

**NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH**

**STANDARD SPECIFICATIONS
FOR
ROADS AND STRUCTURES**



Sections 1034, 1036, and
Division 15

JANUARY 2018

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SECTION 1034 SANITARY SEWER PIPE AND FITTINGS

1034-1 CLAY PIPE

Use extra strength vitrified clay sewer pipe conforming to ASTM C700. Manufacture all joints and seals in accordance with ASTM C425.

1034-2 PLASTIC PIPE

(A) PVC Gravity Flow Sewer Pipe

Use PVC pipe that conforms to ASTM D3034 with a minimum SDR of 35. Use pipe with push-on type joints having bells made as an integral part of the pipe conforming to ASTM D3212.

(B) PVC Force Main Sewer Pipe

(1) Pressure Rated Pipe

Use PVC pipe conforming to ASTM D2241 or to ANSI/AWWA C905 with a minimum SDR of 21 and minimum pressure rating of 200 psi. Use pipe with push-on type joints having bells made as an integral part of the pipe conforming to ASTM D3139 or pipe with butt fused joints made from ASTM D1784 Class 12454B plastic formulated for fusing.

Use PVCO pipe conforming to ASTM F1483 or to ANSI/AWWA C909 for molecularly oriented pipe with a minimum pressure rating of 200 psi. Use pipe with push-on type joints having bells made as an integral part of the pipe conforming to ASTM D3139.

(2) Pressure Class Pipe

Use PVC pipe conforming to ANSI/AWWA C900 with a minimum DR of 18 and a minimum pressure class of 235 psi. Use pipe with push-on type joints having bells made as an integral part of the pipe conforming to ASTM D3139 or pipe with butt fused joints made from ASTM D1784 Class 12454B plastic formulated for fusing.

(C) Polyethylene (PE) Pipe Force Main Sewer Pipe

Use PE pipe and tubing that conforms to AWWA C901 or AWWA C906 with a minimum pressure class of 200 psi.

1034-3 CONCRETE SEWER PIPE

Use reinforced concrete sewer pipe conforming to ASTM C76 or AASHTO M 170 with a Class III minimum rating. Use pipe with gasket joints conforming to ASTM C443 or AASHTO M 198 Type A or B.

1034-4 DUCTILE IRON PIPE

(A) Gravity Flow Sewer Pipe

Use ductile iron pipe that conforms to ASTM A746 or ANSI/AWWA C151/A21.51.

Use ductile iron pipe fittings and specials conforming to ANSI/AWWA C110/A21.10 for standard size fittings or ANSI/AWWA C153/A21.53 for compact fittings.

Use pipe and fittings with push-on joints conforming to ANSI/AWWA C111/A21.11.

(B) Force Main Sewer Pipe

Use ductile iron pipe that conforms to ANSI/AWWA C151/A21.51.

Use ductile iron pipe fittings and specials conforming to ANSI/AWWA C110/A21.10 for standard size fittings or ANSI/AWWA C153/A21.53 for compact fittings. Manufacture

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1 fittings with a cement mortar lining and a seal coat in accordance with
2 ANSI/AWWA C104/A21.4.

3 Use pipe and fittings with either mechanical joints or push-on joints conforming to
4 ANSI/AWWA C111/A21.11. When required or necessary, use approved type joint
5 restraint devices with a minimum working pressure rating of 200 psi and a factor of
6 safety of 2.

SECTION 1036 WATER PIPE AND FITTINGS

9 1036-1 GENERAL

10 All materials when used to convey potable drinking water shall meet the National Sanitation
11 Foundation Standard No. 61. All materials in contact with potable water shall be in
12 conformance with Section 1417 of the Safe Drinking Water Act.

13 1036-2 COPPER PIPE

14 For indoor plumbing use copper pipe and sweated fittings conforming to ASTM B88 for the
15 type and temper called for in the plans and Specifications. Cast fittings for copper pipe shall
16 meet ASTM B61 or ASTM B62.

17 For buried service, use copper water pipe and tube conforming to ASTM B88 soft annealed
18 Type K. Use flared or compression type fittings conforming to ANSI/AWWA C800 and local
19 plumbing codes to connect pipe and tube.

20 1036-3 PLASTIC PIPE

21 (A) PVC Pipe

22 (1) Pressure Rated Pipe

23 Use PVC pipe conforming to ASTM D2241 or to ANSI/AWWA C905 with
24 a minimum SDR of 21 and minimum pressure rating of 200 psi. Use pipe with
25 push-on type joints having bells made as an integral part of the pipe conforming to
26 ASTM D3139 or pipe with butt fused joints made from ASTM D1784 Class 12454B
27 plastic formulated for fusing.

28 Use PVCO pipe conforming to ASTM F1483 or to ANSI/AWWA C909 for
29 molecularly oriented pipe with a minimum pressure rating of 200 psi. Use pipe with
30 push-on type joints having bells made as an integral part of the pipe conforming to
31 ASTM D3139.

32 (2) Pressure Class Pipe

33 Use PVC pipe conforming to ANSI/AWWA C900 with a minimum DR of 18 and
34 a minimum pressure class of 235 psi. Use pipe with push-on type joints having bells
35 made as an integral part of the pipe conforming to ASTM D3139 or pipe with
36 butt-fused joints made from ASTM D1784 Class 12454B plastic formulated for
37 fusing.

38 (B) Polyethylene (PE) Pipe

39 Use PE water pipe and tubing that conforms to AWWA C901 or AWWA C906 with
40 a minimum pressure class of 200 psi.

41 1036-4 STEEL PIPE

42 (A) Water Pipe

43 Use galvanized steel pipe meeting ASTM A53 for standard weight. Fittings for steel
44 water pipe shall meet ASTM A126 for Class B iron or of ASTM A197. Galvanize all
45 fittings in accordance with ASTM A153.

1 (B) Encasement Pipe

2 Use steel pipe meeting an ASTM specification with the minimum yield strength of
3 35,000 psi. Use pipe that is circular in shape and straight in length.

4 1036-5 DUCTILE IRON PIPE AND FITTINGS

5 Use ductile iron pipe that conforms to ANSI/AWWA C151/A21.51.

6 Use ductile iron pipe fittings and specials conforming to ANSI/AWWA C110/A21.10 for
7 standard size fittings or ANSI/AWWA C153/A21.53 for compact fittings. Manufacture
8 fittings with a cement mortar lining and a seal coat in accordance with
9 ANSI/AWWA C104/A21.4.

10 Use either mechanical joints or push-on joints conforming to ANSI/AWWA C111/A21.11.
11 When required or necessary, use approved type joint restraint devices with a minimum
12 working pressure rating of 200 psi and a factor of safety of 2.

13 1036-6 FIRE HYDRANTS

14 Use dry barrel type fire hydrants conforming to ANSI/AWWA C502 with a minimum 4 1/2
15 inch diameter valve opening with a 6 inch mechanical joint inlet connection, with two 2 1/2
16 inch hose connections and with one 4 1/2 inch pumper connection. Outlets shall have
17 national standard fire hose coupling threads. Use fire hydrants with a minimum bury length
18 of 36 inches. Securely chain nipple caps to the barrel. Paint hydrants with one coat of primer
19 paint and two coats of an approved paint of the owner's standard color. Apply the final coat
20 after hydrant installation.

21 1036-7 WATER VALVES**22 (A) Gate Valves**

23 Use iron body gate valves which conform to ANSI/AWWA C500 for bronze mounted,
24 double disc, parallel seat type valves or to ANSI/AWWA C509 for resilient seat-type
25 valves or to ANSI/AWWA C515 for reduced-wall, resilient seat gate valves. For buried
26 service use gate valves with non-rising stems, 2 inch square operating nuts, O-ring seals
27 and which open by turning counter clockwise. Gate valves shall have mechanical joint
28 ends conforming to ANSI/AWWA C111/A21.11. Gate valves shall have a design
29 working water pressure of 200 psi.

30 (B) Bronze Gate Valves

31 Use bronze gate valves conforming to ASTM B62 with tee head operating nuts and solid
32 wedges. Use valves with a design working pressure of 200 psi.

33 (C) Tapping Valves

34 Use tapping valves conforming to Subarticle 1036-7(A) with appropriately sized
35 openings, with flanged by mechanical joint ends and pressure rated at 200 psi.

36 1036-8 SLEEVES, COUPLINGS AND MISCELLANEOUS**37 (A) Tapping Sleeves**

38 Use cast iron, ductile iron or Type 304 stainless steel tapping sleeves pressure rated
39 at 200 psi. Use either the split sleeve type with mechanical joint ends or the full circle
40 type with double seals. Manufacture the outlet flange to mate with the tapping valve
41 flange.

42 (B) Transition Sleeves and Couplings

43 Use sleeve type couplings for transitioning between plain ends of different pipe types.
44 Manufacture couplings in conformance with ANSI/AWWA C219 for a rated working

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1 pressure of 200 psi. Coat the coupling at the factory with an epoxy in conformance with
2 ANSI/AWWA C210 or ANSI/AWWA C213.

3 **1036-9 SERVICE LINE VALVES AND FITTINGS**

4 Use corporation stops and curb stops of all bronze material and high-pressure construction
5 conforming to ANSI/AWWA C800.

6 Use tapping saddles of high-pressure construction, shaped to conform to the pipe and in
7 conformance with ANSI/AWWA C800.

8 Use high-pressure fittings manufactured in conformance with ANSI/AWWA C800.

9 **SECTION 1040**

10 **MASONRY**

11 **1040-1 BRICK**

12 Use clay or shale brick that meets ASTM C62 for Grade SW, except as otherwise provided
13 herein.

14 Use brick of uniform standard commercial size, with straight and parallel edges and square
15 corners that are burned hard and entirely true, free from injurious cracks and flaws, tough,
16 strong and have a clear ring when struck together. The sides, ends and faces of all brick shall
17 be plane surfaces at right angles and parallel to each other.

18 Brick of the same manufacturer shall not vary more than $\pm 1/16$ inch in thickness, $\pm 1/8$ inch
19 in width and $\pm 1/4$ inch in length.

20 Concrete brick may be used instead of clay or shale brick when designated in the plans or in
21 the specifications. Concrete brick shall meet ASTM C55 for Grade S-II except that the
22 absorption of brick used in minor drainage structures shall not exceed 10 lbs/cf.

23 **1040-2 CONCRETE BUILDING BLOCK**

24 Use concrete building block from sources that participate in the Department's Solid Concrete
25 Masonry Brick/Unit QC/QA Program. A list of these sources in North Carolina and adjoining
26 states is available from the Materials and Tests Unit in Raleigh.

27 Use concrete building block that meets ASTM C90. Block shall be pink in color and
28 substantially free from chips and cracks.

29 Use solid concrete block instead of clay brick for minor drainage structures that meet
30 ASTM C139 except that the nominal dimensions shall be 4 inches x 8 inches x 16 inches.

31 Concrete block for block manholes shall meet ASTM C139.

32 **1040-3 CONCRETE PAVING BLOCK**

33 Use concrete paving block from sources that participate in the Department's Solid Concrete
34 Masonry Brick/Unit QC/QA Program. A list of these sources in North Carolina and adjoining
35 states is available from the Materials and Tests Unit in Raleigh.

36 Use concrete paving block that meet ASTM C139, except that the nominal dimensions shall
37 be 4 inches x 8 inches x 16 inches. The block shall have a uniform surface color and texture.

38 **1040-4 SEGMENTAL RETAINING WALL UNITS**

39 Use segmental retaining wall (SRW) units from sources that participate in the Department's
40 Solid Concrete Masonry Segmental Retaining Wall Units QC/QA Program. A list of these
41 sources in North Carolina and adjoining states is available from the Materials and Tests Unit
42 in Raleigh.

43 Use freeze-thaw durable SRW units when noted in the plans. Unless required otherwise in
44 the contract, provide SRW units with a vertical straight face and a concrete gray color with no

DIVISION 15 UTILITY CONSTRUCTION

SECTION 1500 GENERAL UTILITY REQUIREMENTS

1500-1 DESCRIPTION

Construct various utilities as required by the contract or as directed.

Apply the applicable provisions of the rules and regulations of the NCDEQ to the construction of water lines and sanitary sewer lines. Perform all work in accordance with the applicable plumbing codes.

1500-2 COOPERATION WITH THE UTILITY OWNER

The utility owner owns the existing utility facilities and will own the new utility facilities after acceptance by the Department. The Department owns the construction contract and has administrative authority. Communications and decisions between the contractor and utility owner are not binding upon the Department or this contract unless authorized by the Engineer. Agreements between the utility owner and contractor for work that is not part of this contract or is secondary to this contract are allowed, but are not binding upon the Department.

Provide access for Department personnel and the owner's representatives to all phases of construction. Notify Department personnel and the utility owner 2 weeks before commencement of any work and one week before service interruption. Keep utility owners' representatives informed of work progress and provide opportunity for inspection of construction and testing.

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

Notify the utility 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.

1500-3 UTILITY LOCATIONS AND CONTRACTOR'S 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 of material of the existing facilities as necessary for the construction of the proposed utilities and for avoiding damage to existing facilities. Repair any contractor caused damage of 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 utility owner's requirements. Make connections on weekends, at night and on holidays, if necessary.

1500-5 RELATION OF WATER MAINS TO SEWERS

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

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

6 When a proposed water main crosses under a proposed or existing sewer, construct both the
7 water main and the sewer of ferrous materials with joints that are equivalent to water main
8 standards for a distance of 10 feet on each side of the point of crossing. Center the section of
9 water pipe at the point of crossing.

10 1500-6 PROTECTION OF PEDESTRIAN AND VEHICULAR TRAFFIC

11 During the progress of the work, keep sidewalks and crossings open for the passage of
12 pedestrians. Take necessary measures to keep roadways open for traffic unless lane or
13 roadway closures are approved.

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

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

19 1500-7 SUBMITTALS AND RECORDS

20 Deliver only approved materials to the project. Provide sufficient information as required
21 under Sections 105 and 106 to demonstrate the materials meet the specifications and intended
22 use. Provide 2 copies to the utility owner and 6 copies to the Engineer or provide electronic
23 submittals if accepted by the Engineer. Identify each item's intended use. As a minimum, the
24 submitted information shall show the material description, brand name, stock number, size,
25 rating and manufacturing specification.

26 Provide working drawings of thrust restraint designs and connection details along with
27 schedules for performing the work.

28 Provide as-built plans of the installed utility. The plans shall include notations of the size and
29 type material installed, coordinates of utility controls and horizontal and vertical locations of
30 the piping. Provide 2 copies to the utility owner and 2 copies to the Engineer.

31 1500-8 LOCATING AND MARKING

32 Tape a continuous locator wire along the top of all piping. Mechanically fasten locator wire
33 to valve boxes, meter boxes, fire hydrants, manhole covers and other above grade
34 appurtenances. Install marking tape 18 inches to 24 inches below finished grade above all
35 pipelines.

36 1500-9 PLACING PIPELINES INTO SERVICE

37 Make final connections of the new work to the existing mains where indicated in the plans, as
38 required to fit the actual conditions or as directed. Provide sufficient work crews, equipment
39 and materials on site to assure quick and efficient connections.

40 Schedule and notify owners and customers in advance of any interruptions of water service
41 with ample time to make arrangements. Limit interruption of service to water customers to no
42 more than 8 hours. Provide temporary connections as needed to maintain service. Obtain
43 approval from the NCDEQ-Water Resources Section prior to placing a new water line into
44 service. Use backflow prevention assemblies for temporary connections to isolate new water
45 lines from existing water line.

1 **1500-10 MEASUREMENT AND PAYMENT**

2 The general utility construction work will be incidental and will be paid at the contract unit
3 prices of the various utility items included in the contract.

4 **SECTION 1505**
5 **EXCAVATION, TRENCHING, PIPE LAYING**
6 **AND BACKFILLING FOR UTILITIES**

7 **1505-1 DESCRIPTION**

8 Perform all excavation, undercut, foundation conditioning, pipe laying, bedding, backfill and
9 pavement, sidewalk and driveway repair necessary for installation of utilities.

10 **1505-2 MATERIALS**

11 Refer to Division 10.

Item	Section
Portland Cement Concrete, Class B	1000
Select Material	1016

12 Use Class III, IV, V or VI select material for foundation conditioning and bedding.

13 **1505-3 CONSTRUCTION METHODS**

14 Excavate, trench, lay pipe, bed and backfill utilities in conformance with the applicable
15 requirements of Division 1, Division 2 and Articles 300-1, 300-4 and 300-6. Comply with
16 AWWA and ASTM standards along with the product manufacturer requirements for installing
17 utilities.

18 **(A) Shoring**

19 Excavate trenches and pits for the installation of utilities that are safe for the workers and
20 roadway users and that protect the roadway and other property from damage. Provide
21 appropriate groundwater and surface water controls to stabilize the excavation and
22 foundation and to provide a clean working area.

23 (1) Worker Safety

24 Provide any necessary shielding or shoring to protect workers.

25 (2) Roadway Users

26 Provide shielding or shoring as required under Section 150 or as required elsewhere
27 in the contract.

28 (3) Roadbed and Foundation Protection

29 Provide shoring of excavations less than one horizontal to one vertical from existing
30 or proposed pavement to prevent failure or weakening of the roadbed. Provide plans
31 and designs demonstrating the methods and techniques proposed and their adequacy.
32 Provide engineered shoring systems as required for the actual conditions.

33 (4) Building and Structure Protection

34 Provide shoring of excavations less than one horizontal to one vertical from existing
35 structures and buildings, on or off the right of way, to prevent foundation damage.
36 Provide plans and designs demonstrating the methods and techniques proposed and
37 their adequacy. Provide engineered shoring systems as required for the actual
38 conditions.

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1 (B) Foundation Conditioning

2 Undercut and replace weak or saturated soils below the pipe trench with select material to
3 provide a firm foundation.

4 (C) Bedding

5 Provide excavations with sufficient width for placing and compacting bedding around the
6 utility. Bed utilities in select material. Place bedding material to stable ground on both
7 sides and to at least 2 inches below and above the pipe bells. Provide at least 6 inches of
8 bedding material between rock and piping. Shape the bottom of trenches to fit the pipe.
9 Compact bedding material completely in the pipe haunches. Provide recesses in the
10 bedding to accommodate pipe joints.

11 (D) Pipe Laying

12 Lay pipe in accordance with the specifications and the manufacturer's recommendations.
13 Except where necessary in making connections with other lines or as authorized by the
14 Engineer, lay pressurized pipe with the bells facing in the direction of laying.

15 Where possible, keep joints exposed for visual inspection during testing.

16 During the progress of the work and until the completion and final acceptance, keep the
17 pipelines and their appurtenances clean throughout and remove any obstructions or
18 deposits. Provide secure watertight seals on pipe when work is not in progress.

19 Lay gravity sewer pipe upgrade with the spigot ends pointing in the direction of flow.
20 Lay each pipe to form a close concentric joint with the adjoining pipe and to prevent
21 sudden offsets of the flow line.

22 (E) Thrust Restraint

23 Provide thrust restraint for pressurized pipelines and appurtenances. When shown in the
24 plans, construct as specified with modifications to match the actual field conditions.
25 When not shown, engineer the thrust restraint system with a factor of safety of 1.25 for
26 the test pressure specified and for the actual field conditions.

27 Provide thrust restraint on the existing piping system as necessary.

28 Use joint restraint methods, such as integral restraining bells and spigots, restraining
29 retainer glands, restraining gaskets or restraining clamps and lugs with tie rods. Use
30 concrete reaction backing and thrust collars where joint restraint is impractical.

31 Where any section of a main is provided with concrete thrust restraint for fittings,
32 controls or hydrants, perform the hydrostatic pressure test after the concrete reaches
33 appropriate strength.

34 (F) Backfilling

35 Backfill in accordance with Article 300-7 and compact to the density required by
36 Subarticle 235-3(C).

37 1505-4 REPAIR OF PAVEMENTS, SIDEWALKS AND DRIVEWAYS

38 Repair sidewalks and driveways that are disturbed by excavation and trenching to an original
39 or better condition in accordance with Section 848.

40 Use asphalt plant mix to repair or replace pavement damaged by utility work. Perform all
41 work in accordance with Section 654. Immediately upon completion of the utility removal or
42 installation, make repairs to the pavement.

1 **1505-5 CONCRETE ENCASUREMENT OF UTILITY LINES**

2 Encase existing or proposed utility lines in concrete for protection in areas as shown on the
 3 utility plans or as directed. Place the concrete completely around the line with a minimum
 4 thickness of 6 inches.

5 **1505-6 MEASUREMENT AND PAYMENT**

6 *Foundation Conditioning* material will be measured and paid as provided in Article 300-9.

7 *Asphalt Plant Mix* for pavement repair will be measured and paid as provided in
 8 Article 654-4.

9 *Class B Concrete for Encasing Utility Lines* will be measured and paid in cubic yards of
 10 concrete, measured in place.

11 ___" *Concrete Sidewalk* and ___" *Concrete Driveways* will be measured and paid in accordance
 12 with Article 848-4.

13 Trenching, excavation, pipe laying, bedding, backfilling and disposal of unsuitable materials
 14 for utility construction are included in the contract price for the applicable utility item and no
 15 separate measurement or payment will be made.

16 The following work and items are included in the contract price for the applicable utility item
 17 and no separate measurement or payment will be made for items (A) through (F) below:

- 18 (A) Undercut or Wet Excavation,
- 19 (B) Dewatering of Excavation,
- 20 (C) Shoring and Sheet piling (except temporary shoring for maintenance of traffic covered
 21 elsewhere in the contract and protection of structures and buildings),
- 22 (D) Thrust Restraint,
- 23 (E) Bedding Material, or
- 24 (F) Select Material for Backfill.

25 Payment will be made under:

Pay Item	Pay Unit
Class B Concrete for Encasing Utility Lines	Cubic Yard

26 **SECTION 1510**
 27 **WATER LINES**

28 **1510-1 DESCRIPTION**

29 Provide water lines suitable for use in transporting potable water.

30 **1510-2 MATERIALS**

31 Refer to Division 10.

Item	Section
Water Pipe and Fittings	1036

32 The Contractor may use any of the water pipe specified under Section 1036 except where
 33 a particular type pipe is specified in the plans or required by environmental regulations or
 34 Departmental policy. The Contractor shall verify that the pipe is appropriate for the test
 35 pressure of the system and the external loading.

36 Use ductile iron fittings on water lines 4 inches or larger.

37 Use #12 AWG solid-copper wire with blue insulation for the utility locator wires.

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1 Use 2 inch plastic marking tape colored blue with “Caution Water Line” or similar wording,
2 permanently printed at 36 inch centers.

3 Protect steel rods and other metal clamps and lugs by galvanizing or painting with approved
4 bituminous paint.

5 **1510-3 CONSTRUCTION METHODS**

6 **(A) General**

7 Meet the installation standards of AWWA or ASTM for water line construction.

8 Apply Section 1505 for excavation, trenching, pipe laying and backfill to water line
9 installation.

10 Install small diameter pipe (4 inches or less) under existing pavement by a trenchless
11 method at no additional cost to the Department.

12 Connect the ends of the water service piping using AWWA C800 type couplings or
13 fittings. Make NPT screw joints with a double wrap of a polytetrafluoroethylene (PTFE)
14 tape and torque as required by the manufacturer.

15 Store plastic pipe out of direct sunlight until burying. All plastic pipe showing
16 discoloration or deterioration will be rejected for use and replaced with suitable pipe as
17 specified under Article 106-9.

18 Install water lines with 36 inches to 42 inches of cover to finished grade unless otherwise
19 directed or approved. Install water lines with greater cover for short distances to
20 accommodate utility controls, to make tie-ins to existing facilities, to eliminate high
21 points in the pipeline or to provide clearance between existing and proposed utilities,
22 drainage, other obstacles or actual field conditions.

23 **(B) Testing and Sterilization**

24 Perform pressure and leakage tests and sterilization on newly installed water mains and
25 altered water mains prior to placing such pipelines into service. Provide all equipment,
26 piping, controls, pumps, water and safety devices necessary for performing the tests and
27 sterilization.

28 Obtain clean water for cleaning, testing and sterilization from approved sources. Provide
29 connections to potable water sources with approved backflow preventors until acceptance
30 of all test results.

31 Perform tests using clean water and provide certified results demonstrating leakage less
32 than the following amount when pressurized at 200 ± 5 psi for 2 hours.

$$W = LD\sqrt{P} \div 148,000$$

Where:

- W** = allowable leakage in gallons per hour
- L** = length of pipeline tested, in feet
- D** = nominal diameter of the pipe, in inches
- P** = average test pressure during the leakage test, in lb/sq.in.

33 Repair using approved methods or replace pipe, controls or appurtenances as necessary to
34 reduce leakage below acceptable levels. Additionally, repair any leaks that are visible
35 after 2 hours duration.

36 Clean water lines by flushing with water at least 2.5 feet per second velocity. Remove all
37 debris and dirt from water mains larger than 4 inches by passing a medium density foam
38 pig with abrasive strips through the lines.

39 Sterilize water lines in accordance with Section 1003 of the Rules Governing Public
40 Water supply and AWWA C651 Section 4.4.3, the Continuous Feed Method. Provide a

1 chlorine solution with between 50 parts per million and 100 parts per million in the initial
 2 feed. If the chlorine level drops below 10 parts per million during a 24 hour period, then
 3 flush, refill with fresh chlorine solution, and repeat for 24 hours. Provide certified
 4 bacteriological and contaminant test results from a state-approved or state-certified
 5 laboratory. Operate all valves and controls to assure thorough sterilization. Testing,
 6 cleaning and sterilization shall be performed consecutively.

7 Dispose of waste water in accordance with all environmental regulations.

8 For short sections (less than 100 feet) and tie-in sections of water lines perform visual
 9 tests for leakage after installation instead of separate pressure and leakage tests. Sterilize
 10 according to AWWA C651 Sections 4.6 and 4.7.

11 Provide copies of the test results to the Engineer and to the water line owner.

12 Flush with clean water until the residual chlorine is reduced to the same level as in the
 13 existing water mains.

14 Place new water lines into service after approval of all testing and flushing and
 15 authorization by the Engineer.

16 **1510-4 MEASUREMENT AND PAYMENT**

17 Water lines of the various sizes will be measured from end to end in place with no deduction
 18 for length through valves or other fixtures and paid by the horizontal linear foot.

19 The quantity of *Ductile Iron Water Pipe Fittings* will be measured and paid per pound based
 20 on the published weights for ductile iron fittings, exclusive of the weights of any accessories,
 21 as listed in the “DI Fittings Weight Chart” located on the Utilities Unit web site. If the
 22 Contractor elects to use compact ductile iron water pipe fittings, measurement will be based
 23 on the weight of standard size ductile iron water pipe fittings. Any fitting not listed will be
 24 measured based on the published weights for ductile iron fittings listed in ANSI/AWWA C-
 25 110/A21.10. This is limited to pressure pipe 4 inches or larger.

26 If the contract does not include such pay items, measurement will not be made and the work
 27 will be incidental to other contract pay items.

28 Payment will be made under:

Pay Item	Pay Unit
___" Water Line	Linear Foot
Ductile Iron Water Pipe Fittings	Pound

29 **SECTION 1515**
 30 **UTILITY CONTROLS**

31 **1515-1 DESCRIPTION**

32 Provide appropriate control devices, valves, meters, backflow prevention assembly and
 33 hydrants on water lines and force main sewers.

34 **1515-2 MATERIALS**

35 Refer to Division 10.

Item	Section
Sanitary Sewer	1034
Water	1036

36 Deliver only approved materials to the project.

37 Air release valves shall meet AWWA C512. In addition, air release valves for sanitary sewer
 38 force mains shall have long bodies, shall be equipped with back flushing connections and
 39 shall have a hood over the outlet.

Section 1515

1 Double check valves (DCV) and Reduced Pressure Zone principal (RPZ) backflow prevention
2 assemblies shall be listed on the University of Southern California Foundation for Cross-
3 Connection Control and Hydraulic Research list of approved backflow devices. Line stops
4 consist of a sleeve, temporary valve and closure cap. The sleeve and cap shall meet
5 applicable AWWA standards, shall be made of cast iron or stainless steel, shall be pressure
6 rated at 200 psi and shall be sized for the type pipe to be tapped. The temporary valve shall
7 be suitable for contact with potable water with NSF certification and designed to match the
8 actual field conditions.

9 Line stop bypass pipe shall be pressure rated at 200 psi, shall be NSF certified and shall be
10 adequately restrained.

11 Use screw or slip type valve boxes with a base to fit the valve yoke and a removable plug cap
12 with the word "Water" or "Sewer" cast therein.

13 Precast manholes in accordance with Section 1525.

14 **1515-3 CONSTRUCTION METHODS**

15 Apply Section 1505 for excavation, trenching, pipe laying and backfill.

16 Place two 4 inch x 8 inch x 16 inch concrete blocks beneath valves and fire hydrants for
17 support.

18 When necessary, due to project staging, install valves, meters and fire hydrants as appropriate
19 for the current grade and make adjustments to finished grade as work progresses.

20 Provide enclosures with positive drainage for utility controls.

21 **(A) Valves**

22 Install all valves with an approved valve box set flush with the ground or pavement.
23 Place a 24 inch diameter precast concrete ring flush with the ground around all valve
24 boxes not in pavement.

25 Test and sterilize tapping valves before making the tap. Do not allow cuttings to enter
26 the tapped main.

27 **(B) Meters**

28 Install water meters adjacent to the right of way or as shown in the plans.

29 Place meter boxes with the top of the meter box flush with finished grade of the project.

30 **(C) Backflow Prevention Assembly**

31 Install backflow prevention assembly off the highway right of way or as shown in the
32 plans.

33 Licensed installers shall test and certify RPZ backflow preventer installations. Enclose
34 RPZ backflow prevention assembly above grade in a hot box.

35 Enclose DCV backflow prevention assembly below grade in a precast concrete vault with
36 positive drainage or above grade in a hot box.

37 Install the hot box on a 4 inch thick concrete slab that is 6 inches larger than the box and
38 2 inches to 4 inches above finished grade.

39 **(D) Fire Hydrants**

40 Install fire hydrants outside of the vehicle recovery area of the roadway, adjacent to the
41 right-of-way line or in protected areas.

42 Connect fire hydrants to the main with a 6 inch valve and branch line having at least as
43 much cover as the distribution main. Set hydrants plumb with the pumper nozzle facing
44 the roadway and with the breakaway safety flange between 1 inch and 4 inches above the

1 finished surrounding grade. Except where otherwise approved, place hydrants into
 2 service as soon as practicable. Place at least 7 cf of clean crushed stone around the base
 3 of the hydrant to insure drainage of the hydrant barrel.

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

7 **(E) Line Stops**

8 Provide line stop valves to temporarily shut down the flow in pressurized pipes. Provide
 9 line stops to temporarily dead end a pipeline when there are no available working valves
 10 on the existing piping. Provide line stops with bypass to isolate a section of the existing
 11 pipeline while maintaining the flow.

12 After line stop valves are removed, permanently cap the tapping sleeve and backfill the
 13 entire excavation with compacted select material.

14 **(F) Air Release Valves**

15 Install air release valves at the high point of pressurized pipelines. Place a precast
 16 manhole around air release valves.

17 **(G) Miscellaneous Controls**

18 Install corporation stops with tapping saddles for connecting 2 inches or smaller water
 19 lines to larger water lines. Install corporation stops at 45 ± 10 degrees from vertical on
 20 the larger line.

21 To aid in testing and flushing, install corporation stops at all elevated points along the
 22 pipeline to bleed off all entrapped air.

23 **1515-4 MEASUREMENT AND PAYMENT**

24 *Valves, Water Meters, Fire Hydrants, Line Stops* and other items listed in the pay items will
 25 be measured and paid per each for the appropriate size and type. *Fire Hydrant Leg* will be
 26 paid per linear foot.

27 The term *Relocate* in a pay item means to physically move the existing item, either vertically
 28 or horizontally, using the appropriate materials to place the item into working order.
 29 Measurement and payment will be made per each for the appropriate size and type. When
 30 relocating a fire hydrant, valves will only be paid for if there is no properly functioning
 31 existing valve.

32 No additional compensation will be made for adjustments due to project staging on new or
 33 relocated items.

34 *Reconnect Water Meter* means to transfer or replace the piping from a new water line to
 35 an existing water meter that is not relocated. Measurement and payment for meters will be
 36 made per each.

37 ___" *Water Service Line* will be paid per linear foot for pipes 2 inches or greater.

38 *Water Service Line* will be paid per linear foot for pipes less than 2 inches

39 Valve boxes, meter boxes, hot boxes, vaults and manholes for protecting and servicing utility
 40 controls are incidental to the appropriate pay item.

41 A line stop with bypass consists of installing line stops on opposite ends of the piping to be
 42 isolated, tapping the piping beyond the line stops and providing temporary bypass piping
 43 between the taps. The entire assembly of valves and piping will be measured as one unit and
 44 paid per each.

Section 1520

1 Corporation stops or other items to aid in testing and flushing of the piping are incidental
2 items.
3 If the contract does not include such pay items, measurement will not be done and the items
4 will be incidental to other contract pay items. All piping, controls, certifications,
5 appurtenances and other miscellaneous items necessary to place the new or relocated item in
6 proper working condition are incidental.
7 Payment will be made under:

Pay Item	Pay Unit
___" Valve	Each
___" Tapping Sleeve and Valve	Each
___" Air release Valve	Each
___" Blow Off	Each
___" Water Meter	Each
Relocate Water Meter	Each
Reconnect Water Meter	Each
___" DCV Backflow Prevention Assembly	Each
Relocate ___" DCV Backflow Prevention Assembly	Each
___" RPZ Backflow Prevention Assembly	Each
Relocate ___" RPZ Backflow Prevention Assembly	Each
Fire Hydrant	Each
Relocate Fire Hydrant	Each
___" Line Stop	Each
___" Line Stop with Bypass	Each
Fire Hydrant Leg	Linear Foot
___" Water Service Line	Linear Foot
Water Service Line	Linear Foot

8
9 **SECTION 1520**
10 **SANITARY SEWER**

11 **1520-1 DESCRIPTION**

12 Provide sanitary sewers suitable for transporting sewage.

13 **1520-2 MATERIALS**

14 Refer to Division 10.

Item	Section
Sanitary Sewer Pipe and Fittings	1034

15 Use any pipe specified under Section 1034 except where a particular type pipe is specified in
16 the plans or required by environmental regulations or Departmental policy. Verify the pipe is
17 appropriate for the test pressure of the system and the external loading.

18 Use ductile iron fittings on pressurized (force main) pipelines 4 inches or larger.

19 Use screw type plastic or brass clean-out covers.

20 Use #12 AWG solid-copper wire with green insulation for the utility locator wires.

21 Use 2 inch plastic marking tape colored green with "Caution Sewer Line," or similar wording,
22 permanently printed at 36 inch centers.

23 **1520-3 CONSTRUCTION METHODS**

24 Apply Section 1505 for excavation, trenching, pipe laying and backfill to sanitary sewer
25 installation.

26 Assemble pipe in accordance with the recommendations of the manufacturer.

- 1 Install PVC pipe in accordance with approved bedding methods.
- 2 Install vitrified clay sewer pipe in accordance with ASTM C12.
- 3 Install 4 inch minimum diameter sanitary sewer clean-outs flush with finished grade on 4 inch
4 and 6 inch service lines. Provide clean-outs at the right-of-way line and at changes in
5 direction. Do not locate clean-outs within the roadway pavement or shoulders. Provide
6 clean-outs no more than 50 feet apart when beyond the roadway shoulders.
- 7 Use ductile iron pipe for sewers with 10% or greater slope.
- 8 Install sewer lines entering manholes with the crown at or higher than the sewer line leaving
9 the manhole.
- 10 Install small diameter pipe (4 inches or less) under existing pavement by a trenchless method
11 at no additional compensation.

12 **(A) Gravity Sanitary Sewer**

13 Construct gravity sanitary sewers in conformance with *NCDEQ Gravity Sewer Minimum*
14 *Design Criteria*.

15 (1) Pipe Installation

16 Use fittings or saddles to connect service lines to the sewer main.

17 Maintain sewer flow at all times. Use temporary diversions or pumping to maintain
18 flow when connecting proposed sewers to existing sewers. Use engineered
19 temporary pumping systems capable of handling full pipe flow. Use pumping
20 systems with automatic reliable operation or constantly tended manual operation.

21 (2) Testing

22 Perform tests on newly installed sewers and altered sewers before placing into
23 service. Provide all equipment, piping, controls, pumps, water and safety devices
24 necessary for performing the tests.

25 Test all 24 inches and smaller gravity sewer lines for leakage using infiltration,
26 exfiltration, or air test. Perform visual inspection on gravity sewer lines larger than
27 24 inches. Perform line and grade testing and deflection testing on all gravity sewer
28 lines.

29 (a) Infiltration

30 For sewer lines greater than 3 feet below groundwater, measure the amount of
31 water infiltrating into the pipeline between manholes in at least 24 hours. Repair
32 leaks or replace piping when the rate of infiltration exceeds the following
33 equation:

$$W = 0.000789LD$$

Where:

- W** = maximum allowable leakage in gallons per hour
L = length of pipeline tested, in feet
D = nominal diameter of the pipe, in inches

34 (b) Exfiltration

35 For sewer lines above groundwater, perform an exfiltration test on the pipeline
36 between manholes. Repair leaks or replace piping when the rate of exfiltration
37 exceeds maximum allowable leakage calculated in Subarticle 1520-3(A)(2)(a).

38 The exfiltration test shall consist of securely plugging the pipe at the lower
39 manhole and filling the pipeline with water. Allow the water to sit for 24 hours
40 in clay or concrete pipes. Raise the water level in the upstream manhole

Section 1520

1 to 3 feet above the top of pipe. After 4 hours, measure the amount of water
2 required to bring the water level back to the level at the start of the test and
3 record the time.

4 Perform exfiltration tests through a series of manhole to manhole segments to
5 limit the length of pipe tested to between 300 feet and 1,500 feet. Shorter
6 sections may be tested with longer test times. No additional leakage allowance
7 for manholes permitted.

8 (c) Air Test

9 Instead of hydrostatic testing, sewer lines 24 inches in diameter or smaller may
10 be air tested in accordance with ASTM C828, ASTM C924 and the following.
11 Securely plug the sewer pipe at the manholes. Fill the pipe with air to 4.0 psi
12 and hold this pressure for 5 minutes. Reduce the pressure to 3.5 psi. Measure
13 the time for the pressure to drop 1.0 psi to the new pressure of 2.5 psi. Exceed
14 the minimum test time in Table 1520-1 for the appropriate nominal pipe
15 diameter.

Pipe Size (Inches)	Test Time (Minutes/100 ft)	Pipe Size (Inches)	Test Time (Minutes/100 ft)
8	1.2	18	2.4
10	1.5	21	3.0
12	1.8	24	3.6

16 (d) Visual Inspection

17 Visually inspect sewer lines larger than 24 inches from the inside using
18 approved cameras. Correct any leakage, rolled gaskets or defects.

19 (e) Line and Grade

20 Test all sewers for straight alignment by lamping or using a laser.

21 (f) Deflection Testing

22 Perform deflection tests on all flexible pipes. Conduct the test after the final
23 backfill has been in place at least 30 days to permit stabilization of the soil-pipe
24 system. As an alternative to waiting 30 days to permit stabilization of the
25 soil-pipe system, provide certified soil testing verifying the backfill of the trench
26 has been compacted to at least 95% maximum density.

27 No pipe shall exceed a deflection of 5%. If deflection exceeds 5%, relay the
28 pipe.

29 The rigid ball or nine-point mandrel used for the deflection test shall have
30 a diameter not less than 95% of the base inside diameter or average inside
31 diameter of the pipe depending on which is specified in the ASTM, to which the
32 pipe is manufactured. The pipe shall be measured in compliance with
33 ASTM D2122. The test shall be performed without mechanical pulling devices.

34 (B) Force Main Sanitary Sewer

35 Construct force main sewers in conformance with *NCDEQ Minimum Design Criteria for*
36 *the Fast-Track Permitting of Pump Stations and Force Mains.*

37 (1) Installation

38 Install lines with 36 inches to 42 inches of cover to finished grade unless otherwise
39 directed or approved. Install lines with greater cover for short distances to
40 accommodate utility controls, to make tie-ins to existing facilities, to eliminate high

1 points in the pipeline or to provide clearance from existing or proposed utilities,
 2 drainage, other obstacles or actual field conditions.

3 Provide automatic air release valves at all high points.

4 (2) Testing

5 Perform pressure and leakage tests on newly installed force mains and altered sewers
 6 before placing such pipelines into service. Provide all equipment, piping, controls,
 7 pumps, water and safety devices necessary for performing the tests and sterilization.

8 Test all new sewer force mains with clean water at 200 ± 5 psi for a 2 hour duration.
 9 Vent all high points and expel all air. Provide certified results demonstrating leakage
 10 less than:

$$W = 0.000106LD$$

Where:

- W** = allowable leakage in gallons per hour
- L** = length of pipeline tested, in feet
- D** = nominal diameter of the pipe, in inches

11 Repair leaks using approved methods or replace pipe, controls or appurtenances as
 12 necessary to reduce leakage. Additionally, repair any leaks that are visible after
 13 2 hours duration.

14 **1520-4 MEASUREMENT AND PAYMENT**

15 ___" *Sanitary Gravity Sewer* and ___" *Force Main Sewer* will be measured from end to end in
 16 place with no deduction for length through manholes, valves or fittings and paid per linear
 17 foot for the appropriate size. Where two different sizes enter or go from a manhole, each size
 18 will be measured to the center of the manhole. Unless otherwise shown in the plans, branch
 19 connections, ells or other fixtures will be included in the length measurement. All fittings will
 20 be incidental on *Sanitary Gravity Sewer*.

21 *Sanitary Sewer Clean-Out* will be measured and paid per each.

22 *Sewer Service Line* will be paid per linear foot.

23 The quantity of *Ductile Iron Sewer Pipe Fittings* will be measured and paid per pound based
 24 on the published weights for ductile iron fittings, exclusive of the weights of any accessories,
 25 as listed in the "DI Fittings Weight Chart" located on the Utilities Unit web site. If the
 26 Contractor elects to use compact ductile iron sewer pipe fittings, measurement will be based
 27 on the weight of standard size ductile iron sewer pipe fittings. Any fitting not listed will be
 28 measured based on the published weights for ductile iron fittings listed in ANSI/AWWA C-
 29 110/A21.10. This is limited to pressure pipe 4 inches or larger.

30 Payment will be made under:

Pay Item	Pay Unit
___" Sanitary Gravity Sewer	Linear Foot
___" Force Main Sewer	Linear Foot
Sanitary Sewer Clean-Out	Each
Sewer Service Line	Linear Foot
Ductile Iron Sewer Pipe Fittings	Pound

Section 1525

**SECTION 1525
UTILITY MANHOLES**

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1525-1 DESCRIPTION

Provide utility manholes on water and sanitary sewer lines.

1525-2 MATERIALS.

Refer to Division 10.

Item	Section
Brick	1040-1
Concrete Block	1040-2
Curing Agents	1026
Gray Iron Castings	1074-7(B)
Grout, Type 2	1003
Mortar	1040-9
Portland Cement Concrete	1000
Precast Concrete Units	1077
Reinforcing Steel	1070
Select Materials	1016
Steps	1074-8
Structural Steel	1072

Use precast concrete manholes with monolithic bottoms which conform to ASTM C478, AASHTO M 199 and are as shown in the plans or in *Roadway Standard Drawings*. Use ASTM C443 gaskets or AASHTO M 198 flexible sealants for joints between precast manhole sections. Use resilient connectors for piping conforming to ASTM C923. Use ASTM A48, Class 35 cast iron or Grade 60 steel reinforcement steps with polypropylene plastic coating.

Use manhole frames and covers made of cast iron conforming to ASTM A48 Class 35, which are traffic bearing, have machined contact surfaces and are sized as shown. Use covers with two 1 inch diameter air vents for vented manholes and use solid, non-vented covers with gaskets for watertight installation. Use covers with "Sanitary Sewer" or "Water" cast in large letters as appropriate for the type of utility.

Use Type 2 grout with properties that meet Table 1003-2 in the *Grout Production and Delivery* provision except provide grout with a plastic consistency in accordance with ASTM C1107.

1525-3 CONSTRUCTION METHODS

Apply Section 1505 for excavation, trenching, pipe laying and backfill.

Make connections of pipe to manholes in cored or precast holes using a resilient connector. Use horseshoe type holes only when approved. For horseshoe type holes wrap the pipe with a butyl rubber gasket and fill the space between the pipe and manhole with a non-shrinking grout.

Provide an outside drop assembly on manholes for sewer pipes entering with 2.5 feet or more vertical drop. Inside drop assemblies may be used for connections to existing manholes when the drop exceeds 5 feet and the manhole diameter is greater than 4 feet.

In sewer manholes over 3 feet in depth, provide steps spaced 16 inches on center. Install steps in line with the effluent opening unless otherwise specified.

Construct invert channels to confine and direct the flow through sanitary sewer manholes. 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.

- 1 On deep manholes, a transition type manhole may be used provided there is at least 6 feet
 2 from the manhole bench to the transition cone.
- 3 Construct manholes with the top of the cover as shown in Table 1525-1.

TABLE 1525-1 MANHOLE CONSTRUCTION	
Location	Top height above finished grade
Roadway pavement, Driveways, Sidewalks, Parking lots	Flush \pm 1/4"
Vehicle Recovery Area	Flush \pm 3"
Manicured Areas, such as lawns	Flush to + 2" with concrete pad
Flood Zones less than 3 ft above finished grade	1 ft above 100 year flood elevation
Flood Zones greater than 3 ft above finished grade	2 ft above finished grade with watertight frame and cover and vent pipe to 1 ft above 100 year flood
Other areas	2 ft above finished grade

- 4 For manholes installed before finished grading or paving, construct the top flush with the
 5 current grade to provide access during all phases of construction and adjust as grading and
 6 paving work progresses in accordance with Section 858.

7 **(A) Cast-In-Place Concrete, Brick and Block Masonry**

- 8 Construct concrete manholes in accordance with Section 825 with an ordinary surface
 9 finish. Construct brick masonry in accordance with Section 830. Furnish and place
 10 reinforcing steel in accordance with Section 425. Construct block masonry in accordance
 11 with Section 834 except that reinforcing will not be required.

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

14 **(B) Installation of Precast Units**

- 15 Assemble precast manhole units in accordance with the manufacturer's instructions and
 16 grout together to form a sound structural unit. Fill all lifting holes with grout. Where it is
 17 necessary to use cast-in-place, brick masonry or block masonry construction as part of the
 18 structure, apply Subarticle 1525-3(A) to such construction.

19 **(C) Fittings and Connections**

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

- 22 Make pipe connections so that the pipe does not project beyond the inside wall of the
 23 manhole and grout smooth and uniform surfaces on the inside of the manhole.

- 24 Set metal frames for covers in full mortar beds and mechanically secure by an approved
 25 method.

26 **(D) Testing**

- 27 Vacuum test all manholes before grouting and backfilling. Test according to
 28 ASTM C1244.

29 **1525-4 MEASUREMENT AND PAYMENT**

- 30 The height of the manhole will be measured and paid to the nearest tenth of a foot from the
 31 inside bottom (invert) of the manhole to the final finished top of the manhole ring.

- 32 Utility manholes will be measured and paid by appropriate diameter per each for manholes of
 33 0 to 6 feet height and per linear foot of height over 6 feet. Adjustment of existing manholes

Section 1530

1 will be measured and paid in accordance with Article 858-4. Drop assemblies will be
2 incidental to the work being performed.

3 Payment will be made under:

Pay Item	Pay Unit
___' Dia Utility Manhole	Each
Utility Manhole Wall ___' Dia	Linear Foot

4 **SECTION 1530**
5 **ABANDON OR REMOVE UTILITIES**

6 **1530-1 DESCRIPTION**

7 Abandon or remove utility facilities.

8 **1530-2 MATERIALS**

9 Refer to Division 10.

Item	Section
Flowable Fill	1000-6
Portland Cement Concrete	1000
Select Materials	1016

10 **1530-3 CONSTRUCTION METHODS**

11 Apply Section 1505 for excavation, trenching, pipe laying and backfill.

12 **(A) Abandoning Pipe**

13 Abandon utility pipes shown in the plans or designated by the Engineer by emptying the
14 pipeline contents and plugging the ends with grout or flowable fill. Prepare grout to
15 a consistency that will flow and be vibrated in order for the mix to flow uniformly into
16 the pipe to be filled. Use the construction methods in Article 340-3.

17 Fill or remove the following abandoned utility pipes:

- 18 (1) Pipe larger than 24 inches.
- 19 (2) Pipe located within the roadway typical section or the project slope stake line and
20 one of the following:
 - 21 (a) Pipe 12 inches to 24 inches diameter located less than 20 feet below finished
22 grade.
 - 23 (b) Pipe 6 inches to 12 inches diameter located less than 12 feet below finished
24 grade and not made of cast iron, ductile iron, HDPE or PVC.
 - 25 (c) Located below groundwater table that could become a conduit for water
26 movement.

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

30 Fill abandoned pipe with grout or flowable fill to at least 90% full or completely when on
31 railroad right of way.

32 Remove any abandoned utility pipe exposed by grading operations to a minimum depth
33 of 12 inches below subgrade elevation of the proposed roadbed or completed grading
34 template.

35 Plug all abandoned utility pipes. Use grout to plug all abandoned utility pipes at the
36 entrance to all manholes whether the manhole is to be abandoned or not. Use grout to

1 plug all abandoned water mains after new mains are placed in service. Abandon valves
 2 by removing valve box and backfilling with approved material.

3 **(B) Abandoning Manholes**

4 Abandon utility manholes in the construction limits by removing the top of the manhole
 5 to the manhole spring line or to an elevation of 2 feet below the roadway subgrade,
 6 whichever is greater and filling the manhole barrel with approved material.

7 Plug connecting utility pipes before filling or removing the manhole.

8 Remove the manhole taper, wall and base on all manholes to be removed.

9 Removed frames and covers become the property of the Contractor for proper disposal.

10 **(C) Remove Water Meter**

11 Remove water meters by disconnecting and plugging the water service piping at the
 12 source main and plugging the piping at the right-of-way line. Return the meter to the
 13 utility owner. Dispose of all other parts, piping and boxes.

14 **(D) Remove Fire Hydrant**

15 Remove fire hydrants by disconnecting and plugging the hydrant leg piping as close to
 16 the water main as possible. If the hydrant valve is within 4 feet of the main, close the
 17 valve, plug the outlet side of the valve and remove the valve box.

18 Removed hydrants become the property of the Contractor for proper disposal.

19 **1530-4 MEASUREMENT AND PAYMENT**

20 Utility pipe that is abandoned by filling or removal will be measured and paid by the linear
 21 foot for the size of pipe. Utility pipe that is abandoned by plugging the ends only and leaving
 22 in place will not be measured or paid. Abandoned valves will not be measured and paid.
 23 Grout used for plugging of abandoned utility pipe is incidental to the work being performed.
 24 Utility pipe that is removed by other work of the contract will be incidental to the other work.

25 *Abandon Utility Manhole* will be measured and paid per each.

26 *Remove Utility Manhole* will be measured and paid per each.

27 *Remove Water Meter* and *Remove Fire Hydrant* will be measured and paid per each.

28 Payment will be made under:

Pay Item	Pay Unit
Abandon ___" Utility Pipe	Linear Foot
Abandon Utility Manhole	Each
Remove Utility Manhole	Each
Remove Water Meter	Each
Remove Fire Hydrant	Each

29 **SECTION 1540**
 30 **ENCASEMENT**

31 **1540-1 DESCRIPTION**

32 Furnish and install encasement or casing pipes. For the purposes of this specification the
 33 words encasement, casing, encasement pipe and casing pipe are interchangeable.

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1 **1540-2 MATERIAL**

2 Refer to Division 10.

Item	Section
Concrete Pipe	1034-3
Flowable Fill	1000-6
Grout	1003
PVC Pipe	1034-2
Select Materials	1016
Steel Encasement Pipe	1036-4(B)
Treated Timber	1082-3
Clay Pipe	1034-1

3 Other pipe as designed by an engineer licensed by the State of North Carolina.

4 Submit material certifications and obtain approval from the Engineer before installation.

5 **1540-3 CONSTRUCTION METHODS**

6 **(A) Open Cut**

7 Apply Section 1505 for excavation, trenching, pipe laying and backfill.

8 **(B) Welding**

9 Weld in accordance with Article 1032-5.

10 **(C) Encasements for Future Use**

11 Mark encasements for future use with a treated wooden marker post. Place wooden
12 marker post at the right of way or at the ends of encasements if encasements extend
13 beyond the right of way. Encasements 24 inches and larger require certification of
14 durability and a design life of 100 years.

15 **(D) Carrier Pipe Installation**

16 Install carrier pipe through casing using spacers or insulators to support the carrier pipe.
17 Place spacers at intervals sufficient to support the carrier pipe without sagging. Install
18 spacers sized to raise the carrier pipe bells above the encasement pipe invert.

19 Seal ends of casing with concrete, brick or other approved materials. Ensure drainage of
20 encasement by leaving a 1 inch diameter weep hole in the seal of the lower end of the
21 encasement.

22 **(E) Casing Pipe Fill**

23 Pump or place flowable fill; grout; or Class III, Class IV or Class V select materials into
24 the annular void between the carrier pipe and casing pipes 24 inches or larger.
25 Otherwise, certification of durability and a design life of 100 years is required.

26 **1540-4 MEASUREMENT AND PAYMENT**

27 ___" *Encasement Pipe* will be measured from end to end and paid at the contract unit price per
28 linear foot for each size.

29 Payment will be made under:

Pay Item	Pay Unit
___" Encasement Pipe	Linear Foot

SECTION 1550
TRENCHLESS INSTALLATION OF UTILITIES

1550-1 DESCRIPTION

Install pipe using a trenchless method. Pipe refers to the specified pipe, which may be the primary carrier pipe or an encasement pipe. Shoring means the earth support system used for installing the pipe. The terms for encasement, casing, encasement pipe and casing pipe are interchangeable.

An engineer licensed by the State of North Carolina shall design the method and certify the work will not damage the roadway above or endanger the roadway user.

1550-2 MATERIAL

Refer to Division 10.

Item	Section
Concrete	1000
Encasement Pipe	1540
Flowable Fill	1000-6
Structural Timber	1082
Structural Steel	1072
Treated Timber	1082-3

Use pipe joints that are modified to suit the installation method. Provide engineering calculations for piping and shoring. Submit material certifications and obtain approval from the Department's Engineer before installation.

Use steel or concrete liner plates. Steel tunnel liner plates shall meet Sections 16 and 25 in *AASHTO LRFD Bridge Design Specifications*. Concrete liner plates shall meet AASHTO specifications.

Drilling fluids consist of water, bentonite and polymer additives.

Other materials will be considered with adequate design and quality control.

1550-3 CONSTRUCTION METHODS**(A) General**

Apply Section 1505 for excavation, trenching, pipe laying and backfill.

Install the pipe to the lines and grades shown in the plans. Use workers that are skilled in the method of construction. Construct with good workmanship by skilled workers along with proper safety precautions.

Locate ends of trenchless construction and pits beyond the vehicle recovery area of the roadway. The vehicle recovery area may be reduced using acceptable traffic control methods.

(B) Design

Contract plans will show a trenchless method including but not limited to length, profile and bore pit locations based on available information. The Contractor's design shall confirm this method is appropriate for the field conditions and for the specified pipe. Subsurface information in the vicinity of the trenchless installation may be available in accordance with Section 102-7.

Assess soil conditions expected during trenchless operations.

Design the method to minimize the vertical movement of the pipe or the completed roadway section. Use methods of construction and installation that will not disturb the soils outside of the immediate vicinity of the pipeline or pits.

Section 1550

1 Before construction, provide detailed plans for the method of installation certified by
2 an engineer licensed by the State of North Carolina. Provide certified calculations
3 demonstrating the method of installation as safe and of minimal risk. Provide certified
4 calculations of the structural adequacy of all materials. The design shall meet
5 *AASHTO LRFD Bridge Design Specifications*. An engineer licensed by the State of
6 North Carolina shall certify changes or modifications to the designed method as needed
7 for actual field conditions.

8 (C) Water Control

9 Provide groundwater control and removal as appropriate for the method of excavation
10 and installation. Remove the groundwater using an engineered dewatering system
11 provided in the design submittal. Keep surface waters out of the excavation and pits.

12 (D) Shoring

13 Provide temporary or permanent shoring, as needed. Provide temporary shoring to
14 maintain the hole or pit excavation for the duration of the work. Casing pipe 24 inches
15 and larger, tunnel liner, and shoring that is not certified for permanent use is considered
16 temporary. Fill the annular space between the specified pipe and temporary shoring.
17 Provide permanent shoring when desired or specified to maintain the open hole for an
18 indefinite time. Permanent shoring requires certification of durability and a design life of
19 100+ years.

20 Fill all voids around the excavation and shoring with structural fill material as work
21 progresses.

22 Either work continuously (24 hours/day and 7 days/week) on the operations from the
23 time the excavation begins through the filling of voids or use an engineered system for
24 shoring the excavation during work stoppage.

25 (E) Pre-Construction Meeting

26 The Contractor shall conduct a pre-construction meeting with the Department's Engineer
27 to review the proposed method for installation of the pipe. Conduct the meeting at least
28 48 hours before beginning installation. The meeting shall consist of, but is not limited to:

- 29 (1) Presentation of the construction methods for understanding by all involved,
- 30 (2) Presentation of methods for filling any potential voids around the pipe,
- 31 (3) Demonstrating that appropriate equipment and materials are on site,
- 32 (4) Providing a progress schedule, and
- 33 (5) Demonstrating ability to react to failures or roadway settlement or heave.

34 1550-4 TRENCHLESS METHODS

35 (A) Bore and Jack

36 For bore holes up to 6 inches in diameter in stable ground, the hole may be augured and
37 the pipe pushed or jacked through the cleaned out hole. For bore holes greater than 6
38 inches, provide continuous support of the hole by simultaneously jacking the pipe or
39 casing into the hole.

40 Use equipment suitably sized and designed to simultaneously bore or drill the soil or rock
41 while pushing or jacking pipe on a controlled grade. Position the cutter head within one
42 diameter of the leading edge of the pipe. In cohesive, dense and dry soils and rock,
43 position the cutter head in front of the leading edge. In non-cohesive or loose soils,
44 position the cutter head inside the pipe.

1 Dry bore only, do not use jetting or wet boring methods. Use drilling fluids only on the
2 outside of pipe for lubrication or hole stabilization.

3 Minimize over bore, match cutter diameter to the outside diameter of the encasement
4 pipe. Limit overbore to the O.D. + 2 inches.

5 Provide steering controls as necessary to maintain line and grade.

6 If conditions allow and with the approval of the Engineer, the Contractor may elect to use
7 the pipe ramming method in lieu of bore and jack. Payment for the pipe ramming
8 method will be paid as bore and jack.

9 **(B) Directional Drilling**

10 For drilled holes up to 6 inches in diameter in stable ground, the hole may be drilled and
11 reamed followed by pulling the pipe into the hole within 8 hours. For drilled holes
12 greater than 6 inches, simultaneously pull the pipe or casing into the hole as reaming
13 occurs

14 When under pavement or within a one horizontal to one vertical distance from pavement,
15 maintain the depth of cover in Table 1550-1.

TABLE 1550-1 DEPTH OF COVER FOR DIRECTIONAL DRILLING	
Drilled Hole Diameter	Minimum Depth of Cover
2" to 6"	6 ft
> 6" to 15"	12 times the hole diameter
> 15" to 36"	15 ft

16 Begin bores at locations that allow transitioning the bore to meet the above depths.

17 Use drilling fluids as appropriate for the type soils. Pump drilling fluids only while
18 drilling or reaming. Monitor flow rates to match the amount leaving the bore hole. Do
19 not increase pressure or flow to free stuck drillheads, reamers or piping.

20 Limit drilled or reamed holes to 1.5 x O.D. for pipe 12 inches or less and O.D. + 6 inches
21 for pipes larger than 12 inches.

22 **(C) Tunneling**

23 Tunnel using hand mining, mechanical excavation, tunnel boring machine (TBM),
24 microtunneling, or other accepted tunneling method. Use tunnel shields or fore poling
25 along with benched excavation and breast boarding as appropriate for the field
26 conditions. Alternatively, the Contractor's engineer may certify that the soils are
27 self-supporting of the dead and live loads and design tunneling methods as appropriate.

28 Provide active support to the tunnel walls. Shore tunnel walls using liner plates, steel ribs
29 with lagging or other engineered method or by jacking piping into place.

30 Limit over excavation to 2 inches larger than the liner or shield. Grout the external voids
31 as work progresses and as specified by the Contractor's engineer.

32 **(D) Pipe Ramming**

33 Use pipe ramming only where soils are homogeneous and free of rock, boulders, stumps
34 and debris. Do not use in the vicinity of quick or liquefiable soils.

35 Steel bands 1/2 inch thick are allowed on the outside of the leading edge of the pipe or
36 casing to oversize the hole to reduce friction. Steel bands 1/2 inch thick may be used on
37 the inside to compact the spoil and to prevent plugging.

38 Install at the following minimum depth of cover.

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Pipe or Casing Diameter	Minimum Depth of Cover
2" to 6"	4 ft
> 6" to 14"	6 pipe diameters
>14" to 72"	8 ft

1 Contain spoil within the casing during ramming. After completion, use compressed air or
2 augers to remove the spoil. Clean the interior using a pig. Provide appropriate safety
3 devices. Limit air pressure to less than the rating of the pipe or casing.

4 Use lubricants and surfactants as needed and ensure vibration induced consolidation of
5 soils does not result in settlement greater than 0.02 feet.

6 **(E) Other Methods**

7 Other methods will be considered on a case by case basis when thoroughly engineered.

8 **(F) Lubrication and Drilling Fluids**

9 Use drilling fluids for lubrication. Do not use water alone.

10 **1550-5 QUALITY CONTROL**

11 The Contractor, at no cost to the Department, shall replace or repair damaged or defective
12 installations. The method to be used shall be designed by the Contractor's engineer and
13 approved by the Engineer.

14 **(A) Ground Movement**

15 Before excavation, establish control points for measuring vertical movement of the road
16 at 10 feet intervals along the centerline and 10 feet each side of the pipeline. A land
17 surveyor licensed in the State of North Carolina shall monitor these points daily until
18 construction is complete.

19 Cease trenchless operations when measured movement exceeds 0.02 feet. Determine
20 cause of settlement and repair as necessary. Modify trenchless methods as needed.

21 **(B) Leakage**

22 Limit leakage through tunnel walls to minor seepage. All leaks in pipes, casing or other
23 permanent shoring shall be sealed.

24 **(C) Roundness**

25 Provide permanent shoring maintaining at least 95% of nominal diameter in all
26 directions.

27 **(D) External Voids**

28 Fill all external voids greater than 2 inches high or 2 feet wide. Fill with flowable fill,
29 grout or Class II or III select material.

30 **1550-6 MEASUREMENT AND PAYMENT**

31 *Bore and Jack of ___*” will be measured and paid in linear feet. Measurement will be made
32 horizontally to the nearest tenth of a linear foot.

33 *Directional Drilling of ___*” will be measured and paid in linear feet. Measurement will be
34 made horizontally to the nearest tenth of a linear foot.

35 *Tunneling of ___*” will be measured and paid in linear feet. Measurement will be made
36 horizontally to the nearest tenth of a linear foot.

37 Measurement will be made along utility pipes with required trenchless installation. Payment
38 for trenchless installation will be made as additional compensation for utility piping with

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1 contract pay items of the various sizes. No additional payment will be made for access pits or
2 shoring required for the installation. Shoring required for the maintenance of traffic or the
3 protection of building or other structures, on or off the right of way, shall be paid under
4 *Temporary Shoring*. No payment will be made for abandoning defective installations.

5 Payment will be made under:

Pay Item

Bore and Jack of ____”
Directional Drilling of ____”
Tunneling of ____”

Pay Unit

Linear Foot
Linear Foot
Linear Foot