS

5.09.1 DESCRIPTION

Catch basins shall 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.

5.09.2 MATERIALS

(A) Concrete shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(B) Brick and brick masonry shall comply with the requirements of **Section 2.16**.

(C) Frames and hoods shall be of cast iron complying with the requirements of **Section 2.08**, Type 1, unless otherwise shown on the plans.

(D) Gratings and covers shall be of cast iron, unless otherwise shown on the contract plans, complying with the requirements of **Section 2.08**, Type 1. Malleable iron or cast steel gratings and covers, when required, shall comply with the requirements of **Section 2.08 and Section 2.12**.

(E) Hooks shall be of stainless steel one-half (1/2) inch square bar stock, and shall be 18-8 stainless steel Type 303, complying with the requirements of ASTM A582. All other approved hangers together with fasteners shall be 18-8 stainless steel Type 303, complying with the requirements of ASTM A582.

(F) Cement mortar shall comply with the requirements of **Section 2.17**.

(G) Reinforcement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

5.09.3 CONSTRUCTION METHODS

(A) GENERAL - The Contractor is notified that all catch basins installed under the contract shall be Type 1 Catch Basins, unless otherwise specified in the contract documents or directed by the Engineer.

Catch Basins shall 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 shall be installed in accordance with final grade. The brick masonry or concrete for catch basins shall 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** shall apply to the work to be done hereunder.

(2) Frames, gratings, covers, hoods, hooks and all other hardware shall be in accordance with the Sewer Design Standards. The frames shall 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 shall be required to be performed in the sidewalk area. The Contractor shall saw cut the existing sidewalk and curb at a distance of one (1) foot around the perimeter of the 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, shall be deemed included in the prices bid for the respective catch basins items. No separate or additional payment will be made for this work.

(C) CATCH BASIN CONSTRUCTION

(1) Catch basins shall 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 shall apply:

(a) The concrete for bases of catch basins shall be deposited continuously for their entire area together with keys. Bases shall be carefully protected from all injury during the progress of the work. The bases of catch basins shall be true and smooth.

(b) Concrete in sidewalls of catch basins shall be deposited continuously to the height and to the thickness approved and for their entire length.

(c) Concrete in roofs of catch basins shall be deposited continuously for the full depths, and for the entire widths and lengths of the roofs. The outer surfaces of roofs shall be finished true and smooth.

(d) Chutes for Type 3 catch basins shall be poured in one piece. The concrete shall 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 shall, 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 basin shall 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 shall be one (1) foot.

(4) All corner 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 shall 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 shall be placed integrally with the concrete or shall 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 shall be built to within such distance of the final grade as shown, specified or ordered. Frames, grates and covers shall be as shown on the Sewer Design Standards. The frames shall be set on the masonry or concrete in a full bed of stiff fresh cement mortar.

(7) REMOVAL OF FORMS - Forms shall be removed in accordance with **General Specification 11 - Concrete, as modified in Section 2.15**.

(8) REINFORCEMENT - The steel reinforcement shall be of the dimensions and shapes shown, and installed in the manner specified in **General Specification 11 - Concrete, as modified in Section 2.15**.

(9) CONNECTIONS - All connections to catch basin shall be constructed as shown on the plans or as directed. All connections for future catch basin connections shall 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 shall be a minimum of three (3) inches.

(D) CATCH BASIN CONSTRUCTION WHERE NO CURB EXISTS

(1) Where there are no existing curbs, the Contractor shall survey the area and where possible, locate the proposed basins on the future curb line and use a three (3) inch thick asphalt apron to direct the surface flow to the new basin. A swale shall be created for a minimum of three (3) feet around the basin.

(2) All work for catch basin construction where no curb exists shall be done in accordance with the Sewer Design Standards.

(3) Where no curbs exist, basins shall be staked out (lines and grades) by a L.S. or a P.E., and signed and sealed layout sheets shall be submitted to the Engineer prior to excavation. The Contractor shall install the 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 basins, shall be abandoned in accordance with **Subsection 1.06.12(4)**. The curb, sidewalk and pavement affected by the catch basin abandonment shall be permanently restored to match the existing condition.

The Contractor shall 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 basin connections shall be bulkheaded. The cost of all labor, materials and equipment required and necessary to abandon existing catch basins in accordance with **Subsection 1.06.12(4)**, including bulkheading of basin connections and restoration of sidewalks and curbs shall 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.

5.09.4 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 5.09** shall apply unless otherwise amended herein.

(B) MATERIALS

(1) Concrete shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(2) Portland Cement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**, and shall be Type II unless otherwise specified. Coarse and Fine Aggregate for concrete shall be well graded in accordance with **Subsection 2.6.1.1 of General Specification 11 - Concrete, as modified in Section 2.15**. Size of Coarse Aggregate shall be three-quarter (3/4) inch unless smaller size aggregate is required due to nature of work.

(3) Reinforcement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(4) Welded Steel Wire Fabric shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15** and shall 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 shall conform to the Sewer Design Standards that are deemed a part of this contract.

(D) Precast reinforced concrete catch basins shall be manufactured in one (1) piece, as shown.

(E) TESTING - Concrete utilized in the construction of precast reinforced concrete catch basins shall be tested in conformance with **General Specification 11 - Concrete, as modified in Section 2.15**, with the exception that the concrete, steel reinforcement, fabrication and manufacture shall 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 shall 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 shall 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 shall be deemed included in the price bid per catch basin.

(F) OPENINGS FOR LATERAL CONNECTIONS - All catch basin connection pipe openings shall conform to the sizes, dimensions and requirements specified on the Sewer Design Standards for Precast Catch Basins. All catch basin connection pipe openings shall 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 shall note all pipe entries, final grades, etc. The Engineer's review of such submissions shall 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 shall be built in conformance with the standard drawings and shall be cast in steel forms.

Devices used to position reinforcement shall be made of, or coated with, material so that corrosion of the device will not occur. Sufficient devices shall be provided to position the reinforcement for required concrete cover.

Concrete shall be thoroughly consolidated by internal or external vibration or a combination of both.

(I) CURING - All precast catch basins shall 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 shall 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 shall 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 shall 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 shall 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 shall not be subjected to freezing temperatures until the required twenty-eight (28) day compressive strength is achieved.

(J) INSTALLATION - All precast catch basins shall 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 shall be provided in order to assure uniform bedding at subgrade. The cost of the above work shall be deemed included in the prices bid for the catch basins.

(K) MARKINGS - The manufacturer shall mark each catch basin with permanent markings on the inside of each catch basin. The following minimum information shall be listed:

(1) Date of Manufacture
(2) Manufacturer's Logo
(3) Individual Piece Identification
(4) ASTM Designation

(L) DELIVERY OF CATCH BASINS - No catch basin shall 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.

5.09.5 MEASUREMENT

The quantities of catch basins to be measured for payment shall be the number of catch basins of each size and type, incorporated in the work, complete, as shown, specified or required.

5.09.6 PRICE TO COVER

The contract price for “CATCH BASINS” shall be the unit price bid per each size and type catch basin and shall 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 4.03 - 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 shall 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 5.09.3 (D)** where no curbs exist as shown on the plans or as ordered by the Engineer, shall be included in the contract price bid for "CATCH BASINS".

In addition, included in the price hereunder shall 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 1.06.12 and 1.06.27** 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, shall be deemed 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 shall define Catch Basins:

51.41

(2) The sixth character shall 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 shall 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 5.09A
INCREMENTAL COST OF TYPE 3 CATCH BASIN IN LIEU OF (TYPE 1 OR TYPE 2) CATCH BASIN

5.09A.1 DESCRIPTION

Where the substitution of a new Type 3 catch basin is ordered by the Engineer to replace a new Type 1 or Type 2 catch basin that was originally shown or specified to be constructed, payment for this substitution shall be made as specified herein.

The Contractor shall include only the incremental cost of all labor, materials, plant, equipment and incidentals necessary to furnish and install a new Type 3 catch basin in place of a new Type 1 or Type 2 catch basin in the respective “INCREMENTAL COST OF TYPE 3 CATCH BASIN IN LIEU OF (TYPE 1 OR TYPE 2) CATCH BASIN” item.

5.09A.2 MATERIALS AND CONSTRUCTION METHODS

Materials and construction methods for catch basins shall comply with all requirements of **Section 5.09**.

5.09A.3 PAYMENT

Payment for each new Type 3 catch basin directed to be installed by the Engineer in place of a new Type 1 or Type 2 catch basin shall be made under the unit price bid for either Type 1 or Type 2 “STANDARD CATCH BASIN” item, plus the unit price bid for the respective “INCREMENTAL COST OF TYPE 3 CATCH BASIN IN LIEU OF (TYPE 1 OR TYPE 2) CATCH BASIN” item.

Payment for Incremental Cost Of Type 3 Catch Basin In Lieu Of (Type 1 Or Type 2) Catch Basin will be made under the Item Number as calculated below:

The Item Numbers for Incremental Cost Of Type 3 Catch Basin In Lieu Of (Type 1 Or Type 2) Catch Basin have eight characters. (The decimal point is considered a character, the third character.)

(1) The first five characters shall define Incremental Cost Of Type 3 Catch Basin In Lieu Of (Type 1 Or Type 2) Catch Basin:

51.42

(2) The sixth and seventh characters shall define the Type of Catch Basin to be replaced with a Type 3 Catch Basin:

B1 - Type 1
B2 - Type 2

(3) The eighth character shall define the Kind of Type 3 Catch Basin replacement:

W - With Curb Piece
X - Without Curb Piece

(4) The Item Numbers together with Description and Pay Unit as provided in the Bid Schedule are provided below:

Item No.	Description	Pay Unit
51.42B1W	INCREMENTAL COST OF TYPE 3 CATCH BASIN WITH CURB PIECE IN LIEU OF TYPE 1 CATCH BASIN	EACH
51.42B2W	INCREMENTAL COST OF TYPE 3 CATCH BASIN WITH CURB PIECE IN LIEU OF TYPE 2 CATCH BASIN	EACH
51.42B1X	INCREMENTAL COST OF TYPE 3 CATCH BASIN WITHOUT CURB PIECE IN LIEU OF TYPE 1 CATCH BASIN	EACH
51.42B2X	INCREMENTAL COST OF TYPE 3 CATCH BASIN WITHOUT CURB PIECE IN LIEU OF TYPE 2 CATCH BASIN	EACH

SECTION 5.10
PRECAST SEEPAGE BASINS

5.10.1 DESCRIPTION

Precast reinforced concrete seepage basins shall be constructed of the sizes shown on the plans, complete with frames and covers, and all in accordance with the specifications and standards.

5.10.2 MATERIALS

(A) Concrete shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**, except that the concrete shall 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 shall not exceed one-tenth (1/10) of one percent by weight of cement. The maximum water/cement ratio shall not exceed forty-seven (47) percent by weight.

(B) Portland Cement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**, and shall be Type II unless otherwise specified. Coarse and Fine Aggregate for concrete shall be well graded in accordance with **Subsection 2.6.1.1 of General Specification 11 - Concrete, as modified in Section 2.15**. Size of Coarse Aggregate shall be three-quarter (3/4) inch unless smaller size aggregate is required due to nature of work.

(C) Brick and brick masonry shall comply with the requirements of **Section 2.16**.

(D) Frames and covers shall be of cast iron, unless otherwise shown on the contract plans, complying with the requirements of **Section 2.08**, Type 1. Malleable iron or cast steel covers, when required, shall comply with the requirements of **Section 2.08 and Section 2.12**.

(E) Cement mortar shall comply with the requirements of **Section 2.17**.

(F) Reinforcement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(G) Welded Steel Wire Fabric shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15** and shall 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.

5.10.3 CONSTRUCTION METHODS

(A) GENERAL - Precast reinforced concrete seepage basins shall 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 shall be such that the opening in the top slab together with the frame and cover shall 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 shall be approximately seventeen (17) feet as specified on the Sewer Design Standards.

(B) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** shall apply to the work to be done hereunder.

(C) SETTING FRAMES AND COVERS - The brick masonry for the seepage basin shall be built to within such distance of the final grade as shown, specified or ordered. Frames and covers shall be as shown on the Sewer Design Standards. The frames shall be set on the masonry in a full bed of stiff fresh cement mortar.

(D) REINFORCEMENT - The steel reinforcement shall be of the dimensions and shapes shown, and installed in the manner specified in **General Specification 11 - Concrete, as modified in Section 2.15**.

(E) CONNECTIONS - All connections to seepage basins shall 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 shall 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) shall 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 shall 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 shall be tested in conformance with **General Specification 11 - Concrete, as modified in Section 2.15**, with the exception that the concrete, steel reinforcement, fabrication and manufacture shall 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 shall 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 shall 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 shall be deemed 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 shall 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 shall 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 shall note all pipe entries, final grades, etc. The Engineer's review of

such submissions shall 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 shall be built in conformance with the standard drawings and shall be cast in steel forms.

Devices used to position reinforcement shall be made of, or coated with, material so that corrosion of the device will not occur. Sufficient devices shall be provided to position the reinforcement for required concrete cover.

Concrete shall be thoroughly consolidated by internal or external vibration or a combination of both.

(L) CURING - All precast sections shall 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 shall 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 shall 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 shall 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 shall 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 shall not be subjected to freezing temperatures until the required twenty-eight (28) day compressive strength is achieved.

(M) INSTALLATION - All precast seepage basins shall be installed in accordance with the standards and specifications for Precast Seepage Basins and as directed by the Engineer.

(N) MARKINGS - The manufacturer shall mark each individual piece with permanent markings on the inside of each section. The following minimum information shall be listed:

(1) Date of Manufacture
(2) Manufacturer's Logo
(3) Individual Piece Identification
(4) ASTM Designation

(O) DELIVERY OF SECTIONS - No sections shall 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.

5.10.4 MEASUREMENT

The quantities of precast seepage basins to be measured for payment shall be the number of precast seepage basins of each size, incorporated in the work, complete, as shown, specified or required.

5.10.5 PRICE TO COVER

The contract price for "PRECAST SEEPAGE BASINS" shall be the unit price bid for each size precast seepage basin and shall 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 4.03 - 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 shall 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 shall also include the cost of all labor and materials required furnish, deliver and install all stone ballast and ground stabilization fabric (Mirafi-140 or approved equal), as shown on the standards or as directed by the Engineer.

In addition, included in the price hereunder shall 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 1.06.12 and 1.06.27** 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 shall define Precast Seepage Basins:

51.51

(2) The sixth character shall define Standard Precast Seepage Basins:

S - Standard

(3) The seventh and eighth characters shall 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 5.11
OUTFALL STRUCTURES

5.11.1 DESCRIPTION

The outfall structures shall be constructed of the sizes and dimensions and to the lines and grades and within the limits of payment as shown, specified or ordered.

5.11.2 MATERIALS

(A) Concrete shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**. Concrete shall contain entrained air of six percent (6%).

(B) Reinforcement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(C) Structural steel shall comply with the requirements of **Section 2.19**.

(D) The cement used for outfall structure (including headwalls and reinforced concrete sewer outfalls) shall be Type-V cement. (This shall not include cement for concrete cradles and encasements, chambers, manholes, catch basins and precast reinforced concrete pipes for sewers, such cement shall 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 shall comply with the requirements of **Sections 5.01, 5.02, 5.03 and 5.04** respectively except as otherwise amended in the plans and specifications.

(F) Chambers, manholes, drop-pipe manholes, catch basins and catch basin connections shall comply with the requirements of **Sections 5.06, 5.07, 5.08, 5.09 and 5.13** respectively except as otherwise amended in the plans and specifications.

(G) Boulders shall be clean natural stones. Recycled material will not be permitted. The shape of stones shall be such so as to provide a consistent pattern that provides for a minimum of voids between all adjacent stones. Stones shall be seven hundred (700) pounds in nominal weight. (The absolute minimum weight of stone that will be accepted shall be five hundred (500) pounds.)

(H) Tide gates shall be stainless steel low-flow flap gates as manufactured by H. Fontaine Ltd., or approved equivalent. Tide gates shall consist of: Stainless steel for flaps and frames, and thimbles when required shall be in accordance with ASTM A240 Type 316L; Bolts, studs, nuts and anchor bolts shall be in accordance with ASTM A276 Type 316, and ASTM F593 and F594 GR2 for Type 316; Hinges shall consist of stainless steel pin and have Ultra-High Molecular Weight Polyethylene (UHMWPE) bushings in accordance with ASTM D4020; and, Seals shall be made of Ethylene Propylene Diene Terpolymers (EPDM) in accordance with ASTM D2000.

5.11.3 CONSTRUCTION METHOD

(A) GENERAL - The outfall structures shall be constructed “in the dry”. The Contractor’s means and methods of construction for the outfall structure shall be submitted, prior to the start of work, to the Engineer for written approval.

The Contractor shall 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 shall 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 requirement of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** shall apply to the work to be done hereunder.

(C) The concrete for the footings, cradles, encasements, inverts, etc. shall be deposited continuously for the entire cross section and for such longitudinal distances as approved.

(D) The concrete for the walls, headwalls, etc. shall 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 shall remove all debris and clean and prepare the tidal flat/existing ground, and shall 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 shall be placed in compliance with all permits and as shown, specified or ordered. The layer of boulders shall be placed in order to obtain a minimum of voids between stones. Dropping of boulders into place will not be permitted.

5.11.4 PRICE TO COVER

The contract price for "OUTFALLS" shall be the unit price bid per each outfall structure and shall 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 4.03 - Earth Excavation**); all sheeting and bracing; temporary steel 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 shall be the cost of all labor, materials and equipment necessary and required to construct the 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 1.06.12 and 1.06.27** 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 5.11.5** below shall be complete and shall compliment each other, whatever item(s) the Contractor may consider not covered under one shall be deemed covered under one of the others. No separate or additional payment will be made for any such considered item(s).

5.11.5 SEPARATE PAYMENT

The Contractor is notified that payment for the cost of furnishing, delivering and placing of Permanent Steel Sheet Piling Bulkheads; Timber Piles; Structural Steel H-Piles; Stone Ballast; Riprap; Slope Pavements; and Grouted Stone Pavements within outfall limits shall 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 Sheet Piling Bulkheads shall be made under items labeled "ADDITIONAL CONCRETE", and "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 shall define Outfall Structures:
51.61

(2) The sixth character shall define Outfall Structure:
F - Outfall Structure

(3) The seventh, eighth and ninth characters shall 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 5.12
MODIFICATION OF EXISTING STRUCTURES

5.12.1 DESCRIPTION

Existing chambers, siphon chambers, manholes, drop-pipe manholes and catch basins shall be modified in accordance with the contract drawings within the limits and to the sizes, shapes and dimensions and to the elevations shown, complete.

5.12.2 MATERIALS

(A) Concrete shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(B) Brick and brick masonry shall comply with the requirements of **Section 2.16**.

(C) Frames, covers, gratings and hoods shall be of cast iron, unless otherwise shown on the contract plans, complying with the requirements of **Section 2.08**, Type 1. Malleable iron or cast steel covers and gratings, when required, shall comply with the requirements of **Section 2.08 and Section 2.12**.

(D) Steps shall be cast iron and shall comply with the requirements of **Section 2.08**, Type 1, or shall be copolymer polypropylene plastic manhole steps with one-half (1/2) inch Grade 60 steel reinforcement and shall comply with the Sewer Design Standards.

(E) Hooks shall be of stainless steel one-half (1/2) inch square bar stock, and shall be 18-8 stainless steel Type 303, complying with the requirements of ASTM A582. All other approved hangers together with fasteners shall be 18-8 stainless steel Type 303, complying with the requirements of ASTM A582.

(F) Cement mortar shall comply with the requirements of **Section 2.17**.

(G) Reinforcement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(H) Structural steel shall comply with the requirements of **Section 2.19**.

(I) Cast iron pipe shall comply with the requirements of **Section 2.03**.

(J) Vitrified clay pipe shall comply with the requirements of **Section 2.02**.

(K) Ductile iron pipe shall comply with the requirements of **Section 2.06**.

(L) Bluestone shall be tough, sound, durable, fine graded sandstone or quartzite, free from injurious seams and other imperfections and saw cut to the required dimensions. It shall be set in a full bed of fresh mortar in compliance with the requirements of **Section 2.17**.

(M) Granite slabs shall comply with the requirements of **Section 2.11**.

(N) Aluminum floor gratings shall comply with the requirements of **Section 2.14**.

(O) Timber and lumber shall comply with the requirements of **Section 2.20**. Timber columns for supports shall have a minimum (Extreme Fiber in Bending) F_b = 1,700-psi and a minimum (Compression Parallel to Grain) F_c = 1,400-psi.

5.12.3 CONSTRUCTION METHODS

(A) GENERAL - The existing chambers, siphon chambers, manholes, drop-pipe manholes and catch basins shall 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.

(B) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** shall 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 shall be removed within the limits shown, specified or ordered. Removal of portion(s) of structure beyond the limits shown, specified or ordered shall not be permitted unless approved in writing by the Engineer.

The Contractor shall 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 shall 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 shall 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 shall be placed close to the area(s) to be demolished and shall be secure and evenly spaced. (These drawing and computation requirements can be waived by written approval of the Engineer.)

All existing reinforcing bars shall be incorporated into the new modified portion of the structure(s) and shall 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 shall be provided as shown, specified or ordered.

(D) INVERTS - Inverts of chambers, manholes, etc. shall be formed between transverse templates and shall be screeded. Where the radii of inverts are too small to permit screeding between templates, the inverts shall be shaped by means of interior forms. The concrete for inverts shall be deposited continuously for their entire cross section and length. Inverts shall be carefully protected from all injury during the progress of the work. The inverts shall be troweled smooth.

(E) SIDE WALLS - Concrete in the side walls of chambers, manholes, etc. shall 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. shall be deposited continuously for the full depths, and for the entire widths and lengths of the roofs. The outer surfaces of roofs shall be finished true and smooth.

(G) STEPS AND LADDERS - The Contractor shall 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. shall be built to within such distance of the final grade as shown, specified or ordered. Frames and covers shall be as shown on the Sewer Design Standards. The frames shall be set on the masonry or concrete in a full bed of stiff fresh cement mortar.

(I) REINFORCEMENT AND STRUCTURAL STEEL - The steel reinforcement shall be of the dimensions and shapes shown, and installed in the manner specified in **General Specification 11 - Concrete, as modified in Section 2.15**. Structural steel shall be of the shapes and sizes shown, and installed as directed.

(J) REMOVAL OF FORMS - Forms shall be removed in accordance with **General Specification 11 - Concrete, as modified in Section 2.15**.

(K) BULKHEADS - Approved construction joint bulkheads with provisions for keying and doweling for future sewers shall be provided, where shown or required.

(L) CONNECTIONS - All connections to chambers, manholes, etc. of existing, new or future sewers and catch basin connections shall be constructed as shown on the plans or as directed. All connections for future sewers shall be closed with bulkheads of brick masonry eight (8) inches thick, unless otherwise shown on the plans or specified.

(M) WATERSTOPS - Waterstops shall be provided between each successive pour in accordance with **Section 2.13**. Details shall be submitted for waterstops as part of the shop drawings.

5.12.4 PRICE TO COVER

The contract price for “MODIFICATION OF EXISTING STRUCTURES” shall be the unit price bid per each modification of existing structure and shall cover the cost of all labor, materials, plant, equipment, samples and tests 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 4.03 - Earth Excavation**); temporary shoring and bracing; 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; 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 shall 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 shall 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 shall 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 1.06.12 and 1.06.27** of the specifications and as directed by the Engineer.

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 shall define Modification Of Existing Structures:

51.71

(2) The sixth character shall 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

(3) The seventh and eighth characters shall 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
W3 - Type 3 With Curb Piece
X3 - Type 3 Without Curb Piece

(4) The ninth, tenth and eleventh characters shall 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

(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
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

SECTION 5.13
CATCH BASIN CONNECTIONS

5.13.1 DESCRIPTION

Catch basins connections shall be constructed of the sizes, classes and kinds shown, specified or required.

Unless otherwise shown, specified or ordered catch basin connections shall be twelve (12) inch diameter ductile iron basin connection on a stone bedding or encasement.

5.13.2 MATERIALS

(A) Vitrified clay pipe shall comply with the requirements of **Section 2.02**. Kind, class and size of pipe shall be as shown or specified. Joints shall comply with the requirements of **Subsection 5.03.3(C)**.

(B) Ductile iron pipe shall comply with the requirements of **Section 2.06** and shall be Class 56 unless otherwise specified. Joints shall comply with the requirements of **Subsection 2.06.5**. Unless otherwise specified or directed all joints for ductile iron basin connections shall be "push-on" joint type. All fittings required shall 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 shall comply with the requirements of **Section 2.17**.

(D) Cement grout shall comply with the requirements of **Section 2.18**.

(E) Gasket and mortar joint shall comply with the requirements of **Section 2.07**, Type 1, and as specified in **Subsection 5.03.3(C)**.

(F) Premoulded bituminous compound joint shall comply with the requirements of **Section 2.07**, Type 2, and as specified in **Subsection 5.03.3(C)**.

(G) Elastomeric pipe joint shall comply with the requirements of **Section 2.07**, Type 3, and as specified in **Subsection 5.03.3(C)**.

(H) Ring rubber gasket and grooved spigot joint shall comply with the requirements of **Section 2.07**, Type 4, and as specified in **Subsection 5.03.3(C)**.

(I) Concrete for cradle and encasement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(J) Crushed stone shall comply with the requirements of **Section 4.12**.

5.13.3 CONSTRUCTION METHODS

(A) GENERAL - Catch basin connections shall 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 shall 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 shall be a minimum of three (3) inches.

The location and angle of basin connections may be varied to suit field conditions. Basin connections shall 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** shall apply to the work to be done hereunder.

(C) LAYING - The pipe shall be laid with the male ends toward the outlet. The pipes shall 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 shall 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 shall be cut to fit the inner face of the masonry. Unless otherwise directed, such cutting shall be done before the pipes are built in.

Unless otherwise directed the trench for each catch basin connection shall be fully excavated for its entire length before any pipes are laid therein.

(D) JOINTS

(1) Joints shall 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 shall be left exposed for inspection and approval by the Engineer. A suitable ladder affording easy access for such inspection shall be provided.

(E) BEDDING

(1) Ductile iron pipe basin connections shall be laid on a six (6) inch thick compacted layer of crushed stone. The six (6) inch thick layer of crushed stone shall 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 shall 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 shall be backfilled and compacted as specified in the specifications and as directed by the Engineer. The Contractor shall note that in accordance with the Sewer Design Standards a filter fabric (Mirafi 140 or approved equal) shall 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 shall be fully encased in crushed stone or concrete, as directed by the Engineer.

The cost for the crushed stone bedding or encasement, filter fabric and all labor, equipment and expenses necessary and required to place the crushed stone and filter fabric shall be deemed included in the price bid for the contract item labeled "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 shall be paid for at the contract price bid for item labeled "ADDITIONAL CONCRETE".

(2) Where vitrified pipe basin connections are specifically shown, specified or required, vitrified pipe basin connections shall be laid in continuous concrete cradles. Where the cover, from final grade to the inner top of pipe, is less than four (4) feet, the vitrified pipe basin connections shall be fully encased in concrete. The additional concrete required for the encasement of vitrified pipe basin connections shall be paid for at the contract price bid for the item labeled "ADDITIONAL CONCRETE".

Concrete cradles for pipe shall be cast in one (1) pour and shall be of the dimensions shown, specified or directed.

Concrete sills of approved shapes and dimensions shall be used for the temporary support of pipes that are to be permanently supported on concrete cradles. Such sills shall be completely embedded in the concrete cradle. Working drawings of these sills shall be submitted to the Engineer for approval before pipe laying begins.

Forms shall be removed in accordance with **General Specification 11 - Concrete, as modified in Section 2.15**.

(F) DAMAGED PIPE - Pipe damaged from handling or any cause whatsoever, whether in or out of the trench, shall 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 shall 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 shall 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 shall 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 shall 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 shall 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.

5.13.4 MEASUREMENT

The quantities of catch basin connections to be measured for payment shall 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 form 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 shall 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.

5.13.5 PRICE TO COVER

The contract price for “CATCH BASIN CONNECTIONS” (e.c. Items labeled "12” DUCTILE IRON PIPE BASIN CONNECTION", or "12” EXTRA STRENGTH VITRIFIED PIPE BASIN CONNECTION") shall be the unit price bid per linear foot for each size, kind and class of catch basin connection pipe and shall 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 4.03 - 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 shall 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 1.06.12 and 1.06.27** 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 shall define Catch Basin Connections:

52.11

(2) The sixth character shall 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 shall 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 5.14
RISERS FOR HOUSE CONNECTIONS

5.14.1 DESCRIPTION

Risers for house connections shall 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 shall be extra strength full diameter vitrified clay and shall 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 shall be ductile iron and all fittings shall be ductile iron or gray iron and shall be installed in accordance with the Sewer Design Standards for ductile iron pipe alternate.

5.14.2 MATERIALS

(A) Vitrified pipe shall comply with the requirements of **Section 2.02**. Kind, class and size of pipe shall be as shown or specified. Joints shall comply with the requirements of **Subsection 5.03.3(C)**.

(B) Ductile iron pipe shall comply with the requirements of **Section 2.06** and shall be Class 56 unless otherwise specified. Joints shall comply with the requirements of **Subsection 2.06.5**. Unless otherwise specified or directed all joints for ductile iron riser pipe shall be mechanical joint type as per Sewer Design Standards. All fittings required shall 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 shall comply with the requirements of **Section 2.17**.

(D) Cement grout shall comply with the requirements of **Section 2.18**.

(E) Gasket and mortar joint shall comply with the requirements of **Section 2.07**, Type 1, and as specified in **Subsection 5.03.3(C)**.

(F) Premoulded bituminous compound joint shall comply with the requirements of **Section 2.07**, Type 2, and as specified in **Subsection 5.03.3(C)**.

(G) Elastomeric pipe joint shall comply with the requirements of **Section 2.07**, Type 3, and as specified in **Subsection 5.03.3(C)**.

(H) Ring rubber gasket and grooved spigot joint shall comply with the requirements of **Section 2.07**, Type 4, and as specified in **Subsection 5.03.3(C)**.

(I) Concrete for cradle and encasement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(J) Reinforcement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

5.14.3 CONSTRUCTION METHODS

(A) GENERAL - Risers for house connections shall 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 shall 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, shall be understood to be approximate and for information only. The final locations and height of risers shall be as determined by the Engineer at the time of construction.

(B) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** shall apply to the work done hereunder.

(C) PLACING - The riser pipe shall be placed with the male ends toward the outlet. The pipes shall be fitted together and matched so that when placed in the work they will form a drain with a smooth and uniform interior. They shall 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 shall be closed with approved tile or precast concrete plugs or with hand tightening (wing nut type) expandable plugs as manufactured by O.R.H.A. Industries or Jones Manufacturing Co., or approved equal, so as to provide a watertight seal. The threads are to be greased prior to tightening to ensure a proper seal without stripping.

Forms shall be removed in accordance with **General Specification 11 - Concrete, as modified in Section 2.15**.

(D) JOINTS

(1) Joints shall 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 shall be left exposed for inspection and approval by the Engineer. A suitable ladder affording easy access for such inspection shall be provided.

(E) DAMAGED PIPE - Pipe damaged from handling or any cause whatsoever, whether in or out of the trench, shall be replaced and removed from the site of the work by and at the sole expense of the Contractor.

5.14.4 MEASUREMENT

The quantities of risers for house connections to be measured for payment shall 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.

5.14.5 PRICE TO COVER

The contract price for “RISERS FOR HOUSE CONNECTIONS” (e.c. Items labeled "8” DUCTILE IRON PIPE RISER FOR HOUSE CONNECTION", or "8” E.S.V.P. RISER FOR HOUSE CONNECTION") shall be the unit price bid per vertical foot for each size, kind and class of riser pipe and shall 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 4.03 - 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 shall define Risers For House Connections:

52.21

(2) The sixth character shall 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 shall 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 5.15
SPURS FOR HOUSE CONNECTIONS

5.15.1 DESCRIPTION

Spurs for house connections shall be constructed of the sizes, classes and kinds shown, specified or required.

5.15.2 MATERIALS

(A) Vitrified pipe shall comply with the requirements of **Section 2.02**. Kind, class and size of pipe shall be as shown or specified. Joints shall comply with the requirements of **Subsection 5.03.3(C)**.

(B) Ductile iron pipe shall comply with the requirements of **Section 2.06** and shall be Class 56 unless otherwise specified. Joints shall comply with the requirements of **Subsection 2.06.5**. Unless otherwise specified or directed all joints for ductile iron spur pipe shall be mechanical joint type. All fittings required shall 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 shall 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 shall comply with the requirements of **Section 2.03**. Kind, class and size of pipe shall be as shown or specified. Joints shall comply with the requirements of **Subsection 2.06.5** as defined for ductile iron pipe. Unless otherwise specified or directed all joints for cast iron spur pipe shall be mechanical joint type. All fittings required shall 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 shall comply with the requirements of **Section 2.17**.

(E) Cement grout shall comply with the requirements of **Section 2.18**.

(F) Gasket and mortar joint shall comply with the requirements of **Section 2.07**, Type 1, and as specified in **Subsection 5.03.3(C)**.

(G) Premoulded bituminous compound joint shall comply with the requirements of **Section 2.07**, Type 2, and as specified in **Subsection 5.03.3(C)**.

(H) Elastomeric pipe joint shall comply with the requirements of **Section 2.07**, Type 3, and as specified in **Subsection 5.03.3(C)**.

(I) Ring rubber gasket and grooved spigot joint shall comply with the requirements of **Section 2.07**, Type 4, and as specified in **Subsection 5.03.3(C)**.

(J) Concrete for cradle and encasement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

5.15.3 CONSTRUCTION METHODS

(A) GENERAL - Spurs for house connections shall 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 shall 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 shall be understood to be approximate and for information only. The final locations of spurs shall be as determined by the Engineer at the time of construction.

(B) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** shall apply to the work to be done hereunder.

(C) INSTALLATION - In precast reinforced concrete pipe sewers, spur pipe shall be bell and spigot with the spigot end moulded 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 shall be smooth with no protruding spur pipe. The spur pipe spigot end shall be of sufficient length to reach the exterior of the sewer.

Vitrified pipe sewers shall have spurs of the sizes shown, specified or ordered moulded thereon to form the required Wye or Tee branch spur pipe sewer. Cast iron pipe sewers and ductile iron pipe sewers shall have spurs of the sizes shown, specified or ordered moulded thereon to form the required Wye or Tee branch spur pipe sewer and all joints shall be mechanical joint type. Such spur pipe sewer shall be furnished and laid in pipe sewers where directed by the Engineer.

The Contractor shall be permitted, with the approval of the Engineer, to use on eighteen (18) inch in diameter and larger ductile iron pipe sewer as a substitute for ductile iron pipe Wye and Tee branch premoulded spur pipe sewer an approved seal tight type saddle similar to Geneco Sealtite Type "C", Model "CO" Sewer Pipe Saddle.

Unconnected dead ends of spurs shall be closed with approved tile or precast concrete plugs or with hand tightening (wing nut type) expandable plugs as manufactured by O.R.H.A. Industries or Jones Manufacturing Co., or approved equal, so as 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, shall 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 moulded spur thereon shall 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 shall conform to the Sewer Design Standards for ductile iron pipe alternate.

5.15.4 MEASUREMENT

The quantities of spurs for house connections to be measured for payment shall be the number of each size, kind and class spur pipe incorporated in the work, complete, as shown, specified or required.

5.15.5 PRICE TO COVER

The contract price for “SPURS FOR HOUSE CONNECTIONS” (e.c. Items labeled “6” DUCTILE IRON PIPE SPUR FOR HOUSE CONNECTION ON 18” D.I.P. SANITARY SEWER", or "6” E.S.V.P. SPUR FOR HOUSE CONNECTION ON 18” E.S.V.P. SANITARY SEWER") shall be the unit price bid per each size,

kind and class of spur and shall 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 shall 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 shall define Spurs For House Connections:
52.31

(2) The sixth character shall 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 shall 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 shall define the Type of Sewer Effluent:
S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer

(5) The tenth and eleventh characters shall 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”

(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
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
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

SECTION 5.16
HOUSE CONNECTION DRAINS

5.16.1 DESCRIPTION

Whenever new house connection drains are proposed, the Contractor shall be able to use and/or substitute ductile iron or cast iron soil pipe for new house connection drains. New house connection drains shall 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 shall be reconstructed and reconnected of the same sizes, classes and kinds. The minimum size of reconnection shall be six (6) inches.

5.16.2 MATERIALS

(A) Vitrified pipe shall comply with the requirements of **Section 2.02**. Kind, class and size of pipe shall be as shown or specified. Joints shall comply with the requirements of **Subsection 5.03.3(C)**.

(B) Ductile iron pipe shall comply with the requirements of **Section 2.06** and shall be Class 56 unless otherwise specified. Joints shall comply with the requirements of **Subsection 2.06.5**. Unless otherwise specified or directed all joints for ductile iron pipe house connection drain shall be "push-on" joint type. All fittings required shall 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 shall comply with the requirements of **Section 2.04**. Joints shall comply with the requirements of **Subsection 2.04.3**. Unless otherwise specified or directed all joints for cast iron soil pipe house connection drain shall be "push-on" joint type.

(D) Cement mortar shall comply with the requirements of **Section 2.17**.

(E) Cement grout shall comply with the requirements of **Section 2.18**.

(F) Gasket and mortar joint shall comply with the requirements of **Section 2.07**, Type 1, and as specified in **Subsection 5.03.3(C)**.

(G) Premoulded bituminous compound joint shall comply with the requirements of **Section 2.07**, Type 2, and as specified in **Subsection 5.03.3(C)**.

(H) Elastomeric pipe joint shall comply with the requirements of **Section 2.07**, Type 3, and as specified in **Subsection 5.03.3(C)**.

(I) Ring rubber gasket and grooved spigot joint shall comply with the requirements of **Section 2.07**, Type 4, and as specified in **Subsection 5.03.3(C)**.

(J) Concrete for cradle and encasement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(K) Crushed stone shall comply with the requirements of **Section 4.12**.

5.16.3 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 shall, 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 shall 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 shall 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 shall have a vested or contingent interest in the building, or notice of refusal if consent is not obtained, shall be filed with the Engineer at least two (2) days before the commencement of examination.

(B) GENERAL - The Contractor shall 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 shall 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 shall be a minimum of eight (8) feet at the curb line. The new house connection drains shall 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 shall be left at the end of the pipe for the plumber's future connection. In no case shall 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, shall have their house connection drains reconstructed of the same sizes, classes and kinds of pipe, and shall 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** shall apply to the work to be done hereunder.

(D) LAYING - The pipe shall be laid with the male ends toward the outlet. The pipes shall 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 shall 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 shall be fully excavated for its entire length before any pipes are laid therein.

The unconnected hub end shall be plugged with a hand tightening (wing nut type) expandable plug as manufactured by O.R.H.A. Industries or Jones Manufacturing Co., or approved equal, so as 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 shall be used to connect house connection drains. The coupling shall be Fernco, or approved equal.

(E) BEDDING

(1) Cast iron soil pipe and ductile iron pipe used for new house connection drain shall be laid on a six (6) inch thick compacted layer of crushed stone. The six (6) inch thick layer of crushed stone shall 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 shall 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 shall be backfilled and compacted as specified in the specifications and as directed by the Engineer. The Contractor shall note that in accordance with the Sewer Design Standards for ductile iron pipe alternate, a filter fabric (Mirafi 140 or approved equal) shall 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 shall be fully encased in concrete, as directed by the Engineer.

    The cost for the crushed stone bedding or encasement, filter fabric and all labor, equipment and expenses necessary and required to place the crushed stone and filter fabric shall 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 shall be paid for at the contract price bid for item labeled "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 shall 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 shall 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 shall be deemed included in the price bid for the contract item for "HOUSE CONNECTION DRAIN ON CONCRETE CRADLE (RECONNECTION)". The additional concrete required for the concrete encasement of the house connection drains shall be paid for at the contract price bid for item labeled "ADDITIONAL CONCRETE".

Concrete cradles for pipe shall be cast in one (1) pour and shall be of the dimensions shown, specified or directed.

Concrete sills of approved shapes and dimensions shall be used for the temporary support of pipes that are to be permanently supported on concrete cradles. Such sills shall be completely embedded in the concrete cradle. Working drawings of these sills shall 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 shall be removed in accordance with **General Specification 11 - Concrete, as modified in Section 2.15**.

(F) LEAKAGE TESTING - The sewer main and new house connection drains shall be tested for leakage in accordance with **Section 4.11**.

(G) DAMAGED PIPE - Pipe damaged from handling or any cause whatsoever, whether in or out of the trench, shall 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 shall be relaid and reconnected to the existing sewers as directed by the Engineer. The cost of this work shall 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 shall be paid for in accordance with **Articles 25 and 26** of the Contract.

Where necessary, drains and house connections affected by this work shall be extended and connected as directed.

(I) FIELD CUTTING - Ductile iron pipe and cast iron soil pipe shall 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 shall 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 shall 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 shall 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.

5.16.4 MEASUREMENT

The quantities of house connection drains to be measured for payment shall 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.

5.16.5 PRICE TO COVER

The contract price for "NEW HOUSE CONNECTION DRAINS" (e.c. Items labeled "NEW 6" D.I.P. HOUSE CONNECTION DRAIN ON STONE BEDDING", or "NEW 6" C.I.S.P. HOUSE CONNECTION DRAIN ON STONE BEDDING", or "NEW 6" E.S.V.P. HOUSE CONNECTION DRAIN ON CONCRETE CRADLE") shall be the unit price bid per linear foot for each size, kind and class of house connection drain pipe and shall 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 4.03 - Earth Excavation**); preconstruction survey including test pits; concrete cradles; crushed stone bedding and encasements; 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.c. 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 shall be deemed included in the price bid for the proposed house connection drain pipe.

The contract price for "RECONNECTION OF HOUSE CONNECTION DRAINS" (e.c. Items labeled "6" D.I.P. HOUSE CONNECTION DRAIN ON CONCRETE CRADLE (RECONNECTION)", or "6" C.I.S.P. HOUSE CONNECTION DRAIN ON CONCRETE CRADLE (RECONNECTION)", or "6" E.S.V.P. HOUSE CONNECTION DRAIN ON CONCRETE CRADLE (RECONNECTION)") shall be the unit price bid per linear foot for each size, kind and class of house connection drain pipe and shall 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 4.03 - 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 shall 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 1.06.12 and 1.06.27** 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 shall define House Connection Drains:

52.41

(2) The sixth character shall 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 shall 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 shall 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 5.16A
REMOVAL OF PROTRUDING SERVICE CONNECTIONS

5.16A.1 DESCRIPTION

Under this section the Contractor will be required to remove or trim protruding service connections.

5.16A.2 METHOD

Upon completion of televising the existing sewer and prior to lining the Contractor shall 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 shall remove or trim the protrusion. This shall be accomplished from the interior of the sewer by means of a television camera directed cutting device.

5.16A.3 MEASUREMENT

The quantity to be measured for payment shall be the number of protrusions actually removed or trimmed (regardless of the materials and sizes) as directed and approved by the Engineer.

5.16A.4 PRICE TO COVER

The contract price for "REMOVAL OF PROTRUDING SERVICE CONNECTIONS" shall be the unit price bid per each protruding service connection removed or trimmed and shall 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 shall define Removal Of Protruding Service Connections:
52.51

(2) The sixth and seventh characters shall 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 5.16B
RE-OPENING OF SERVICE CONNECTIONS

5.16B.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.

5.16B.2 METHOD

After the liner has been installed and cured the Contractor shall re-open all existing active service connections and those inactive connections ordered by the Engineer. The re-opening of connections shall 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 shall be satisfactorily opened to the approximate size and shape of the original opening and shall be smooth and flush wherever there is a potential for debris buildup.

5.16B.3 MEASUREMENT

The quantity to be measured for payment shall be the number of active service connections or inactive connections (regardless of the sizes) actually opened as required and directed by the Engineer.

5.16B.4 PRICE TO COVER

The contract price for "RE-OPENING OF SERVICE CONNECTIONS" shall be the unit price bid per each active service connection or inactive connection re-opened and shall 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 shall define Re-Opening Of Service Connections:
52.61

(2) The sixth and seventh characters shall 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 5.17
TELEVISION INSPECTION AND DIGITAL AUDIO-VISUAL RECORDING OF SEWERS

5.17.1 DESCRIPTION

Prior to the final inspection of the work completed under this contract, the Contractor shall 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.

5.17.2 ENGINEER'S APPROVALS

(A) The Contractor shall 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 shall be provided in strict accordance with the most current Industry Standards and are subject to final approval by the Engineer.

5.17.3 NOTICE

The Contractor shall give the Engineer five (5) days notice of the Contractor's intention to begin the work included under this section.

5.17.4 DEFINITIONS

(1) Digital Inspection - Operation necessary to complete a true-color audio-visual inspection of all sewers constructed under this contract. The Contractor shall 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 shall 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 shall be named using .mpg as the file extension.

(3) CD-ROM - Compact Disk-Read Only Memory. For the purposes of this specification, CD-ROM shall 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.

5.17.5 SUPERVISION AND TECHNICIAN

(1) An experienced supervisor who has a minimum of three (3) years experience in the field of pipeline inspection shall coordinate the entire inspection operation stated under this section and as approved by the Engineer.

(2) The skilled technician required herein shall have a minimum of three (3) years experience in the field of pipeline inspection and shall perform all work as directed by the Engineer.

5.17.6 EQUIPMENT

(1) The Contractor shall 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 shall provide the electricity for all operations.

(2) The digital scanning equipment shall be capable of inspecting a minimum of one thousand two hundred fifty (1,250) linear feet of sewer line. The inspection equipment shall 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 shall be transported in a stable condition through the sewer line under inspection. Throughout the inspection the scanning equipment shall 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 shall be stable with either locking or ratcheting drums. All winches shall be inherently stable under loaded conditions. The bonds shall be steel or of an equally non-elastic material to ensure the smooth and steady progress of the equipment. The bonds shall be oriented in such a manner as to enable unhindered extension or retraction through the sewer conduit. All efforts shall 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 shall be borne by the Contractor.

(4) Prior to inspection, water shall be introduced to the upstream manhole to aid in identifying sags in the sewer.

(5) The digital scanning studio shall 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 shall be insulated against noise and extremes in temperature, and shall 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 shall have access to view the digital monitor at all times. The digital monitor, central control panel and

control shall be located in the mobile studio. The studio shall 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 shall be specifically designed and constructed for pipeline inspection. The unit shall be waterproof and shall be operative in any conditions that may be encountered in the inspection environment. The Contractor shall provide pan and tilt functions to facilitate the inspection of service laterals and sewer line defects (open joints, cracks, infiltration, etc.). The scanning equipment shall 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 shall 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 shall 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 shall be transmitted to a monitor of not less than fourteen (14) inches in size. The equipment shall 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) shall be uniform and shall not exceed the maximum speed of thirty (30) feet per minute or as ordered by the Engineer.

(7) The Contractor shall test the equipment to verify the picture quality. The Equipment manufacturer's recommendation shall be used to clearly differentiate between the following colors: white, yellow, cyan, green, magenta, red, blue and black.

(8) The digital inspection equipment shall 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 shall be clearly resolved with the primary and complementary colors in order of decreasing luminance.

(b) Linearity: The background grid shall show squares of equal size, without convergence/divergence over the whole of picture. The center circle shall 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 shall provide similar results when used with its own illumination source, the lighting shall be fixed in intensity prior to commencing the inspection. In order to ensure color consistency no variation in illumination shall take place during the inspection.

(e) The inspection monitor display shall 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 shall use a suitable metering device that enables the cable length to be accurately measured; this shall be accurate to ±1% or six (6) inches whichever is greater. The Contractor shall 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.

5.17.7 EXECUTION

(1) Digitally Formatted Inspections: The Contractor shall 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 shall be carried out in a format approved by the Engineer. A skilled technician who shall be located at the control panel in the mobile television studio shall control the operation of the equipment.

(2) The unit shall be positioned to reduce the risk of picture distortion. In circular sewers, the lens shall be positioned centrally at the spring-line (i.e. in prime position) within the sewer. In non-circular sewers,

unit orientation shall be at mid-height, unless otherwise approved by the Engineer, and centered horizontally. In all instances the lens shall be directed along the longitudinal axis of the sewer when in prime position. A positioning tolerance of ±10% of the vertical sewer dimension shall be allowed when the camera is in prime position.

5.17.8 INSPECTION REQUIREMENTS

(1) Any operator responsible for data collection and defect coding shall hold a current PACP Certification. Such certification shall 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 shall commence from starting point to termination point as specified herein and as directed by the Engineer.

(4) The operator shall 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 shall not be less than 3" x 4". The cost of the photographs, ordered taken by the Engineer, shall be deemed included in the contract price for item labeled "TELEVISION INSPECTION AND DIGITAL AUDIO-VISUAL RECORDING OF SEWERS". The photographs taken during the inspection shall be mounted within the post inspection report and keyed to their exact location on the route sheet.

5.17.9 DIGITAL AUDIO-VISUAL RECORDING

(1) Visual Recording: Continuous digital recordings of the inspection view as it appears on the monitor shall be stored. It is intended that a digital recording will be made of the complete pipe inspection. The recording shall also be used as a permanent record of the inspection. The recording shall be MPEG1 and shall comply with ISO/IEC 11172 MPEG 1 Specifications. The digital encoding shall 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 shall be 1.5-Mb/s. The replay of the compressed video information, when reviewed on Windows Media Player Version 6.4 or higher, shall be free of electrical interference and shall produce a clear stable image. The audio portion of the composite digital coding shall be sufficiently free of electrical interference and background noise to produce an oral report that is clear and completely and easily discernible. The operator shall pause the digital recording at any time that there is a delay in the inspection, the pause shall in no way affect, freeze or interrupt the replay of the video and shall not close the video file during the inspection. The operator shall store a single video file for each inspection. The data shall be time coded using the elapsed time from the video file. The elapsed time specifications shall comply with PACP requirements. The naming of the video file shall be automatic and shall match the inspection file name.

(2) The audio portion of the inspection report shall 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 shall be continuously connected to the monitoring equipment. The digital scanning unit and monitoring equipment shall 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 shall be created for each sewer line segment. MPEG files and the data inspection files shall be written to CD-ROM media for delivery to the Engineer. Multiple MPEGs may exist on each CD-ROM. Each CD-ROM shall be labeled, at a minimum, with the following information: Project ID. No., Location(s), Date Began and Date Completed.

(4) MPEG files shall 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 shall 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.

Each D.A.V.R. will be so designated and marked "D.A.V.R.A" and "D.A.V.R.B".

The digital audio-visual recording (D.A.V.R.A) will be included in the post inspection report that is to be given to the City's Engineer or a duly designated representative.

The digital audio-visual recording from "D.A.V.R.A" will have the following information on it:

(a) Project ID. No.
(b) Location
(c) Date Began
(d) Date Completed

5.17.10 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 shall furnish to both the Engineer and the Contractor a complete bound report for their permanent records.

The report shall 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 shall become the property of the Department of Design and Construction and shall 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 City representative present at the time of the inspections shall sign the report.

One (1) copy of the report shall be furnished to the Department of Design and Construction. The report shall 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 shall 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 shall 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 shall 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 shall 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 shall be continuously displayed on the viewing monitor and the MPEG1 file. The size and position of the data display shall be such as not to

interfere with the main subject of the picture yet shall 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 shall 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, shall be entered on a separate data file. Where a Contractor elects to "pass through" a manhole during an inspection the Contractor shall start a new data file at the manhole "pass through" and shall re-set the distance to zero.

5.17.11 MEASUREMENT

The quantity of television inspection and digital audio-visual recording to be measured for payment shall 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 5.17** and as directed by the Engineer.

5.17.12 PRICE TO COVER

The contract price for "TELEVISION INSPECTION AND DIGITAL AUDIO-VISUAL RECORDING OF SEWERS" shall be the unit price bid per linear foot of sewer inspected by television inspection and digital audio-visual recording under this section and shall 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 shall define Television Inspection And Digital Audio-Visual Recording Of Sewers:

53.11

(2) The sixth and seventh characters shall 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 5.18A
SEWER CLEANING

5.18A.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.

5.18A.2. WORK INCLUDED

The Contractor shall furnish all labor, materials and equipment and shall 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.

Prior to the start of work the Contractor will be required to submit a fluming detail in accordance with **Subsection 1.06.12 - (3) Existing Flow**. This fluming diagram shall detail the Contractor's method to prevent debris, silt, and grease from migrating downstream during the cleaning operation. The Contractor shall be required to clean the downstream sewer if the debris, grease, oil and silt from the cleaning are not captured and removed.

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 shall receive a thorough cleaning by 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.

5.18A.3 DISPOSAL

All material removed from the sewers and sewer portions through the manholes under this contract, with the exception of contaminated materials, shall become the property of the Contractor and shall be properly disposed of away from the site, at the Contractor’s expense. Contaminated material shall be disposed of separately in accordance with contract requirements.

In the event that the cleaning of sewers and sewer portions through the manholes is subcontracted, it shall be Contractor’s responsibility to ensure that the subcontractor properly disposes of the material removed away from the site.

5.18A.4 MEASUREMENT

The quantity of sewer cleaning to be measured for payment shall 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.

5.18A.5 PRICE TO COVER

The contract price for “SEWER CLEANING” shall be the unit price bid per linear foot and shall cover the cost of all labor, materials and equipment required or necessary for the proper removal and disposal of all loose debris, grease, oil, 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 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.

5.18A.6 ADDITIONAL PAYMENT

For the purposes of payment, loose debris shall 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. Chipping shall mean removal by pneumatic or conventional hand held hammers and chisels. Silt shall 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. shall be made in accordance with **Article 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 shall define Sewer Cleaning:
54.11

(2) The sixth and seventh characters shall 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 5.18B
CLEANING OF DRAINAGE STRUCTURES

5.18B.1 INTENT

(A) When an item labeled "CLEANING OF DRAINAGE STRUCTURES" is specifically provided for in the Bid Schedule of the contract the Contractor shall perform the work as specified in this **Section 5.18B**.

(B) When there is no specific item provided for in the Bid Schedule for cleaning of drainage structures the Contractor shall clean the existing catch basins and connections in accordance with **Subsection 1.06.12(2)**. The cost of this required cleaning of existing catch basins and connections shall be deemed included in the prices bid for all items of work. No separate or additional payment will be made for this work.

5.18B.2 DESCRIPTION

Under this section, the Contractor shall 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 shall 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.

5.18B.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 there of, all drainage structures, both new and existing, shall 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 5.41 - Maintenance Of Site**.

5.18B.4 DISPOSAL

All material removed from the existing drainage structures under this contract shall become the property of the Contractor and shall 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 shall be Contractor's responsibility to ensure that the subcontractor properly disposes of the material removed away from the site.

5.18B.5 MEASUREMENT

The quantity to be measured for payment shall be the number of cubic yards of debris removed from the drainage structures.

5.18B.6 PRICE TO COVER

The contract price for "CLEANING OF DRAINAGE STRUCTURES" shall be the unit price bid per cubic yard of debris removed from the drainage structure and shall cover the cost of all labor, materials, plant, equipment, samples and tests 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 shall define Cleaning Of Drainage Structures:
54.12

(2) The sixth and seventh characters shall 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 5.19
CLEANING OF EXISTING DUCTILE IRON OR CAST IRON SEWERS

5.19.1 INTENT

This section describes cleaning of existing ductile iron or cast iron sewers.

5.19.2 WORK INCLUDED

The Contractor shall furnish all labor, materials and equipment and shall 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 detail in accordance with **Subsection 1.06.12 - (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 diagram and detailed description of material extraction shall 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 shall 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 shall be of adequate capacity and size to handle the flow. The Contractor shall 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 shall also be required to 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 shall be submitted to the Engineer for approval and no work shall commence until such approval is granted. The Contractor shall 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 shall 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 shall 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 shall be of adequate capacity and size to handle the flow. All excavations for bypassing service connections shall be backfilled, compacted and pavement restored as directed by the Engineer. All service connections damaged shall 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 shall 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 shall 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 shall 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 shall reclean the pipe as ordered and perform additional television inspection(s) and digital audio-visual recording(s) of the pipe.

5.19.3 CONSTRUCTION METHODS

The Drag Cleaning Method shall be used for the primary cleaning of existing ductile iron or cast iron sewers on this project. The Contractor shall 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 shall consist of pulling a mechanical cleaner assembly of steel scraper blades and tight-fitting rubber squeegees through the pipe sections (between manholes). This shall 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 shall 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 shall 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 shall receive a thorough final cleaning by a method approved by the Engineer.

The Contractor shall be responsible for the proper disposal of all debris collected from the pipe and shall comply with all requirements of this contract.

5.19.4 DISPOSAL

All material removed from the existing ductile iron or cast iron sewers under this contract shall become the property of the Contractor and shall 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 shall be Contractor's responsibility to ensure that the subcontractor properly disposes of the material removed away from the site.

5.19.5 MEASUREMENT

The quantity of ductile iron or cast iron sewer cleaning to be measured for payment shall be 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.

5.19.6 PRICE TO COVER

The contract price for "CLEANING OF EXISTING DUCTILE IRON OR CAST IRON SEWERS" shall be the unit price bid per linear foot for each size and type of existing sewer cleaned and shall 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 shall 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.

5.19.7 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 shall be made once for the linear foot of pipe cleaned.

5.19.8 ADDITIONAL PAYMENT

For the purposes of payment, loose debris shall be defined as solids that can be removed from the existing ductile iron or cast iron sewer without chipping to facilitate removal. Chipping shall mean removal by pneumatic or conventional hand-held hammers and chisels. The Engineer shall 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. shall 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 shall define Cleaning Of Existing Ductile Iron Or Cast Iron Sewers:
54.13

(2) The sixth character shall define the Type of Sewer Effluent:
S - Sanitary Sewer
M - Storm Sewer
C - Combined Sewer

(3) The seventh and eighth characters shall 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 shall 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'
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
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 5.20A
PORTLAND CEMENT (TYPE V) - INJECTION GROUTING

5.20A.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.

5.20A.2 MATERIALS

Injection Grout shall be neat Portland Cement. Water used in the mix shall be clean fresh water and in no case shall the water-cement ratio exceed eight (8) gallons of water per bag of cement. Portland Cement shall be Type V.

5.20A.3 CONSTRUCTION METHOD

(A) Injection grout holes shall be located in the sewer as necessary to insure injection grout penetration. In general, injection grout holes shall 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 shall be injected through the injection grout holes to insure filling of the voids. Adjacent injection grout holes shall serve as vent holes.

(C) Injection grouting pressure shall be the minimum pressure required to overcome the hydrostatic pressure beneath the sewer.

(D) Injection grouting shall commence at the upstream end of the sewer.

(E) Depending upon the conditions encountered in the existing sewer, injection grouting shall be performed prior to or after the repair of any damaged areas as directed by the Engineer.

5.20A.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, shall be deducted from the measurement.

5.20A.5 PRICE TO COVER

The contract price for "PORTLAND CEMENT (TYPE V)" shall be the unit price bid per bag used for injection grouting under and around the sewer and shall 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 shall define Portland Cement (Type V) - Injection Grouting:
54.21

(2) The sixth and seventh characters shall 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 5.20B
SHOTCRETE FOR REPAIR WORK

5.20B.1 INTENT

This section describes shotcrete for repair work that is required to repair the existing sewer to it original structural lines.

5.20B.2 MATERIALS

(A) Shotcrete for Repair shall 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 shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15** and **Section 5.38**.

5.20B.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 shall 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 shall 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 shall not be singled out for special repair. Where cracks and gaps exceed the above listed parameters, the Contractor shall 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 shall 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 shall cease work in that unsafe section of the sewer. The Contractor shall 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 shall not perform any remedial work prior to receiving written notification of the Engineer's approval. This "make safe" work shall be considered as extra work, and shall 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 shall be trimmed back so that the ends of their spigots will line up with the proposed inside face of the shotcreted sewer.

5.20B.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.

5.20B.5 PRICE TO COVER

(A) The contract price for “SHOTCRETE FOR REPAIR WORK” shall be the unit price bid per cubic foot and shall 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 shall be made under item labeled "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 shall define Shotcrete For Repair Work:
54.31

(2) The sixth and seventh characters shall 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 5.21
ABANDONING BASINS AND INLETS

5.21.1 INTENT

(A) When an item labeled "ABANDONING BASINS AND INLETS" is specifically provided for in the Bid Schedule of the contract the Contractor shall perform the work as specified in this **Section 5.21**.

(B) When there is no specific item provided for in the Bid Schedule for abandoning existing basins and inlets the Contractor shall abandon the existing basins and inlets in accordance with **Subsection 1.06.12(4)**. The cost of this required abandoning of basins and inlets shall be deemed included in the prices bid for all items of work. No separate or additional payment will be made for this work.

5.21.2 DESCRIPTION

Under this section, the Contractor shall abandon existing basins and inlets shown, specified or ordered.

Abandoning basins and inlets shall 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:

5.21.3 MATERIALS

(A) Brick and brick masonry shall comply with the requirements of **Section 2.16**.

(B) Cement mortar shall comply with the requirements of **Section 2.17**.

(C) Fill material shall comply with the requirements of **Subsection 4.06.2**.

5.21.4 METHOD

The Contractor shall perform (at a minimum) the following work in order to properly abandon existing basins and inlets:

(A) Existing frames, grates, covers and other castings shall be removed.

(B) Existing basins and inlets shall be broken down to a depth four (4) feet below final grade.

(C) Pipe connection openings to existing basins and inlets shall be bulkheaded with brick masonry.

(D) The bottom slabs of existing basins and inlets shall be broken up in such a manner as to prevent water from being trapped.

(E) The entire openings of existing basins and inlets shall be filled in and compacted in accordance with **Subsection 4.06.3** and as directed by the Engineer.

(F) All castings and debris removed as a result of the above demolition work shall become the property of the Contractor and shall be properly disposed of away from the site, at the Contractor's expense. Such castings and debris shall not be permitted for use as fill in the abandoned basin and inlet openings.

5.21.5 MEASUREMENT

The quantity of abandoned existing basins and inlets to be measured for payment shall be the number of each existing basin and inlet abandoned in place.

5.21.6 PRICE TO COVER

The contract price for "ABANDONING BASINS AND INLETS" shall be the unit price bid per each existing basin and inlet abandoned and shall 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 4.03 - 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 shall define Abandoning Basins And Inlets:
55.11

(2) The sixth and seventh characters shall 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

SECTION 5.22
PILES

5.22.1 DESCRIPTION

Piles of the kinds and types, and of the sizes and shapes shown, specified or ordered for construction shall 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 shall 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.

5.22.2 MATERIALS

(A) TIMBER PILES

(1) Timber piles and driving shoes shall comply with the requirements of **Section 2.22**.

(2) Preservative treatment for timber piles shall comply with the requirements of **Section 2.23**.

(B) STRUCTURAL STEEL H-PILES

(1) Steel piles shall be new rolled structural steel H-sections.

(2) The material in steel piles and splices shall conform to structural steel ASTM A36.

(C) STEEL PIPE PILES

(1) Steel pipe piles shall be spiral weld or seamless steel pipe conforming to ASTM A252, Grade 3. The steel pipe piles shall 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 shall be perpendicular to its axis. Metal to metal bearing joints shall be machine cut. Other joints may be flame-cut.

(2) Unless otherwise shown or specified, all steel pipe piles shall have an outer diameter of twelve (12) inches and have a minimum shell thickness of five-sixteenths (5/16) of an inch.

(3) All steel pipe piles shall be filled with concrete. Concrete shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

5.22.3 GENERAL PILE INSTALLATION PROVISIONS

(A) TEST PILES - The Contractor shall 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 shall be required to drive test piles and perform load tests in order to obtain this necessary information. Test piles shall 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 shall be the same as those to be used in the installation of the permanent piles. Such load tests shall 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 shall 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 shall submit recommendations and designs to the Engineer for approval prior to the start of load testing.

The maximum test load shall be twice the proposed working load value of the pile. The test load shall be applied in seven (7) increments equal to one-half (1/2), three-fourths (3/4), one (1), one and one-fourth (1-1/4), one and one-half (1-1/2), one and three-fourths (1-3/4) and two (2) times the proposed working load. Readings of settlement and rebound shall be referred to a constant elevation benchmark and shall be recorded to one-thousandth (1/1,000) of a foot for each increment or decrement of load. After applying each increment test load, the load shall remain in place until there is no settlement of the test pile for a period of forty-eight (48) hours, before the next increment test load is applied. No settlement shall mean when there is not more than one-thousandth (1/1,000) of a foot of settlement in a forty-eight (48) hour period. After the maximum test load is applied and achieves no settlement for a period of forty-eight (48) hours, the total test load shall then be removed in decrements not exceeding one-fourth (1/4) of the total test load with intervals of not less than one (1) hour. The rebound shall be recorded after each decrement is removed, and the final rebound shall be recorded twenty-four (24) hours after the entire test load has been removed. The maximum allowable pile load shall 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 shall be one-half (1/2) that which causes a gross settlement of one (1) inch, which ever 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, shall remain in place, be incorporated in the work, and will be paid for at the respective prices bid for the contract items for "TIMBER PILES (TREATED OR UNTREATED)", or for "STRUCTURAL STEEL H-PILES", or for "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 shall 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 shall be deemed 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 shall be deemed 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 shall 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 shall 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 shall be numbered and shall indicate all proposed piles for the structures, and the sequence of the pile installation operation.

(C) PILE LOCATION SURVEYS - The Contractor shall conduct all required pile location surveys prior to commencement of the Contractor's pile installation operations. The Contractor shall 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) No piles shall 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 shall 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 shall 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 shall be driven and/or installed and spaced as shown on the plans and standards or as directed by the Engineer. All piles shall be driven and/or installed in the presence of the Engineer or the Engineer's representative. All piles shall 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 shall mark the pile driver ways legibly with paint at intervals of one (1) foot, fixing the zero point where directed. All piles shall be plainly marked with keel or paint to indicate length installed.

(6) PERMANENT PILES - No permanent piles shall be driven except at the locations where the excavation has been completed to subgrade. All timber piles (except brace, batter or spur piles) shall be driven vertically to bedrock or to the specified refusal, and shall 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) shall be driven vertically to the specified loads, and shall be flame-cut and capped at the elevations shown, or as directed.

(7) Pile drivers shall 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 shall 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 shall 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 shall 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.

(11) BRACE, BATTER OR SPUR PILES - Where shown on the plans, brace, batter or spur piles shall 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 shall 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 shall 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, shall be either welded, riveted or bolted with high strength bolts, as shown, specified or directed.

(12) REFUSAL - All timber piles shall be driven and/or installed to bedrock or to refusal. Refusal shall 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 shall be driven to a bearing capacity of twenty (20) tons.

Structural steel H-piles and steel pipe piles shall be installed to a penetration which will result in an allowable bearing capacity as shown, specified or ordered.

Each pile shall 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 shall be driven with a hammer of the same weight as that used in driving the vertical piles. Allowance shall 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 shall be provided for the driving of the brace, batter or spur piles. When directed, a heavier hammer shall be used.

(14) Hammer and piles shall be supported in rigid leads designed to hold the pile firmly in position and alignment and in axial alignment with the hammer.

(15) Driving shall be a continuous operation, but when driving is interrupted before final penetration is reached, the record of penetration shall 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, shall 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 shall be driven by power hammer.

(18) Piles shall 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 shall be made to determine any uplift of the piles. If uplift occurs, piles so affected shall 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 shall be made under the prices bid for the respective contract items for "ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS", for "EXCAVATION OF BOULDERS IN OPEN CUT" and for "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 shall be deemed 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 shall be made under the prices bid for the respective contract items for "ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS", for "EXCAVATION OF BOULDERS IN OPEN CUT" and for "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 shall be deemed 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 shall have on hand suitable equipment for spudding, augering or drilling through buried timbers, cribbing, boulders and other obstructions, and shall 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 5.22.3(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 shall 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 tolerances 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 shall be withdrawn or abandoned and cut off below subgrade, as ordered by the Engineer. Additional pile or piles shall be installed in locations designated by the Engineer to replace rejected piles, and pile caps shall 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 shall be deemed included in the prices bid for the respective pile items.

(H) TOLERANCES FOR PILES - Piles as finally placed, shall 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 shall 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 5.22.3(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 shall 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 shall be a minimum of twelve (12) inches and any additional costs involved in meeting these requirements shall be at the expense of the Contractor.

Payment will be made in accordance with the **Subsection 5.22.3(I)** for piles driven outside of tolerances due to obstructions. The Engineer shall 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 shall 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 shall be made under the prices

bid for the contract items for "ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS", for "STONE BALLAST", for "ADDITIONAL CONCRETE" and for "ADDITIONAL STEEL REINFORCING BARS".

(J) ANALYSIS AND CORRECTIVE MEASURES - The Engineer in accordance with **Subsections 5.22.3(G) and 5.22.3(H)** shall analyze conditions at each pile cap and shall 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 shall 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 shall cooperate with the Engineer to obtain all necessary data. The data shall 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 - Payment for spudding, augering and drilling when ordered by the Engineer, will be made at the unit prices bid under the respective contract items for "TIMBER PILES (TREATED OR UNTREATED)" or for "STRUCTURAL STEEL H-PILES" or for "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.

Spudding, augering or drilling time shall be as computed by the Engineer from the time pile driving stops to the time pile driving is resumed as hereinafter described, provided no interim delay occurs due to the fault of the Contractor. Spudding, augering or drilling time shall include 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.

No spudding, augering or drilling shall be performed unless approved by the Engineer and done in the presence of the Engineer. The method employed (spudding, augering or drilling) shall be performed at the direction of the Engineer.

(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 shall be jetted only with the written approval of the Engineer. Sufficient jets and adequate water pressure shall 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 shall be withdrawn and the piles shall 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 shall be deemed included in the prices bid under the respective contract items for "TIMBER PILES (TREATED OR UNTREATED)"or for "STRUCTURAL STEEL H-PILES" or for "CONCRETE FILLED STEEL PIPE PILES".

(N) EXISTING PILES AND ABANDONED PILES - Where existing piles are encountered along the line of the proposed structure or within the limits of the structure, or where new piles are ordered abandoned, all such existing piles or abandoned piles shall 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 shall 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 shall be deemed included in the prices bid under the respective contract items for "ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS" and for "STONE BALLAST".

Payment for the cost of removal of the existing pile(s) as determined by the Engineer shall 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 shall 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 shall be such that the resultant vertical and lateral loads are adequately transmitted. Splices shall 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 shall be spliced is specified under **Section 2.22**.

Where necessary for structural steel H-piles, one (1) splice per pile will be permitted. Splices for structural steel H-piles shall be designed to develop the full strength of the pile. The Contractor shall submit details of the splices for structural steel H-piles to the Engineer for approval.

For steel pipe piles an Associated Pipe Pile Splicer (drive fit pipe sleeve S-18000) or equal shall be acceptable whenever a maximum of two (2) splices are anticipated. Wheresoever more than two (2) splices are anticipated all splices shall be welded.

All splices for brace, batter or spur structural steel H-piles or steel pipe piles shall be welded.

Shop and field welding on piles shall be done in accordance with AWS D1.1 - Structural Welding Code. Qualifications of welding procedures and operators shall be in accordance with "Standard Qualification Procedure" requirements of AWS. Welding electrodes shall comply with AWS D1.1, and be of proper classification for type of weld and material to be welded.

Records shall be kept of test results, welding procedures and for each qualified welding operator. Copies of these records shall be made available for review by the Engineer.

No separate or additional payment will be made for splicing but the cost thereof shall be deemed included in the prices bid under the respective contract items for "TIMBER PILES (TREATED OR UNTREATED)" or for "STRUCTURAL STEEL H-PILES" or for "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 contract item for "TIMBER PILES (TREATED OR UNTREATED)".

(Q) LIMITS OF PILE SECTION - The limits of the pile section 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 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 limits.

The deletion of items and/or quantities either in part or in whole shall form no basis for any claim for anticipated profits or for loss of profits.

5.22.4 SAFE OR ALLOWABLE LOAD

(A) The safe or allowable load of the piles shall 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 shall 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 shall 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 shall 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 shall 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, shall change driving equipment so that a hammer with lighter striking parts will be used. Work shall not continue with a hammer or driving equipment that in the opinion of the Engineer is likely to damage the piles.

5.22.5 TIMBER PILES

The weight of hammer to be used shall be large enough so that the average net penetration per blow at refusal shall not be less than one-quarter (1/4) inch.

5.22.6 STRUCTURAL STEEL H-PILES

Piles shall be driven with power hammers developing energy per blow of at least fifteen thousand (15,000) or twenty-two thousand (22,000) foot pounds in accordance with the New York City Building Code. An approved steel driving head shall be used.

5.22.7 STEEL PIPE PILES

(A) Piles shall be driven with power hammers developing an energy per blow of at least nineteen thousand (19,000) foot-pounds in accordance with the New York City Building Code. Suitable anvils or

cushions, if required, shall be used to prevent undue damage to the pipe pile butt. Anvils and cushions shall be of a material that will not permit excessive loss of hammer energy.

(B) All steel pipe piles shall be provided with sixty (60) degree conical points. These conical points shall be P-13006-R as manufactured by Associated Pile and Fitting Corporation or approved equal.

(C) PLACING CONCRETE - Prior to placing concrete the piles shall be internally inspected by the Engineer. All material and equipment necessary or required for internal inspection shall 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 shall be rejected by the Engineer. Any cost a Contractor shall incur in order to render a rejected pipe pile suitable shall be borne solely by the Contractor.

No concrete shall 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, no concrete shall be placed in any pipe pile that is within fifty (50) feet of an ongoing pile driving operation.

Concrete shall be placed through a funnel in a continuous operation and shall be solidly compacted as approved by the Engineer.

5.22.8 MEASUREMENT

The quantities of timber piles (treated or untreated), structural steel H-piles and concrete filled steel pipe piles to be measured for payment shall 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.

5.22.9 PRICE TO COVER

The contract price for “TIMBER PILES (TREATED OR UNTREATED)” shall be the unit price bid per vertical foot for each type of timber pile and shall 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 “STRUCTURAL STEEL H-PILES” shall be the unit price bid per vertical foot for each size and type of structural steel H-pile and shall 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 “CONCRETE FILLED STEEL PIPE PILES” shall be the unit price bid per vertical foot for each size and type of concrete filled steel pipe pile and shall 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 shall also be the cost for all connections and guide works.

5.22.10 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 shall define Piles:
70.11

(2) The sixth and seventh characters shall 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 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 5.22A
CONTINUOUS FLIGHT AUGER (CFA) PILES

5.22A.1 DESCRIPTION

(A) Under this contract, the Contractor shall furnish, install and cutoff continuous flight auger (CFA) piles as shown on the contract drawings and as specified herein. The Contractor shall furnish all labor and material and perform all operations necessary to install continuous flight auger piles at the locations shown on the plans to an axial capacity as shown on the contract drawings.

(B) Examination Of The Site:

(1) Prior to starting pile installations, the Contractor shall make a documented inspection of the existing structures, site conditions, pavement and improvements adjacent to the pile installation site to examine and record their present condition. If available a copy of the vibration monitoring, condition survey and geotechnical evaluation report may be reviewed by the Contractor. Such report is only for information purposes. Therefore, the Contractor is encouraged to conduct additional investigation and survey to ensure that the CFA piling work will not cause any damage to any of the structures within the project site.

(2) The Contractor shall prepare a report of such conditions, verified by the photographs and signed by the Contractor's Professional Engineer, which shall be reviewed by the Engineer to verify the existing site conditions that may be affected by this CFA piling work.

(3) The Contractor shall also fully examine the existing site conditions to ensure that the Contractor's equipment can operate without damage to or relocation of existing infrastructure or facilities. The Contractor shall provide all required equipment, modified if needed to accommodate site conditions, including restricted headroom and other headroom limitations. If available, the Contractor is encouraged to review the boring logs showing subsurface conditions and the existing building condition survey.

(C) Qualifications:

The work shall 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 shall submit proof of:

(1) at least two (2) projects in the past two (2) years on which the Contractor has successfully designed, tested and installed CFA piles;
(2) a Registered Professional Engineer licensed in New York State, employed by the Contractor and having experience in the construction of at least five (5) completed CFA pile projects over the past five (5) years of similar scope to this project.

The Professional Engineer shall be directly responsible for the work. The Contractor shall 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.

5.22A.2 MATERIALS

(1) GROUT

(A) Grout Mix for Continuous Flight Auger (CFA) Piles: The grout used to fill the CFA drilled holes shall 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. The grout mix shall 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.

(B) The Contractor's grout mix design shall 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, as designed.

(C) Cement shall conform to ASTM C150, Type II, low alkali.

(D) Grout admixture shall conform to ASTM C494 and/or ASTM C937. The admixture shall be so selected to:

(1) increase workability,
(2) reduce water,
(3) produce early and ultimate high strength,
(4) control setting time,
(5) compensate for shrinkage, and,
(6) reduce fluid loss (i.e. reduce bleeding).

The Contractor shall verify that the use of admixture(s) shall not result in a reduction in the long term strength and/or imperviousness of the grout, nor shall it create an environment to accelerate corrosion of the steel pipe and/or reinforcement bars. The admixture(s) shall be used only after the approval of the Engineer.

(E) Water for grout shall conform to AASHTO T26 and shall 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.

(F) Sand shall meet the requirements of ASTM C144 fine aggregates, except as specified herein. The sand shall be well graded from fine to coarse with a fineness modulus between 2.3 and 3.1. The fineness modulus is defined as the total divided by 100 of the cumulative percentages retained on U.S. Standard Sieve Nos. 4, 8, 16, 30, 50 and 100.

(G) Information regarding the mix design and testing, water source, fine aggregate, admixture (s), and cement supplier shall be submitted to the Engineer for approval prior to placing grout.

(2) REINFORCEMENT BARS (OR STEEL PIPES-IF APPROVED)

(A) Piles shall be reinforced with reinforcement bars to 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 (C), below).

(B) Deformed reinforcing steel bars shall have a minimum yield strength of 60,000-psi, conforming to ASTM A615, Grade 60.

(C) Steel pipes can also be utilized to reinforce CFA piles if approved by the Engineer. If used, steel pipes shall conform to ASTM A252, Grade 2 or 3 except that the yield strength shall be a minimum 36,000-psi, shall include tolerances for pipe diameter, edge alignment, end match marking, roundness and straightness and shall conform to the steel pile splice welding requirements. The carbon equivalency (CE) as defined in AWS D 1.1, Section X15.1, shall not exceed 0.45. The sulfur content shall not exceed 0.05%. Steel pipe shall not be joined by welded lap splicing. Steel pipe seams and splices shall be complete penetration welds. Partial welds of steel pipe may be restored.

5.22A.3 REFERENCES

(A) ASTM A36 - Standard Specification for Carbon Structural Steel.
(B) ASTM A252 - Standard Specification for Welded or Seamless Steel Pipe Piles.
(C) ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
(D) ASTM C33 - Standard Specification for Concrete Aggregates.
(E) ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
(F) ASTM C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube specimen).
(G) ASTM C150 - Standard Specification for Portland Cement.
(H) ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
(I) ASTM C937 - Standard Specification for Grout Fluidifier for Preplaced-Aggregate Concrete.
(J) ASTM C939 - Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
(K) ASTM D1143 - Standard Test Methods for Deep Foundations Under Static Axial Compressive Load.
(L) ASTM D3689 - Standard Test Methods for Deep Foundations Under Static Axial Tensile Load.
(M) ACI 301 - Specification for Structural Concrete.
(N) ACI 305 - Hot Weather Concrete.
(O) ACI 306 - Cold weather Concreting.
(P) AWS D1.1 - Structural Welding Code-Steel.
(Q) AASHTO T26 - Standard Method of Test for Quality of Water to Be Used in Concrete.
(R) American Concrete Institute (ACI).
(S) New York City Building Code (NYBC).

5.22A.4 SUBMITTALS

(A) The Contractor shall install continuous flight auger pile (CFA) as shown on the pile section and elevation drawings to depths and elevations shown on the plan and profiles. Prior to installation, the Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of the General Conditions, Working Drawings, Design and Shop Drawings and the submittal procedures. Working drawings and shop drawings shall include, but not be limited to:

(1) Detailed step-by-step description of the proposed CFA pile construction procedure, including personnel, testing and equipment to assure quality control. This step-by-step procedure shall be shown on the working drawings in sufficient detail to allow the Engineer to monitor the construction and quality of the CFA piles.

(2) Pile location plan, size and numbering system.

(3) Pile location survey during installation.

(4) Additional pile locations (for test piles and reaction piles).

(5) Final pile location survey.

(6) Sample of pile record form including grout mix and sample details.

(7) Pile installation sequence and final pile tip and cutoff elevations.

(B) The Contractor shall also submit the following for review and approval:

(1) 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.

(2) Material certification and specifications, including a certified mill test report for the reinforcing bars. The ultimate strength, yield strength, elongation, and material properties composition shall be included.

(3) 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).

(4) 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.

(5) Welding procedure for the reinforcement shall be certified by a qualified welding specialist.

(6) Test pile report.

(7) Grout mix design and type of materials to be used in the grout, including certified test data and trial batch reports.

(8) 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.

(9) Procedure for grouting rate calculations: The calculations shall 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.

(10) 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.

(11) Information on space requirements for installation equipment that verifies that the proposed equipment can perform at the site.

(12) Plan describing how drilling fluids and excess waste grout will be controlled and disposed of.

(13) Contingency procedures for clearing or drilling through obstructions, handling blockage of pipes or lines, or equipment breakdown.

(14) Estimated curing time for grout to achieve specified strength.

(15) Procedure and equipment for Contractor monitoring of grout quality.

(16) Pile Installation Schedule:

Work shall not begin until the construction submittals have been received, reviewed, and accepted in writing by the Engineer. The Contractor shall provide the above submittals prior to initiating CFA pile construction. The Contractor shall allow the Engineer a minimum of ten (10) business days to review the construction submittals after a complete set has been received. Additional time required due to incomplete or unacceptable submittals shall not be cause for delay or impact claims. All costs associated with incomplete or unacceptable Contractor submittals shall be the responsibility of the Contractor. No CFA pile construction work shall commence without all required submittals being approved.

(17) The Contractor shall have these drawings (six (6) copies) prepared by a Licensed Professional Engineer, currently registered in the State of New York. Such drawings shall be submitted together with CFA piles design calculations and both drawings and design calculations shall bear the imprint of Licensed Professional Engineer's seal and signature. These shop drawings shall 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 shall 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 shall 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 shall be the same size as the contract drawings.

5.22A.5 GENERAL PILE INSTALLATION PROVISIONS

(1) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** shall apply to the work to be done hereunder.

(2) PERFORMANCE REQUIREMENTS

(A) The Contractor shall be responsible for the installation of the continuous flight auger (CFA) piles, which shall conform to the plans and specifications.

(B) Pile design loadings, grout strengths, reinforcing bars (or an alternative reinforcement element, for example steel pipe-if approved by the Engineer) and dimensions of the piling are as shown on the contract drawings or specified in this specification.

(C) Continuous flight auger (CFA) piles shall 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 shall be fitted with a protective cap on the outlet at the base of the central stem. The protective cap shall be detached under the pressure of the grout.

(D) Other removal methods shall not be used unless such methods are reviewed and approved by the Engineer prior to pile installation.

(E) Pressurized grout shall be injected concurrently through the hollow shaft (stem) as the auger is being withdrawn. The continuous flight augers shall be withdrawn while rotating the auger in the same direction as during the boring stage. The Contractor shall adjust the rotation of the auger and the flow of grout to match so that collapse of the sides of the hole is avoided.

(F) Reinforcing gage or an alternative reinforcement element (for example steel pipe-if approved by the Engineer) shall be placed immediately after grout injection and shall 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 shall then be lowered into the grout. If the reinforcing cage does not slide in without difficulty, the Contractor shall use a vibrator to lower the cage to the design depth.

(G) The Contractor shall install test piles as specified in **Subsection 5.22A.6(1)**.

(H) During installation of the piles, the Contractor shall develop a monitoring program for lateral movements and settlements. This program shall be implemented by a land surveyor licensed in the State of New York, hired by the Contractor. Monitoring shall be done on a daily basis and the data shall be submitted to the Engineer for the Engineer's review within 24-hours of monitoring.

(I) Load tests shall be performed in accordance with ASTM D1143, Section 5.6 - Quick Load Test Method for Individual Piles and/or ASTM D3689, Section 7.7 - Quick Load Test Method for Individual Piles, and as directed by the Engineer.

(3) PILE INSTALLATION, GENERAL

(A) The CFA piles shall only be installed after submission, review and approval of the submittal listed in **Subsection 5.22A.4** of this specification.

(B) Prior to the start of drilling, the leads shall 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.

(C) The hole through which the high-strength mortar is injected during the placement of the pile shall be located at the bottom of the auger head, below the bar containing the cutting teeth. The grout shall be injected (pumped) typically 150-psi above hydrostatic pressure.

(D) The auger head shall be fitted with a protective cap at the base of the central stem. The protective cap shall be detached under the pressure of the grout. The Contractor's grout pump shall be a positive displacement type pump and shall be capable of developing displacement pressures at the pump of not less than 350-psi. Other removal methods shall not be used unless such methods are reviewed and approved by the Engineer prior to such use.

(E) The auger flighting shall be continuous, with no gaps or breaks, and shall always be advanced at a continuous rate to prevent removal of excess soil. The pitch of the auger flighting shall not exceed nine (9) inches.

(F) Piling leads shall be prevented from rotating by a stabilizing arm.

(G) Auger hoisting equipment shall be so designed as to enable the auger to be withdrawn smoothly and steadily. Auger in excess of 40-feet in length shall be provided with a traveling guide.

(H) Reinforcing, as detailed on the contract drawings, shall be placed immediately after grout injection and extraction of the continuous flight auger.

(I) Centralizers shall 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.

(J) Each truckload of grout shall be tested using the Flow Cone Test ASTM C939, except a 3/4-inch opening shall be used rather than the 1/2-inch opening specified. Grout fluidity of between 10 and 25-seconds shall be maintained.

(K) The spoil that accumulates around the auger during injection of the grout shall 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 shall be removed immediately by bailing-out and replaced with fresh grout. A protective cover shall be provided for each pile after installation.

(4) DRILLING

(A) The installation shall be performed in an orderly sequence progressing in one direction across each foundation element. Leads and auger shall be carefully plumbed before installation.

(B) On no account shall the continuous flight augers be extracted from the drilled hole before placement of grout.

(C) Each pile shall be continuously installed at the locations indicated, to the elevation shown on the contract drawings or in the specifications.

(D) The center of gravity shall be carefully maintained for each group or cluster of piles to conform to the locations shown on the contract drawings.

(E) Pile centers shall be located to an accuracy of ±3-inches. Piles shall be plumb within two (2) percent.

(F) The holes in the bottom of the auger shall be plugged with a protective cap while being advanced into the ground. The plug shall be removed by mortar pressure or by other approved means as described in **Subsection 5.22A.5(3)(D)**, above.

(G) When installing piles within 20-feet of existing structures, attention shall 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 shall develop measures to mitigate against accidental "running" of sands. At a minimum, the auger rotations required to advance or withdraw a fixed length shall be limited (for example, limit to two rotations or less per flight advance) and auger rotation shall be immediately stopped following the reaching of the maximum depth and shall not start again until grouting has begun.

(H) Piles installed on the same day shall not be any closer than six (6) pile diameters (i.e. 6-feet), as measured from center to center, of each other.

(I) Accurate records shall be maintained showing the depth to which piles are placed and the quantity of mortar placed. Any unusual conditions encountered during pile installation shall be noted.

(J) The excess spoil that accumulates around the auger due to drilling process and grout injection shall be promptly cleared away.

(5) GROUT MIXING AND PUMPING

(A) Only approved mixing and pumping equipment shall be used in the preparation and handling of grout. A screen to remove oversized particles shall be placed at the pump inlet. All soil or other rust inhibitors shall be removed from the mixing drums, stirring mechanisms and other portions of the equipment in contact with the grout before the mixers are used.

(B) All materials shall be accurately measured by volume or weight as they are fed into the mixer. The time of mixing shall be not less than one (1) minute. If agitated continuously, the mortar 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 shall not be placed when the grout temperature falls below 40ºF or exceeds 100ºF, unless approved procedures for cold and hot weather followed. The grout shall 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.

(C) The grout shall be pumped with pressure through a tremie pipe or a set of packers as the auger is withdrawn, allowing the mortar 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 shall 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 shall 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 shall 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 shall be lifted between six (6) and twelve (12) inches of the bottom to facilitate expelling the tip plug. The auger shall then be lowered back down to the previously established tip elevation.

(D) The grout pump shall be provided with a calibrated pressure gauge in clear view of the equipment operator. A digital counter shall be used to measure the number of grout pump strokes during installation.

(1) The grout pump shall 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 shall be used as a guideline in estimating the amount of grout pumped into the drill hole. The volume per stroke determined by calibration shall be correlated/compared with the manufacturer's literature.

(2) The pump shall be recalibrated following repair or switching pumps or at least once at the request of the Engineer during pile installation.

(3) The Contractor shall have on hand a spare counter and a spare pump. The spare pump shall be utilized when the primary pump is not functioning properly and when directed by the Engineer.

(6) GROUT PLACEMENT

(A) Grout shall be placed in the pile hole as soon as is practicable after mixing, and in no case shall 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.

(B) Positive rotation of the auger shall be maintained throughout placement of the grout. The rate of grout injection and rate of auger withdrawal from the soil shall 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.

(1) The total volume of grout shall 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 shall be pumped. However, the total volume of grout pumped shall be at least 25-percent greater than the theoretical volume of the pile.

(2) Augers shall 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 shall reinsert the auger at least five (5) feet into the pile and re-grout.

(C) If less grout is placed than the net volume required for any five (5) foot increment, the pile shall be reinstalled by rotating the auger to the bottom of the pile, followed by the controlled removal of the auger and grout injection.

(D) A head of at least 10-feet of grout above the injection point shall 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 shall 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.

(E) The grout quantity shall be determined by counting pump strokes and using the predetermined grout volume per pump stroke.

(F) 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 shall reduce pressure, fill the hole with grout while extracting the augers and stop work after the augers are fully withdrawn. Reinforcement shall not be inserted into such piles. The Engineer and the Contractor shall 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 shall be redrilled between six (6) and twelve (12) hours of stoppage to full length, regrouted and the pile shall be completed as specified.

(G) The level of grout in completed piles shall be inspected at least twice between two (2) hours and eight (8) hours after completion for settlement. Should grout settlement occur, the Contractor shall fill the pile with grout only after removal of deleterious materials that may have accumulated. On no account shall the level of grout be permitted to settle below the groundwater table prior to initial set.

(H) Special attention shall be paid to inspecting the level of grout in a completed pile while installing an adjacent pile within six (6) pile diameter.

(I) 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 shall be entirely the responsibility of the Contractor.

(7) REINFORCEMENT AND REINFORCEMENT INSTALLATION

(A) Reinforcing steel assemblies shall be detailed and fabricated in accordance with the manual of Standard Practice for Detailing Reinforced Concrete Structures (ACI-Edition).

(B) The Contractor shall 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 shall submit its characteristics for the Engineer's review and approval.

(C) The bars shall be spliced by complete penetration welding in conformance with AWS D1.1 (Structural Welding Code). Lap splicing is not allowed.

(D) The reinforcement cage (or steel pipe) shall be designed to facilitate their placing to the required depth thorough grout. The main reinforcing element shall be provided in continuous lengths without joints (except for welded joints-see below).

(E) Where reinforcing cages are used, hoops, in lieu of helical bindings shall be used. The hoops shall be tack welded in conformance with AWS D1.1.

(F) Following the completion of grouting, the reinforcing cage (or the steel pipe) shall be lifted and placed centrally over the pile and shall then be lowered into the grout.

(G) Should the reinforcement fail to slide freely to the required depth, then the Contractor shall use a vibrator to facilitate the placement of the reinforcement. The Engineer shall be informed of in advance of any use of a vibrator.

(H) The reinforcing element shall be supported at such a level that it will maintain the required projection above the final pile cutoff level.

(8) JETTING

Jetting shall not be employed.

(9) OBSTRUCTIONS

(A) 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 shall be completed to the depth of the non-augerable material in accordance with these specifications.

(B) The length of such short piles shall be included in the total linear feet of piles for payment.

(C) If required by the Engineer, one or more additional adjacent piles shall be placed and the length of these additional piles shall also be included in the total linear feet of piles for payment.

(10) TOLERANCE

(A) Piles shall be installed from the ground surface existing after excavation work has been completed.

(B) Piles shall not be out of alignment by more than two (2) percent of their length. The center of each pile at the level of cutoff shall 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.

(C) 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.

(D) No pile shall be left partially completed overnight but must be completely grouted and protected at the termination of each day's operation.

(11) PILE CUTOFF

(A) All piles shall be cutoff to true planes at the elevation shown on the contract drawings.

(B) If and where the pile cutoff is near or above the surrounding ground, or above the bottom of the excavation, the Contractor shall install sleeve or a casing pipe of proper diameter and at least eighteen (18) inches in length around the pile top.

(C) Cutoffs are the property of the Contractor and shall be disposed of off-site.

(12) PILE SURVEY

(A) The Contractor shall engage the services of a New York State Licensed Surveyor, approved by the Engineer, for the performance of the survey work. The Contractor shall, 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 shall be established by survey and shown on drawings prepared for this purpose.

(B) Copies of the drawings shall be submitted by the Contractor in accordance with the provisions as hereinafter specified in this **Subsection 5.22A.5(12)** and **Subsection 5.22A.5(13)**. 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.

(C) Upon completion of all pile installation, the Contractor shall 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 shall be the same size as the contract drawings. The final as built survey plan shall be signed and sealed by the Contractor's Land Surveyor licensed in New York State.

(13) ANALYSIS AND CORRECTIVE MEASURES

(A) The analysis called for herein will be performed by the Engineer.

(B) 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.

(C) 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 shall be removed in its entirety and replaced by another pile installed in the design location.

(D) If corrective measures involve the installation of additional piles, the Engineer will prepare supplemental drawings showing the details of the required corrective work.

(1) The Engineer will then obtain the approval of the supplemental drawing(s) by the Engineer. New York City Department of Design and Construction will obtain the signature of the Engineer of Record required on the amendment from which the drawing showing corrective measures is to be submitted for approval.

(2) After the approval of the Engineer 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.

(3) After approval, copies of the drawing(s) will be issued to the Contractor and the work shall be installed in accordance with the drawings.

(E) Cost of Additional Work

(1) 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 shall be borne by the Contractor at no additional cost to the City.

(2) The cost of installing additional piles (as called for on the supplemental drawings for the corrective measures) shall be borne by the Contractor in the case of rejected, defective, damaged or incorrectly installed piles.

(3) 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.

(4) Payment for corrective work necessitated by obstructed piles will be made in accordance with the contract unit price.

(14) DAMAGED OR MISPLACED PILES

(A) All damaged or misplaced piles shall be removed or abandoned, and new piles shall be driven as directed by the Engineer at no cost to the City.

(B) Abandoned piles shall be cut off one (1) foot below cutoff elevation shown on the contract drawings or specified in the specifications.

(C) All cutoff sections shall be removed from the site by the Contractor.

(15) REJECTED PILES

(A) When any pile exceeds the installation tolerances specified in **Subsection 5.22A.5(10)**, the Engineer shall determine whether it shall be rejected.

(B) 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 shall be rejected.

(C) Rejected piles shall be cutoff at an elevation as directed by the Engineer.

(16) ADDITIONAL PILES

Additional piles shall be installed in locations designated by the Engineer to replace rejected piles, at no additional cost to the City.

(17) PRODUCTION PILES

(A) All piles, within the area of uniform subsurface conditions pertaining to a given load-tested pile of satisfactory performance, shall be installed in the same manner as the successful load tested pile, and shall bear in or on the same bearing stratum as the load tested pile.

(B) The same equipment (or heavier equipment of the same type) that was used to install the load tested pile shall be used to install all other building piles, and the equipment shall be operated identically.

(C) All piles shall be of the same type, shape and equal or greater external dimensions as the load tested pile.

(18) INSPECTION

(A) All inspections will be performed by the Engineer designated for controlled inspection.

(B) The installation of each pile is a mandatory hold point for which prior notification of the Engineer is required, and installation of each pile shall be performed in the presence of the Engineer. Installation records will be kept by the Engineer.

(C) The Contractor shall cooperate with the Engineer and shall mark the leads, prior to the start of drilling, in one (1) foot increments for monitoring the auger.

5.22A.6 TESTING

(1) TEST PILES AND LOAD TESTS

(A) The Contractor shall be responsible for the proper length of the piles required to develop the specified loads. The piles shall be of sufficient length so that when they are installed to their final position, the tops will be at or above the elevation shown.

(B) All available samples and information relating to boring records and subsurface conditions are expressly excluded from, and are not a part of, the contract and are available for information purposes only. It shall be the Contractor's responsibility:

(1) To make application for inspection and review of these data in order to select the proper length of test piles.

(2) To obtain any additional subsurface data the Contractor deems required or necessary.

(C) The Contractor shall determine the lengths of the reaction piles required to develop the specified loads by installing test piles. The location and number of test piles shall be selected by the Engineer. The test piles shall 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.

(1) Arrangement: The Contractor shall provide all equipment, instruments, personnel, accessories and appurtenances required for the tests as required in ASTM D1143 (Section 5.6 - Quick Load Test Method for Individual Piles) and ASTM D3689 (Section 7.7 - Quick Load Test Method for Individual Piles). The Contractor shall place reaction piles and beams, as required, to transmit load into the test pile. Calibrated pressure gauges shall be used to determine the actual load placed on the test pile.

(a) The Contractor shall 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.

(b) The Contractor's shop drawings shall 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.

(2) Procedure: Test loads shall be applied by direct weight or by means of a hydraulic jack. The loading platform or box shall be carefully constructed to provide a concentric load on the pile. If direct weight is employed, the loading increments shall be applied without impact or jar. The weight of the loading platform or box shall be obtained prior to the test, and this weight shall 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 shall be provided. The gage and the jack shall be calibrated as a unit.

(a) Increment: The test load shall be twice the proposed working load of the pile. The test load shall 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 proposed working load has been applied, and for each increment thereafter, the test load shall remain in place until there is no measurable settlement in a 2-hour period. The total test load shall remain in place until settlement does not exceed one one-thousands of a foot (0.001-feet) in twelve (12) hours. The total load shall be removed in decrements not exceeding 25-percent of the total load at one (1) hour intervals or longer. The rebound shall be recorded after each decrement is removed, and the final rebound shall be recorded twelve (12) hours after the entire test load has been removed.

(b) Observation: Under each load increment, settlement observations shall 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 shall be maintained.

(c) The allowable pile load shall be such that fifty (50) percent of the applied load causing a net settlement of the pile of three-quarters (3/4) of an inch, where net settlement equals gross settlement due to the total test load, minus the rebound, after removing 100-percent of the test load.

(D) Submittal: The entire test program will be observed by the Engineer. All the test data shall 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 shall remove all equipment and restore the site to the condition and satisfaction of the Engineer.

(E) The Engineer shall 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.

(F) 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.

(G) Payment for load tests shall be made in accordance with **Subsection 5.22A.10**.

(2) TESTING OF GROUT

(A) The grout mix selections and proportions shall be established based on the provisions of ACI 301.

(B) The Contractor shall submit to the Engineer for approval, ten (10) business days prior to the start of work, the proposed grout mix strength testing program.

(C) The grout mix shall 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 and C492 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 shall 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).

5.22A.7 MEASUREMENT

The quantities of continuous flight auger (CFA) piles in linear 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 linear footage of pile to be measured for payment shall be the length in place below the cutoff elevation measured to the tip shown on the drawings.

5.22A.8 PRICE TO COVER

The contract price for "CONTINUOUS FLIGHT AUGER (CFA) PILES" shall be the unit price bid per vertical foot and shall 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 shall also be the cost for all design submittals, shop drawing submittals, documentation, connections and guide works.

5.22A.9 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 shall be deemed included in the unit price bid for item labeled, "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 shall be included in the unit price bid for all items of the contract. Also no payment shall be made for any condition survey, additional borings, any laboratory testing, site photography, delays due to site conditions, access, traffic conditions, permits, etc.

5.22A.10 SEPARATE PAYMENT

Separate payment will be made for load tests for continuous flight auger (CFA) piles. Payment for the cost for each continuous flight auger (CFA) pile load test, including all labor, materials, plant, equipment, tests and insurance required and necessary to complete the continuous flight auger (CFA) pile load test shall be made under the contract price bid for item labeled "CONTINUOUS FLIGHT AUGER (CFA)

PILES, LOAD TEST". Included in price bid hereunder shall 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 shall define Continuous Flight Auger (CFA) Piles:
70.12

(2) The sixth character shall define Continuous Flight Auger (CFA) Piles:
A - Continuous Flight Auger (CFA) Piles

(3) The seventh character shall 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 5.22B
MINI-PILES (GROUTED)

5.22B.1 DESCRIPTION

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 shall be used in conjunction with the requirements of **Section 5.22 - 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 driving equipment.

No additional payment shall be made for the use of different equipment as deemed necessary to complete the work as described herein. All costs shall be deemed included in the price bid for the item labeled "MINI-PILES (GROUTED)".

5.22B.2 MATERIAL AND EQUIPMENT

Contractor shall provide the additional materials and equipment for the installation of the mini-piles:

(A) Plant:

(a) Klemm 704 hydraulic drilling rig or approved equal
(b) Drilling rods and drill tools
(c) Grout pump/mixer
(d) Storage container, as required
(e) Water Tanks, as required
(f) Lifting Equipment, as required

(B) Material:

(a) Grout: 4,000-psi
(b) Threadbar: Minimum 60-ksi, epoxy coated (ASTM A775/AASHTO M282 or ASTM A936 or approved equal)
(c) Steel Shell: Minimum 36-ksi (yield strength)

5.22B.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 shall 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 shall visually examine the drill spoils during installation of the pile. The Contractor shall 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 shall inform the Engineer and appropriate actions shall be specified.

The final borehole depth shall be measured by the driller, checked by the Contractor and recorded on the Daily Report. On reaching the required depth, the borehole shall be water flushed to remove any remaining debris. Spoils arising from drilling and flushing of the borehole shall be deposited around the pile for disposal by the Contractor.

The Contractor shall prepare and submit to the Department of Design and Construction (DDC) full-length installation records for each mini-pile installed.

(B) Placing Reinforcement:

A No. 8 all-thread reinforcing bar shall be used to reinforce each pile. The reinforcing bar shall be centralized within the borehole by wrap-round spacers. The bars shall be spliced using proprietary full strength couplers until the required depth is reached. Each length shall be hoisted into position manually or by using the lifting arm mounted on the drill rig. The lower bar shall 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 shall be attached to the reinforcing bar to allow grouting from the base of borehole.

(C) Placing Grout

The Contractor shall be responsible for ensuring that sufficient cement is ordered and grout is mixed to meet contract requirements. All grout shall be mixed in accordance with the approved mix design.

The Contractor shall be responsible for ensuring that the correct method of grout placement is used and recorded. The grout shall be pumped through a tremie pipe to the base of the pile and the hole filled prior to lifting up the temporary casing. Grout shall be allowed to flow until clean grout is returned to the surface. Thereafter, the casing shall be slowly withdrawn using the drill rig while maintaining a positive grout pressure of a minimum of 50-psi. The casing shall be withdrawn to the required design depth and then pushed back two (2) feet to form the unbonded length.

The Engineer shall be immediately notified of any significant loss of grout. The Contractor shall 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.

5.22B.4 QUALITY ASSURANCE

Mini-piles shall be installed by a specialty contractor having no less than five (5) years experience in this type of construction.

An independent testing laboratory shall test each batch of grout mixed as follows:

Make a set of six (6) grout cubes each day. Two (2) grout cubes each shall be tested at three (3), seven (7) and twenty-eight (28) days for compressive strength in accordance with ASTM C109.

The Contractor shall install all piles in the presence of the Engineer.

5.22B.5 LOAD TEST FOR MINI-PILES

Load test for mini-piles shall be in accordance with ASTM D1143, and as directed by the Engineer. The cost for mini-piles load test, including all material, labor and equipment shall be paid under the bid item labeled “MINI-PILES, LOAD TEST”.

5.22B.6 MINI-PILE (GROUTED) INSTALLATION NOTES

(1) Install grouted piles at locations shown on contract drawing, and as directed by the Engineer.

(2) The drilling equipment shall be a hydraulic mini-drill rig capable of 5,000-ft-lbs of torque and 10,000-lbs of crowd (pushing load). The drill shall have a self-contained hydraulic double acting cylinder grout pump capable of 600-psi pressure and hydraulic grout mixer.

(3) The diameter of the cutting shoe of the casing shall not exceed the outer diameter of the casing by more than 0.25-inch.

(4) The pile shall be reinforced with No. 8, Grade 60, threadbar with spacers at ten (10) foot on centers and couplers as required. Threadbar shall be epoxy coated (ASTM A775) or approved equal.

(5) Grout shall produce a compressive strength of 4,000-psi in seven (7) days. The Contractor shall design a grout mixture, which is expected to produce 4,000-psi in seven (7) days and submit it to DDC for approval.

(6) Grout shall be mixed thoroughly with a high-shear colloidal type mixer capable of handling a minimum of six (6) bag mix.

(7) Grout shall be pumped using a hydraulic pump capable of 600-psi pressure and capable of a minimum of sixty (60) gallons per minute capacity.

(8) A set of six (6) cubes of grout samples (2-inch by 2-inch) shall be taken for each day during which mini-piles are grouted. The cube samples shall be tested by an independent testing laboratory in accordance with the concrete section of the specifications.

(9) The Contractor shall 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.

5.22B.7 MINI-PILE (GROUTED) DESIGN AND SHOP DRAWINGS SUBMITTAL

(1) Before commencing any mini-pile installation operations the Contractor shall have approved shop drawings from the Department of Design and Construction for mini-piles (grouted). The shop drawings shall 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.

(2) The Contractor shall 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.

(3) The Contractor shall have these drawings prepared by a Licensed Professional Engineer, currently registered in the State of New York. Such drawings shall be submitted together with mini piles design calculations and both drawings and design calculations shall bear the imprint of the Licensed Professional Engineer's seal and signature. These shop drawings shall 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 shall be dated and contain the name of the project and the contract number

5.22B.8 MONITORING PROGRAM

(A) Settlement Monitoring Due To Pile Installation:

(1) Settlement points shall be installed at all columns of overhead structures adjacent to proposed construction work. A minimum of two (2) settlement points shall be established at each column.

(2) The survey of settlement points shall be done by a surveyor licensed in the State of New York.

(3) A minimum of two (2) benchmarks shall be established for the settlement monitoring. The benchmark should be a minimum of fifty (50) feet distance from columns and construction work alignment.

(4) The initial survey of the settlement points shall be done prior to pile installation within one hundred (100) feet of the columns.

(5) A warning shall be issued if settlement reaches 1/8-inch.

(6) All pile installation work within one hundred (100) feet of the columns shall be stopped if settlement reaches 1/4-inch.

(7) Frequency of settlement monitoring shall be as follows:

(a) Pile installation between fifty (50) feet and one hundred (100) feet distance from the columns; once every four (4) days.
(b) Pile installation within fifty (50) feet of the columns; once every two (2) days.
(c) If the settlement reaches 1/8-inch; once a day.

(8) The results of the settlement survey shall be submitted to the Engineer on the same day survey was taken.

(B) Vibration Monitoring:

(1) Vibrations at the columns shall be monitored during the driving of piles that are between fifty (50) feet and one hundred (100) feet from the columns.

(2) A total of two (2) seismographs shall be used for the monitoring; one (1) at each of the closest two (2) columns from pile driving.

(3) Check the ambient vibration prior to vibration monitoring.

(4) 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.

(5) The results of the vibration monitoring shall be submitted to the Engineer on the same day of monitoring.

5.22B.9 MEASUREMENT

The quantities of Mini-Piles to be measured for payment shall 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.

5.22B.10 PRICE TO COVER

The contract price for "MINI-PILES" shall be the unit price bid per vertical foot and shall 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 shall also be the cost for all connections and guide works.

5.22B.11 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 shall define Mini-Piles (Grouted):
70.13

(2) The sixth character shall define Mini-Piles (Grouted):
M - Mini-Piles (Grouted)

(3) The seventh character shall 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 5.23
DECKING

5.23.1 DESCRIPTION

When and where specifically specified in the contract documents (i.e. plans, specifications, addenda or traffic stipulations) decking for open trenches shall be provided as shown, specified or required.

Decking shall be defined as a temporary timber mat roadway structure over trenches and excavations built flush with the existing roadway for vehicular and pedestrian traffic.

The placing of anchored steel plates for vehicular traffic, the installation of pedestrian crossings and the installation of walkways at hydrant locations to bridge across trenches and excavations shall not be considered as decking. The cost of all labor, materials, equipment, and insurance required and necessary

to place anchored steel plates for vehicular traffic, the installation of pedestrian crossings and the installation of walkways at hydrant locations to bridge across trenches and excavations shall be deemed included in the price bid for all items of work related to the Maintenance and Protection of Traffic.

5.23.2 MATERIALS

(A) Timber and lumber shall be new or acceptable used timber and lumber free from injurious defects.

(B) Timber and lumber bracing, bridging and decking shall conform to the requirements of **Section 2.20**.

(C) Steel beams and girders shall comply with the requirements of **Section 2.19**, except that approved used material will be permitted. Steel used for decking shall conform to the requirements of the ASTM A36 and all other applicable requirements of ASTM.

(D) Bolts shall conform to the requirements of ASTM A307 or ASTM A325, or as otherwise shown on approved shop drawings.

5.23.3 CONSTRUCTION METHODS

The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** shall apply to the work to be done hereunder. The requirements of **Section 4.05** shall apply, except as otherwise herein amended.

5.23.4 DESIGN CRITERIA

(A) Design criteria shall conform to the requirements set forth in **Subsection 4.05.6.**

(B) Decking shall 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 4.05.6(G)(2)**.

5.23.5 SHOP DRAWINGS

Detailed shop drawings and design calculations shall be prepared for each and every decking system and shall be submitted in accordance with **Subsection 4.05.5**.

5.23.6 MEASUREMENT AND PAYMENT

The quantity of decking to be measured for payment shall be the number of square yards of decking placed, complete, as shown, specified or ordered. Pay limits for decking shall 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.

5.23.7 PRICE TO COVER

The contract price for "DECKING" shall be the unit price bid per square yard for decking and shall 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 shall 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 shall define Decking:
70.21

(2) The sixth and seventh characters shall 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 5.24
FENCING

5.24.1 DESCRIPTION

The Contractor shall 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.

5.24.2 MATERIALS

Fencing shall be five (5) foot high above the existing surface and shall be constructed in ten (10) linear foot removable sections to facilitate construction. Each section shall consist of three (3) horizontal rails of 2" x 8" lumber nailed at each end to 2" x 8" vertical posts. The lower rail shall be located not more than six (6) inches above ground or street surface. The posts shall be of sufficient height to be firmly anchored in a manner approved by the Engineer. The spaces between rails shall 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.

5.24.3 CONSTRUCTION METHODS

(A) The Contractor shall be solely responsible for the furnishing, erecting, relocating, maintenance and removal and replacement of all temporary fencing required under this contract.

The Contractor shall maintain all fencing in a satisfactory and safe condition. The Contractor shall 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 shall be 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 shall be restored to their original locations at the end of each workday.

5.24.4 MEASUREMENT

The quantity of fencing to be measured for payment shall be the number of linear feet of temporary fencing incorporated into the work, complete, as shown, specified or required.

5.24.5 PRICE TO COVER

The contract price for "FENCING" shall be the unit price bid per linear foot fencing and shall 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 shall define Fencing:
70.31

(2) The sixth and seventh characters shall 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 5.25
SHORING, BRACING, UNDERPINNING, SUPPORTING, PROTECTING AND MAINTAINING OF BUILDINGS AND/OR STRUCTURES

5.25.1 INTENT

Under this section the Contractor shall be 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.

5.25.2 WORK TO BE PERFORMED

Before the start of this work, the Contractor shall 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 shall be submitted for approval before the work. Upon acceptance of the Professional Engineer's services, the following work shall 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 shall make quantitative analysis of each building and/or structure specified to determine whether permanent underpinning work is required with reference to the Contractors proposed method of construction. The analysis shall 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 shall state whether underpinning is required. If permanent underpinning is not required, a detailed explanation shall be provided in the analysis as to why such is not needed and shall 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 shall 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 shall be submitted to the Engineer for review

If by the analysis, permanent underpinning work is required, the following **Subsections 5.25.3 through 5.25.10** inclusively, shall be complied with.

5.25.3 SHOP DRAWINGS AND COMPUTATIONS

Prior to the actual underpinning work, the approved Engineer for this work; presumed to be the same Engineer (if different, all qualification papers shall be submitted for review and acceptance); shall submit shop drawings together with design computations detailing the means and methods for underpinning of each building and/or structure. Shop drawings shall 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 shall be submitted separately on 8-1/2" x 11" paper. Shop drawings with computations shall be submitted to the Engineer for review and approval, and shall bear the seal and signature of a licensed New York State Professional Engineer.

(A) Shop drawings shall 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 shall 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.

5.25.4 PERMITS

The Contractor shall apply for all permits required in order to work at the designated location(s), and shall adhere to all requirements of such permits. The Contractor shall 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 shall 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 shall have a vested or contingent interest in the building or structure, or notice of refusal if consent is not obtained, shall 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 shall make application for permits to the Department of Buildings (DOB) or other city agencies having jurisdiction. Applications shall include all forms, drawings, cloth prints, insurance certificates, all required fees, etc. with the result that the Contractor shall have an approval by the City agency having jurisdiction before starting this work.

5.25.5 EXPERIENCE

The Contractor and/or subcontractor performing underpinning work shall demonstrate to the satisfaction of the Engineer that it has engaged 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.

5.25.6 MATERIALS

(A) Concrete used in permanent underpinning or in other permanent supporting construction shall be Class 40, Type IIA, complying with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(B) Brick and brick masonry shall comply with the requirements of **Section 2.16**.

(C) Cement mortar shall comply with the requirements of **Section 2.17**.

(D) Reinforcement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(E) Structural steel shall comply with the requirements of **Section 2.19**.

5.25.7 METHODS

(1) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** shall apply to the work to be done hereunder.

(2) Forms shall be removed in accordance with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

5.25.8 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, shall 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 shall be removed after completion of construction. Before removal of temporary supports, a written report shall 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.

5.25.9 PRICE TO COVER

The contract price for "SHORING, BRACING, UNDERPINNING, SUPPORTING, PROTECTING AND MAINTAINING" of Existing Building and/or Structure shall be for the lump sum price bid for each building and/or structure requiring shoring, bracing, underpinning, support, protection and maintenance and shall 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 shall 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.

5.25.10 SEPARATE PAYMENT

In the event that a building and/or structure specified does not require support or permanent underpinning, which determination shall be made only after the performance of the engineering study set out in **Subsection 5.25.2**, then the Contractor shall 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 shall define Shoring, Bracing, Underpinning, Supporting, Protecting And Maintaining Of Buildings And/Or Structures:

70.41

(2) The sixth character shall 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 shall define the Block Number building or structure is at:

02610 - Block No. 2610
10767 - Block No. 10767

(4) The twelfth, thirteenth, fourteenth and fifteenth characters shall define the Lot Number building or structure is at:

0027 - Lot No. 27
0240 - Lot No. 240

(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.

SECTION 5.26
EXCAVATION OF BOULDERS IN OPEN CUT

5.26.1 DESCRIPTION

Excavation of boulders in open cut shall 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 shall include riprap, rock fill, thrust blocks and loose masonry. It shall not include pavement and pavement foundation, or existing sewer or water main structures.

5.26.2 CONSTRUCTION METHODS

(A) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS, Section 4.04** shall 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 shall 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.

5.26.3 MEASUREMENT

The quantity of excavation of boulders in open cut to be measured for payment shall 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 shall 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.

5.26.4 PRICE TO COVER

The contract price for “EXCAVATION OF BOULDERS IN OPEN CUT” shall be the unit price bid per cubic yard and shall 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.

5.26.5 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 shall define Excavation Of Boulders In Open Cut:
70.51

(2) The sixth and seventh characters shall 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 5.26A
EXCAVATION OF BOULDERS IN TUNNEL SECTION

5.26A.1 DESCRIPTION

Excavation of boulders shall 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 shall include riprap, rock fill and loose masonry.

5.26A.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 shall be measured for payment. Boulders encountered that are broken down and removed by the tunneling machine shall 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) NOTICATION

Should the advancement of the microtunneling machine be halted due to the presence of a boulder the Contractor shall immediately notify the Engineer.

After the boulder has been removed the Engineer shall 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.

5.26A.3 MEASUREMENT

The quantity of boulders in tunnel section to be measured for payment shall 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 shall be measured for payment.

5.26A.4 PRICE TO COVER

The contract price for “EXCAVATION OF BOULDERS IN TUNNEL SECTION” shall be at the unit price bid per cubic yard and shall cover the cost of all labor materials, plant, equipment and insurance, 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 5.05A and 5.05B**, and the costs thereof shall be deemed included in the price bid per cubic yard under the item labeled "EXCAVATION OF BOULDERS IN TUNNEL SECTION".

5.26A.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 shall perform this additional work in accordance with **Section 5.26B - 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 5.26B**. 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. 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 shall define Excavation Of Boulders In Tunnel Section:
70.52

(2) The sixth and seventh characters shall 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 5.26B
ALLOWANCE FOR BOULDER REMOVAL

5.26B.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.

5.26B.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 shall be made in accordance with the item labeled "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.

5.26B.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.

5.26B.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 the item labeled “ALLOWANCE FOR BOULDER REMOVAL”. This item shall 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 shall 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 shall be submitted to the Engineer on a monthly basis.

The “fixed sum” in the Bid Schedule is for bidding purposes only and shall 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.

5.26B.5 NO SEPARATE PAYMENT

No separate payment will be made for any submissions required under **Subsection 5.26B.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 shall define Allowance For Boulder Removal:
70.53

(2) The sixth and seventh characters shall 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 5.27
ROCK EXCAVATION

5.27.1 INTENT

This section describes Rock Excavation.

5.27.2 DEFINITION, ROCK EXCAVATION

Rock excavation is the removal of a formation that cannot be excavated without the use of systematic drilling.

Rock excavation shall include the excavation, removal and disposal of unbroken ledge rock from within the rock excavation payment lines as shown, specified or ordered.

5.27.3 CONSTRUCTION METHODS

(A) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** shall 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 shall 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 shall 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 shall 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) DISPOSAL OF ROCK FROM SITE - All rock excavated from the trench shall be properly disposed of immediately by the Contractor after its removal from the trenches and excavations.

5.27.4 WIDTH AND DEPTH OF ROCK EXCAVATION

The rock shall be excavated to the widths and to the depths required for the pipes, cradles and foundations of the structures. (See **Section 4.02**.)

5.27.5 LENGTH OF ROCK TO BE STRIPPED

Unless otherwise specified in the contract documents or ordered in writing by the Engineer, all rock shall 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 shall not be less than fifty (50) feet. The only exception to this is at its upper end or ends, where rock shall 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 shall 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.

5.27.6 EXPOSED STRUCTURES TO BE PROTECTED

All exposed water mains, valves, sewers, manholes, receiving basins and other structures shall be carefully protected. The Contractor at the Contractor's own expense shall promptly repair any damage done to such structures.

5.27.7 MEASUREMENT

The quantity of rock excavation to be measured for payment shall 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 4.02**.

5.27.8 PRICE TO COVER

The contract price for "ROCK EXCAVATION" shall be the unit price bid per cubic yard and shall 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 shall be done in accordance with **Section 4.06**. In addition, included in the price hereunder shall 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.

5.27.9 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 shall be deemed 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 shall define Rock Excavation:

70.61

(2) The sixth and seventh characters shall 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 5.28
RIPRAP, STONE BALLAST, BROKEN STONE AND SLOPE PAVEMENT

5.28.1 DESCRIPTION

Riprap, stone ballast, broken stone and slope pavement shall consist of stones placed where shown, specified or required.

Stone ballast shall 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 shall 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.

5.28.2 MATERIALS

Riprap, stone ballast, broken stone and slope pavement shall be in accordance with **Section 2.25**.

5.28.3 CONSTRUCTION METHODS

(A) GENERAL CONSTRUCTION PROVISIONS - The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** shall apply to the work to be done hereunder. All riprap, stone ballast, broken stone and slope pavements shall be placed as directed by the Engineer.

(B) RIPRAP - The slopes of riprap embankment exposed to water and wave action shall be covered with large stones of approved dimensions.

(C) STONE BALLAST - Stone ballast shall be deposited in such a manner as to form a compact mass.

(D) BROKEN STONE - Broken stone shall be deposited in such a manner as to form a compact mass.

(E) SLOPE PAVEMENT - The stones shall 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 shall extend through the pavement.

5.28.4 MEASUREMENT

The quantity of riprap, stone ballast, broken stone or slope pavement to be measured for payment shall 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.

5.28.5 PRICE TO COVER

The contract price for “RIPRAP”, “STONE BALLAST”, “BROKEN STONE” and “SLOPE PAVEMENT” shall be the unit price bid per cubic yard for riprap, stone ballast, broken stone or slope pavement and shall 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 shall be paid for at the price bid for item(s) labeled "ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS".

No separate or additional payment shall be made for any additional sheeting required due to the additional excavation, the cost of the additional sheeting shall be deemed 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 shall define Riprap, Stone Ballast, Broken Stone And Slope Pavement:

70.71

(2) The sixth and seventh characters shall 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 5.28A
GROUTED STONE PAVEMENT

5.28A.1 DESCRIPTION

Grouted stone pavement shall consist of stones placed on grout where shown, specified or required.

5.28A.2 MATERIAL

Grouted Stone Pavement shall consist of sound, quarried or spilt stones weighing 100-pounds to 200-pounds per stone. The stones shall be of the same character and coloration as that used for the adjoining slope stone.

Grout shall comply with the requirements of **Section 2.18**, and shall be Cement and Sand Grout.

5.28A.3 CONSTRUCTION METHOD

The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** shall apply to the work to be done hereunder.

Stone shall be set on the exposed roof of the outfall structure with flat side facing upwards. The stones shall be placed as close together as possible and shall crown at the center of the structure, to the satisfaction of the Engineer. The stones shall be installed on a grout bed and prior to the setting up of the grout bed additional grout shall be poured and tamped into the jointing between stones. Where spaces

between larger stones exceed six (6) inches, smaller stone shall be placed to fill the void. Grout shall fill all remaining voids and shall be poured as close to the top surface of the stone as possible. The surface of the stones shall remain exposed and project sufficiently to produce a rough textured face.

5.28A.4 MEASUREMENT

The quantity of grouted stone pavement to be measured for payment shall 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.

5.28A.5 PRICE TO COVER

The contract price for "GROUTED STONE PAVEMENT" shall be the unit price bid per square yard for grouted stone pavement and shall cover the cost of all labor, materials, plant, equipment, samples and tests 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 shall define Grouted Stone Pavement:
70.72

(2) The sixth and seventh characters shall 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 5.29
CLEAN BACKFILL

5.29.1 DESCRIPTION

Clean backfill shall be the clean fill ordered in writing by the Engineer, where there is a deficiency of acceptable backfill in accordance with **Subsections 4.06.2, 4.06.6 and 4.06.8**. This backfill shall be exclusive of the normal backfill requirements as specified in **Subsection 4.06.2**. Clean backfill shall 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 shall 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.); and, 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.).

5.29.2 MATERIALS

Clean Backfill shall comply with the requirements of **Subsection 2.24.2(D)**.

If approved in writing by the Engineer, excavated material determined to be unsuitable, in accordance with **Subsection 4.06.2**, 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 5.29.1** shall be accepted for payment under the contract item for "CLEAN BACKFILL" computed in accordance with **Subsection 5.29.4**.

5.29.3 CONSTRUCTION METHODS

The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** shall apply to the work to be done hereunder.

5.29.4 MEASUREMENTS

The quantity of clean backfill to be measured for payment shall 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 5.29.1** of the specifications.

If actual trench widths are less than payment maximums stated in **Subsection 4.02.4(A)(2)**, those smaller widths shall 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 shall 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.

5.29.5 PRICE TO COVER

The contract price for "CLEAN BACKFILL" shall be the unit price bid per cubic yard for clean backfill and shall 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 shall be deemed 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 shall define Clean Backfill:
70.81

(2) The sixth and seventh characters shall 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 5.30
PAVEMENT EXCAVATION

5.30.1 DESCRIPTION

This section describes the removal of pavements.

5.30.2 CONSTRUCTION METHODS

(A) OPENING OF PAVEMENTS

(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) full-depth saw cuts of pavement along the initial opening limits of all trenches and excavations;
(b) full-depth saw cuts of pavement along the edges of all trenches and excavations for cutbacks of trenches and excavations;
(c) full-depth saw cuts of asphaltic top course along the edges of all trenches and excavations for cutbacks of asphaltic top course.
(d) full-depth saw cuts of pavement across the widths of trenches, excavations and cutbacks.

NOTE: A “FULL-DEPTH SAW CUT” shall be 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 full-depth saw cuts.)

(2) The Contractor will be required to full-depth saw cut all sidewalks and curbs along the limits of all trenches and excavations or as directed by the Engineer.

(3) All saw cutting shall be done with approved power tool equipment.

(B) BREAKING EXISTING PAVEMENT

All pavements shall be initially opened as specified in **Subsection 5.30.2 paragraphs (A)(1)(a) and (A)(2)** above. 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 shall be kept as clean and neat as possible and no material shall restrict water flow in gutter areas. These requirements shall be 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 shall 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 the removal and restoration of brick or block pavements the edges of the pavement shall be toothed or racked back.

5.30.3 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 shall 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 shall not be included), or
(d) brick or block pavers top course on asphaltic concrete base course or cement concrete base course (sidewalks and curbs shall not be included).

5.30.4 MEASUREMENT

(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), shall 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 4.02.4(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 4.02.4(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 4.02.4(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 4.02.4(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 4.02.4(A)(2)** plus two (2) feet.

(B) These Payment Limits Shall Be Maximums: The width of pavement components to be excavated is based on the maximum trench width, as specified in **Subsection 4.02.4(A)(2)**. If actual trench widths are less than those maximums, the smaller widths shall 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 shall be increased or decreased by the dimension equal to that of the change in the trench width.

(2) 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), shall be as defined and approved in writing by the Engineer.

(3) 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), shall 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.

(4) 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), shall 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 shall be deducted from the above calculated volumes.

(C) Payment limits for the volume of pavement excavation for odd shaped excavations shall be as defined by the Engineer. In all kinds of pavement, cutback limits at all edges of excavation shall be as determined by the Engineer.

(D) These Payment Limits Shall 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 shall 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 shall be increased or decreased by the dimension equal to that of the change in the excavation length and width.

(5) 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), shall 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 4.02.4(A)(2)** plus two (2) feet. If actual unsheeted trench widths are less than those maximums, the smaller widths shall become the basis for calculating payment limits.

(6) The method of measurement for computing the average depths specified herein shall be as ordered by the Engineer and shall be taken in the Engineer's or the Engineer's representative's presence. The Engineer shall verify all measurements. No quantities for volume of pavement excavated will be accepted unless approved in writing by the Engineer.

5.30.5 PRICE TO COVER

Payment for the volume of pavement excavated shall be made under the unit price bid for the item labeled "UNCLASSIFIED EXCAVATION". The contract price for "UNCLASSIFIED EXCAVATION" shall be the unit price bid per cubic yard for excavation of pavement and shall 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, specifications and as ordered by the Engineer.

5.30.6 NO SEPARATE PAYMENT

(A) Sidewalk and driveway pavements shall be removed in whole flags, squares or sections, or as directed by the Engineer. Curb removal shall 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, shall be deemed 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 the following saw cutting work. The costs of these saw cutting work shall be deemed 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 Trenches And Excavations;

(2) Full-Depth Saw Cutting Of Pavements Along The Edges Of All Trenches And Excavations For Cutbacks Of Trenches and Excavations;

(3) Full-Depth Saw Cutting Of Asphaltic Top Course Along The Edges Of All Trenches And Excavations For Cutbacks Of Asphaltic Top Course;

(4) Full-Depth Saw Cutting Of Pavements Across The Widths Of Trenches, Excavations And Cutbacks;

(5) Full Depth Saw Cutting Of All Sidewalks And Curbs Along The Limits Of Trenches And Excavations Or As Directed By The Engineer; and;

(6) Partial Depth Precutting Or Scoring Of Existing Pavement.

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.

SECTION 5.31
TEMPORARY RESTORATION OF PAVEMENTS

5.31.1 DESCRIPTION

Street surfaces shall be temporarily restored as specified in **Section 4.08** and as directed by the Engineer.

5.31.2 MATERIALS

(A) The material for temporary pavement shall be either Binder Mixture or Asphaltic Concrete Mixture, as applicable, and as determined by the Engineer.

Binder Mixture and Asphaltic Concrete Mixture shall 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 shall be Recycled Portland Cement Concrete (Material D).

Recycled Portland Cement Concrete (Material D) shall be in conformance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 6.67 - Subbase Course, Select Granular Material**.

5.31.3 CONSTRUCTION METHODS

Temporary restoration of pavements shall be done according to the requirements of **Section 4.08** of these specifications, and **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 4.02 - Asphaltic Concrete Wearing Course**.

5.31.5 PAYMENT AND MEASUREMENT

Payment for the temporary restoration of pavements shall be made under either the item labeled, “BINDER MIXTURE” or the item labeled “ASPHALTIC CONCRETE MIXTURE”, as applicable, and as determined by the Engineer.

The quantities of “BINDER MIXTURE” or “ASPHALTIC CONCRETE MIXTURE” to be measured for payment shall 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**.

5.31.6 PRICE TO COVER

(A) The contract price for “BINDER MIXTURE” shall be the unit price bid per ton and shall 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 "ASPHALTIC CONCRETE MIXTURE" shall be the unit price bid per ton and shall 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.

5.31.7 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 shall 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 5.32
FINAL RESTORATION OF PAVEMENTS

5.32.1 DESCRIPTION

Restoration of permanent roadway pavement shall include the restoration of each kind of roadway pavement shown, specified or ordered.

5.32.2 MATERIALS

The materials for roadway pavement to be restored shall 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.

5.32.3 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 shall be excavated and pending installation of concrete or asphaltic concrete base at any time.

All trenches and excavations shall be backfilled and compacted to the underside of the pavement in accordance with **Section 4.06**.

All manhole covers and other street hardware shall 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 shall 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 shall be deemed 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 shall install the permanent or temporary pavement as directed by the Engineer. All pavement materials and methods of restoration shall comply with the Standard Details of Construction and the Standard Highway Specifications of the New York City Department of Transportation. The temporary pavement shall consist of binder mixture or asphaltic concrete mixture (as applicable, and as determined by the Engineer) as specified in **Section 4.08**, flush with the adjacent roadway surfaces. Immediately upon completion of the installation of the temporary pavement, all equipment construction materials and debris shall be removed from the site.

Final restoration of pavements shall conform to the requirements of **Section 4.09**.

Whenever a permanent pavement is to be installed and a temporary restoration has been used all of the temporary pavement shall be removed and the new roadway shall be installed.

All concrete used for base shall be Class B-32 (3,200-psi) Type 1A. For bus stops or reinforced pavements, Class A-40 (4,000-psi) Type 11A shall be used.

When a permanent full depth concrete pavement is to be installed as the final pavement, all work shall be done in accordance with **Department of Transportation Standard Detail of Construction No. H-1042B**.

When existing granite block pavements are encountered the Contractor shall 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 shall 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 shall be cleaned and delivered to the Borough Highway Yard of the Department of Transportation. The Contractor shall coordinate delivery with the Borough's Administrative Superintendent of Street Maintenance. In the restoration of block pavements the edges of the pavement shall be toothed or racked back.

All roadway markings including crosswalks and thermoplastic lane dividers removed as a result of construction shall 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 shall 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 shall 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 shall be deemed included in the price bid for all pavement restoration items, and no separate or additional payment shall be made for this work.

Roadways, driveways and sidewalk pavements, crosswalks, curbs, etc., shall 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 shall be restored in whole flags, squares or sections, and in general, shall 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 shall conform in all respects to the standards and specifications of the Department of Transportation for similar work and materials. The cost for these restorations shall be included and payment shall 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 shall 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 shall 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 shall be made for the work performed in accordance with **Articles 25 and 26** of the Contract.

The Contractor shall 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 shall be constructed in compliance with NYCDOT's requirements and specifications. Payment for this work shall 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 shall 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 shall be deemed 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 shall comply with Highway Standard Drawing No. H1011 (dated September 15, 2006), with a detectable warning surface installed in the ramp, within two (2) feet of the curb. Payment for this work shall 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.

5.32.4 SPECIFIC PAVEMENT RESTORATION PROVISIONS

(A) The permanent restoration requirements shall 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 shall 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, shall be replaced in kind to the Department of Transportation specifications.

(C) The Contractor shall 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.

5.32.5 MEASUREMENT

(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 shall 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 shall be:

(1) For The Base Course - the actual length of the trench plus two (2) feet; and the maximum width as specified in **Subsection 4.02.4(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 4.02.4(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 shall be:

(1) For The Base Course - the actual length of trench plus two (2) feet; and the maximum width as specified in **Subsection 4.02.4(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 4.02.4(A)(2)** plus four (4) feet.

(c) Pay limits for laying pavement consisting of cement concrete shall be:

For The Full Pavement - the actual length of trench plus two (2) feet; and the maximum width as specified in **Subsection 4.02.4(A)(2)** plus two (2) feet.

(B) These Payment Limits Shall Be Maximums: The width of pavement components to be restored is based on the maximum trench width, as specified in **Subsection 4.02.4(A)(2)**. If actual trench widths are less than those maximums, the smaller widths shall 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 shall be increased or decreased by the dimension equal to that of the change in the trench width.

(2) 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 pavement components' restoration, shall be as defined and approved in writing by the Engineer.

(3) 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, shall be the actual length of the excavation plus one (1) foot, and the actual width of the excavation plus one (1) foot. However, the 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.

(4) 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 shall 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 shall be:

(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 shall be:

(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 shall be:

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 shall be deducted from the above pavement components' restoration quantities.

(C) Payment limits for the quantities of pavement components' restoration for odd shaped excavations shall be as defined by the Engineer. In all kinds of pavement, cutback limits at all edges of excavation shall be as determined by the Engineer.

(D) These Payment Limits Shall 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 shall 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 shall be increased or decreased by the dimension equal to that of the change in the excavation length and width.

(5) 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, shall 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 4.02.4(A)(2)** plus two (2) feet. If actual unsheeted trench widths are less than those maximums, the smaller widths shall become the basis for calculating payment limits.

(6) Sidewalk And Driveway Pavement And Curb Restoration - When sidewalk and driveway pavement restoration is required whether due to 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 shall be measured in whole flags, squares or sections, or as directed by the Engineer.

When curb restoration is required whether due to 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, shall be as ordered or approved in writing by the Engineer.

5.32.6 PRICE TO COVER

Payment for furnishing, delivering and placing of all pavement restoration of each kind of roadway pavement required shall 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 shall be made under the appropriate bid items.

The cost for cleaning and delivery of granite block as specified herein shall be deemed 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 shall 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 shall be deemed included in the unit prices bid for all items of the contract.

Payment for installing pedestrian ramps shall 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, shall be deemed 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 shall 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.

5.32.7 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 shall be deemed 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 shall 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 shall 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 shall 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 shall be deemed 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 5.33
HYDRAULIC FILL FOR ABANDONED SEWERS AND WATER MAINS

5.33.1 INTENT

This section describes the provision and placement of Hydraulic Fill For Abandoned Sewers And Water Mains.

5.33.2 DESCRIPTION

The Contractor shall 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.

5.33.3 MATERIALS

(A) Cement shall be Type-I or Type-II Portland Cement that conforms to the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**. Each bag of cement shall be deemed to be one (1) cubic foot.

(B) Fine Aggregate - Sand shall be Concrete Sand or Natural Sand and shall conform to the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

(C) Fly Ash shall 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 shall not exceed four percent (4%).

(D) Water shall 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 shall 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 shall 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.

5.33.4 METHODS

(A) Mix Design

HYDRAULIC FILL MIX (EXCAVATABLE FLOWABLE FILL) - The Contractor shall 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 shall not be altered unless otherwise directed by the Engineer. The mix design proportion parameters per cubic yard shall 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 shall 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 shall 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 shall be discarded. Remixing or tempering shall not be permitted.

(B) Application

The hydraulic fill mix shall not be placed during freezing weather at the site of application. The hydraulic fill mix shall 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 shall be submitted to the Engineer for prior approval and shall 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 shall 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.

5.33.5 MEASUREMENT

The quantity of Hydraulic Fill For Abandoned Sewers And Water Mains to be paid for shall 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.

5.33.6 PRICE TO COVER

The contract price for “HYDRAULIC FILL FOR ABANDONED SEWERS AND WATER MAINS" shall be the unit price bid per cubic yard for hydraulic fill for abandoned sewers and water mains and shall cover the cost of all labor, materials, plant, equipment, samples and tests 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 shall define Hydraulic Fill For Abandoned Sewers And Water Mains:
72.11

(2) The sixth and seventh characters shall 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 5.34
ADDITIONAL BRICK MASONRY

5.34.1 DESCRIPTION

Additional brick masonry shall 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 shall also be the brick masonry shown, specified or ordered placed in water main structures in accordance with water main standard drawings.

5.34.2 MATERIALS

Brick masonry shall be in accordance with **Section 2.16**.

Cement mortar shall be in accordance with **Section 2.17**.

5.34.3 CONSTRUCTION METHODS

(1) The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** shall apply to the work to be done hereunder.

(2) Brick Masonry shall comply with the provisions of **Subsection 2.16.9**.

(3) Brick shall be laid to a line and with close joints, and all joints exposed to view shall be pointed and shall be left in a neat condition.

(4) All unfinished work shall be racked back, or toothed, as directed, and before new work is joined to its surface, the bricks shall be scraped, thoroughly cleaned and scrubbed with a stiff brush and well moistened.

5.34.4 MEASUREMENT

The quantity of brick masonry to be measured for payment shall be the number of cubic yards of brick masonry furnished and incorporated into the work, complete, as shown, specified or required.

5.34.5 PRICE TO COVER

The contract price for "ADDITIONAL BRICK MASONRY" shall be the unit price bid per cubic yard for brick masonry and shall 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 shall define Additional Brick Masonry:
73.11

(2) The sixth and seventh characters shall 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 5.35
ADDITIONAL CONCRETE

5.35.1 DESCRIPTION

Additional concrete shall 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 shall 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.

5.35.2 MATERIALS

Concrete shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

5.35.3 MEASUREMENT

The quantity of additional concrete to be measured for payment shall be the number of cubic yards of additional concrete incorporated into the work, complete, as shown, specified or ordered.

5.35.4 PRICE TO COVER

The contract price for “ADDITIONAL CONCRETE” shall be the unit price bid per cubic yard for additional concrete and shall 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 shall be paid for at the price bid for item(s) labeled "ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS".

No separate or additional payment shall be made for any additional sheeting required due to the additional excavation, the cost of the additional sheeting shall be deemed 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 shall define Additional Concrete:
73.21

(2) The sixth and seventh characters shall 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 5.36
ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS

5.36.1 DESCRIPTION

This section describes earth excavations other than normal trench excavations required and approved in writing by the Engineer.

5.36.2 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 shall 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** shall apply to the work to be done hereunder.

5.36.3 MEASUREMENT

The quantity of additional earth excavation to be measured for payment shall be 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.

5.36.4 PRICE TO COVER

The contract price for "ADDITIONAL EARTH EXCAVATION INCLUDING TEST PITS" shall be the unit price bid per cubic yard for additional earth excavation (within limits specified) and shall 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 4.03 - 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 shall 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 1.06.12 and 1.06.27** of the specifications and as directed by the Engineer.

Where the Engineer orders the area excavated under this item to be backfilled, the work shall be done in accordance with **Section 4.06** and payment will be made as per **Section 5.29 - Clean Backfill and Section 5.37 - Additional Select Granular Backfill**.

All pavement disturbed, either within or outside the limits of the trench and excavation, shall 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 shall define Additional Earth Excavation Including Test Pits:
73.31

(2) The sixth and seventh characters shall define Additional Earth Excavation Including Test Pits:
AE - Additional Earth Excavation Including Test Pits (Not Less Than Item)

(3) The eighth characters shall 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 5.37
ADDITIONAL SELECT GRANULAR BACKFILL

5.37.1 DESCRIPTION

Additional select granular backfill shall 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 shall be exclusive of the normal backfill requirements as specified in **Subsection 4.06.2**.

5.37.2 MATERIALS

Select Granular Backfill shall comply with the requirements of **Subsection 2.24(B)**.

If approved in writing by the Engineer, excavated material determined to be unsuitable, in accordance with **Subsection 4.06.2**, 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 5.37.1** shall be accepted for payment under the contract item for "ADDITIONAL SELECT GRANULAR BACKFILL" computed in accordance with **Subsection 5.37.4**.

5.37.3 CONSTRUCTION METHODS

The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** shall apply to the work to be done hereunder.

5.37.4 MEASUREMENT

The quantity of additional select granular backfill to be measured for payment shall 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 5.37.1**.

Where additional select granular backfill is ordered by the Engineer to be placed within the limits of the ordered trenches, the following shall apply:

> If actual trench widths are less than either payment maximums stated in **Subsection 4.02.4(A)(2)**, those smaller widths shall 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 shall 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.

5.37.5 PRICE TO COVER

The contract price for "ADDITIONAL SELECT GRANULAR BACKFILL" shall be the unit price bid per cubic yard for additional select granular backfill and shall 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.

5.37.6 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 4.06.2(B)(2) and 4.06.2(B)(3)**, 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 shall define Additional Select Granular Backfill:
73.41

(2) The sixth and seventh characters shall 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 5.38
ADDITIONAL STEEL REINFORCING BARS

5.38.1 DESCRIPTION

Additional steel reinforcing bars shall 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 shall be all the steel reinforcing bars placed in pile caps of sewers and structures on piles as shown on the Sewer Design Standards.

5.38.2 MATERIALS

Reinforcement shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

5.38.3 CONSTRUCTION METHODS

Construction methods for fabricating, protecting, bending, splicing, lapping, supporting and placing steel reinforcing bars shall comply with the requirements of **General Specification 11 - Concrete, as modified in Section 2.15**.

5.38.4 MEASUREMENT

The quantity of additional steel reinforcing bars to be measured for payment shall be the number of pounds of steel reinforcing bars incorporated into the work, complete, as shown, specified or required.

5.38.5 PRICE TO COVER

The contract price for “ADDITIONAL STEEL REINFORCING BARS” shall be the unit price bid per pound for additional steel reinforcing bars and shall 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 shall define Additional Steel Reinforcing Bars:
73.51

(2) The sixth and seventh characters shall 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 $XX.XX/LB.)	LBS.

SECTION 5.39
ADDITIONAL STONE BALLAST

5.39.1 DESCRIPTION

Additional stone ballast shall 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 shall 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 shall be made under **Subsection 5.39.5**.

5.39.2 MATERIALS

Stone ballast or broken stone shall be in accordance with **Section 2.25**.

5.39.3 CONSTRUCTION METHODS

The requirements of **DIVISION IV - GENERAL CONSTRUCTION PROVISIONS** shall apply to the work to be done hereunder.

Stone ballast or broken stone shall be deposited in such a manner as to form a compact mass.

5.39.4 MEASUREMENTS

The quantity of additional stone ballast to be measured for payment shall 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 5.39.1** of the specifications.

5.39.5 PRICE TO COVER

The contract price for “ADDITIONAL STONE BALLAST” shall be the unit price bid per cubic yard for additional stone ballast and shall 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 shall 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 shall define Additional Stone Ballast:
73.61

(2) The sixth and seventh characters shall 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 5.40
MAINTENANCE AND PROTECTION OF TRAFFIC

5.40.1 DESCRIPTION

Maintenance And Protection Of Traffic shall 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 5.41
MAINTENANCE OF SITE

5.41.1 DESCRIPTION

Maintenance Of Site shall 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 5.42
REMOVAL OF ABANDONED TRACKS

5.42.1 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 shall 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.

5.42.2 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 shall 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 shall be cut and removed from the site.

(C) All material removed hereunder shall become the property of the Contractor, unless otherwise provided, and shall be disposed of away from the site by the Contractor.

5.42.3 MEASUREMENT

The quantity of removal of abandoned tracks to be measured for payment shall 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.

5.42.4 PRICE TO COVER

The contract price for "REMOVAL OF ABANDONED TRACKS" shall be the unit price bid per linear foot of trench where removal of track system components in part or in full are removed and shall 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 shall 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 5.42.2(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 shall define Removal Of Abandoned Tracks:
75.11

(2) The sixth and seventh characters shall 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 5.43
CONSTRUCTION REPORT

5.43.1 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 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.

5.43.2 SPECIAL EXPERIENCE REQUIREMENTS

Within thirty (30) days of the award of this contract, the Contractor shall 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 shall submit the qualifications of another proposed firm within fifteen (15) days of notice to do so.

5.43.3 SUBMISSION OF PRECONSTRUCTION REPORT

Upon approval and prior to construction the chosen firm (hereinafter referred to as the firm) shall submit six (6) copies of a report incorporating their findings and recommendations. The report shall 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 shall 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 and pile system.

(B) an inspection of the interior and exterior (including photographs and videotapes 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.

(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.

(G) a geological profile of the soils in the area. This profile shall be based upon the boring logs taken for this project.

The report shall include all field notes, measurements and photographs and videotapes, as required, of existing conditions which may be aggravated by the proposed construction work and shall 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 shall be taken to show any existing cosmetic or structural damage on buildings.

Applications for consents to enter buildings for the purpose of inspection shall 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 shall have a vested or contingent interest in the building, or notice of refusal if consent is not obtained shall be filed with the Engineer at least ten (10) days before the commencement of work which affect the building or structure.

The report shall 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 shall 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.

5.43.4 PRICE TO COVER

The contract price for the "CONSTRUCTION REPORT" shall be a lump sum price and shall 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.

5.43.5 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 shall define Construction Report:
76.11

(2) The sixth and seventh characters shall 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 5.43A
MONITORING AND POST-CONSTRUCTION REPORT

5.43A.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. The Contractor is notified that either a Preconstruction Report will be required in accordance with **Section 5.43 - Construction Report**, or a Preconstruction Report prepared for the City by an independent firm will be provided as part of the contract for the Contractor's information and review.

5.43A.2 SPECIAL EXPERIENCE REQUIREMENTS

Within thirty (30) days of the award of this contract, the Contractor shall 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 shall submit the qualifications of another proposed firm within fifteen (15) days of notice to do so.

If a preconstruction report is required in accordance with **Section 5.43 - Construction Report**, the firm approved for the preparation of the preconstruction report may also be submitted for approval to perform the monitoring and post-construction report work.

5.43A.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 shall include sketches noting the location of all monitoring

points. Should any of the criteria set forth in the Preconstruction Report be exceeded, the Engineer shall be notified immediately. Monitoring shall include but not be limited to the following:

(A) Monitoring Settlement

A series of reference points shall be established outside of the "radius of influence" as previously described for monitoring structural settlements. All initial and subsequent readings shall be taken to the nearest one-hundredth (0.01) of a foot.

Structures and/or buildings shall 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 shall 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 shall be performed within twenty-four (24) hours of the event.

All readings shall be done by or under the immediate supervision of a Surveyor Licensed by the State of New York as evidenced by the imprint of the Surveyor's seal and signature.

The Contractor shall transmit a copy of all readings to the Engineer on the same day they are taken.

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 shall immediately, at the Contractor's own expense, take steps to rectify the situation and prevent any further settlement of such building and/or structure. The Contractor shall 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 done by the Contractor, whether it is accidental or due to negligence or carelessness in performing the work included in this contract shall be made good by the Contractor at the Contractor's own expense.

(B) Vibration Monitoring

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 shall monitor and record particle velocity. Locations of the monitoring points shall be placed in such a manner so as to ensure recordings that reveal any possibility of damage to existing buildings.

These points shall be monitored at all times when means and methods of construction resulting in vibrations are employed. The maximum permissible peak particle velocity shall be that noted in the Preconstruction Report. Should particle velocities be exceeded the Contractor shall immediately cease operations and resort to another method which will eliminate or minimize the effect of vibrations.

It shall be 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.

(C) Post-Construction Report

Within thirty (30) days of the completion of all work that necessitated monitoring the chosen firm shall prepare a report detailing the results of the monitoring program. The report shall include a comparison of all assumptions and field-measured values. Should there be excessive discrepancies between the two, an explanation shall be presented within the report. This report shall include sketches of all monitoring points. Should this contract provide for the installation of piles the report shall include the location and length of all piles driven superimposed on the geological profile. The Engineer shall provide the location and lengths of piles.

5.43A.4 RESPONSIBILITIES OF THE CONTRACTOR

Prior to bidding the Contractor shall 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.

5.43A.5 PRICE TO COVER

The contract price for the "MONITORING AND POST-CONSTRUCTION REPORT" shall be a lump sum price and shall 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.

5.43A.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.

5.43A.7 PAYMENT

Payment for this work shall be made under the item labeled "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 shall define Monitoring And Post-Construction Report:
76.21

(2) The sixth and seventh characters shall 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 5.43B
CONTINUOUS REAL-TIME MONITORING FOR VIBRATIONS AND MOVEMENTS AND POST-CONSTRUCTION REPORT

5.43B.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 shall 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 shall 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. The Contractor is notified that either a Preconstruction Report will be required in accordance with **Section 5.43 - Construction Report**, or a Preconstruction Report prepared for the City by an independent firm will be provided as part of the contract for the Contractor's information and review.

5.43B.2 SPECIAL EXPERIENCE REQUIREMENTS

Within thirty (30) days of the award of this contract, the Contractor shall 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 shall submit the qualifications of another proposed firm within fifteen (15) days of notice to do so.

If a preconstruction report is required in accordance with **Section 5.43 - Construction Report**, the firm approved for the preparation of the preconstruction report may also be submitted for approval to perform the continuous real-time monitoring for vibrations and movements and post-construction report work.

5.43B.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 shall include sketches noting the location of all monitoring points. Should any of the criteria set forth in the Preconstruction Report be exceeded, the Engineer shall be notified immediately. Monitoring shall include but not be limited to the following:

(A) Monitoring Structural Movement (Horizontal And Vertical)

(1) The Contractor shall 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 shall 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 shall 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 shall 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 shall 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 shall 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) shall be installed on sturdy structures. The location(s) shall be approved by the Engineer.

(6) The monitoring system shall 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 shall 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 shall 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 shall broadcast an alarm message, indicating that the prism is missing.

(9) The monitoring system shall 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 shall 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 shall be able to provide real-time differential calculations between designated prism targets.

(12) A minimum of eight (8) reference targets, per total station, shall be set up at sturdy structures that are outside the zone of construction influence. The reference targets shall be read by the total stations during each cycle and the data collected for these reference targets shall 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 shall 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 shall 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 shall 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 shall be referenced and compared to the optical prisms used for continuous monitoring. The manual readings shall be done by or under the immediate supervision of a Land Surveyor currently Licensed by the State of New York as evidenced by the imprint of the Surveyor's seal and signature.

(16) The Contractor shall 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 shall immediately notify the Engineer. The Contractor at the Contractor's own expense shall take steps to rectify the situation and prevent

any further settlement or movement of such building and/or structure. The Contractor shall 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, shall be made good by the Contractor at the Contractor's own expense.

(B) Monitoring Construction Vibrations

(1) The Contractor shall provide equipment to continuously monitor and record particle velocities and frequencies resulting from construction activities, and provide real-time monitoring. The equipment shall be able to monitor the particle velocities and frequency ranges listed below. The equipment shall 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 shall 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 shall install no less than twelve (12) vibration monitors, equally spaced, directly in front of the specified location(s).

(4) The vibration monitors shall be linked to the same Central Monitoring Location as the monitors for structural movement. The collected data shall be sent to the Central Monitoring Location via wired or wireless transmission. The method used for data transmission shall neither disturb nor interfere with ongoing work at any time.

(5) The Contractor shall 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 shall notify the Engineer and provide an equal replacement as soon as possible.

(6) The Contractor shall provide power (electric or batteries) to the vibration monitors. If battery-operated equipment is used, the Contractor shall 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 shall 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 5.43B.3(B)(2)**, and be able to provide a printout (either directly at the equipment's terminal or downloadable to a computer). The Contractor shall 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 shall cease operations and immediately notify the Engineer. The Contractor and Engineer shall 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 shall be made for using equipment and methods needed to reduce construction activity vibrations.

(9) It shall be the Contractor's responsibility to repair any damage caused as a result of vibrations exceeding the maximum limits listed in **Subsection 5.43B.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 shall prepare a report detailing the results of the monitoring program. The report shall include a comparison of all assumptions and all automated and field-measured values. Should there be excessive discrepancies between the two, an explanation shall be presented within the report. This report shall include sketches of all monitoring points. Should this contract provide for the installation of piles the report shall include the location and length of all piles driven superimposed on the geological profile. The Engineer shall provide the location and lengths of piles.

5.43B.4 RESPONSIBILITIES OF THE CONTRACTOR

Prior to bidding the Contractor shall 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.

5.43B.5 PRICE TO COVER

The contract price for the "CONTINUOUS REAL-TIME MONITORING FOR VIBRATIONS AND MOVEMENTS AND POST-CONSTRUCTION REPORT" shall be the unit price bid per month and shall 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.

5.43B.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.

5.43B.7 PAYMENT

Payment for the final month of "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 shall define Continuous Real-Time Monitoring For Vibrations And Movements And Post-Construction Report:

76.31

(2) The sixth and seventh characters shall 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 MOVEMENTS AND POST-CONSTRUCTION REPORT	MONTH

SECTION 5.44
TREES (PROTECTION, PRUNING, REMOVAL, TRANSPLANTING AND PLANTING)

5.44.1 DESCRIPTION

Trees (Removal, Transplanting And Planting) shall be done in accordance with **Subsection 1.06.5 and New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 4.16 - Trees (Removal, Transplanting, Planting)**.

Tree Pruning shall be done in accordance with **Subsection 1.06.5 and New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 4.18 - Tree Pruning**.

Protective Tree Barrier shall be done in accordance with **Subsection 1.06.5 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
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 5.44A
SODDING, SEEDING AND TOPSOIL

5.44A.1 DESCRIPTION

Topsoil shall be done in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 4.15 - Topsoil**.

Sodding shall be done in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 4.19 - Sodding**.

Seeding shall 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 5.44B
TREE CONSULTANT

Tree Consultant shall 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 5.45
REPLACEMENT OF FIRE COMMUNICATION SYSTEM

5.45.1 DESCRIPTION

Replacement Of Fire Communication System shall 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 5.46A
ENGINEER'S FIELD OFFICE (TYPE A, B, C, CU, D, OR DU)

5.46A.1 DESCRIPTION

Engineer's Field Office (Type A, B, C, CU, D or DU) shall 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 DU	ENGINEER'S FIELD OFFICE (JOINT USE) (TYPE DU)	MONTH

SECTION 5.46B
TRANSPORTATION FOR THE ENGINEER

5.46B.1 DESCRIPTION

Transportation For The Engineer shall be done in accordance with **New York City Department of Transportation (NYCDOT) Standard Highway Specifications Section 6.40 TFS - Transportation For The Engineer**.

Payment for Transportation For The Engineer will be made under the NYCDOT Item Number listed below:

Item No.	Description	Pay Unit
6.40 TFS	TRANSPORTATION FOR THE ENGINEER	F.S./MONTH

SECTION 5.47
STORM WATER POLLUTION PREVENTION

5.47.1 DESCRIPTION

Storm Water Pollution Prevention shall 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 5.48
RODENT AND WATERBUG PEST CONTROL

5.48.1 DESCRIPTION

Rodent And Waterbug Pest Control shall 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 5.49
MOBILIZATION

5.49.1 DESCRIPTION

Mobilization shall 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 Number listed below:

Item No.	Description	Pay Unit
6.39 A	MOBILIZATION	L.S.

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