

**DIVISION 15
UTILITIES****SECTION 1500
GENERAL UTILITY REQUIREMENTS****1500-1 DESCRIPTION.**

Construct various utilities as required by the plans and special provisions or as directed. Furnish all materials, labor, equipment, and incidentals necessary to complete the proposed utility work unless indicated otherwise in the proposal.

Apply the applicable provisions of the Rules and Regulations of the North Carolina Department of Environment and Natural Resources, Division of Environmental Health to the construction of water lines. Apply the Rules and Regulations of the North Carolina Department of Environment and Natural Resources, Division of Environmental Management to the construction of sanitary sewer lines except as otherwise provided.

1500-2 COOPERATION WITH THE UTILITY OWNER.

Provide access for Department Personnel and the owner's representatives to all phases of construction. Notify Department Personnel and the owners two weeks prior to commencement of any work and one week prior to service interruption.

Except in an emergency, do not operate any of the controls on the existing systems without prior approval of the owner.

1500-3 UTILITY LOCATIONS AND CONTRACTORS RESPONSIBILITY.

The plans depict the best available information for the location, size, and type of material for all existing utilities. Make investigations for determining the exact location, size, and type material of the existing facilities as necessary for the construction of the proposed utilities and for avoiding damage to existing facilities. Repair any damage incurred to existing facilities to the original or better condition at no additional cost to the Department.

1500-4 WEEKEND, NIGHT AND HOLIDAY WORK.

Make connections between existing and proposed utilities at times most convenient to the public, without endangering the utility service, and in accordance with the owner's requirements. Make connections on weekends, at night, and on holidays if necessary.

Should the position of any pole, pipe, conduit, or other structure require removal or adjustment, the Engineer will coordinate the change with the owner of the obstructions or a representative of the owner.

1500-5 RELATION OF WATER MAINS TO SANITARY SEWERS.

Lay water mains at least 10 feet (3.0 m) laterally from existing or proposed sanitary sewers. If local conditions or barriers prevent a 10 foot (3.0 m) separation, lay the water main with at least 18 inches (457.2 mm) vertical separation above the top of the sanitary sewer pipe either in a separate trench or in the same trench on a bench of undisturbed earth.

When a proposed water main crosses over a proposed or existing sanitary sewer, lay the water main with at least 18 inches (457.2 mm) vertical separation above the top of the sanitary sewer. If local conditions or barriers prevent an 18 inch (457.2 mm) vertical separation, construct both the water main and the sanitary sewer for a distance of 10 feet (3.0 m) on each side of the point crossing with ferrous pipe having water main quality joints.

When a proposed water main crosses under a proposed or existing sanitary sewer, construct both the water main and the sanitary sewer of ferrous materials with joints that

are equivalent to water main standards for a distance of 10 feet (3.0 m) on each side of the point of crossing. Center the section of water pipe at the point of crossing.

1500-6 PROTECTION OF PEDESTRIAN AND VEHICULAR TRAFFIC.

During the progress of the work, keep sidewalks and crossings open for the passage of pedestrians. Unless otherwise authorized, do not obstruct streets; and unless the complete closing of a street is authorized, take such measures as may be necessary to keep the street open for traffic.

Construct and maintain adequate and approved bridges over excavations as may be necessary for the purpose of accommodating pedestrians or vehicles.

When open cut installation is allowed across a roadway and traffic is to be maintained, construct the installation in sections so that half the width of the roadway will be available to traffic. Provide all traffic control measures necessary to provide for safe traffic passage.

1500-7 COMPENSATION.

No direct payment will be made for utility construction work required by the preceding provisions, which are general requirements applying to utility construction. All of the requirements stated will be considered incidental work, paid for at the contract unit prices, of the various utility items included in the contract.

**SECTION 1505
EXCAVATION, TRENCHING & BACKFILLING
FOR UTILITIES**

1505-1 DESCRIPTION.

Perform all pipe undercut excavation, furnish, place and compact foundation conditioning material, shape the pipe foundation, haul and dispose of undercut materials, and perform pavement, sidewalk and driveway repair necessary for installation of water and sanitary sewer mains and services as shown in the plans and special provisions.

1505-2 MATERIALS.

Refer to Division 10:

Select MaterialSection 1016
Portland Cement ConcreteSection 1000

Meet the requirements of Article 1016-3 for the classification of select material. Use the location and class of select material for foundation conditioning, bedding and backfill as shown on the plans or as directed.

1505-3 CONSTRUCTION REQUIREMENTS.

Apply the applicable requirements of Section 107, Articles 300-1, 300-4, 300-6 and Section 654 of the Standard Specifications and the following specifications:

In general, construct all portions of the excavations so that the safe slope of the earth is not exceeded. Comply with all OSHA requirements and provide a competent person on site to supervise the excavation at all times. Properly and adequately protect any part of the excavation from caving or slipping by the use of sheeting, bracing, or shoring as required.

Install all shoring in trench excavations so that it may be withdrawn in stages on both sides of the trenches to prevent lateral movement of the pipe as the backfilling progresses, except where the Engineer permits the shoring to be left in place at the Contractor's request. Cut off any sheeting left in place at least twenty-four inches (609.6 mm) below finished grade wherever directed. Remove and properly dispose of the cut off material.

Wherever necessary, in quicksand, soft or wet ground, or for the protection of surrounding structures and property, drive sheeting to such depth below the bottom of the

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excavation as may be necessary. The Contractor may use well points or other methods in lieu of sheeting to stabilize the banks or for protection at the discretion of the Contractor.

Take all measures necessary to keep surface water out of the foundations and trenches by diking, ditching, or otherwise avoiding it. Use approved methods for surface drainage.

Keep all excavations free of water while the work is in progress. Water may be removed by pumps or the use of underdrains, whichever will produce the above results.

Deposit all excavated material in a manner that will not endanger the work and that will avoid obstructing sidewalks and driveways. Leave hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, fire and police call boxes, or other utility controls unobstructed and accessible at all times. Keep gutters clear or use other satisfactory provisions for street drainage. Do not obstruct natural watercourses.

Take whatever measures necessary to control erosion and keep silt runoff from contaminating adjoining property.

Do not lay pipe upon a foundation into which frost has penetrated, or at any time, that in the opinion of the Engineer, there is danger of the formation of ice or frost at the bottom of the excavation. The Engineer may at his discretion allow construction of the pipeline to continue under freezing conditions provided the Contractor promptly backfills the trench as directed.

Carefully lower pipe and accessories into the trench with suitable equipment. Do not drop or dump any of the materials into the trench under any circumstances.

Take care to avoid abrasion of the pipe coating. Use wooden poles as levers for removing skids across trenches which have broad flat faces to prevent damage to the pipe or pipe coating.

Perform backfilling in accordance with Article 300-6 and compact to the density required by Subarticle 235-4(C).

1505-4 REPAIR OF PAVEMENTS, SIDEWALKS AND DRIVEWAYS.

Repair sidewalks and driveways that are disturbed by the excavation and trenching operation to an original or better condition using Class B Concrete.

Use asphalt plant mix for pavement repair to replace pavement which was removed in order to remove or place utility pipe lines. Perform all work in accordance with Section 654. Immediately upon completion of the pipe line removal or installation, make repairs within the pavement area.

1505-5 CONCRETE ENCASEMENT OF UTILITY LINES.

Encase existing or proposed utility lines in Class B concrete for protection in areas as shown on the utility plans, special provisions and/or as directed. Place the concrete completely around the line with a minimum thickness of 6 inches (152.4 mm).

1505-6 METHOD OF MEASUREMENT.

(A) General:

1. Trenching, excavation, and backfilling for utilities will be considered as included in the contract price for the applicable utility item and no separate measurement will be made.
2. The following work and items will also be considered as included in the contract price for the applicable utility item and no separate measurement will be made:
 - a. Undercut or Wet Excavation
 - b. Dewatering of Excavation
 - c. Shoring and Sheet piling (unless the shoring is needed to maintain traffic. Then it would be paid for as described in Section 1175)

d. Repair of Sidewalks and Driveways

(B) Foundation Conditioning:

Select material for foundation conditioning will be measured as provided for in Subarticle 300-9B(2).

(C) Select Material for Backfill:

Select material for backfill will be measured as provided for in Subarticle 300-9C.

(D) Asphalt Plant Mix:

Asphalt Plant Mix for pavement repair will be measured as provided for in Article 654-4.

(E) Concrete for Encasing Utility Lines:

The quantity of Class B concrete for encasing utility lines will be measured by the actual number of cubic yards (cubic meters) of concrete, measured in place, installed in accordance with Article 1505-5 completed and accepted.

1505-7 BASIS OF PAYMENT.

(A) General:

No direct payment will be made for any work in Subarticle 1505-6(A). Payment will be made in the applicable utility item.

(B) Foundation Conditioning:

(1) Using Local Material:

The quantity of foundation conditioning material, measured as provided in Subarticle 300-9(B)(1), will be paid for as provided in Article 225-8 for "Unclassified Excavation" or in Article 230-6 for "Borrow Excavation", depending on the source of the material.

(2) Using Other Than Local Material:

The quantity of foundation conditioning material, measured as provided in Subarticle 300-9(B)(2), will be paid for at the contract unit price per ton (metric ton) for "Foundation Conditioning Material for Utilities, Class _____".

No direct payment will be paid for undercut excavation. Payment at the contract unit price for "Foundation Conditioning Material for Utilities, Class _____" will be full compensation for all work of pipe undercut excavation.

(C) Select Backfill Material:

Where local material meeting the requirements for select backfill material as specified in Section 1016 is used for backfilling above the foundation, this material will be paid for as provided in Article 225-8 for "Unclassified Excavation" or in Article 230-6 for "Borrow Excavation", depending on the source of the material.

Where other than local material is used for backfilling above the foundation, the quantity of select backfill material, measured as provided in Subarticle 300-9(C), will be paid for at the contract unit price per ton (metric ton) for "Select Backfill Material for Utilities, Class _____", or where there is no unit price in the contract applicable to the class of select backfill material involved, the select backfill material will be paid for as extra work in accordance with Article 104-7.

(D) Asphalt Plant Mix, Pavement Repair:

The quantity of asphalt plant mix measured as provided in Article 654-4, completed in place and accepted will be paid for at the contract unit price per ton (metric ton) for "Pavement Repair for Utility Work".

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The above price and payment will be full compensation for all work covered by this section, including but not limited to cutting, removal, and disposal of pavement, base and subgrade; furnishing and applying tack coat; furnishing, placing, and compacting of bituminous plant mix; furnishing of asphalt cement for the bituminous plant mix; and furnishing scales.

Any provisions included in the contract in the form of project special provisions or in any other form which provide for adjustments in compensation due to variations in the price of asphalt cement will not be applicable to payment for the work covered by this section.

The item of "Pavement Repair for Utility Work" will be considered to be a minor item. In the event that the item of "Pavement Repair for Utility Work" overruns the original bid quantity by more than 100 percent, the provisions of Article 104-5 pertaining to revised contract unit prices for overrunning minor items will not apply to this item.

(E) Concrete for Encasing Utility Lines:

Class B concrete, installed in accordance with Article 1505-5 and accepted will be measured and paid for at the contract unit price per cubic yard (cubic meter) for "Class B Concrete for Encasing Utility Lines". Such prices and payments will be full compensation for all materials, labor, excavation, backfilling, and incidentals necessary to complete the work as required.

(F) Pay Items:

Payment will be made under:

Foundation Conditioning Material for Utilities, Class_____	.....	Ton (Metric Ton)
Select Backfill Material for Utilities, Class_____	.....	Ton (Metric Ton)
Pavement Repair for Utility Work		Ton (Metric Ton)
Class "B" Concrete for Encasing Utility Lines		Cubic Yard (Cubic Meter)

**SECTION 1510
WATERLINE INSTALLATION**

1510-1 DESCRIPTION.

Furnish and install all materials, including valves and valve boxes, fire hydrants, water meters, meter boxes, special valves, valve boxes with necessary extensions, special structures service lines pipe, accessories, fittings, compression couplings, detectable marking tape, anchoring, connections, pressure test, leak test, sterilization, excavation, backfilling, compaction, incidentals and accessories, in accordance with these specifications and in reasonably close conformity with the lines, grades, dimensions and locations as shown on the Plans or established by the Engineer.

1510-2 MATERIALS.

Refer to Division 10:

Portland Cement Concrete	Section 1000
Water Pipe and Fittings	Section 1036

Submit catalog cuts and/or shop drawings for such materials as valves, hydrants, special fittings, lift stations, and manholes proposed for use on the project. Submit to the State Design Services Engineer and to the utility owner for review and approval. Allow forty days for the review of each submittal.

Deliver only approved materials to the project. Submit eight (8) copies of each catalog cut and/or drawing which shows the material description, brand name, stock number, size, rating, manufacturing specification and the use for which it is intended.

1510-3 CONSTRUCTION REQUIREMENTS.

Meet the installation and material standards of the AWWA for waterline construction, unless specified otherwise.

Use the size, type and pressure rating class of waterline material as shown on the plans and/or project special provisions.

Apply all the requirements in Section 1505 for excavation, trenching and backfill to waterline installation.

Install all ductile iron water pipe in accordance with laying condition Type 2 as stated in ANSI/AWWA C-151/A21.51 unless otherwise shown on the plans.

Connect the ends of the plastic water pipe using approved compression type couplings and/or compression type fittings.

Use Ductile Iron Water Pipe Fittings with Polyvinyl chloride (PVC) water pipe 4" or larger.

Mark PVC pipe location by using an approved detectable marking tape, installed 18 to 24 inches (457.2 to 609.6 mm) below finished grade.

Install corporation stops as shown on the plans and at each reconnected water service connection, on small water lines.

Install curb stops as shown on the plans and at each relocated water meter or at other locations as directed using an approved curb box. Use telescoping curb boxes with a removal plug and lid with the word "WATER" cast therein.

Required service pipe to reconnect any disrupted water pipe to corporation stop or curb stop will be considered new pipe. Install bronze gate valves on small water service lines at the locations as directed.

Install tapping sleeves, tapping saddles, valves, and valve boxes as shown on the utility plans, and/or as directed.

Install all valves with an approved valve box, normally flush with the ground or pavement. Use screw or slip type valve boxes with a base to fit the valve yoke and removable plug cap with the word "WATER" cast therein.

Install existing water meters and meter boxes that are to be relocated adjacent to the right of way, as shown on the utility plans, or as directed.

Relocation of water meters consists of the removal and installation at the appropriate location of the water meter, meter yoke, meter valve, and meter box. Perform all work in accordance with the applicable plumbing codes, as shown on the plans, and as directed.

Place relocated meter boxes with the top of the meter box flush with finish grade of the project.

Locate and install fire hydrants as shown on the utility plans.

Relocate all existing fire hydrants in the road construction area, and others that will be a hazard to the motorist, adjacent to the right of way, as shown on the plans, and/or as directed.

Separate existing fire hydrants to be relocated at the hydrant base from the existing pipe and place in the new location.

Where necessary, remove the hydrant shoe and replace with the appropriate type to connect the relocated hydrant to the new pipe. Furnish, install or remove hydrant extension pieces to provide the proper bury of the pipe and hydrant.

Handle pipe and appurtenances in such a manner as to ensure delivery to the site and installation in a sound, undamaged condition.

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Store plastic pipe out of direct sunlight until placement. All plastic pipe showing discoloration, or deterioration will be rejected for use and replaced with suitable pipe, at no additional cost.

Carefully examine all pipe, fittings, and appurtenances for defects before placing, rejecting any found defective.

If, at any time before completion of the contract, any broken pipe or any defects are found in the lines or in any of their fittings or appurtenances, replace them.

1510-4 WATER SYSTEM INSTALLATION.

Lay pipe in accordance with the specifications and the manufacturer's recommendations.

Have the full length of each section of pipe rest solidly upon the pipe bed with recesses excavated to accommodate the joints. Remove and relay all pipe that has the grade or joint disturbed after initial placement.

Do not lay pipe in water, or when weather conditions are unsuitable for the work. When work is not in progress, close the open ends of pipe and fittings securely so that no trench water, earth or other substance will enter the pipes and fittings.

During the progress of the work and until the completion and final acceptance, keep the pipelines and their appurtenances clean throughout. Remove any obstructions or deposits.

Except where necessary in making connections with other lines or as authorized by the Engineer, lay pipe with the bells facing in the direction of laying.

Maintain a minimum cover of thirty-six inches (914.4 mm) and a maximum cover of forty-two inches (1066.8 mm) below finish grade over all pipes unless otherwise directed or shown on the plans. Due to the heights of valves, increase the cover depths adjacent to the valves or varied at points of tie-in to existing lines.

The Contractor is herein forewarned as to the possibility of having to vary the depth of pipeline installation to achieve minimum clearance of existing or proposed utilities while maintaining minimum cover specified (whether existing or proposed pipelines, conduits, cables, mains, storm drainage, etc. are shown on the Plans or not).

Install small diameter pipe (4" [101.6 mm] or less) when placed under the existing pavement by first boring a small hole slightly larger than the outside diameter of the pipe to be used and then inserting the pipe with a pilot guide attached through the bored hole.

Make mechanical joints in accordance with the recommendations of the manufacturer. Draw joint bolts up equally around the entire periphery maintaining equal spacing from the gland to the face of the flange at all points around the joint. Tighten all bolts to within the following torque range.

<u>MECHANICAL JOINT BOLT TORQUE</u>		
PIPE SIZE in. (mm)	BOLT SIZE in. (mm)	RANGE OF TORQUE ft.-lb. (N•m)
3 (76.2)	5/8 (15.9)	45-60 (61 – 81.3)
4-24 (101.6 – 609.6)	3/4 (19.1)	75-90 (101.7 – 122)
30-36 (762 – 914.4)	1 (25.4)	100-120 (135.6 – 162.7)
42-48 (1066.8 – 1219.2)	1 1/4 (31.8)	120-150 (162.7 – 203.4)

Handle, lubricate where necessary, and install rubber-gasket joints in accordance with the recommendations of the manufacturer.

Make all screw type joints with a double wrap of teflon tape and torque as required by the manufacturer.

On new water lines and tie-in sections of existing water lines, the method of anchoring pipe bends, plugs, caps, tees, reducing sections, fire hydrants, valves, and related

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appurtenances will be the responsibility of the Contractor. Tying into existing water lines may alter such lines to the extent that these pipelines with existing pipe bends, plugs, caps, tees, reducing sections, fire hydrants, valves, and appurtenances may also require reaction backing; perform this work as necessary. Submit proposed method of anchoring for review and approval prior to any applicable water line construction. Such approval will not relieve the Contractor of his responsibility of properly anchoring the water system.

Provide all fire hydrants, pipe bends, tees, and plugs used on water mains 4 inches (101.6 mm) in diameter or larger and other types of pipe as determined to need restraint with reaction backing, thrust blocking, metal tie rods with clamps or lugs or other approved methods. Use Class B Concrete for reaction backing masonry. Place the backing between solid ground and the pipe fitting to be restrained and so that the fitting or joint will be accessible for repair. Protect steel rods and other metal clamps and lugs by galvanizing or painting with approved bituminous paint.

In areas where the soil is firm and the required pressure tests do not exceed 150 pounds per square inch (1034.2 kPa), pipe bends less than 22.5 degrees on pipe sizes less than 6 inches (152.4 mm) in diameter will not require restraint.

Connect fire hydrants to the main with a 6 inch (152.4 mm) branch line having at least as much cover as the distribution main. Set hydrants plumb with the pumper nozzle facing the roadway and with the breakaway safety flange between 1 and 4 inches (25.4 and 101.6 mm) above the finished surrounding grade. Except where approved otherwise, compact the backfill around hydrants thoroughly to the final grade immediately after installation in order to put the hydrant into service as soon as practicable.

Place at least 7 cubic feet (0.2 cubic meters) of clean crushed stone around the base of the hydrant to insure drainage of the hydrant barrel.

Place a concrete block underneath tapping valves to support the valve and prevent rotation of the valve and sleeve around the tapped main.

Where any section of a main is provided with concrete reaction backing for fittings or hydrants, perform the hydrostatic pressure test 3 days after installation of the concrete reaction backing, unless otherwise approved. Furnish all labor, materials, and appurtenances to perform the tests.

On tie-in sections, the Contractor may be required to anchor pipe bends, tees, etc. with precast concrete blocking, timbers, rodding, or other approved method to allow the water line to be placed back into service as soon as possible.

Make final connections to existing mains where indicated on the drawings, as required to fit the actual conditions, or as directed. Order materials, install the new line, provide thrust restraint, and perform sterilization and pressure tests on the new line prior to installation and tie-in of the new line into service to the satisfaction of the Engineer.

Notify owners in advance of any interruptions of water service with ample time to make arrangements. Limit interruption of water service on main lines to a maximum of 8 hours unless otherwise approved.

1510-5 WATER SYSTEM - PRESSURE TEST, LEAKAGE TEST AND STERILIZATION:

Perform specific pressure and leakage tests and sterilization on newly installed water mains and altered water mains prior to placing such pipelines into service.

Pressure tests and leakage tests on some short sections of pipelines and tie-in sections may not be feasible, however, sterilize such pipelines and tie in sections.

Perform pressure tests, leakage tests, and sterilization of water pipelines as outlined herein. Similar data contained in "A Guide for the Installation of Ductile Iron Pipe", by the Ductile Iron Pipe Research Association, and data contained in ANSI/AWWA C-600 and AWWA C-651, may be used if necessary.

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Before pressure testing installed water mains, other than lock joint type pipe, secure and anchor such mains including any valves and fire hydrants by backfilling and tamping around the pipe, and by placing approved reaction backing at all pipe bends, dead ends, tees, and plugs for restraint. Keep all pipe joints uncovered, where possible for leakage inspection.

Install corporation stops at all elevated points along the pipeline in order to bleed off all entrapped air and aid in testing and flushing.

Flush all water lines to remove sediment and other impurities before pressure testing, however, if in the opinion of the Engineer, the installed pipe does not require flushing, or if a chemical has been placed at all pipe joints during pipe installation, then initial flushing of the pipe may not be required. In order to save time and eliminate the disposal of excessive waste water, it is recommended that the water being used to pressure test contain a minimum of 100 ppm chlorine.

After the installed pipe, fittings, valves, hydrants, corporation stops and end plugs are inserted and secured, subject the pipeline to a hydrostatic pressure of 150 psi (1034.2 kPa) for a period of 2 hours, by pumping the section full of clean water using an approved pressure pump.

Remove any cracked, damaged, or defective pipe, fittings, valves, hydrants, or other attachments discovered as a result of the pressure test and replace with sound material. Repeat the tests until test results are satisfactory.

After the pressure test is complete, make a leakage test. Perform the leakage test at least 2 hours at a pressure of 150 psi (1034.2 kPa). To be acceptable, the leakage must not exceed the amount determined by the following formula:

$$\frac{W = LD (\text{Square Root of } P)}{133,200}$$

In which W equals the allowable leakage in gallons per hour; L is the length of pipeline tested, in feet; D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test, in pounds per square inch.

$$\frac{W = LD (\text{Square Root of } P)}{715,317}$$

In which W equals the allowable leakage in litres per hour; L is the length of pipeline tested, in meters; D is the nominal diameter of the pipe, in millimeters; and P is the average test pressure during the leakage test, in kilopascals.

When pressure testing or making a leakage test on a section of installed water pipe, provide a centrifugal water pump, capable of delivering adequate water pressure, a small water control valve, and a calibrated pressure gage all interconnected to a calibrated water storage tank. Use the storage tank to supply and mix chlorine chemicals and measure quantities of chlorinated water to be pumped into the water main through a small pipeline from pump to valve, to pressure gage, to water main.

When the chlorinated water in the pipe being pressure tested has reached specified pressure limits, the control valve closed, and water pump stopped, the pressure gage will hold steady if there is no leakage. Any leakage can be measured by running the water pump with control valve in a partially closed position to maintain constant pressure and measuring the amount of water used from the calibrated storage tank, provided the leakage does not exceed pump capacity.

After the pressure and leakage tests have been completed and accepted, fill the pipe section with clean water containing 100 ppm chlorine. For the chlorinating material use liquid chlorine, hypochlorite or HTH material introduced into the pipeline from the calibrated storage tank noted herein or by other approved methods. Allow the chlorinated water to remain in the pipe long enough for the chlorine chemical to destroy all non-spore

forming bacteria. Except where a shorter period is approved by increasing the chlorine content, use a retention time of at least 24 hours or until chemical tests reveal a minimum of 10 ppm of chlorine in the chlorinated water line.

Open and close all valves on the lines being sterilized several times during the chlorinated period. Then flush the pipeline with clean water until the residual chlorine is reduced to less than 1.0 ppm or at the same level as in the existing water mains. Take samples of water at representative points along the pipeline, in approved containers and submit to a certified testing laboratory for bacterial and chlorine content.

Perform chlorinating of short sections of mains and connection of sections by stockpiling, and spraying or swabbing inside of each pipe and fitting with clean water containing 100 ppm chlorine or other approved chemical, sealing each pipe opening, and allowing them to stand for 24 hours or longer, then flushing the sections thoroughly before connecting into the system.

During pressure, chlorinating, and leakage testing, furnish all water fittings, valves, extra pipe, pumps, and incidentals necessary to complete these procedures.

This is considered incidental to the cost of the proposed water pipe.

The pipeline being sterilized will not be accepted until satisfactory bacterial and chlorine limits have been obtained.

Give a copy of the test report to the Engineer and one copy to the water line owner.

1510-6 METHOD OF MEASUREMENT.

The quantity of waterlines of the various sizes and types which has been incorporated into the completed and accepted work will be measured from end to end by the linear foot (linear meters) in place with no deduction for length through valves or other fixtures.

The quantity of ductile iron water pipe fittings will be measured based on the published weights for ductile iron fittings listed in ANSI/AWWA C-110/A21.10 exclusive of the weights of any accessories. If the Contractor elects to use compact ductile iron water pipe fittings, measurement will be based on the weight of standard size ductile iron water pipe fittings as published in ANSI/AWWA C-110/A21.10. No measurement of the accessories will be made as the accessories are considered incidental to other work being paid for by the various items in the contract.

The quantity of the various sizes and types of stops, valves, sleeves, saddles, fire hydrants and other items listed in the pay items will be measured by the actual number of each of these items incorporated into the completed and accepted work.

If the contract does not include such pay items, measurement will not be done and the items for payment will be incidental to other contract pay items.

1510-7 BASIS OF PAYMENT.

The quantities of waterline measured as provided in Article 1510-6, will be paid for at the contract unit prices per linear foot (linear meter) for each size and type shown below. The quantities of stops, valves, sleeves, saddles, fire hydrants and other items measured as provided in Article 1510-6, will be paid for at the contract unit prices each for the various sizes and types.

The quantity of ductile iron water pipe fittings, installed in accordance with the plans and provisions herein and accepted, will be measured and paid for at the contract unit price per pound (kilogram) (based on the published weights for ductile iron fittings).

Payment will be made under:

- ___" (mm) D.I. Water Pipe Class ____, ____ # (MPa) WP Linear Foot (Linear Meter)
- ___" (mm) D.I. Water Pipe PC Linear Foot (Linear Meter)
- ___" (mm) D.I. Restrained Joint Water Pipe,
Class __, __ #WP..... Linear Foot (Linear Meter)

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Ductile Iron Restrained Joint Water Pipe Fittings, 250 # (MPa) Min. WP...Pound (kg)
__" (mm) Copper Water Pipe, Type_____	..... Linear Foot (Linear Meter)
__" (mm) PE Water Pipe, SDR _____, _____ # (MPa) WP..	Linear Foot (Linear Meter)
__" (mm) PVC Water Pipe, SDR _____, _____ # (MPa) WP	Linear Foot (Linear Meter)
__" (mm) PVC Water Pipe, (C-900), DR __, __ # (MPa) WP ..	Linear Foot (Linear Meter)
Ductile Iron Water Pipe Fittings, 250 # (MPa) Min. WP	Pound (kg)
__" (mm) Corporation Stop.....	Each
__" (mm) Curb Stop.....	Each
__" (mm) Gate Valve and Valve Box, _____ # (MPa) WP	Each
__" (mm) Bronze Gate Valve and Valve Box, _____ # (MPa) WP	Each
__" (mm) Tapping Sleeve, Valve and Valve Box, _____ # (MPa) WP	Each
__" (mm) X __" (mm) Tapping Saddle.....	Each
__" (mm) Transition Coupling.....	Each
Relocate existing water meter	Each
Fire Hydrant_____ # (MPa) WP	Each
Relocate Existing Fire Hydrant.....	Each

**SECTION 1520
SANITARY SEWER INSTALLATION**

1520-1 DESCRIPTION.

Furnish and install all materials, including pipe, accessories, fittings, compression couplings, detectable marking tape, anchoring, connections, pressure test, leak test, excavation, backfilling, compaction and incidentals necessary to complete the construction or reconstruction of sanitary sewers and appurtenances in accordance with these Specifications.

1520-2 MATERIALS.

Refer to Division 10:

Sanitary Sewer Pipe and FittingsSection 1034

Submit catalog cuts and/or shop drawings for such materials as special fittings, lift stations, and manholes proposed for use on the project. The Engineer may submit these to the State Design Services Engineer and to the utility owner for review and approval. Allow forty days for the review of each submittal.

Deliver only approved materials to the project. Submit eight (8) copies of each catalog cut and/or drawing with each showing the material description, brand name, stock number, size, rating, manufacturing specification and the use for which it is intended.

1520-3 CONSTRUCTION REQUIREMENTS.

Use sewer line material with the size, type, class and thickness or pressure rating as shown on the utility plans and/or project special provisions.

Assemble PVC pipe joints in accordance with the recommendations of the manufacturer.

Mark PVC pipe location by using an approved detectable marking tape, installed 18 to 24 inches (457.2 to 609.6 mm) below finished grade.

Install PVC pipe in accordance with approved bedding methods.

Use Ductile Iron Sewer Pipe Fittings as noted elsewhere in these specifications on 4" (101.6 mm) or larger PVC sewer pipe.

Install all ductile iron sewer pipe in accordance with laying condition Type "2" as stated in ANSI/AWWA C-151/A21.51, unless otherwise shown on the plans.

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Install all ductile iron force main sewer pipe in accordance with laying condition Type "2" as stated in ANSI/AWWA C-150/A21.50 unless otherwise shown on the plans.

Use Class III, B wall reinforced concrete sewer pipe unless otherwise shown on the plans.

Install ductile iron sewer pipe, fittings and specials in accordance with the manufacturer's recommendations.

Install vitrified clay sewer pipe in accordance with ASTM C12.

Install sanitary sewer clean-outs in accordance with the applicable utility provisions, as shown on the utility plans and/or as directed. Use clean-outs which are 4 inch (101.6 mm) minimum in diameter and have screw type covers installed flush with the ground unless otherwise approved.

During the progress of the work and until the completion and final acceptance, keep the pipelines and their appurtenances clean throughout and remove any obstructions or deposits.

Carefully examine pipes, fittings, and appurtenances for defects before placing and do not use any found to be defective.

When work is not in progress, close the open ends of pipe, fittings, and valves securely so that water, earth, or other foreign substances can not enter.

Adjust manhole tops as required to provide access during all phases of construction. Make the final adjustment of the manhole flush with finish grade unless specified otherwise.

Make final connections of the proposed sewer work to the existing system where indicated on the drawings, as required to fit the actual conditions, or as directed. Notify the owner at least 24 hours in advance of all arrangements for temporary service and for agreement with the owner as to the time that service may be interrupted.

1520-4 SEWER SYSTEM INSTALLATION.

(A) Pipe Installation:

Lay sewer lines in trenches of adequate width to allow the proper installation of the line. Perform excavation trenching and backfill in accordance with Section 1505.

Shape the bottom of the trench to give substantially uniform circumferential support to the lower fourth of each pipe. Proceed with pipe laying upgrade with the spigot ends pointing in the direction of flow. Lay each pipe in such manner as necessary to form a close concentric joint with the adjoining pipe and to prevent sudden offsets of the flow line. As the work progresses, clear the interior of the sewer of all foreign materials. Where cleaning after laying is difficult because of small pipe size, keep a suitable swab or drag in the pipe and pull forward past each joint immediately after the jointing has been completed. Keep trenches free from water until backfilled and do not lay pipe when the condition of the trench or the weather is unsuitable for such work.

Consider any fittings or saddles necessary to connect service lines to the sewer main incidental to the pipe.

Do everything necessary, including temporary pumping, in order to keep all existing sewers active for either the duration of this contract or until the Engineer authorizes connections.

(B) Sewer Line Testing:

(1) General

Test all new sewer lines for watertightness. Contain leakage into the sewer lines so that it does not exceed 100 gallons per inch diameter per mile (236.6 liters per 25.4 mm diameter per kilometer) of pipe per 24 hours for any section of the line between

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adjoining manholes and 100 gallons per inch diameter per mile (236.6 liters per 25.4 mm diameter per kilometer) of pipe per 24 hours for any line, or system of lines, extending through two or more manholes. When determination of infiltration is not practicable because of dry trench conditions, exfiltration tests shall be made if, as and where directed. Make the tests by filling the sewer between successive manholes with water to the top of the outlets of the upper manhole. Measure the amount of water required to maintain the pipe full for the required test period and determine the rate of leakage. When the leakage exceeds the specified amount, make satisfactory corrections and retest as described above.

In lieu of hydrostatic testing, sewer lines 24 inch (609.6 mm) in diameter or smaller may be air tested in accordance with ASTM C-828, ASTM C924 and the following. Perform tests which consist of securely plugging the sewer line between manholes, pumping the section full of air to 4.0 psi (27.6 kPa) and holding this pressure for 5 minutes. Then the pressure should be reduced to 3.5 psi (24.1 kPa) and the time recorded for the pressure to drop 1.0 psi (6.9 kPa) to the new pressure of 2.5 psi (17.2 kPa). Exceed the minimum test time given in the chart below for test times per 100 feet (30.5 m) for the appropriate nominal pipe diameter.

Pipe Size Inches (mm)	Test Time Minutes/100 Ft. (30.5m)	Pipe Size Inches (mm)	Test Time Minutes/100 Ft.(30.5m)
8 (203.2)	1.2	18 (457.2)	2.4
10 (254)	1.5	21 (533.4)	3.0
12 (304.8)	1.8	24 (609.6)	3.6

Visually inspect sewer lines larger than 24 inch (609.6 mm) from the inside. Correct any leakage, rolled gaskets, or defects.

(2) Force Main Sewers

Test all new sewer force mains hydrostatically at 150 psi (1034.2 kPa). Fill the pipeline slowly and exercise care to vent all high points and expel all air. Keep vents open until water flows from them at a steady flow. In addition, properly anchor all fittings before the test is made. After the air is expelled from the line, apply pressure by means of a hand pump, a gasoline pump, or some type of approved pumping equipment.

After the main has been brought up to the required pressure, hold the test for a period of 2 hours, and measure the make-up water with a displacement meter or by pumping the water from a vessel of known volume as approved. If possible, inspect the pipe and joints thoroughly while under test pressure, and correct any leak or excessive moisture at the joints. No piping installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula $W = 0.000106 LD$ ($W = 0.000401515(3.28L)(D/25)$) in which W equals the allowable leakage in gallons (liters) per hour; L is the length of pipe tested in feet (meters); and D is the nominal diameter of the pipe, in inches (mm). Should test of any pipe laid disclose leakage greater than that specified above, repair the defective joints until the leakage is within the specified amount.

1520-5 METHOD OF MEASUREMENT.

The quantity of sewer lines of the various sizes and types which has been incorporated into the completed and accepted work will be measured from end to end by the linear foot (linear meter) in place with no deduction for length through manholes. Where two different sizes enter or go from a manhole, each size will be measured to the center of the manhole. Unless otherwise shown on the plans, branch connections, ells, or other fixtures will be included in the length measurement.

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The quantity of ductile iron sewer pipe fittings will be measured based on the published weights for ductile iron fittings listed in ANSI/AWWA C-110/A21.10 exclusive of the weights of any accessories. If the Contractor elects to use compact ductile iron sewer pipe fittings, measurement will be based on the weight of standard size ductile iron water pipe fittings as published in ANSI A21.10. No measurement of the accessories will be made as the accessories are considered incidental to other work being paid for by the various items in the contract.

The quantity of the sanitary sewer cleanouts will be measured by the actual number of each of these incorporated into the completed and accepted work.

1520-7 BASIS OF PAYMENT.

The quantities of sewer line measured as provided in Article 1520-5, will be paid for at the contract unit prices per linear foot (linear meter) for each size and type shown below.

The quantity of ductile pipe fittings, installed in accordance with the plans and provisions herein and accepted, will be measured and paid for at the contract unit price per pound (kg) (based on the published weights for ductile iron fittings).

The quantity of sanitary sewer clean-outs, installed in accordance with the plans and utility provisions and accepted, will be paid for at the contract unit price for each.

Payment will be made under:

__" (mm) PVC Sewer Pipe SDR _____	.....	Linear Foot (Linear Meter)
__" (mm) PVC Force Main Sewer Pipe		
SDR _____, _____ # (MPa) WP	.....	Linear Foot (Linear Meter)
__" (mm) DI Sewer Pipe, Class _____	.....	Linear Foot (Linear Meter)
__" (mm) DI Sewer Pipe, PC _____	.....	Linear Foot (Linear Meter)
__" (mm) DI Force Main Sewer Pipe,		
Class __, __ # (MPa) WP	.....	Linear Foot (Linear Meter)
__" (mm) DI Force Main Sewer Pipe, PC _____	.....	Linear Foot (Linear Meter)
Ductile iron sewer pipe fittings, 250 # (MPa) Min. WP	.....	Pound (kg)
__" (mm) R.C. Sewer Pipe, Class _____	.....	Linear Foot (Meter)
__" (mm) VC Sewer Pipe	.....	Linear Foot (Linear Meter)
Sanitary Sewer Cleanout	.....	Each

**SECTION 1525
SANITARY SEWER MANHOLES**

1525-1 DESCRIPTION.

Construct sanitary sewer manholes, including all materials, labor, equipment, excavation and backfill, installation of reducing cones, manhole extensions, ties to existing manholes, manhole adjustments, and manhole frame and covers when specified in the contract, and incidental items necessary to complete the work as required, at the locations and to the lines, grades, and dimensions shown in the utility plans or special provisions.

Construct manholes complete with covers, steps, fittings, and other appurtenances, in accordance with the details shown in the plans or provisions.

1525-2 MATERIALS.

Refer to Division 10:

Portland Cement Concrete	.....	Section 1000
Curing Agents	.....	Section 1026
Brick	.....	Article 1040-1
Concrete Block	.....	Article 1040-2
Mortar	.....	Article 1040-8
Precast Concrete Units	.....	Section 1077

Reinforcing Steel.....Section 1070
 Structural Steel.....Section 1072
 Steps Article 1074-8
 Gray Iron CastingsSubarticle 1074-7(B)
 Select MaterialSection 1016

Use cement grout meeting the requirements of Article 1040-9 except use the mix portions of 1 part portland cement to 2 parts mortar sand.

Submit eight (8) catalog cuts and/or shop drawings for precast sections, castings and manholes proposed for use on the project. Have each catalog cut or shop drawing show the material description, brand name, stock number, size, rating, manufacturing specification and the use for which it is intended. The Engineer may submit these to the State Design Services Engineer and to the utility owner for review and approval. Allow forty days for the review of each submittal.

Deliver only approved materials to the project.

1525-3 CONSTRUCTION REQUIREMENTS.

Use precast concrete sanitary sewer manholes which conform to ASTM C478 and are as shown on the plans and/or in Roadway Standard Drawings.

Use sanitary sewer manholes with brick bases as shown in the Standard Drawings where directed for manholes of extra depth with more than two (2) pipes entering or where an extra large pipe is entering. Construct such manhole bases with standard size common red brick conforming to ASTM C32 grade MS, and as required in Section 830 of the Standard Specifications with approved mortar. Plaster the inside and outside of brick bases with mortar a minimum of 1/2 inch (12.7 mm) thick.

Use O-ring rubber gaskets for joints between precast manhole sections conforming to ASTM C-443 or butyl rubber gaskets conforming to AASHTO M198.

Make connections of pipe to manholes for cored or precast holes using a resilient connector conforming to ASTM C923 and for "horseshoe" type holes using resilient material of rubber or butyl rubber and cement grout.

Provide an outside drop assembly for manholes, either designated by the plans or having sewer pipes entering with two and one half (2 1/2) feet (0.8 m) or more vertical drop as shown on the plans and/or as shown on Standard Drawings.

Only manholes which are required to have outside pipe and fittings for dropping sewage into the lower line will be designated as drop manholes.

Inside drop manholes, where the incoming line discharges directly into the manhole and does not require special fittings, are considered standard manholes.

Provide steps in sewer manholes over 3 feet (0.9 m) in depth spaced 16 inches (406.4 mm) on center, of the type shown in the Standard Drawings. Use ASTM A48 Class 30 cast iron, or Grade 60 steel reinforcement with polypropylene plastic coating. Install steps in accordance with the plans or standard details and test as required in ASTM C478.

Construct sanitary sewer manholes with invert channels, as shown on the plans or standard drawings, to confine and direct the flow through the manhole.. Use smooth finished invert channels that provide easy transition from inlet to outlet. Finish the benches or shelves to a non-slip texture and slope toward the invert channel. Precast invert channels are recommended but not required. Provide manhole frames and covers made of cast iron conforming to ASTM A48 Class 30, which are traffic bearing, have machined contact surfaces and the word "Sewer" cast in, and are as shown in the Standard Drawings. Use covers which have two (2) one inch (25.4 mm) diameter air vents for vented manholes, and solid, non-vented covers with gaskets for watertight installation as shown on the plans. On deep manholes, a transition type manhole may be used provided there is

a minimum of 6 feet (1.8 m) from the manhole bench to the transition cone and the Engineer approves.

1525-4 MANHOLE INSTALLATION.

Perform excavation and backfill in accordance with Section 1505.

(A) Foundation:

Do not place sanitary sewer manholes until the foundation has been approved.

Where the foundation material is found to be of poor supporting value or of rock, the Engineer may make minor adjustment in the location of the structure to provide a more suitable foundation. Where this is not practical, condition the foundation by removing the existing foundation material by undercutting to the depth as directed and backfilling with either a suitable local material secured from unclassified excavation or borrow excavation at the nearest accessible location along the project, or foundation conditioning material as classified in Article 1016-3, consisting of crushed stone or gravel or a combination of sand and crushed stone or gravel approved as being suitable material for the purpose intended. The class of select material to be used for foundation conditioning will be stated on the plans or determined by the Engineer.

Where precast foundation slabs are used, set the slab to within plus or minus 1/2 inch (12.7 mm) of grade on a bed of compacted foundation conditioning material that is from 2 to 3 inches (50.8 to 76.2 mm) thick.

(B) Cast-In-Place Concrete, Brick, and Block Masonry:

Construct concrete in accordance with Section 825 and give it an ordinary surface finish. Construct brick masonry in accordance with Section 830. Furnish and place reinforcing steel in accordance with Section 425. Construct block masonry in accordance with Section 834 except that reinforcing will not be required.

Use Class B concrete unless otherwise indicated on the plans.

Where necessary to fit field conditions, vary the dimensions of the manhole and footings as directed.

(C) Installation of Precast Units:

Assemble the precast sanitary sewer manhole units in accordance with the manufacturer's instructions and grout together to form a sound structural unit. Fill all lifting holes with non-shrink grout. Where it is necessary to use cast-in-place, brick masonry, or block masonry construction as part of the structure, apply the requirements of Subarticle 1525-4 (B) to such construction.

Where necessary to fit field conditions, vary the dimensions of the manhole and footings as directed.

(D) Fittings and Connections:

Where fittings enter the manhole, place them as the work is built up, thoroughly bonded, and accurately spaced and aligned.

Make pipe connections so that the pipe does not project beyond the inside wall of the manhole, and grout as necessary to make smooth and uniform surfaces on the inside of the manhole. Set metal frames for covers in full mortar beds or secure by an approved method.

(E) Backfill:

After the manhole has been completed, and all forms, falsework, sheetings, and bracing have been removed and the sewer line installed, backfill the excavation with approved material compacted to the density required by Subarticle 235-4(C). Do not backfill until the concrete or brick masonry has cured for at least seven (7) days, unless otherwise

permitted. A curing day is defined in Article 825-9 for concrete or Article 830-5 for brick or block masonry.

1525-5 METHOD OF MEASUREMENT.

Sanitary sewer manholes will be measured on a "per each" basis and on a "linear foot (linear meter)" basis for that portion exceeding 6 feet (1.8 m) in height.

Measurements will be made for the appropriate diameter of manhole on the actual number constructed as required and accepted. The height of the manhole will be measured, to the nearest tenth of a foot (meter), from the inside bottom of the manhole to the top of the manhole ring.

Measurement will include manhole base section, transition cone, riser sections, riser cones, steps, grade rings, ring and cover (vented or watertight), and vent pipe if noted on plan sheets.

Outside drop assemblies will be measured on a linear foot (linear meter) basis to the nearest tenth of a foot (meter) from the invert of the drop inlet pipe to the invert of the top inlet pipe.

1525-6 BASIS ON PAYMENT.

Sanitary sewer manholes measured as provided above and accepted will be paid for at the contract unit price per each and at the contract unit price per linear foot (linear meter) of depth.

Outside drop assemblies will be paid for at the contract unit price per lineal foot (linear meter) of depth.

Payment will be made under:

__' (m) Diameter Precast Concrete Sewer Manhole 0-6' (0 - 1.8 m) Depth	Each
Precast Concrete Manhole Wall __' (m) Diameter,	
Over 6' (1.8 m) Height	Linear Foot (Linear Meter)
Sewer Manhole Outside Drop Assembly	Linear Foot (Linear Meter)

**SECTION 1530
ADJUST, ABANDON OR REMOVE UTILITIES**

1530-1 DESCRIPTION.

Adjust, abandon, or remove utility facilities. Provide all material, labor, equipment, pumping flowable fill or placing grout, removal and disposal of pipe, plugging pipe openings, breaking down manhole, rebuilding new manhole, pargeting, steps, excavation, backfill, and incidentals necessary to complete the proposed utility work unless indicated otherwise in the proposal.

1530-2 MATERIALS.

Refer to Division 10:

Portland Cement Concrete	Section 1000
Fine Aggregate	Article 1014-1
Portland Cement	Section 1024
Fly Ash*	Article 1024-5
Water	Article 1024-4
Chemical Admixtures	Article 1024-3
Precast Concrete Units	Section 1077
Masonry	Section 1040
Select Materials	Section 1016
Cement Grout	Article 1040-9

*Certain requirements of this article and ASTM C618 may be waived with permission of the Engineer.

Prepare cement grout to a consistency that will flow and be vibrated in order for the mix to flow uniformly into the pipe to be filled.

Use flowable fill in accordance with Section 812.

1530-3 CONSTRUCTION REQUIREMENTS.

(A) Pipe:

Fill abandoned pipe, designated on the plans or by the Engineer, with flowable fill or remove, at the discretion of the Contractor.

Excavate, remove, and dispose of properly any abandoned pipe to be removed. Backfill the resulting trench and properly compact using local excavated material or select backfill as required.

Fill all abandoned utility pipe located in the roadway, which is twelve inches (304.8 mm) in diameter and larger and has a cover of less than twenty feet (6.1 meters) below finished grade with flowable fill or remove pipe to the satisfaction of the Engineer.

Remove any abandoned utility pipe exposed by grading operations to a minimum depth of twelve inches (304.8 mm) below subgrade elevation of the proposed roadbed or completed grading template.

Plug all abandoned utility pipes. Use portland cement grout to plug all abandoned sewer pipes at the entrance to all manholes whether the manhole is to be abandoned or not. Use portland cement grout to plug all abandoned water mains after new mains are placed in service.

(B) Manholes:

For all utility manholes in the construction area that will be abandoned, plug all connecting utility pipes. Remove the top of the manhole to an elevation of two (2) feet (0.6 m) below subgrade or below the spring line, and fill the manhole barrel with select earth material properly tamped. For any abandoned manhole that will have the connecting pipes filled with flowable fill, fill the manhole with cement grout to the top of main pipe. Plug connecting utility pipes that do not require filling with cement grout in an acceptable manner before the manhole is filled with earth material.

Remove the frame and cover, manhole taper, wall, and base on all manholes that are required to be removed. Maintain ownership and properly dispose of the frame and cover.

Remove the frame, cover, the manhole taper, and necessary manhole wall on manholes, which require rebuilding. Include in reconstruction of the manhole, the rebuilding of the manhole wall, manhole taper, steps, and replacing the frame and cover.

Have manhole construction conform to the applicable requirements of Article 1525-3.

Bring all adjusted utility manhole covers to an elevation slightly higher than the surrounding terrain so that surface water will not enter the manhole after the adjustment. Construct manholes located in paved areas flush with the surrounding pavement.

1530-4 METHOD OF MEASUREMENT.

The quantity of pipe filled with flowable fill, or removed as required and accepted, shall be measured at the contract unit price per linear foot (linear meter) for the size of pipe filled or removed.

The quantity of abandoned utility manholes broken down, filled in and accepted, shall be measured at the contract unit price for each manhole abandoned.

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The quantity of manholes rebuilt by removing and replacing manhole frame and cover, removing and rebuilding manhole taper and removing and rebuilding manhole wall will be based on a contract unit price for each manhole rebuilt.

The quantity of manholes removed and accepted will be measured at the contract unit price for each manhole removed.

The quantity of cement grout used for plugging of abandoned pipe is incidental to the items listed above.

1530-5 BASIS OF PAYMENT.

(A) Pipe:

Utility pipe measured as provided above and accepted will be paid for at the contract unit price per linear foot (linear meter), for the size of pipe filled or removed.

(B) Manholes:

Utility manholes measured as provided above will be paid for at the contract unit price for each.

Payment will be made under:

Fill or Remove Abandoned __" (mm) Pipe	Linear Foot (Linear Meter)
Break Down, Plug, and Fill Abandoned Utility Manhole.....	Each
Break Down and Rebuild Existing Manhole	Each
Remove Existing Manhole.....	Each

**SECTION 1540
ENCASEMENTS**

1540-1 DESCRIPTION

Furnish and install encasements or casing pipes in close conformity with the lines, grades, dimensions and locations shown on the Plans. Include all materials, excavation, equipment, labor, installation, grouting, backfilling, and incidentals necessary to complete the work as required. For the purposes of this specification the words encasement, casing, encasement pipe and casing pipe are interchangeable.

1540-2 MATERIAL

Refer to Division 10:

Steel encasement pipe	Subarticle 1036-4(B)
Treated Timber.....	Article 1082-2

Submit material certifications and obtain approval from the Engineer prior to installation.

1540-3 CONSTRUCTION REQUIREMENTS

(A) PREPARATION

Excavate and shore boring pits in conformance with section 1505 of these specifications. Determine soil conditions expected to be encountered during bore and jack operations. Review planned methods of boring and auger design with the Engineer prior to beginning bore. When high groundwater or running sand are present, cease operations.

(B) TRENCHLESS METHODS

Bore and jack encasement pipe into place using equipment designed to bore and push or jack casings on controlled grade. Dry bore only, do not use jetting or wet boring methods. Utilize drilling mud or polymer fluids only on the outside of encasements for lubrication.

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Abandon and grout all encasement pipes that do not allow proposed sewer pipe to be installed at required alignment and grade.

Abandon and grout all encasement pipes for proposed water main that vary more than 2% of total length from required vertical and horizontal alignment or that do not maintain minimum cover for water main installation.

Minimize over bore, match cutter diameter to the outside diameter of the encasement pipe. Limit overbore to 5% of bore diameter.

(C) OPEN CUT

Install encasement pipe by open cut in conformance with section 1510 of these specifications.

(D) WELDING

Butt weld new sections of encasement pipe to previously installed sections. Weld continuously around the circumference of the encasement pipe to ensure that welds are watertight. Do not leave unwelded sections or holes in joints.

(E) MARKER POSTS

Mark encasements for future use with CCA treated wooden marker post. Place wooden marker post at the right of way or at the ends of encasements if encasements extend beyond the right of way.

(F) CARRIER PIPE INSTALLATION

Install carrier pipe through casing by using spacers or insulators to support carrier pipe. Place spacers at intervals sufficient to support carrier pipe without sagging. Install spacers sized to raise the carrier pipe bells above the encasement pipe invert. Test carrier pipe in accordance with Section 1510-5 prior to sealing ends of casing.

Seal ends of casing with concrete, brick or other approved materials. Ensure drainage of encasement by leaving a 1-inch (25.4 mm) diameter weep hole in the seal of the lower end of the encasement.

1540-4 METHOD OF MEASUREMENT

Encasement pipe installed by trenchless methods or by open cut methods in accordance with the plans and provisions herein and accepted will be measured along the encasement pipe from end to end by the linear foot (linear meter).

1540-5 BASIS OF PAYMENT

The quantity of encasement pipe measured as provided in Article 1540-4, will be paid for at the contract unit price per linear foot (linear meter) for each size and type shown below.

Payment will be made under:

- ___ Steel Encasement Pipe, ___" (mm) Thick,
by Trenchless Method” Linear Foot (Linear Meter)
- ___ Steel Encasement Pipe, ___" (mm) Thick,
by Open Cut” Linear Foot (Linear Meter)

NOTES

