CITY OF MEMPHIS – STANDARD CONSTRUCTION SPECIFICATIONS
SECTION 02531 MANHOLES AND SPECIAL STRUCTURES

PART 1 - SCOPE

1.01 This work consists of the construction of manholes and special structures for sanitary sewers of the type and dimensions shown on the Plans, stipulated in the Contract Documents, or as directed by the Engineer. The construction will be accomplished according to these Specifications and Plans or as established by the Engineer. The Contractor will perform all work necessary to complete the Contract with the best modern practice. Unless otherwise provided, the Contractor is required to furnish all labor, material, equipment and other items necessary to complete the manholes and structures as shown on the Plans.

PART 2 - MATERIALS AND EQUIPMENT

2.01 MATERIAL

A. Construction Material

1. All material furnished by the Contractor will be new, high quality and free from defects. Previously used material in acceptable condition is allowed for bracing, forms, false work, and similar uses. Material not conforming to the requirements of the Specifications will be considered defective and will be removed immediately from the site.

B. Qualifications of Manufacturers

1. Manholes for sanitary sewers will be the standard product of an established, reputable manufacturer made in a permanent plant. Suppliers for each material to be used by the Contractor are subject to the approval of the Engineer. No material will be delivered until the manufacturer and product have been approved by the Engineer.

C. Material Inspection and Testing

1. Representative samples of material intended for incorporation in the work will be submitted for examination when so specified or requested. All material to be used in the work will be sampled, inspected, and tested by current ASTM specifications, or other standard specifications. The Contractor will furnish the Engineer with three copies of certified reports from an accredited testing laboratory showing the results of the tests carried out on representative samples of material to be used on the Project. Each structure delivered to the project will show the laboratory's stamp. The performance or cost of all testing is the responsibility of the Contractor.

2. The Contractor will notify the Engineer before any deliveries of material and will make whatever provisions are necessary to aid the Engineer in the inspection and culling of the material before installation.

D. Storage

1. The contractor will provide storage facilities and exercise measures that will maintain the specified quality and fitness of materials to be incorporated in the work.

E. Portland Cement Concrete

1. Portland cement concrete will be as designated in Specification Section 02530 Paragraph 2.01.V.

F. Steel Reinforcement

1. Deformed steel reinforcing bars and welded wire fabric will be as shown on the Plans or as directed by the Engineer. All steel reinforcement will be as specified in Specification Section 03310.

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G. Mortar

1. Mortar will be as designated in Specification Section 02530 Paragraph 2.01.Y.

H. Brick

1. All brick will be as designated in Specification Section 02530 Paragraph 2.01.BB.

2. No new brick manholes are to be allowed in the City of Memphis system. This specification is included for repair of existing brick manholes and incidental use of brick for leveling courses in new construction.

I. Gray Iron Castings

1. Castings will be of the standard Memphis type as detailed on the Plans and Design Standards. Castings will be made of good quality, even grained cast iron and will be smooth and free from scale, lumps, blisters, sand-holes, and defects of any nature that would render them unfit for the service for which they are intended. They will be thoroughly cleaned and subjected to a careful hammer inspection.

2. Castings will meet the requirements of ASTM A 48, Class No. 35, or Grade 65-45-12 ductile iron meeting the requirements of ASTM A 536. Manhole rims and covers will be designed to withstand HS-20-44 loading defined in the AASHTO Specifications. Rims and covers will be machined or ground at touching surfaces to seat firmly and prevent rocking. Any set not matching will be removed and replaced at no additional cost.

J. Manhole Steps

1. Steps are not allowed in sewer structures.

K. Precast Concrete Manhole Sections, Bases and Other Structures

1. All precast reinforced concrete manhole risers, cones, grade rings, and flat slab tops will conform to the requirements of ASTM C 478 for the specified diameter and strength class. All cone sections and transition sections will be eccentric. Barrel sections will be custom made with openings to meet indicated pipe alignment and invert elevations. The Contractor will submit shop drawings for each typical structure shown on the Plans for approval by the Engineer. After approval by the Engineer, the Contractor can place the order for structures. The bottom manhole section and pipe(s) will be in place (supported by concrete blocks) before pouring the cast-in-place manhole base. The bottom of all precast base slabs 4 feet in diameter will extend a minimum of 6 inches beyond the outside wall of the manhole riser. The bottom of all precast base slabs 5 feet in diameter will extend a minimum of 7 inches beyond the outside wall of the manhole riser. The bottom of all precast base slabs 6 feet and larger in diameter will extend a minimum of 8 inches beyond the outside wall of the manhole riser. All poured in place bases will extend 12 inches beyond the outside wall of the manhole riser.

2. For sewer manholes four (4) to six (6) feet in diameter and less than twenty (20) feet deep, precast reinforced concrete manhole base sections shall be a minimum of 8 inches thick. For sewer manholes greater than six (6) feet in diameter or more than twenty (20) feet deep, precast reinforced concrete manhole base sections shall be a minimum of 12 inches thick. All precast manhole base sections shall be reinforced with Number 4 steel reinforcing bars placed 6 inches on center each way and at mid depth of the slab, unless shown otherwise on the plans. Steel reinforcement shall conform to Specification Section 03310.

3. The interior of the manhole sections will be a smooth, cylindrical surface. Lifting holes, when provided, will be filled with expanding grout, or other approved material.

4. Gaskets between manhole sections will be a flexible material meeting the requirements of Federal Specification SS-S-00219 for Type I gaskets and AASHTO M 198 for Type B gaskets unless otherwise specified on the Plans. Joint contact surfaces will be formed with machined castings. Joints between a manhole section and precast concrete flat tops will be mortar joints conforming to the requirements of this Specification. All sewer manholes must pass the Negative Air Pressure (Vacuum) Test as required in Specification Section 02531 Paragraph 4.02.A.

5. All pump station wet wells and siphon structures shall be lined or coated with a material conforming to either Section 02530 paragraph 2.01.DD or Section 02531 paragraph 2.01.R.

6. All manholes and structures on pipe 36 inches in diameter and larger shall be lined or coated with a material conforming to either Section 02530 paragraph 2.01.DD or Section 02531 paragraph 2.01.R.

7. Manhole manufacturer shall install plastic liner as recommended by lining manufacturer.

L. Sand

1. Sand for structure abandonment will consist of sand or a natural sandy soil, all of which passes a 3/8 inch sieve and not more than 10 percent passes a No. 200 sieve.

M. Pit Run Gravel

1. Pit run gravel will be as designated in Specification Section 02530 Paragraph 2.01.AA.

N. Non-Shrinking Grout

1. Non-shrinking grout will be as designated in Specification Section 02530 Paragraph 2.01.CC.

O. Waterproofing

1. Waterproofing for manhole exteriors will consist of two coats of asphalt or coal tar pitch. Asphalt will conform to the requirements of ASTM D 449. Coal tar pitch will conform to the requirements of ASTM D 450.

P. Vent Stack

1. Vent stack pipe will be a 4-inch diameter galvanized steel pipe conforming to the requirements of ASTM A 53 with a minimum wall thickness of standard weight pipe. One end of the vent stack pipe will have a 180-degree bend fabricated by either shop welding a manufactured 180 degree elbow or fitting the pipe with a manufactured 180 degree threaded elbow and coupling. The opposite end of the pipe will be plain end. The maximum height for vent stacks for this specification shall be 20 vertical feet.

2. Vent stack supports will be fabricated from steel shapes conforming to ASTM A 36, and to the dimensions and details shown on the Plans. The vent stack supports will be welded to the vent stack pipe and to the vent stack support bottom ring around the entire contact surface.

3. The vent stack support bottom ring will be shop fabricated with bolt holes at the spacing shown on the plans for anchorage to the manhole top. All welding will be according to the American Welding Society Structural Welding Code.

4. A vent stack support ring with threaded coupling may be cast in the flat top for installation of the vent stack.

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5. All surfaces of the completed vent stack and welds will be cleaned and painted. The color of the finish coat will be silver.

Q. Flexible Pipe Connectors to Manholes

1. All connections of pipe to manhole sidewalls will be made with flexible connectors. Openings in the manhole sidewall for the pipe will be precast or cored to provide required size and location. The hole will be manufactured to allow for lateral and vertical movement, and angular adjustments through 20°. A connector between manholes and pipes such as Press-Seal, Kor-N-Seal, or Z-LOK will be installed in the precast or cored opening. The connector will meet the requirements set forth in the latest revision of ASTM C 923. A corrosion resistant, stainless steel external band will be used around the flexible connector to create the external seal around the pipe.

2. Any void between the pipe and connector will be filled with an approved flexible gasket material.

3. Flexible connectors will be considered an integral part of the manhole sidewall, and no separate payment will be allowed.

R. Protective Linings and Coatings

1. All poly vinyl chloride (PVC) protective lining for concrete structures shall conform to Section 02530 Paragraph 2.01.DD.

2. Protective coating properties:

Product Type	Polymer based Polyurethane or Solid Epoxy
Color	Light
Compressive Strength	4,000 psi (minimum)
Tensile Strength	1,500 psi (minimum)
Hardness Type D	60
Bond Strength-Concrete	> than 750 psi
Dry Film Thickness	125 mils

3. Warranty: The COATINGS MANUFACTURER shall warranty the entire project to include any and all aspects of the surface preparation, base material installation and protective coating applications for a period of TEN (10) YEARS from the date of acceptance by the City of Memphis. The warranty shall make no distinction between installation practices and material performance and shall not be prorated with respect to elapsed time for the entire warranty period. Manufacturer shall, within a reasonable period of time after receipt of written notice thereof by the City of Memphis [period not to exceed sixty (60) calendar days], repair defects in materials or workmanship during said TEN (10) year period, and any damage to other work caused by such defects or repairing of same at his own expense and without cost to the City of Memphis.

4. Protective coatings for concrete structures will be SpectraShield® Liner System Products, Structure-Guard as manufactured by Quadex Rehabilitation Products, or as approved.

S. Grade Adapter Rings

1. Grade adapter rings shall be the standard Memphis type, compatible with City of Memphis standard rings and covers. Grade adapter rings shall be gray iron castings conforming to paragraph 2.01.I in these specifications.

T. Repair Materials

1. Repair materials are to be used in the rehabilitation of existing sewer manholes and structures. Repair materials shall be used to fill voids and to structurally reinforce and/or rebuild substrate surfaces as deemed necessary by the Engineer.

2. Quick blending, rapid setting, high early strength, fiber-reinforced, non-shrink repair mortar that can be trowelled or spray applied must be compatible with the specified protective coating.

3. Material properties:

Product Type	Fused Calcium Aluminate or Cementitious Fiberglass
Cure Time	<48 hours
Curing Gasses	Non-Toxic
Compressive Strength	5,000 psi (minimum)
Tensile Strength	500 psi (minimum)
Flexural Strength	600 psi (minimum)
Shrinkage	0% at 90% Relative Humidity

4. Repair materials for concrete structures will be QM-1s Restore as manufactured by Quadex Rehabilitation Products, or as approved.

2.02 EQUIPMENT

A. The Contractor will furnish and maintain in good condition all equipment and facilities as required for the proper execution and inspection of the Work. All equipment and facilities will be on site and approved by the Engineer before work will be permitted to begin.

PART 3 - CONSTRUCTION REQUIREMENTS

3.01 SITE PREPARATION AND RESTORATION

A. Site preparation and restoration for sewer manhole and structure construction will be performed per Specification Section 02530 Paragraph 3.01.

3.02 EARTHWORK

A. Earthwork for sewer manholes and structures will be performed per Specification Section 02530 Paragraph 3.02.

3.03 REMOVAL OR ABANDONMENT OF EXISTING MANHOLES AND STRUCTURES

A. Removal

1. Existing manholes and structures to be removed will be shown on the Plans or as directed by the Engineer. The City reserves the right to retain or reject salvage of any materials encountered. Unless otherwise specified, salvaged rims and covers remain the property of the City and will be delivered by the Contractor to a City yard as directed by the Engineer. All remaining materials become the property of the Contractor who will be responsible for disposal.

2. The excavation will be backfilled per Specification Section 02530 Paragraph 3.11.

B. Abandonment

1. Existing manholes and structures to be abandoned in place will be shown on the Plans or as identified by the Engineer.

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2. After removing manhole and structure rims, covers, and similar items, all pipes will be bulkheaded. The walls will be lowered to 2 feet below final grade if in earth or to 12 inches below subgrade if in a proposed pavement area. The remaining manhole or structure will be filled with sand to the limits previously mentioned.

3. The sand will be placed in approximately 12 inch layers and each layer compacted to 75 percent relative density or 95 percent of maximum density (standard proctor) as applicable. A 12 inch thick plain concrete slab will be installed over the manhole top extending 12 inches beyond the outside face of the manhole.

4. The City reserves the right to retain or reject salvage of any materials encountered. All remaining materials become the property of the Contractor who will be responsible for disposing of same.

5. All manholes that must be removed to perform excavation for the proposed sewer pipe and/or structures will be removed as part of the sewer excavation and no additional payment will be due the Contractor.

3.04 GENERAL CONSTRUCTION REQUIREMENTS

A. New manholes and structures will be constructed of plain or reinforced concrete. Work may include the repairing of brick masonry manholes or structures. Where the top elevation is not shown on the Plans, the manhole or structure will be built to conform to the elevation ordered by the Engineer. Standard depth manholes are those having a depth of 6'-0" from rim to invert of the sewer. Manholes and special structures will be built as the pipe laying progresses. The Engineer, at his discretion may stop the laying of pipe or the building of other manholes until the manhole just passed has been completed. Completion of the manhole will include the installation of fittings, connections to pipes, placing of castings, testing, and other construction as shown on the Plans.

B. Inlet and outlet pipes will extend through the walls of manholes and special structures to allow for water tight connections with the manhole walls. The ends will be cut off flush with the inside surface of the wall as shown on the Plans, Details, or otherwise directed. The pipes will intersect at the structures so the inlet pipe will be aligned in the direction of outlet pipe such that counterflow is prevented. Water stops will be installed around pipes as they pass through the sanitary manhole wall.

C. Inverts will be of Class A concrete poured to conform to the shapes shown on the Plans or otherwise directed. The inverts will be so constructed as to cause the least possible resistance to flow. The shape of the inverts will conform uniformly to inlet and outlet pipes. A smooth and uniform finish will be required.

D. All castings, rims, covers and fittings will be placed in the positions shown in the Plans or as directed by the Engineer. Rims on manhole cones will be set concentrically with the top of the cone in a full bed of mortar so that the space between the top of the manhole cone and the bottom flanges of the rim will be filled and made watertight. A ring of mortar at least 1 inch thick and pitched to shed water away from the rim will be placed around the outside of the bottom flange. Mortar will extend to the outer edge of the cone and will be finished smooth and flush with the top of the flange. If rim fittings are to be bolted or anchored in concrete or brick masonry, all anchors or bolts will be set and held in place before the concrete or mortar is placed. The unit will not be disturbed until the mortar or concrete has hardened to adequate strength. Bolt-down manhole covers will be installed at the locations shown on the Plans and all bolts securely tightened following acceptance of the manhole to provide a watertight seal.

E. Vent stacks will be installed on manholes at locations and to the elevations shown on the Plans or as directed by the Engineer. Vent stacks will be installed on flat top manholes only. The vent stack pipe will be positioned in the hole provided in the manhole top and the vent stack support bottom ring

will be attached to the concrete manhole top with anchor bolts in drilled holes with expansion sleeves. A vent stack support ring with threaded coupling may be cast in the flat top for installation of the vent stack.

F. Protective Linings and Coatings

1. The contractor shall take all necessary measures to prevent damage to installed lining from equipment and materials used in or taken through the work.

2. Wherever a pipe lateral (not of plastic lined concrete) is installed through a lined concrete manhole, the lining shall be extended over and around the end of the pipe and back into the structure for not less than 4 inches. This protecting cap may be molded or fabricated from the lining material but needs not be locked into the pipe.

3. All welding of joints is to be in strict conformance with the specifications and instructions of the lining manufacturer.

4. Welding shall fuse both sheets and weld strip together to provide a continuous joint equal in corrosion resistance and impermeability to the liner plate.

5. Hot-air welding guns shall provide effluent air to the sheets to be joined at a temperature between 500° and 600°F. Welding guns shall be held approximately 0.5 inch from and moved back and forth over the junction of the two materials to be joined. The gun shall be moved slowly enough as the weld progresses to cause a small bead of molten material to be visible along both edges and in front of the weld strip. All welders shall be certified by the manufacturer.

6. Protective coatings shall be installed in strict conformance with the manufacturer's recommendations.

3.05 REPAIRING OF BRICK MANHOLES AND STRUCTURES

A. Where shown on the Plans or directed by the Engineer, the Contractor will repair brick manholes or structures. The work will conform to the applicable portions of Specification Section 02640 Paragraph 3.02.B.1.

3.06 PRECAST CONCRETE CONSTRUCTION

A. Precast concrete manholes will be neatly and accurately built according to the Plans or as directed by the Engineer. All precast manholes will use either a concrete slab constructed of Class A concrete on a 12 inch thick crushed stone foundation and which will be cast integrally with the base section and the inlet and outlet pipes as shown on the Plans or the precast manhole will use a precast base section conforming to Specification Section 02531 Paragraph 2.01.K.

1. Precast concrete manhole base sections shall be placed on a 12 inch minimum thickness No. 67 crushed limestone base. The stone base will be fully encapsulated in a geotextile fabric as indicated on the plans or as directed by the Engineer. Geotextile fabric shall conform to Section 02370 paragraph 2.01.C, and grade No. 67 stone shall conform to Section 02530 paragraph 2.01.W.

B. Precast concrete sections will be set so the structure will be vertical and with sections in true alignment. Joint surfaces of the base or previously installed section will have a flexible rubber gasket installed in the recess after being primed with an asphaltic cement material recommended by the manufacturer. Flexible rubber gaskets and primers will not be applied to wet or damp surfaces. Each joint will be completely filled with nonshrinking grout on the inside and outside of the manhole after sections have been placed.

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C. All holes in precast sections used for their handling will be thoroughly plugged with nonshrinking grout. The grout will be finished smooth and flush with the interior and exterior manhole wall surfaces.

D. All precast concrete manhole cones will be of eccentric construction as shown on the Plans or Details.

E. If brick masonry is used to adjust manhole rims to grade, the masonry work will be performed according to Specification Section 02640 Paragraph 3.02.B.1.

F. All flat top manhole slabs will be steel reinforced with a minimum thickness of 6 inches. The manhole rim and cover will be placed eccentrically in the slab as shown on the Plans or Details. Waterproofing will be applied per Specification Section 02531 Paragraph 3.09.

3.07 CAST-IN-PLACE CONCRETE CONSTRUCTION

A. All cast-in-place manholes and structures will be built of Class A concrete as shown on the Plans. The manholes and structures will be built on an undisturbed earth foundation and conform to the dimensions, shapes and details shown on the Plans. Concrete construction will conform to the methods, forms, mixture, placement, protection, and curing for concrete per Specification Section 03310.

B. Cast-in-place manholes will be neatly and accurately built according to the Plans or as directed by the Engineer. Wall thicknesses will be as detailed on the Plans but not less than 6 inches thick.

C. All cast-in-place manholes will be of eccentric construction as shown on the Plans. Any required reinforcement will be of the kind, type, and size and will be spaced, bent, and fastened as shown on the Plans.

D. Connection of inlet and outlet pipes will conform to the sizes, alignments, and elevations shown on the Plans. Concrete reinforcement and inlet and outlet pipes will be in place and approved by the Engineer before any concrete is placed. If concrete placement is not continuous, a rubber water stop gasket will be required at each construction joint.

E. The inside and outside surfaces of the manhole or structure walls will receive a Class 1, Ordinary Surface Finish as defined by Specification Section 03310 Paragraph 3.11. Waterproofing will be applied per Specification Section 02531 Paragraph 3.09.

3.08 MANHOLE DROP CONSTRUCTION

A. Drop Construction for New Manholes

1. Drop construction will be installed for new manholes at the locations shown on the plans and/or as directed by the Engineer. Drop construction will conform to the details shown on the plans and Details SST-2 for outside drop construction. If precast manhole construction is used, the manhole sections will be custom made with openings for both the upper and lower inlet pipes. The pipe connections to the manhole sidewalls shall be made with flexible connectors conforming to Specification Section 02531 Paragraph 2.01.Q. Water stops will be installed around pipes as they pass through the sanitary manhole wall. Grout will be finished smooth and flush with the adjoining interior and exterior manhole wall surfaces. If cast-in-place manhole construction is used, the upper and lower inlet pipes will be in place and approved by the Engineer before any concrete being placed. All drop construction will be constructed of either ductile iron pipe with push-on or mechanical joints or PVC pipe conforming to the appropriate section of these Specifications. PVC pipe for drop construction at new manholes will be used only on improved property as defined in Specification Section 02530 Paragraph 3.11.A. On unimproved property the section of inlet pipe making the connection to the manhole at the higher

elevation and all fittings and drop pipe shall be ductile iron pipe. Solvent cement joints may be used on PVC for drop construction. Encasement of the outside drop pipe will be constructed of Class C concrete.

B. Drop Construction for Existing Manholes

1. Drop construction will be installed in existing manholes at the locations shown on the plans and/or as directed by the Engineer. Drop construction will conform to the details shown on the plans and Detail SST-2 for inside drop construction. The Contractor will core a hole in the manhole wall to permit installation of a flexible connector as specified in Specification Section 02531 2.01 Q Flexible Pipe Connectors to Manholes and the inlet pipe at the required flow line elevation, horizontal angle, and slope. Care will be used to avoid unnecessary damage to the existing masonry or concrete.

2. All loose material will be removed from the cut surfaces, which will be completely coated with grout before setting the pipe. Before inserting the pipe and flexible connector, a sufficient thickness of grout will be placed at the bottom and sides of the opening for proper bedding of the pipe. After setting, all spaces around the pipe will be solidly filled with grout and neatly pointed up on the inside to present a smooth joint, flush with the inner and outer wall surface. Any necessary modifications to the existing invert will be made to provide a smooth, plastered surface for properly channeled sewage flow from the new connection. All drop construction will be constructed of either ductile iron pipe with push-on or mechanical joints or PVC pipe conforming to the appropriate section of these Specifications. Solvent cement joints may be used on PVC for drop construction. The vertical drop construction will have the dead weight held by suitable means until the steel support straps are secured in place and tightened. The pipe mechanical joint bolts, if used, will not be positioned against the manhole wall. The steel support straps will be fastened to the manhole wall with two bolts per strap set in expansion sleeves in drilled holes.

3.09 WATERPROOFING

A. After the manhole masonry and concrete construction are complete, the exterior surface of each manhole wall within the limits shown on the Plans will be given two coats of approved waterproofing material. Total minimum dry film thickness will be 12 mils. Each coat will be applied at a rate not to exceed one gallon per 100 square feet. The waterproofing materials will be applied by brush or low pressure sprayer and according to the instructions of the manufacturer. Time will be allowed between coats to permit sufficient drying so that the application of the second coat does not affect the first coat.

B. Care will be exercised during backfilling to prevent damage to the waterproofing. Any waterproof coating damaged during backfill operations will be cleaned of all dirt and two coats of waterproofing reapplied as previously specified.

3.10 DEWATERING

A. Contractor shall furnish, install and operate pumps, pipes, appurtenances, and all equipment of sufficient capacity required to remove any groundwater encountered in the excavation. Contractor shall conduct said groundwater away from the construction site in an approved manner. Generally, dewatering is considered to be an incidental to the construction of sewer manholes, special structures, pipeline, etc. In some cases, at the City's discretion, dewatering may be measured and paid for as defined in Specification Section 02531 Parts 5 and 6.

3.11 BYPASS PUMPING

Contractor shall furnish, install and operate pumps, pipes, appurtenances, and all equipment of sufficient capacity required to maintain sewage flow around the work area. Contractor shall conduct

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said bypass pumping in an approved manner. Generally, bypass pumping is considered to be an incidental to the construction of sewer manholes, special structures, pipeline, etc. In some cases, at the City's discretion, bypass pumping may be measured and paid for as defined in Specification Section 02531 Parts 5 and 6.

3.12. ADJUSTMENT OF RIMS AND COVERS

A. Standard adjustment method:

1. Any manhole covers not adjusted and set at final grade by others shall be adjusted by the Contractor. If the cover requires lowering, the manhole rim shall be removed, sufficient upper courses of brick removed, and the rim reset at proper grade by use of cement mortar over the top course of brick remaining.

2. If the cover requires raising, all defective courses of brick shall be removed and the manhole rebuilt to proper grade and the rim reset as described above. The maximum finished collar height as measured from the top of the manhole rim to the beginning of the conical section shall be 18 inches. If the adjustment would require a collar of greater than 18 inches in height, then the existing collar and conical section of the manhole shall be removed, the riser section raised the required amount, the conical section and collar rebuilt and the rim reset at the proper grade.

3. Any changes in grade for manhole covers of precast or poured-in-place manholes shall be as shown on the plans or as directed by the Engineer.

B. Manhole adjustment with adapter rings:

1. For manhole covers to be raised less than or equal to 5 inches and where the total collar height would not exceed 18 inches, manhole adapter rings may be used if approved by the Engineer. Adapter rings may be up to a maximum of 5 inches utilizing no more than one ring. Adapter rings shall be tack welded to the existing rim at a minimum of 4 locations.

C. Alternate adjustment method:

1. For manhole covers requiring adjustment where Cement Stabilized Aggregate Base (Specification Section 02710.1) or Soil Cement Base (Specification Section 02710.2) is being placed, the Contractor may, at his option, remove manhole rims and covers and adequately seal off the top of the existing manholes below the bottom of the base course prior to the aggregate or soil cementing operations. If this option is exercised, the Contractor shall reference the location of all manholes so sealed off and aggregate or soil cementing operations shall then continue over the entire street. Within 24 hours after the final compaction of a section of roadway or paved area, all manholes located within this section shall be raised to grade by removing a section of the soil or aggregate base a minimum 3 feet square directly over each manhole. The manhole rims and covers shall then be replaced with Class A concrete to the subgrade. If, in the process of adjusting the manhole rims, the Contractor removed a larger section than specified, he shall replace the entire area so removed with Class A concrete at this expense.

3.13 PUMPING STATIONS

A. Pumping stations and force mains will conform to the latest edition of the State of Tennessee Department of Environment and Conservation Division of Water Pollution Control Specification "Design Criteria for Sewage Works." The City will be responsible for providing the secondary electrical service to the top of the utility pole installed by the contractor. The City will also be responsible for any necessary extension of MLG&W water mains necessary to serve the pump stations. The Contractor will be responsible for providing the water service connection from the MLG&W main or meter box to the pump station.

PART 4 - ACCEPTANCE TEST FOR MANHOLES AND STRUCTURES

4.01 VISUAL INSPECTION

A. All work constructed will be subject to visual inspection for faults, defects, or deviations from the Plans and any such deviation or omission will be corrected at once. All tests will be made by the Contractor who will provide necessary equipment for testing and lamping the manhole or structure in the presence of and under the supervision and instructions of the Engineer. Lamp tests will be observed first hand by the Engineer. All defects found will be corrected before conducting leakage tests. Repair methods must be approved by the Engineer.

4.02 MANHOLE LEAKAGE TEST

A. All manholes and special structures will be subjected to a vacuum test as outlined in ASTM C 1244 or as specified. The manhole, including the frame, will be placed under a vacuum of 10 inches Hg (4.9 psig). The manhole will be considered acceptable if the time measured for the vacuum to drop to 9 inches Hg (4.4 psig) is greater than that shown in the table on the following page. Manholes not meeting the vacuum test requirements will be repaired and retested or replaced.

Minimum Test Times for Various Manhole Diameters

	Manhole Diameter (ft)				
	4	**5**	**6**	**7**	**8**
Depth (ft)			**Test Time (sec)**		
8	20	26	33	42	55
10	25	33	41	51	64
12	30	39	49	66	86
14	35	46	57	74	96
16	40	52	67	87	113
18	45	59	73	95	123
20	50	65	81	105	137
22	55	72	89	116	150
24	59	78	97	126	164
26	64	85	105	137	177
28	69	91	113	147	191
30	74	98	121	157	205

B. The Contractor will be required to furnish all equipment necessary for this test including the manhole sealing apparatus, gauges, pump, plugs and operating personnel. The cost of this work is to be included in the unit bid price for manholes.

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4.03 PROTECTIVE LININGS AND COATINGS

A. After the manhole or other structure is installed, all surfaces covered with lining, including welds, shall be tested with an approved electrical hole detector (Tinker & Rasor Model No. AP-W with power pack) with the instrument set at 20,000 volts minimum. All welds shall be physically tested by a nondestructive probing method. All patches over holes, or repairs to the liner or coating wherever damage has occurred, shall be accomplished in accordance with manufacturer's recommendations.

B. Defective welds will be retested after repairs have been made. Tabs shall be trimmed away neatly by the installer of the liner after the welding strip has passed inspection. Inspection shall be made within 2 days after joint has been completed in order to prevent tearing the projecting weld strip and consequent damage to the liner from equipment and materials used in or taken through the work.

PART 5 - MEASUREMENT

5.01 STANDARD DEPTH SEWER MANHOLE

A. Standard depth manholes will be measured per each, for the various diameters and types less manhole rim and cover. Standard depth is a manhole depth less than or equal to 6 feet as measured vertically from the top of the manhole cone or slab to the invert of the manhole. No measurement shall be made for protective linings or coatings. Linings and coatings shall be considered incidental to the construction of sewer manholes. No measurement shall be made for any transition slab to switch to 4 feet diameter riser sections from larger diameter bases. No measurement shall be made for flat tops. Transition slabs and flat tops, if used, shall be incidental to the construction of the sewer manhole.

5.02 EXTRA DEPTH SEWER MANHOLE

A. Extra depth manholes will be measured per vertical foot along the vertical centerline of the manhole from a point 6.0 feet above the invert of the manhole to the top of the manhole cone or slab for the various diameters and types. Only manholes deeper than 6.0 feet will be considered for extra depth measurement. No measurement shall be made for protective linings or coatings. Linings and coatings shall be considered incidental to the construction of extra depth sewer manholes. No measurement shall be made for any transition slab to switch to 4 feet diameter riser sections from larger diameter bases. No measurement shall be made for flat tops. Transition slabs and flat tops, if used, shall be incidental to the construction of the extra depth sewer manhole.

5.03 SEWER MANHOLE DROP CONSTRUCTION

A. Drop construction in new or existing manholes will be measured per vertical foot as measured from the upper inlet pipe flowline to the flowline of drop pipe elbows at the bottom of the drop construction. Payment for drop construction for new manholes will be in addition to payment for standard depth manhole and extra depth construction (if required).

5.04 REPAIR BRICK SEWER MANHOLE AND STRUCTURE

A. Repair of brick manholes and structures will be measured per each.

5.05 SPECIAL SEWER STRUCTURE

A. Special structures will be measured per each including access shafts, but less manhole rim and cover. No measurement of depth will be made. No measurement shall be made for protective linings or coatings. Linings and coatings shall be considered incidental to the construction of the special structure.

5.06 SEWER MANHOLE RIM AND COVER

A. Manhole rims and covers will be measured per each set consisting of one rim and one cover for the various types.

5.07 VENT STACK

A. Vent stacks will be measured per each set consisting of stack pipe, 180° bend and support. No measurement of height will be made.

5.08 SEWER MANHOLE AND STRUCTURE REMOVAL

A. Removal of existing manholes and structures will be measured per each. Removal of existing manholes and structures within the limits of excavation for new sewer facilities will not be measured or paid for separately but will be included in the price of the new sewer facility.

5.09 SEWER MANHOLE AND STRUCTURE ABANDONMENT

A. Manholes and other sewer structures to be abandoned will be measured for payment per each. Material for backfilling abandoned structures will not be measured.

5.10 DEWATERING

A. Generally, dewatering is considered to be an incidental to the construction of sewer manholes, special structures, pipeline, etc. In some cases, at the City's discretion, dewatering may be measured for payment. If measured for payment, dewatering will be measured by the day, each day that the pumps are in operation and that the contractor is actively working within the excavation being dewatered. If the contractor is not actively working within the excavation, no measurement will be made for dewatering. The actual quantities used will be jointly agreed upon between the City and the Contractor.

5.11 BYPASS PUMPING

A. Generally, bypass pumping is considered to be an incidental to the construction of sewer manholes, special structures, pipeline, etc. In some cases, at the City's discretion, bypass pumping may be measured for payment. If measured for payment, bypass pumping will be measured by the day, each day that the pumps are in operation and the contractor is working on the sewer downstream of the bypass. If the contractor is not actively working on the sewer downstream of the bypass, no measurement will be made for bypass pumping. The actual quantities used will be jointly agreed upon between the City and the Contractor.

5.12 ADJUSTMENT OF RIMS AND COVERS

A. Standard adjustment method:

1. Standard manhole adjustments will be measured per each manhole rim adjusted to grade.

B. Manhole adjustment with adapter rings:

1. Manhole adjustment with adapter rings will be measured per each manhole rim adjusted to grade.

5.13 PUMPING STATION

A. Pumping station(s) constructed according to Plans and Specifications will be measured per lump sum for each pumping station, complete in place and operational. Included as a part of the pumping

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station is the water service connection from the MLG&W main shown on the Plans to the pump station(s). The power pole set by the Contractor to receive MLG&W secondary service and all electrical service from the top of the pole to pumping station equipment are included in the lump sum measurement.

5.14 PROTECTIVE COATINGS

A. Generally, protective coatings are considered to be an incidental to the construction of sewer manholes and special structures. In some cases, at the City's discretion, protective coatings may be measured for payment. If measured for payment, protective coatings will be measured by square foot of surface area covered. No measurement shall be made for repair materials.

PART 6 - PAYMENT

6.01 STANDARD DEPTH SEWER MANHOLE

A. The accepted quantities of standard depth sewer manholes will be paid for at the contract unit price per each, complete in place for the various diameters and types less rim and cover, which will be full compensation for materials and materials testing, excavation, special protection, and curing of concrete, placing and jointing precast sections, transition slabs, flat tops, construction of base slabs, inverts, connection of inlet and outlet pipes, waterproofing, linings or coatings, cleaning and inspection, conducting acceptance tests, removal and/or abandonment of existing pipe, manholes, or structures within the limits of manhole excavation, and backfilling outside of pavement areas.

6.02 EXTRA DEPTH SEWER MANHOLE

A. The accepted quantities of extra depth sewer manholes will be paid for at the contract unit price per vertical foot, complete in place for the various diameters and types, which will be full compensation for materials and materials testing, excavation, special protection, placing, protection, and curing of concrete, placing and jointing precast sections, construction and installationof base slab, transition slab, flat top, invert, connection of inlet and outlet pipes, waterproofing, lining or coating, cleaning and inspection, conducting acceptance tests, removal and/or abandonment of existing pipe, manholes or structures within the limits of excavation, and backfilling outside of pavement areas.

6.03 SEWER MANHOLE DROP CONSTRUCTION

A. The accepted quantities of sewer manhole drop construction will be paid for at the contract unit price per vertical foot, complete in place for drop construction in new manholes or drop construction in existing manholes, which will be full compensation for materials and materials testing, excavation, special protection, maintenance of sewage flow during construction, construction of drop pipe, pipe fitting and connections, installation of steel support straps, placement, curing, and protection of concrete from the manhole base to the top of drop construction, cleaning and inspection, and backfilling outside of pavement areas. Payment for drop construction for new manholes will be in addition to payment for standard depth manhole and extra depth construction (if required).

6.04 REPAIR BRICK SEWER MANHOLE AND STRUCTURE

A. The accepted quantities of repair brick sewer manholes and structures will be paid for at the contract unit price per each, complete according to detail, which will be full compensation for materials and materials testing, excavation, special protection, maintenance of sewage flow during construction, masonry work, plastering, waterproofing, cleaning and inspection, conducting acceptance test, and backfilling outside of pavement areas.

6.05 SPECIAL SEWER STRUCTURE

A. The accepted quantities of special sewer structures will be paid for at the contract unit price per each, complete in place according to detail, which will be full compensation for materials and materials' testing, excavation, special protection, maintenance of sewage flow during construction, placement, curing, and protection of concrete, cleaning and inspection, waterproofing, linings or coatings, conducting acceptance test, and backfilling outside pavement areas.

6.06 SEWER MANHOLE RIM AND COVER

A. The accepted quantities of sewer manhole rim and cover set will be paid for at the contract unit price per each set complete in place for various types which price will be full compensation for materials and materials' testing, setting rim and cover, placing gaskets and bolts, protection and curing of mortar, cleaning and inspection.

6.07 VENT STACK

A. The accepted quantities of vent stacks will be paid for at the contract unit price per each, complete in place, which will be full compensation for materials and materials' testing, fabrication, painting, and installation of vent stacks.

6.08 SEWER MANHOLE AND STRUCTURE REMOVAL

A. The accepted quantities of sewer manhole and structure removal will be paid for at the contract unit price per each, which price will be full compensation for excavation, special protection, protection of existing utilities, structure removal, disposal of debris, and backfill.

6.09 SEWER MANHOLE AND STRUCTURE ABANDONMENT

A. Sewer structures to be abandoned will be paid for at the contract unit price per each, which price will be full compensation for preparing the structure for abandonment, sealing connecting pipes, furnishing and placing backfill material, compaction, handling of salvageable material, and disposal of debris.

6.10 DEWATERING

A. If measured for payment, the accepted quantities shall be paid for at the contract unit price per day, which shall be full compensation for material, installation, and operation of pumps, pipes, appurtenances, and all equipment of sufficient capacity required to conduct the groundwater away form the construction site and to satisfactorily complete the work.

6.11 BYPASS PUMPING

A. If measured for payment, the accepted quantities of bypass pumping shall be paid for at the contract unit price per day, which shall be full compensation for material, installation, and operation of pumps, pipes, appurtenances, and all equipment of sufficient capacity required to maintain sewage flow around the work area and to satisfactorily complete the work.

6.12 ADJUSTMENT OF RIMS AND COVERS

A. Standard adjustment method:

1. The accepted quantities of manholes adjusted will be paid for at the contract unit price per each for raising or lowering the manhole cover to final grade, which price will be full compensation for furnishing all labor and materials necessary for the complete adjustment of the covers to the satisfaction of the Engineer.

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B Manhole adjustment with adapter rings:

1. The accepted quantities of manholes adjusted by the adapter ring method will be paid for at the contract unit price per each for raising the manhole to final grade, which price will be full compensation for furnishing all labor and materials necessary for the complete adjustment of the cover to the satisfaction of the Engineer.

6.13 PUMPING STATION

A. Payment will be made for pumping station at the contract lump sum price, which will be full compensation for material, structures (i.e., wet and dry wells), equipment and controls, excavation, special protection, maintenance of sewage flow, protection of existing utilities, provision of the water service connection from the MLG&W water main (valve box) to the pumping station, connection to the source of power on the site, connecting a power supply to the pumping station from top of the pole set by the Contractor at pump site, conducting acceptance tests, backfilling, and all items incidental to the construction of a complete, operational pumping station.

6.14 PROTECTIVE COATINGS

A. If measured for payment, the accepted quantities of protective coatings shall be paid for at the contract unit price square foot, which shall be full compensation for material, surface preparation, installation, testing, and all equipment required to satisfactorily complete the work. No separate payment shall be made for repair materials.

6.15 PAYMENT WILL BE MADE UNDER:

Item No.	Pay Item	Pay Unit
02531-6.01	STANDARD DEPTH SEWER MANHOLE	EA
02531-6.01.01_____Ft.	Diameter Standard Depth Precast Concrete Manhole	EA
02531-6.01.02._____Ft.	Diameter Standard Depth Poured-in-Place Concrete Manhole	EA
02531-6.02	EXTRA DEPTH SEWER MANHOLE	VF
02531-6.02.01._____Ft.	Diameter Extra Depth Precast Concrete Manhole Vertical Foot	VF
02531-6.02.02._____Ft.	Diameter Extra Depth Poured-in-Place Concrete Manhole	VF
02531-6.03	SEWER MANHOLE DROP CONSTRUCTION	VF
02531-6.03.01._____In.	Diameter Drop Construction in New Manhole	VF
02531-6.03.02._____In.	Diameter Drop Construction in Existing Manhole	VF
02531-6.04	REPAIR BRICK SEWER MANHOLE AND STRUCTURES	EA
02531-6.05	SPECIAL STRUCTURE	EA
02531-6.06	SEWER MANHOLE RIM AND COVER	EA
02531-6.06.01	No. 7 Manhole Rim and Cover	EA
02531-6.06.02	Bolted Down Manhole Rim and Cover	EA
02531-6.06.03	No. 6 Manhole Rim and Cover	EA
02531-6.07	VENT STACK	EA
02531-6.08	SEWER MANHOLE AND STRUCTURE REMOVAL	EA
02531-6.09	SEWER MANHOLE AND STRUCTURE ABANDONMENT	EA
02531-6.10	DEWATERING	DAY
02531-6.11	BYPASS PUMPING	DAY
02531-6.12	ADJUSTMENT OF RIMS AND COVERS	EA
02531-6.12.01	Adjustment of rim and cover by standard method	EA
02531-6.12.02	Adjustment of rim and cover with adapter rings	EA
02531-6.13	PUMPING STATION	LS
02531-6.14	PROTECTIVE COATING	SF

END OF SECTION 02531