Item No. 304
Manholes

304.1 Description

This item shall govern construction of manholes complete in place for lines smaller than 18-inches, lines 18-inches and greater in diameter shall utilize polymer concrete manholes, covered under Item No. 303. This item shall also govern the materials used therein, including excavation, installation, backfilling and surface restoration. It shall also include furnishing and installing rings, covers, coatings, and appurtenances, as well as any incidental work including pumping and drainage necessary to complete the work. Wastewater manholes shall be 'acceptance tested' by the Contractor.

Items contained in the SPL cannot be substituted for items shown on the Drawings, or called for in the specifications, or specified in the Bidding Requirements, Contract Forms and Conditions of Contract, unless approved by the Engineer or designated representative. The Standard Product List current at the time of plan approval will govern.

304.2 Standards

Comply with local governing regulations if more stringent than specified herein. Manholes shall meet the following standards (latest edition).

A. ASTM International (ASTM) Standards:

ASTM C478	Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
ASTM C443	Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C923	Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
ASTM D4787	Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates
ASTM D4976	Standard Specification for Polyethylene Plastics Molding and Extrusion Materials
ASTM D6132	Standard Test Method for Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Using an Ultrasonic Coating Thickness Gage
ASTM D7234	Standard Specification for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers

304.3 Quality Assurance

Applicators of coatings to the interior surfaces of wastewater manholes, as specified in shall be listed on the New Braunfels Utilities Standard Products Lists (SPLs). Individual(s) setting up and operating equipment to core through the walls of existing manholes or junction boxes shall have experience in coring similar size holes through the walls of similar size and type structures on at least ten (10) projects (or 15 manholes) in New Braunfels' jurisdiction in the last 5 years.

304.4 Submittals

The submittal requirements of this specification item must include:

A. Products and Materials

The Contractor shall submit descriptive information and evidence that the materials and equipment the Contractor proposes for incorporation in the Work are of the kind and quality that satisfies the specified functions and quality as specified or presented in the Drawings. The New Braunfels Utilities Standard Products Lists (SPLs) form a part of the Specifications for the Work. Contractors may, when appropriate, elect to use products from the SPL; however, submittal to the Engineer or designated representative shall still be required. If the Contractor elects to use any materials from these lists, each product shall be completely and clearly identified by its corresponding SPL number, when making the product submittal. This will expedite the review process in which the Engineer or designated representative decide whether the products meet the Contract requirements and the specific use foreseen by the Engineer or designated representative in the design of this engineered Project.

The products included in the SPLs current at the time of plan approval shall govern, unless a specific product or products on the lists have subsequently been removed from those SPLs because of quality or performance issues. Products and materials that are not covered by SPLs shall meet the requirements in the contract documents.

Submittals for the products and materials covered by this specification shall include manufacturer catalog sheets, technical data sheets, shop drawings, product or material test results, requirements listed below, and any other information needed to adequately describe the product or material. For products covered by SPLs, the submittal shall include a copy of the applicable SPL with the proposed product identified. An SPL by itself is not considered an adequate submittal.

The submittal requirements of this specification item include:

1. For pre-cast manholes and junction boxes: shop drawings for each structure showing, at a minimum, the Project and Contractor's name: manufacturer's name and plant location; applicable specifications; list of materials (such as adjusting rings, boots, gaskets, and pre-cast sections) by type and quantity; elevation view showing diameter or size, ring and cover size and elevation, ring type (bolted or unbolted, flared top or flared bottom) wall thickness, elevations of transitions from large diameter sections to smaller diameter sections, base width and thickness, total depth, size of openings, reinforcement, and length of each pre-cast section; structure identification number and station location; pipe line identification; pipe material and size; pipe flowline elevations; plan view showing azimuthal orientation (based on 360 degrees clockwise) of the pipes relative to the outflow pipe; technical data sheets covering pipe-to-manhole or pipe-to-junction box connectors, and gaskets.
2. For cast-in-place manholes and junction boxes: formwork drawings sealed by a registered Professional Engineer licensed in the State of Texas with documented experience in formwork design for wall pours that exceed four (4) feet in height and slabs that are not ground supported.
3. For hydraulic cement concrete; mix components and proportions, material sources, materials test results.
4. For mortar: mix components and proportions, material sources, materials test results.

5. For non-shrink grout: technical data sheet indicating ASTM type and containing instructions on surface preparation, mixing, placing, and curing procedures.
6. For wastewater manhole coatings and linings: technical data sheets that include instructions on surface preparation, mixing, placing, and curing procedures; technical data sheets for coating thickness measuring equipment and for holiday detection test equipment.
7. For connections to existing manholes or junction boxes: details showing the size, location, and method of removal of the wall section, including any temporary supports attached to the manhole or junction box wall; details showing the location of existing joints, other connecting pipes, and other features that penetrate or attach to the wall; and technical data sheets covering the pipe-to-manhole or pipe-to-junction box connectors.

B. Acceptance Test Records

Submittal of acceptance test records is required for wastewater manholes and shall include as a minimum the following items:

1. Name of manhole manufacturer
2. Interior surface coating type and application method.
3. Model and manufacturer of vacuum tester.
4. Date tested/date re-tested.
5. Indication of whether test passed or failed and statement of corrective action taken if test failed.
6. Test Method Used.
7. Location/station of manhole.
8. Type of base: Precast/cast-in-place.
9. Type of repairs made to the joints.

The test records shall also be included as part of the Project records turned in with acceptance package.

C. Acceptance Test Records

The Contractor shall submit evidence that the individual(s) setting up the equipment and coring through the walls of manholes and junction boxes are experienced with the equipment and procedures and have successfully cored through the same types of materials using the same types of equipment.

304.5 Materials and Components

A. Concrete and Cement Stabilized Sand

All concrete shall conform to TXDOT Standard Specification Item No. 421, "Hydraulic Cement Concrete". The cast in place concrete shall be Class A, and the precast concrete manhole base sections, riser sections and appurtenances shall conform to the requirements of ASTM C478/C478M, with Class I concrete. All interior surfaces of wastewater manholes shall receive a coating by an application method acceptable to the Engineer or designated

representative or shall be otherwise acceptably protected from the acidic effects of municipal wastewater. Concrete for backfill of over-excavated areas shall be Class A or Class J as indicated on the Drawings. Cement stabilized sand for bedding or backfilling, when indicated or required on the Drawings, shall contain two (2) bags of Portland Cement per cubic yard. The sand shall meet the requirements for "Fine Aggregate" in TXDOT Standard Specification Item No. 421, "Hydraulic Cement Concrete".

B. Mortar

The mortar shall be composed of one part Portland cement, one part masonry cement (or 1/4 part hydrated lime), and sand equal to 2-1/2 to 3 times the sum of the volumes of the cements and lime used. The sand shall meet the requirements for "Fine Aggregate" as given in TXDOT Standard Specification Item No. 421, "Hydraulic Cement Concrete".

C. Reinforcement

The reinforcing steel shall conform to the requirements of TXDOT Standard Specification Item No. 440, “Reinforcement for Concrete”. Secondary, non-structural steel in cast-in-place wastewater manholes may be replaced by collated fibrillated polypropylene fibers, if approved by the Engineer or designated representative.

D. Rings and Covers

Rings and covers shall conform to the requirements of Standard Specification Item No. 312, “Frames, Grates, Rings and Covers”.

1. Replacement Rings and Covers, 24 in. Diameter Lids.

   This ring and cover shall be used for the replacement of broken rings and covers, minor manhole adjustment, or as otherwise directed by the Engineer or designated representative.

3. Rings and Covers, 32 in. Diameter Lids.

   This ring and cover shall be used for all new manhole construction and major manhole adjustment, except as otherwise directed by the Engineer or designated representative.

E. Bulkheads.

Bulkheads shall meet the requirements of Standard Specification Item No. 507 “Bulkheads”

F. Precast Base Sections, Riser Sections, and Cones.

Precast concrete base sections, riser sections, and cones shall conform to the requirements of ASTM C478. The width of the invert shall be specifically sized for the connecting pipes. Inverts shall be “U” shaped with a minimum depth of three fourths of the largest pipe diameter. Where lines enter the manhole up to 24 inches above the flowline of the outlet, the invert shall be filleted to prevent splashing and solids deposition. A drop pipe shall be provided for a sewer entering a manhole at more than 24 inches above the flowline of the outlet.

Joints for wastewater base sections, riser sections, and cones shall conform to the requirements of ASTM C443. Precast bases for 48 inch inside diameter manholes shall have preformed inverts. Inserts acceptable to the Engineer or designated representative shall be embedded in the concrete wall of the manhole sections to facilitate handling; however, through-wall holes for lifting will not be permitted. Any voids between the pipe and

boot shall be filled to the springline with a product recommended by the manhole manufacturer to prevent solids collection.

G. Precast Junction Boxes.

Precast junction boxes shall be allowed only where indicated on the Drawings or acceptable to the Engineer or designated representative. Joints for wastewater junction boxes shall conform to the requirements of ASTM C443.

H. Pipe-to-Manhole/Junction Box Assemblies

Precast bases and precast junction boxes shall have flexible, resilient and non-corrosive boot connectors or ring waterstops acceptable to the Engineer or designated representative conforming to the requirements of ASTM C923 on all wastewater pipe connections.

I. Precast Flat-Slab Transition/Junction Box Lids.

Precast slab transitions and lids shall be designed to safely resist pressures resulting from loads which might result from any combination of forces imposed by an HS-20 loading as defined by the American Association of State Highway and Transportation Officials (AASHTO). The joints of precast slab transitions and of lids for wastewater applications shall conform to the requirements of ASTM C443.

J. Precast-Prefabricated Tee Manholes.

Tee manholes shall be allowed only where indicated on the Drawings or as directed by the Engineer or designated representative. The main pipe section shall conform to the requirements of New Braunfels Utilities Standard Specification Item No. 510, “Pipe”. The vertical manhole portion (tee) above the main pipe shall conform to the requirements of the precast components.

The manhole tee shall have a minimum inside diameter of 48 inches and shall rise vertically centered or tangent to the main pipe, as indicated on the Drawings or as directed by the Engineer or designated representative. An access hole less than 48-inches in diameter shall be cut into the main pipe to allow a ledge for support of access ladders. Unless otherwise specified on the Drawings, the main pipe portion of the tee manhole shall be paid subsidiary to the unit tee manhole price.

K. Precast Grade Rings

Rings shall be reinforced Class A or I concrete.

1. Precast Grade Rings, 24-1/2 inches Inside Diameter:

   This adjustment ring shall be used only for adjusting existing manholes with 24 inch lids and for Wastewater Access Device. Inside to outside diameter dimension of ring shall be six (6) inches with a thickness of three (3) inches to six (6) inches.

2. Precast Grade Rings, 35 inches Inside Diameter:

   This adjustment ring shall be used for all new manhole construction with 32 inches lids. Inside to outside diameter dimension of ring shall be six (6) inches with a thickness of four (4) inches to six (6) inches.

L. New Manhole Construction and Minor Manhole Adjustment:

New manhole construction and minor manhole adjustments shall be performed as indicated on Standard Detail 322, “New Manhole Construction and Minor Manhole Adjustment”, and shall consist of adding precast reinforced concrete rings to adjust the manhole to final grade.

For new manhole construction, the maximum vertical allowable ring adjustment, including the depth of the ring casting, shall be limited to 18 inches. For adjustments of existing manholes that fall within the limits of overlay and street reconstruction projects, the maximum vertical allowable, including the depth of the ring casting, shall be limited to two feet. All other existing manholes shall have a maximum allowable ring adjustment, including the depth of the ring casting, of one foot. Any adjustment that will exceed these requirements shall be accomplished as indicated on Standard Detail 321, "Major Manhole Adjustment" and as described below in subsection (M). All manholes not located in paved areas shall have bolted covers.

M. Major Manhole Adjustment:

Any adjustment that exceeds the requirements of subsection (L) Minor Manhole Adjustments, shall be accomplished as indicated on Standard Detail 321, “Major Manhole Adjustment”, and shall consist of any combination of removing the concrete rings, and/or the manhole cone section, and/or the straight riser section of the manhole in order to bring the manhole to final grade. All manholes not located in paved areas shall have bolted covers.

N. Waterproofing Joint Materials.

O-rings and wedge seals for the joints of all wastewater manholes, when indicated on the Drawings, shall conform to the requirements of ASTM C443. The connections between reinforced concrete wastewater manhole structures and pipes shall meet the requirements of ASTM C923.

O. Interior Surface Coatings for Wastewater Manholes

1. New Construction

The interior surface of the wastewater manholes should be properly prepared prior to product application per specifications of the approved product, typically NACE No.6/SSPC-SP13.

The interior surfaces shall be coated with one of the following products:

i. Specialty Coating Products SCP Dropliner – 125 mils

ii. Raven Lining Systems Raven 405 - 125 mils

iii. SprayRoq SprayWall – 125 mils

iv. Kerneos SewperCoat 2000 HS – 250 to 500 mils

v. Kerneos SewperCoat PG – 250 to 500 mils

Product to be applied per specification and by certified personnel. or approved equal product) or designated in writing by the Engineer.

2. Documentation

Contractor shall submit to NBU documentation regarding the certified applicator of the product(s) and type of product(s) used for coating of the wastewater manhole(s).

P. Abandonment of Existing Manholes

When designated on the Drawings for abandonment, existing manholes shall be removed to a level not less than four feet below grade. The inlets and outlets shall be securely plugged and the structure filled with material in accordance with Standard Detail 340, “Abandoned Manhole” or as directed by the Engineer or designated representative.

Q. External Seals

Manholes shall be sealed with Infi-Shield ® Gator Wrap external rubber sleeve as manufactured by Sealing Systems, Inc. The seal shall be made of Stretchable, Self-Shrinking, Intra-Curing Halogenated based rubber with a minimum thickness of 30 mils. The back side of each unit shall be coated with a cross-linked re-enforced butyl adhesive. The butyl adhesive shall be non-hardening sealant, with a minimum thickness of 30 mils. The seal shall stretch around the substrate then overlapped creating a cross-link and fused bond between the rubber and butyl adhesive.

304.6 Construction

All manholes shall have a minimum inside diameter of 48 inches. Manhole base section or junction box dimension shall be appropriately increased to accommodate all converging pipe. A minimum horizontal clearance of 12 inches shall be maintained between adjacent pipes. Pipe ends within the base section or junction box walls shall not be relied upon to support overlying manhole dead and live load weights. All wastewater branch connections to new or existing mains shall be made at manholes with the influent pipe crown installed at the elevation of the effluent pipe crown. Where lines enter the manhole up to 24 inches above the flowline of the outlet, the invert shall be sloped upward to receive the flow, thus preventing splashing or solids deposition. Where the springline of an influent pipe is 24 inches or more above the springline of the effluent pipe, a drop manhole shall be used. Construction of extensions to existing systems shall require placement of bulkheads at locations indicated or directed by the Engineer or designated representative. Unless otherwise indicated on the Drawings; wastewater manholes shall have concentric cones, except on manholes over large mains where an eccentric cone shall be situated to provide access to an invert ledge. Eccentric cones may be used where conflicts with other utilities dictate. Flat-slab tops may be used where clearance problems exist [see 304.5(I) above].

Manholes shall be founded at the established elevations on uniformly stable subgrade. Unstable subgrade shall be over-excavated a minimum of 12 inches (and replaced with a material acceptable to the Engineer or designated representative. Precast base units shall be founded and leveled on a 6 inch coarse aggregate bedding. A pipe section with a prefabricated tee manhole and half the length of the adjoining pipe sections on each side shall be founded on a minimum of 6 inch unreinforced Class A concrete (TXDOT Standard Specification Item No. 421, “Hydraulic Cement Concrete). The cast-in-place concrete cradle shall be placed against undisturbed trench walls up to the pipe's springline.

All adjustments shall be completed prior to the placement of the final surface.

Manhole components to be reused shall be carefully removed and the contact areas shall be cleaned of all mortar, concrete, grease and sealing compounds. Any items broken in the process of removal and cleaning shall be replaced in kind by the Contractor at its expense.

If the adjustment involves lowering the top of a manhole, a sufficient depth of precast concrete rings or brick courses shall be removed to permit reconstruction. The mortar shall be cleaned from the top surface remaining in place and from all brick or concrete rings to be reused and the manhole rebuilt to the required elevation. The manhole ring and cover shall then be installed with the top surface conforming to the proposed grade.

If the adjustment involves raising the elevation of the top of the manhole in accordance with 304.5 (L), "New Manhole Construction and Minor Manhole Adjustment", the top of brick or concrete ring shall be cleaned and built up vertically to the new elevation, using new or salvaged concrete rings and the ring and cover installed with the top surface conforming to the proposed grade.

Cast-in-place foundations shall have a minimum depth of 12 inches at the invert flowline. The widths of all manhole inverts shall be specifically sized for the connecting pipes. Inverts shall be “U” shaped with a minimum depth of three fourths of the largest pipe diameter. The lowermost riser section may be set in the Portland cement concrete, while still green, after which the foundation shall be cured a minimum of 24 hours prior to proceeding with construction of the manhole up to 12 feet in depth. The foundation shall be cured an additional 24 hours prior to continuing construction above the 12 foot level. Manhole depth shall be measured from the invert flowline to the finish surface elevation.

Wastewater manholes having cast in place foundations may be constructed over existing wastewater pipes, except polyvinyl chloride (PVC), and the top half of the pipe removed to facilitate invert construction. The manhole bottom shall rise from the springline elevation of the pipe, approximately one inch for each 12 inches of run (1:12,8%). Wastewater manholes with lines larger than 18 inches shall require precast bases; manholes constructed over in-service mains however, may be built on cast-in-place foundations if the flow cannot be interrupted. Precast and cast-in-place wastewater junction boxes shall be allowed only where indicated on the Drawings or acceptable to the Engineer or designated representative.

Wastewater lines, except reinforced concrete pipe, set in cast-in-place foundations, shall require a water stop seal or gasket acceptable to the Engineer or designated representative around the outside perimeter of the pipe. It shall be approximately centered under the manhole section wall.

Cast-in-place wastewater manholes, junction boxes and flat-slab transitions shall be reinforced, Class A concrete (TXDOT Standard Specification Item No. 421, "Hydraulic Cement Concrete"). All structural concrete work shall conform to TXDOT Standard Specification Item No. 420, “Concrete Substructures”. Forms will be required for all cast-in-place walls above the foundation. Where the surrounding material can be trimmed to a smooth vertical face, outside forms may be omitted.

Backfilling for manholes shall conform to the density requirements of Special Specification Item No. 120, “Utility Trenching and Backfill”. Manhole construction in roadways may be staged to facilitate base construction. Manholes constructed to interim elevations shall be covered with steel plates of sufficient thickness to support vehicular traffic. Steel plates on wastewater

manholes shall be set in mortar to minimize inflow. Manholes shall be completed to finish elevation prior to placement of the roadway's finish surface. The excavation for completion of manhole construction shall be backfilled with cement stabilized sand with two (2) sacks of cement per cubic yard up to the bottom of Portland Cement pavement slabs or to within two (2) inches of finish elevation of asphaltic concrete pavements. The cement stabilized sand shall be a minimum of 12 inches thick.

After rings and covers are set to grade, the inside and outside of the concrete rings shall be wiped with mortar so placed as to form a durable water-tight joint smooth and even with the manhole cone section. No grouting shall be performed when the atmospheric temperature is at or below 40°F (5oC), and when necessary, because of a sudden drop in temperature, joints shall be protected against freezing for at least 24 hours.

When applying manhole protective coating, surface is to be prepped per NACE No.6 / SSPC – SP13. 125 mils of approved protective coating is to be applied per the manufacturer's instructions.

304.7 Acceptance Testing of Wastewater Manholes:

The Contractor shall notify the Inspector and Engineer 48 hours prior to beginning of manhole testing. The Contractor shall perform the testing for all sanitary sewer manholes in accordance with the following:

A. All manholes must pass the leakage test.

B. The Contractor shall test each manhole (after assembly and backfilling) for leakage, separate and independent of all other sanitary sewer piping, by means of either a hydrostatic test, vacuum test, or other methods approved by the Engineer.

C. The Contractor is hereby instructed to conduct either Vacuum Testing or Hydrostatic Testing in the following manner:

1. Vacuum Testing: Manholes shall be tested after construction/installation and backfilling with all connections (existing and/or proposed) in place.
    a. Drop-connections and gas sealing connections shall be installed prior to testing.
    b. The lines entering the manhole shall be temporarily plugged with the plugs braced to prevent them from being drawn into the manhole.
    c. The plugs shall be installed in the lines beyond drop connections, gas sealing connections, etc.
    d. Prior to performing the test, the Contractor shall plug all lift holes and exterior joints with a non-shrink grout and plug all pipes entering the manhole.
    e. Only a cementitious coating may be applied.
    f. Contractor shall use a minimum 60 inch-lb. torque wrench to tighten the external clamps that secure the test cover to the top of the manhole.

g. The test head shall be inflated in accordance with the manufacturer's recommendations.

h. A vacuum of 10 inches of mercury shall be drawn, and the vacuum pump will be turned off.

i. With the valve closed, the level vacuum shall be read after the required test time.

j. If the drop in the level is less than 1 inch of mercury (final vacuum greater than 9 inches of mercury), the manhole will have passed the vacuum test.

k. The required test time is 2 minutes.

2. Hydrostatic Testing shall be conducted by utilizing approved plugs to seal all influent and effluent pipes in the manhole and filling the manhole to the top of the cone with water.

a. Additional water may be added over a 24-hour period to compensate for absorption and evaporation losses.

b. At the conclusion of the 24-hour saturation period, the manhole shall be filled to the top and observed.

c. Any measurable loss within a 30 minute period shall be considered an unsuccessful test and thus require the Contractor to assess the needed repairs, perform such repairs (subject to the approval of the Engineer), and notify the Inspector when the retest will be performed.

d. All effort, materials, or other costs shall be solely at the Contractor’s expense.

3. Protective Coating Testing

a. Spark (Holiday)Test – After the coating product(s) have cured in accordance with manufacturer recommendations, all surfaces shall be inspected for holidays per NACE RPO188-99, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates, or ASTM D4787, Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates. All detected holidays shall be marked and repaired according to the coating product(s) manufacturer’s recommendations.

1. Test voltage shall be a minimum of 100 volts per mil of coating system thickness.
2. Detection of a known or induced holiday in the coating product shall be confirmed to ensure proper operation of the test unit.
3. All areas repaired shall be retested following cure of the repair material(s).

b. Adhesion Test – Adhesion of the coating system to the substrate shall be confirmed in a minimum of 5% of the manholes coated (no fewer than one (1) manhole). After the coating product(s) have cured in accordance with manufacturer recommendations, testing

shall be conducted in accordance with ASTM D7234, Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers. Owner's representative shall select the manholes and areas to be tested.

4. Acceptance: Any manhole which fails the initial test must be repaired with a non-shrink grout or other suitable material based on the material of which the manhole is constructed.
5. The manhole shall be retested as described above until a successful test is attained.
6. After a successful test, the temporary plugs will be removed.
7. To ensure that the plugs have been removed, Contractor shall only do so in the presence of the Inspector.
    a. Repairs to Existing Manholes: Any existing manhole which fails to pass the hydrostatic/vacuum test shall be closely examined by the Inspector and the Contractor to determine if the manhole can be repaired.
8. Thereafter, the Contractor shall either repair or remove and replace the manhole as directed.
9. Any manhole excavated for repairs or excavated for tie in, shall be backfilled with a minimum of 12 inches thickness of flowable fill to one foot above the top of the cone section to allow for the concrete ring encasement.
10. After abrading and cleaning, additional protective coating material shall be applied to the repair area.
11. All touch-up repair procedures shall follow the protective coating manufacturer's recommendations.

D. If a sanitary manhole fails to pass one of the above tests, it shall be repaired in accordance with the manufacturer's recommendations and re-tested. Should the test fail a second time, Contractor shall perform another leak test utilizing the other testing option in this specification Should the test fail the third time, Contractor shall remove and replace the manhole and perform all the necessary test at no additional cost to NBU. Manholes shall not be accepted until it passes all tests.

E. Engineer of Record must witness all tests over the EARZ.

F. Inspection.

The Engineer or designated representative shall make a visual inspection of each manhole after it has passed the testing requirements and is considered to be in its final condition. The inspection shall determine the completeness of the manhole; any defects shall be corrected to the satisfaction of Engineer or designated representative.

304.8 Measurement:

All junction boxes and manholes of the type indicated shall be measured as units complete in place.

New manholes constructed to interim elevations to facilitate stage construction shall be measured as one unit regardless of the number of interim elevations constructed. All labor, materials and other expenses necessary for the stage construction shall be considered subsidiary to the completed unit. Abandonment of existing manholes shall be considered subsidiary to the completed unit, unless separate Pay Item is indicated on the Drawings and identified in Standard Contract Bid Form.

An "Extra Depth Manhole" will be measured by linear vertical foot of Standard Pre-cast Manhole with Pre-cast Base, Standard Pre-cast Manhole with CIP Base, Drop Manhole with Pre-cast Base, Drop Manhole with CIP Base, Special Manhole, Centered Tee Manhole, or Tangent Tee Manhole of the indicated size in excess of eight feet of depth. Manhole depth will be measured from the invert flow line to the finished surface elevation.

304.9 Payment:

Payment for completed junction boxes and manholes of the type indicated shall be made at the unit bid price for each. The unit bid price shall include all labor, equipment, materials, time and incidentals necessary to complete the work. When indicated in the Drawings, abandonment of existing manholes shall be made at the unit price for abandonment.

Payment for that portion of a Standard Pre-cast Manhole with Pre-cast Base, Standard Pre-cast Manhole with CIP Base, Drop Manhole with Pre-cast Base, Drop Manhole with CIP Base, Special Manhole, Centered Tee Manhole, or Tangent Tee Manhole in excess of eight (8) feet in depth will be made at the unit price bid for "Extra Depth Manhole" of the indicated type and size, complete in place.

Pay Item:	New Manhole Construction, ___ Dia.	Per Each
Pay Item:	Special Manhole, ___ Dia.	Per Each
Pay Item:	Drop Manhole, ___ Dia.	Per Each
Pay Item:	Centered Tee Manhole, __ Dia. x ___ Dia.	Per Each
Pay Item:	Tangent Tee Manhole, ___ Dia. x ___ Dia.	Per Each
Pay Item:	Junction Box, ___ Ft x ___ Ft	Per Each
Pay Item:	Major Manhole Adjustment, ___ Dia.	Per Each
Pay Item:	Minor Manhole Adjustment, ___ Dia.	Per Each
Pay Item:	Abandonment of existing Manholes:	Per Each
Pay Item:	Extra Depth___Manhole, ___Dia.	Per Linear Vert. Foot

End