SECTION 31 2200
GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal of topsoil.

B. Rough grading the site for work as indicated on drawings.

C. Topsoil and finish grading. Replacement of topsoil and finish grading.

1.02 RELATED REQUIREMENTS

A. Section 31 2316 - Excavation.

B. Section 31 2316.13 - Trenching.

C. Section 31 2323 - Fill: Filling and backfilling.

1.03 PRICE AND PAYMENT PROCEDURES – LUMP SUM

A. Compensation for this project will be on the basis of a single Lump Sum Price. There will be no measurement for payment for individual items of work.

1.04 SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with Shelby County and City of Bartlett standards.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil: Topsoil excavated on-site.
   1. Graded.
   2. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.

B. Other Fill Materials: See Section 31 2323.

C. The material to be used for topsoil shall be tested by a laboratory under the supervision of an Agronomist or soil scientist to determine what, if any, amendments the soil requires. The amendments shall be blended into the topsoil as it is spread.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey benchmark and intended elevations for the Work are as indicated.

B. Verify the absence of standing or ponding water.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect from damage above- and below-grade utilities to remain.

D. Provide temporary means and methods to remove all standing or ponding water from areas prior to grading.

E. Protect site features to remain, including but not limited to bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs, from damage by grading equipment and vehicular traffic.

F. Protect trees to remain by providing substantial fencing around entire tree at the outer tips of its branches; no grading is to be performed inside this line.

G. Protect plants, lawns, rock outcroppings, and other features to remain as a portion of final landscaping.

3.03 ROUGH GRADING

A. Remove topsoil from limits of work as shown on drawings, without mixing with foreign materials.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.

E. When excavating through roots of trees designated to remain, perform work by hand and cut roots with sharp axe.

F. See Section 31 2323 for filling procedures.

G. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

H. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack surface water control.

3.04 SOIL REMOVAL

A. Stockpile topsoil to be re-used on site; remove remainder from site.

B. Stockpile subsoil to be re-used on site; remove remainder from site.

C. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet; protect from erosion.

3.05 FINISH GRADING

A. Before Finish Grading:
   1. Verify building and trench backfilling have been inspected.
   2. Verify subgrade has been contoured and compacted.

B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size.

C. Where topsoil is to be placed, scarify surface to depth of 3 inches.

D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 6 inches.

E. Place topsoil in areas where seeding, sodding, and planting are indicated.

F. Place topsoil to the following rolled thicknesses:
   1. Areas to be Seeded with Grass: 6 inches.
   2. Areas to be Sodded: 4 inches.
   3. Shrub Beds: 18 inches.
   4. Flower Beds: 12 inches.
   5. Planter Boxes: To within 3 inches of box rim.
   6. In areas where mulch will be placed, the topsoil shall be placed 4 inches below finished grade.

G. Place topsoil during dry weather.

H. Remove roots, weeds, rocks, and foreign material while spreading.

I. Near plants, buildings, and appurtenances spread topsoil manually to prevent damage.

J. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

K. Roll placed topsoil.

L. Maintain stability of topsoil during inclement weather. Replace topsoil in areas where surface water has eroded thickness below specifications.

3.06 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) from required elevation.

B. Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch).

3.07 REPAIR AND RESTORATION

A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

B. Trees to Remain: If damaged due to this work, trim broken branches and repair bark wounds; if root damage has occurred, obtain instructions from Engineer as to remedy.

C. Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size.

3.08 FIELD QUALITY CONTROL

A. See Section 31 2323 for compaction density testing.

3.09 CLEANING

A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.

B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION

SECTION 31 2316
EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavating for site drainage improvements.

1.02 RELATED REQUIREMENTS

A. Section 31 2200 - Grading: Grading.

B. Section 31 2316.13 - Trenching.

C. Section 31 2323 - Fill: Fill materials, backfilling, and compacting.

1.03 PRICE AND PAYMENT PROCEDURES – LUMP SUM

A. Compensation for this project will be on the basis of a single Lump Sum Price. There will be no measurement for payment for individual items of work.

1.04 PROJECT CONDITIONS

A. Verify that survey benchmark and intended elevations for the Work are as indicated.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. See Section 31 2200 for topsoil removal.

C. Locate, identify, and protect utilities that remain and protect from damage.

D. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Protect plants, lawns, rock outcroppings, and other features to remain.

F. Grade top perimeter of excavation to prevent surface water from draining into excavation. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by Engineer.

3.02 EXCAVATING

A. Common excavation to establish cut and fill surfaces conforming to lines and grades as shown on the plans by moving and placing the materials as required. All cut surfaces shall be compacted; fill areas shall be placed in accordance with section 31 2323.

B. Underpin adjacent structures that could be damaged by excavating work.

C. Excavate to accommodate new structures and construction operations.

D. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

E. When shown on the plans, or when instructed by the Engineer, undercut those areas where materials unsuitable are encountered.

F. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

G. Do not interfere with 45 degree bearing splay of foundations.

H. Cut utility trenches wide enough to allow proper installation and inspection of installed utilities.

I. Hand trim excavations. Remove loose matter.

J. Remove lumped subsoil, boulders, and rock up to 1/3 cubic yard measured by volume. See Section 31 2316.26 for removal of larger material.

K. Provide temporary means and methods, as required, to remove all water from excavations until directed by Engineer. Remove and replace soils deemed suitable by classification and which are excessively moist due to lack of dewatering or surface water control.

L. Remove excavated material that is unsuitable for re-use from site.

M. Stockpile excavated material to be re-used in area designated on site in accordance with Section 31 2200.

N. Remove excess excavated material from site.

3.03 PROTECTION

A. Divert surface flow from rains or water discharges from the excavation.

B. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.

C. Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in satisfactory, undisturbed condition.

D. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

E. Keep excavations free of standing water and completely free of water during concrete placement.

END OF SECTION

SECTION 31 2316.13
TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Backfilling and compacting for utilities outside the building as indicated on the drawings.

1.02 RELATED REQUIREMENTS

A. Section 31 2200 - Grading: Site grading.

B. Section 31 2316 - Excavation: Building and foundation excavating.

C. Section 31 2323 - Fill: Backfilling at site.

1.03 PRICE AND PAYMENT PROCEDURES – LUMP SUM

A. Compensation for this project will be on the basis of a single Lump Sum Price. There will be no measurement for payment for individual items of work.

1.04 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

B. Subgrade Elevations: Indicated on drawings.

1.05 REFERENCE STANDARDS

A. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18 in.) Drop.

B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

C. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.

D. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).

E. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

F. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

G. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.06 SUBMITTALS

A. Materials Sources: Submit name of imported materials source.

B. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

C. Compaction Density Test Reports.

1.07 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where they will not interfere with other site construction activities.
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 BEDDING AND BACKFILL MATERIALS

A. Class I Material: Angular, 1/4 to 1 inch graded stone including a number of fill materials that have regional significance such as crushed stone, cinders, slag, and crushed shells.

B. Class II Material: Coarse sands and gravels with a maximum particle dimension of 1-1/2 inches, including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry.

C. Class III Material: Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures.

D. Class IV Material: Silt, silty clays, and clays, including inorganic clays and silts of medium to high plasticity and liquid limits conforming to Standard Soils Classification (ASTM D2487) CL, CL-ML, ML.

E. Class V Material: Organic soils, as well as soil containing frozen earth, debris, rocks larger than 1-1/2 inches, and other foreign material.

2.02 PIPE BEDDING CLASSIFICATIONS

A. Type “A” bedding shall consist of a concrete cradle which shall be used only at the direction of the Engineer or if specifically called out and detailed in the construction plans.

B. Type “B” bedding shall consist of material meeting the Class II material requirement in section 2.01, B. and meeting the following gradation:

Sieve Size	1-1/2"	1"	3/4"	3/8"	No. 4	No. 10	No. 100
% Passing	100	85-100	60-95	50-80	40-65	20-40	9-18

1. Bedding shall be a minimum of 6” of material under the pipe. The pipe shall be laid on the bedding with bell holes shaped to insure the full length of the pipe is supported. Material shall be rammed with hand tools under the haunches of the pipe. The Type II material shall be used for the initial backfill. It shall be installed in minimum 6” compacted lifts until the crown of the pipe has a minimum of 6” cover.

C. Type “C” Bedding shall consist of Class III or IV material as defined in section 2.01, C. or D. Type “C” bedding may be required when the material excavated from the trench is considered unsuitable for use as bedding and backfill material. It shall be installed in the same manner as Type “B” bedding described above.

D. Type “D” Bedding shall consist of suitable materials excavated from the trench meeting the requirements of Class I, II, III, or IV materials. Class V materials shall not be used. The pipe may be laid directly on the trench bottom with bell holes shaped as needed to insure the full length of the pipe is supported. After soil has been rammed under the haunches of the pipe the initial backfill using the excavated material shall proceed as described in 2.02,B. If the excavated material is unsuitable for use as backfill material Class “C” bedding shall be used.

2.03 ACCESSORIES

A. Geotextile: Non-biodegradable, nonwoven having a maximum EOS of 100.

2.04 SOURCE QUALITY CONTROL

A. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.

B. If tests indicate materials do not meet specified requirements, change material and retest.

C. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey benchmarks and intended elevations for the work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Locate, identify, and protect utilities that remain and protect from damage.

C. Notify utility company to remove and relocate utilities when so noted in the construction documents.

D. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Protect plants, lawns, rock outcroppings, and other features to remain.

F. Grade top perimeter of trenching area to prevent surface water from draining into trench. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by the Engineer.

G. Install barriers and other devices to protect areas adjacent to construction.

3.03 TRENCHING

A. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

B. Slope banks of excavations from 1' foot above the crown (top) of pipe to angle of repose or less until shored.
   1. When necessary furnish, put in place, and maintain such sheeting, bracing, etc., as may be required to support the sides of the excavation and to prevent movement. The trenching and excavation requirements of 29CFR 1926.651 and 1926.652 or comparable OSHA approved State requirements shall be used by the Contractor.
   2. Take care to prevent voids outside the sheeting.
   3. If voids are formed, immediately fill and ram to the satisfaction of the Engineer.
   4. Devise plans for performing this work subject to the approval of the Engineer.
   5. Unless it is to remain in place, advance the removal of all sheeting, shoring, and bracing as the bedding and initial backfill is placed around the pipe to insure intimate contact between the bedding and the trench walls.
   6. Cut off shoring to remain in place a minimum of 2’ below finished grade.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Trench width: minimum is pipe diameter plus 1 foot; the maximum is outside diameter of the pipe plus 4 feet.

E. Cut pavement along neat, straight lines with either a pavement breaker or pavement saw.

F. Trench depth: for waterlines--sufficient to provide minimum cover of 36 inches over the top of the pipe; for sewer lines--as shown on the Plans or as specified.

G. Align trench as shown on the Plans unless a change is necessary to miss an unforeseen obstruction. Do not make field adjustment in the alignment or grade of gravity lines without written approval of the Engineer.

H. Hand trim excavations. Remove loose matter.

I. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

J. Remove lumped subsoil, boulders, and rock up to 1/3 cubic yard measured by volume. See Section 31 2316.26 for removal of larger material.

K. Remove excavated material that is unsuitable for re-use from site.

L. Stockpile excavated material to be re-used in area designated in Section 31 2200.

M. Remove excess excavated material from site.

N. Provide temporary means and methods, as required, to remove all water from trenching until directed by the Engineer. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

O. Determine the prevailing groundwater level prior to trenching. If the proposed trench extends less than 1 foot into the prevailing groundwater, control groundwater intrusion with perimeter drains routed to sump pumps, or as directed by the Engineer.

P. When unstable soil is encountered at the trench bottom, remove it to a depth required to assure support of the pipeline and backfill to the proper grade with coarse aggregate AASHTO M-43, Size No. 2. Before placing any bedding material over stone a non-woven filter fabric with a maximum 100 EOS shall be placed over the stone for full width and length of the trench where the stone foundation is used.

Q. Remove rock encountered in trench excavation to a depth of 6 inches below the bottom of the pipe barrel, backfill with an approved material, and compact to uniformly support the pipe. In no case shall solid rock exist within six (6) inches of the finished pipeline.

R. When rock borings or soundings are provided, they are for information only and do not guarantee existing conditions. Make such investigations as deemed necessary to determine existing conditions.

3.04 PREPARATION FOR UTILITY PLACEMENT

A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.05 BACKFILLING

A. Backfill to contours and elevations indicated using unfrozen materials.

B. Fill up to subgrade or finish elevations unless otherwise indicated.

C. Employ a placement method that does not disturb or damage other work.

D. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

E. Maintain optimum moisture content (+/- 2%) of fill materials to attain required compaction density.

F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 8 inches compacted depth.

G. Soil Fill: Place and compact material in equal continuous layers not exceeding 6 inches compacted depth.

H. Slope grade away from building minimum 2 inches in 10 feet (2%), unless otherwise noted. Make gradual grade changes. Blend slope into level areas.

I. Correct areas that are over-excavated.
   1. Thrust bearing surfaces: Fill with concrete.
   2. Other areas: Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.

J. Compaction Density Unless Otherwise Specified or Indicated:
   1. Under paving, slabs-on-grade, and similar construction: 98 percent of maximum dry density.
   2. At other locations: 95 percent of maximum dry density.

K. Reshape and re-compact fills subjected to vehicular traffic.

3.06 BEDDING AND FILL AT SPECIFIC LOCATIONS

A. Sanitary Sewer Pipe
   1. All sanitary sewer pipe 15” diameter or less whether classified as flexible or rigid shall be installed using Type “B” bedding.
   2. Sewer pipe with a diameter greater than 15” classified and flexible (PVC, HDPE, etc.) shall be installed using Type “B” bedding.
   3. Sewer pipe with a diameter greater than 15" classified as rigid (RCP, DI, etc.) may be installed using Type "D" bedding, unless otherwise noted on the construction drawings.

B. Storm Sewer Pipe
   1. All storm sewer pipe classified as flexible (PVC, HDPE, CMP, etc.) shall be installed using Type “B” bedding.
   2. Storm sewer pipe classified as rigid (RCP, D.I., etc) may be installed using Type “D” bedding, unless otherwise noted on the construction drawings.

C. Water and Gas Lines - shall be installed using Type “D” bedding, unless otherwise noted on the construction drawings.

3.07 FINAL BACKFILLING

A. After the initial backfill has been placed, perform final backfilling.

B. Backfilling in unimproved areas.
   1. Dispose of and replace all soft or yielding material which is unsuitable for trench backfilling with suitable material.
   2. Suitable material excavated from the trench may be used as backfill material. It shall be installed in maximum of 8” loose lifts and compacted to a minimum of 95% standard Proctor.

C. Backfilling beneath driveways and streets where non-rigid and rigid type surfacing is to be replaced.
   1. Use granular backfill of crushed stone or gravel meeting the requirements for Type A, Grading D as set forth in subsection 903.05 in the TDOT Standard Specifications for Road and Bridge Construction.
   2. Carefully deposit in uniform layers, not to exceed 6" thick.
   3. Compact each layer thoroughly by rolling, ramming, and tamping with tools suitable for that purpose in such a manner so as to not disturb the pipe.

D. Backfilling of shoulders along streets and highways.
   1. Backfilling methods and materials for shoulders along streets and highways shall be in accordance with the requirements of governing local, county, or state departments maintaining the particular roadway or highway.
   2. Replace with similar materials, all shoulders which may be damaged or destroyed as a result of pipe trenching.
   3. Backfilling of shoulders shall not be directly measured for payment unless traffic whips out the shoulder material rather than settling it, then any additional crushed stone placed shall be paid for as crushed stone for shoulder replacement.
   4. Where shoulders along state highways have seal coat surfaces, replace with double bituminous seal.
   5. Where the State Highway Department or local authority requires trenches to be backfilled entirely with granular material in the shoulder of roads, granular material so placed shall not be a pay item, but included in the prices per linear foot of pipe.

E. Crushed stone for pavement maintenance and shoulder replacement.
   1. Where possible, salvage and reuse all base material that is removed during construction.

2. Wet and thoroughly compact crushed stone and blade to tie into the existing surface prior to final acceptance.
3. Base material placed as a portion of pavement replacing items will not be directly measured for payment unless traffic whips out the base material rather than settling it, then any additional base material placed shall be paid for as crushed stone for pavement maintenance.

3.08 TOLERANCES

A. Top Surface of General Backfilling: Plus or minus 0.1 ft. from required elevations.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 0.4 ft. from required elevations.

3.09 FIELD QUALITY CONTROL

A. Before installing the initial backfill the Contractor shall examine the pipe to insure proper line and grade has been established and all joints are fully belled up and properly installed. Should tests or observation made at a later date reveal problems with the pipe integrity and/or alignment it shall be the responsibility of the Contractor to correct the problem(s) at his own expense.

B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, or ASTM D6938.

C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D1557 ("modified Proctor"), AASHTO T 180, or ASTM D698 ("standard Proctor").

D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

E. Frequency of Tests: Minimum every 200 lineal feet of trench for each lift of backfill.

3.10 CLEANING

A. Leave unused materials in a neat, compact stockpile.

B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 31 2323
FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Filling, backfilling, and compacting to establish finished grades throughout the site.

B. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.02 RELATED REQUIREMENTS

A. Section 31 2200 - Grading: Removal and handling of soil to be re-used.

B. Section 31 2316 - Excavation: Removal and handling of soil to be re-used.

C. Section 31 2316.13 - Trenching: Excavating for utility trenches to utility main connections.

1.03 PRICE AND PAYMENT PROCEDURES – LUMP SUM

A. Compensation for this project will be on the basis of a single Lump Sum Price. There will be no measurement for payment for individual items of work.

1.04 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

B. Subgrade Elevations: Indicated on drawings.

1.05 REFERENCE STANDARDS

A. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

C. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.

D. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).

E. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

F. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

G. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.06 SUBMITTALS

A. Materials Sources: Submit name of imported materials source.

B. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

C. Compaction Density Test Reports.

1.07 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where they will not interfere with other site construction activities.
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. General Fill - Borrow Fill : Subsoil excavated offsite.
   1. Graded.
   2. Free of lumps larger than 2 inches, rocks larger than 2 inches, and debris.
   3. Conforming to ASTM D2487 Group Symbol CL, CL-ML, ML.

B. Granular Fill - Crushed stone fill, graded in accordance with ASTM C136 within the limits listed in ASSHTO M43 of the size specified: # 57, # 2, # 68 or # CR6-10.

C. Topsoil: See Section 31 2200.

2.02 ACCESSORIES

A. Geotextile: Non-biodegradable, nonwoven with a maximum EOS 100.

2.03 SOURCE QUALITY CONTROL

A. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.

B. If tests indicate materials do not meet specified requirements, change material and retest.

C. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey benchmarks and intended elevations for the Work are as indicated.

B. Identify required lines, levels, contours, and datum locations.

C. See Section 31 2200 for additional requirements.

D. Verify areas to be filled are not compromised with surface or ground water.

3.02 PREPARATION

A. Proof roll to identify soft spots, then scarify subgrade surface to a depth of 6 inches.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

A. Fill to contours and elevations indicated using unfrozen materials.

B. Fill up to subgrade elevations unless otherwise indicated.

C. Employ a placement method that does not disturb or damage other work.

D. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

E. Maintain optimum moisture content (+/- 2%) of fill materials to attain required compaction density.

F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.

G. Soil Fill: Place and compact material in equal continuous layers not exceeding [____] inches compacted depth.

H. Slope grade away from building minimum 2 inches in 10 feet (2%), unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

I. Correct areas that are over-excavated.
   1. Load-bearing foundation surfaces: Fill with concrete.

2. Other areas: Use general fill, flush to required elevation, compacted to minimum 98 percent of maximum dry density.

J. Compaction Density Unless Otherwise Specified or Indicated:
1. Under paving, slabs-on-grade, and similar construction: 98 percent of maximum dry density.
2. At other locations: 95 percent of maximum dry density.

K. Reshape and re-compact fills subjected to vehicular traffic.

L. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Engineer. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.04 TOLERANCES

A. Top Surface of General Filling: Plus or minus 1 inch from required elevations.

B. Top Surface of Filling Under Paved Areas and under slabs on grade: Plus or minus 0.4 foot from required elevations.

3.05 FIELD QUALITY CONTROL

A. Perform compaction density testing on compacted fill in accordance with ASTM D1556 or ASTM D6938.

B. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor"), or AASHTO T 180.

C. If tests indicate work does not meet specified requirements, remove work, replace and retest.

D. Frequency of Tests: minimum 5 tests per 10,000 square yards for each lift placed.

E. Proof roll compacted fill at surfaces that will be under slabs-on-grade.

3.06 CLEANING

A. Leave unused materials in a neat, compact stockpile.

B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 33 0513
MANHOLES AND STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Monolithic concrete manholes with masonry transition to lid frame, covers, anchorage, and accessories.

B. Modular precast concrete manhole sections with tongue-and-groove joints with masonry transition to lid frame, covers, anchorage, and accessories.

C. Masonry manhole sections with masonry transition to lid frame, covers, anchorage, and accessories.

1.02 RELATED REQUIREMENTS

A. Section 31 2316 - Excavation.

B. Section 31 2323 - Fill.

C. Section 33 4211 - Stormwater Gravity Piping.

1.03 PRICE AND PAYMENT PROCEDURES - LUMP SUM

A. Compensation for this project will be on the basis of a single Lump Sum Price. There will be no measurement for payment for individual items of work.

1.04 SUBMITTALS

A. Shop Drawings: Indicate manhole locations, elevations, piping sizes and elevations of penetrations.

B. Manufacturer's qualification statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.06 FIELD CONDITIONS

A. Maintain materials and surrounding air temperature to minimum 50 degrees F prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Manhole Sections: Reinforced precast concrete in accordance with ASTM C478 (ASTM C478M), with resilient connectors complying with ASTM C923 (ASTM C923M).

B. Concrete Brick Units: 1 or ASTM C 55 Grade N, cored, normal weight; nominal modular size of 2-1/4 x 3-5/8 x 7-5/8 inches.

2.02 COMPONENTS

A. Lid and Frame: ASTM A48/A48M, Class 30B Cast iron construction, machined flat bearing surface, removable lockable lid, closed lid design; AASHTO HL93; sealing gasket; lid molded with identifying name.

B. Manhole Steps: Formed copolymer polypropylene plastic reinforced with 1/2 inch diameter, grade 60 steel, 10-3/4 inch tread width, 4-3/8 inch embedment depth; minimum 5-3/8 inch distance from wall of structure to the edge of tread. Color orange.

2.03 CONFIGURATION

A. Shaft Construction: Concentric with eccentric cone top section; lipped male/female dry joints; sleeved to receive pipe sections.

B. Shape: Cylindrical or as noted in project drawings.
C. The minimum Clear Inside Dimensions: 48 inch diameter.
D. Clear Inside Dimensions: As indicated for each structure.
E. Design Depth: As indicated for each structure.
F. The minimum Clear Lid Opening: 26 inches diameter.
G. The minimum Clear Lid Opening: 26 inches diameter.
H. Clear Lid or Grate Opening: As indicated for each structure.
I. Pipe Entry: Provide openings as indicated.
J. Steps: 10-1/2 inches wide, 16 inches on center vertically, set into manhole wall.
K. Steps: When indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify items provided by other sections of work are properly sized and located.
B. Verify that built-in items are in proper location, and ready for roughing into Work.
C. Verify excavation for manholes is correct.

3.02 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.03 MANHOLES

A. Precast concrete base sections with an integrated bottom shall be placed on a No. 67 crushed stone base having a minimum thickness of 12 inches. The stone base shall be fully encapsulated in a geotextile fabric. The fabric must have an AOS greater than 100.
B. Precast concrete base sections with an open bottom shall have a poured in place bottom as detailed in the project drawings.
C. Place precast manhole sections to the correct lines and grades.
D. Poured in place manholes shall be installed to the correct lines and grades. All form work shall be designed to be fully removed without damage to the structure.
E. Pipe and conduit opening in pre-cast structures shall be formed or cut smooth. The diameter of the opening shall be 4 inches larger than the outside diameter of the pipe or conduit.
F. All structures shall have a fully developed invert. The invert shall be built up with concrete and/or grout to provide a smooth flow channel through the structure.
G. If needed use concrete grade rings to adjust the top to finished grade.
H. The rim iron shall be set using butyl sealant and be bolted to the concrete structure using (4) 3/4 inch x 5-1/2 inch stud type expansion anchors.
    1. In non-paved areas the rim iron shall be set level.
    2. In paved areas the rim iron shall be set to match the line and grade of the surrounding finished pavement.

3.04 MASONRY WORK

A. Brick structures shall only be used when authorized by the Engineer.
B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
C. Lay masonry units in running bond. Course one unit and one mortar joint to equal 8 inches.
D. Form flush mortar joints.

E. Lay masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

F. Every fifth course of brick shall be a header bond.

END OF SECTION

SECTION 33 4211
STORMWATER GRAVITY PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Stormwater drainage piping, fittings, accessories, and structures.

B. Extension of the drainage system to point of discharge for the site.

C. All structures and connections as listed in the storm drainage tables on the drawings

1.02 RELATED REQUIREMENTS

A. Section 31 2316 - Excavation: Excavating of trenches.

B. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

C. Section 31 2323 - Fill: Bedding and backfilling.

D. Section 33 0513 - Drainage Manholes and Structures.

1.03 PRICE AND PAYMENT PROCEDURES – LUMP SUM

A. Compensation for this project will be on the basis of a single Lump Sum Price. There will be no measurement for payment for individual items of work.

1.04 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.06 SUBMITTALS

A. Product Data: Provide data indicating pipe, pipe accessories, pre-cast structures and castings.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

D. Field Quality Control Submittals: Document results of field quality control testing.

E. Project Record Documents:
   1. Record location of pipe runs, connections, and invert elevations.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.07 REGULATORY REQUIREMENTS

A. Conform to Shelby County and City of Bartlett Standard Construction regulations.

PART 2 PRODUCTS

2.01 STORM SEWER PIPE MATERIALS

A. Concrete Pipe: Reinforced, ASTM C76. Provide in the pipe sizes as noted in the Drainage Table(s) contained in the drawings. Unless otherwise noted in the drawings, all reinforced concrete pipe shall be Class III, with wall Type B. Joints may be bell and spigot or tongue and groove.

B. Reinforced Concrete Pipe Joint Device: ASTM C443 (ASTM C443M) rubber compression gasket joint.

C. Plastic Pipe: ASTM D2729, Poly Vinyl Chloride (PVC) material; inside nominal diameter in size(s) as noted in the Drainage Table(s) contained in the drawings. Solvent weld joints are

allowed.

D. Plastic Pipe: ASTM D3034, Type PSM, Poly Vinyl Chloride (PVC) material; inside nominal diameter in size(s) as noted in the Drainage Table(s) contained in the drawings. Joints shall be bell and spigot with elastomeric gasket joints.

E. PE or PP Profile Wall Pipe: ASTMs F2648; F2736, F2881; size(s) as noted in the Drainage Table(s) contained in the drawings. Joints shall be bell and spigot watertight joints.

2.02 PIPE ACCESSORIES

A. Pipe connections to structures; made using non-shrinking grout, mechanical clamp ring type, stainless steel, expanding and contracting sleeve, neoprene, or ribbed gasket for positive seal.

B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

C. Filter Fabric: Non-biodegradable, non-woven with an EOS 100.

2.03 CATCH BASIN, DRAIN MANHOLES, TRENCH DRAINS AND AREA DRAINS

A. All structures shall be constructed (or furnished when prefabricated) in general conformance to the details on the drawings and/or standard details referenced on the drawings.
   1. Gray Iron Castings shall conform to AASHTO M105 and include the following:
      a. Unless otherwise noted castings shall be Class 30.
      b. Sand blast the castings clean of all sand and scale.
      c. Paint all castings with coal tar epoxy, black in color.
      d. The lid and lid seat of the rim of manhole castings.
   2. Trench drain grates shall conform to Load Class A.
      a. The grate shall be constructed of Ductile Iron,

2.04 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Section 31 2316.13.

B. Cover: As specified in Section 31 2316.13.

PART 3 EXECUTION

3.01 TRENCHING

A. See Section 31 2316.13 - Trenching for additional requirements.

B. See Section 31 2316 - Excavation and Section 31 2323 - Fill for additional requirements.

C. Hand trim excavation for accurate placement of pipe to elevations indicated.

D. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION - PIPE

A. Prepare the trench ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
   1. Install bedding and initial backfill in accordance with section 31 2316.13.
   2. Install the final backfill in accordance with Section 31 2316.13.

C. Lay pipe to slope gradients noted on drawings.

D. Connect to building storm drainage system, foundation drainage system, and utility/municipal system.

E. Make connections through walls through sleeved openings, where provided.

3.03 INSTALLATION - CATCH BASINS, TRENCH DRAINS AND CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Prepare the base to accept the structure.
   1. Poured in place: Install reinforcing; make appropriate accommodations for pipe lines intercepted by structure; pour base to dimensions and thickness indicated on the details using 3000 psi minimum strength concrete.
   2. Precast / Prefabricated: Install a stone base using #57 stone to the dimensions and thickness indicated in the details.

C. Establish the flowline elevations called out in the drawings for the structure; and all drainage pipes entering and exiting the structure.

D. Backfill around structure using material meeting the requirements of Class III, or Class IV material as defined in Section 31 2316.13, Part 2, 2.01, C and D. Install in 6" lifts, hand tamp, equally on all sides of the structure.

E. Set and anchor the rim iron in accordance with the details; and install the grates and/or lids.

F. Prefabricated trench drains:
   1. Excavate; prepare substrate and supports according to the manufacturer's printed installation instructions.
   2. Install prefabricated trench drain system according to the manufacturer's printed installation instructions.
   3. Expansion, Construction, and Control Joints: Do not locate trench drain system on an expansion, construction or control joint in concrete or pavement. Where concrete or pavement joints running transverse to direction of flow cross the trench drain system, locate concrete or pavement joints and trench drain system joints so that both coincide.
   4. Concrete Trench Support: 3000 psi compressive strength, minimum.
      a. Provide support on all sides of trench in minimum thickness recommended by trench drain system manufacturer.
      b. Screed and finish top edge of concrete flush with top surface of trench drain system.
      c. Do not use secondary edge finishing tools.

3.04 FIELD QUALITY CONTROL

A. Testing: Perform testing of completed piping in accordance with local authorities having jurisdiction.

B. The piping shall be visually inspected as the work proceeds:
   1. Insure that a full circle is observed. If not, then take corrective action.
      a. For rigid pipe (concrete, D.I. ect.) relay pipe to establish a straight line and grade.
      b. For flexible pipe (PVC, PE, PP) determine what section(s) of the pipe is(are) overly deflected; remove the backfill and bedding; reinstall the bedding taking care to provide full support of the pipe walls; then reinstall the backfill.
   2. If damaged pipe is observed, the damaged sections(s) shall be immediately removed and replaced. Progress on laying additional storm sewer shall cease until the problem is corrected.
   3. If hanging gaskets are observed, the entire run of pipe shall be removed and relaid.

C. Completion Inspection
   1. Each run of pipe shall be visually inspected by shining the line (using sunlight and mirrors).
      a. Debris observed shall be removed by flushing and balling if necessary. The material shall be trapped to insure that it is not washed downstream of the project.
      b. Damaged pipe sections shall be removed and replaced.
   2. Flexible Pipe shall be deflection tested for 5% maximum deflection.
      a. A go-no-go mandrel shall be used on all pipe 18 inches and smaller.

b. The vertical diameter of pipes with a diameter greater than 18 inches shall be measured, recorded, and compared to the factory specified inside diameter of the pipe. Measurements shall be taken 4 feet either side of each joint and at the midpoint of each section of pipe.
c. Any section of pipe determined to be over-deflected (greater than 5%) shall be corrected.

D. The cost of testing and all corrective actions necessary to provide an acceptable system shall not be paid for directly. The Contractor shall include the costs in the value established for the installation of the system.

3.05 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation has been completed.

B. Protect the piping and drainage structures from silt and debris being washed into the system. Clear the pipe immediately upon observing such contamination. Do not allow silt or debris to exit the site.

END OF SECTION