# STANDARD GAS SPECIFICATIONS

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SECTION 02010

GENERAL MISCELLANEOUS SPECIFICATIONS

PART 1 – GENERAL

There are some miscellaneous guidelines that exist for performing work in the City of Clarksville. These are general in nature and are itemized below:

1. Design of utility-related projects shall comply with the provisions of the Subdivision Regulations prepared by the Clarksville-Montgomery County Regional Planning Commission.

2. For information on The City of Clarksville’s water or sewer systems, please refer to the “Standard Water and Sewer Specifications” on the City of Clarksville’s website. [https://www.cityofclarksville.com/DocumentCenter/View/4114/Standard-Water-and-Sewer-Specifications-PDF](https://www.cityofclarksville.com/DocumentCenter/View/4114/Standard-Water-and-Sewer-Specifications-PDF)

3. Changes to bid documents are acceptable only if they are made with the prior agreement of the City Engineer’s Office or their designated representative prior to submission of a bid and issued as a change in an Addendum.

4. Any item not specifically listed on the Bid Form shall be considered to be included in the price of other related items on the Bid Form, or otherwise considered incidental to the scope of the Contract.

5. All survey elevations shall be referenced to mean sea level (msl). Elevation references to temporary benchmarks not referenced to mean sea level shall be rejected.

6. Pre-construction photographs and/or video shall be taken on projects performed for the City of Clarksville, with particular attention to improved areas, to aid in restoring landscaping and other features to their initial condition.

7. Where utilities are installed in new fill, a compaction letter sealed by a Geotechnical Engineer registered in the State of Tennessee shall be submitted to the owner prior to accepting said utilities. An acceptable compaction letter shall state that field density testing indicates the fill has been compacted to at least 95% of the maximum dry density according to the Standard Proctor. In special instances and cases where compaction letters may not have been requested for fill slopes the Engineer retains the right to request additional testing and/or remedies for ensuring the integrity of the installed utilities and surrounding property.

8. Tracer wire shall be installed as specified in Section 02550.
9. Upon completion of the installation of all natural gas lines and prior to acceptance by the City of Clarksville, the Contractor shall submit one (1) hardcopy and one (1) electronic copy on CD or flash drive in AutoCad .dwg format of the record drawings.

A. All drawings shall be referenced to Tennessee State Plane Coordinates (NAD27).

B. The record drawings shall also include detailed valve locations showing a minimum of three measurements to permanent features.

C. The as-built submission should also be accompanied by a text file, which will include points in State plane format and point type (Ex. 788870.372, 1568830.499, Regulator Station). At a minimum, the text file should include all valves, tapping tees, service taps, risers and/or meter sets, regulator stations, test stations, anodes, plastic to steel transitions, benchmarks, or any other major portions of the newly installed natural gas lines. Benchmark data should include elevation and description.

10. All electrical wiring shall be copper conductor. Aluminum is not an acceptable substitute. All control and instrument panels shall be supported by galvanized steel posts set in concrete. Wooden posts are not acceptable.

11. Utility work necessary for after normal business hours may be required to be performed by all contractors and subcontractors working on or adding to the City’s natural gas system at the direction of the City Engineer or his designated representative. Work of this nature may be necessary to limit impact to the utility customers and will not be considered for additional payment.

12. Warranties

A. The developer and/or Contractor shall warrant all utilities and related appurtenances for a one (1) year period (minimum) following testing and acceptance by the City. The Contractor agrees that he will obtain warranties from the manufacturers of equipment and materials furnished under this Contract, guarantees against defective materials and workmanship, and if those guarantees furnished by the manufacturer do not extend for the term of one (1) year from and after the date upon which the final estimate is formally approved by the City or other established date as set forth hereinbefore, he shall make the necessary arrangements and assume all cost for extending this guarantee for the required period.

B. The Contractor shall promptly make such repairs or replacement as may be required under the above specified guarantee, and, when the repairs or replacements involve one or more items of installed equipment, shall provide the
services of qualified factory-trained servicemen in the employ of the equipment manufacturers to perform or supervise the repairs or replacements.

C. When the Engineer or the City deems it necessary, and so orders, such replacements or repairs under this section shall be undertaken by the Contractor within twenty-four (24) hours after service of notice. If the Contractor unnecessarily delays or fails to make the ordered replacements or repairs within the time specified, or if any replacements or repairs are of such nature as not to admit of the delay incident to the service of a notice, then the City shall have the right to make such replacements or repairs, and the expense thereof shall be paid by the Contractor or deducted from any moneys due the Contractor. The Performance Bond shall remain in full force and effect throughout the Warranty Period.

13. The equipment items furnished shall comply with all governing federal and state laws regarding safety, including all current requirements of the Occupational Safety and Health Act (OSHA). The Contractor shall be solely responsible for job safety in accordance with all laws, regulations, methods, etc. of OSHA and the state.

PART 2 – NOT USED

PART 3 – NOT USED

END OF SECTION
SECTION 02110
CLEARING & GRUBBING

PART 1 - GENERAL

1.01 Work Included

A. Clearing, grubbing, removal and disposal of vegetation, rocks, roots and debris within the limits of the work except objects designated on the drawings to remain.

B. Preserve from injury or defacement all vegetation and objects to remain.

1.02 Related Work

A. Section 02200: Erosion Prevention and Sediment Control

B. Section 02221: Trenching, Bedding and Backfilling

1.03 Limits of Work

A. Rights-of-way or easement area established by Owner.

B. Construction area including the area bounded by lines five feet outside the construction lines established by Owner.

C. Approved borrow pit areas.

D. Designated stockpiles of construction material other than borrow material.

1.04 Protection

A. The Contractor shall observe the requirements stated in Clarksville City Ordinance 1-1710, which describes the precautions required to protect any City trees. If the work entails removal of any trees on City owned property, the City Forester shall be notified in advance of removing the trees. City trees are described as any tree 6” diameter or greater that is located on City owned property or right-of-way. The City Forester may permit removal of the tree(s), and in some instances may require replacement in kind with a tree(s) of equal size (i.e. one 6” diameter tree or three 2” diameter trees). The replacement requirements are described in City Ordinance 1-1708. These requirements must be included in any bid submittal and are considered incidental unless specifically addressed in the Bid Form.
B. Protect living trees not marked for removal inside and outside the construction area. To protect trees from injury, erect construction fences around trees allowing one foot of space from the trunk for each inch of trunk diameter. Treat cut or scarred surfaces of trees or shrubs with a paint prepared especially for tree surgery.

C. Protect benchmarks and existing structures, roads, sidewalks, paving and curbs against damage from vehicular or foot traffic.

D. Maintain designated temporary roadways, walkways and detours, for vehicular and pedestrian traffic.

E. Establish all erosion prevention and sediment control devices.

PART 2 - NOT USED

PART 3 - EXECUTION

3.01 Preparation

Maintain benchmarks, monuments and other reference points. Re-establish if disturbed or destroyed at no cost to Owner.

3.02 Clearing and Grubbing

A. Clear rights-of-way, borrow pit and other stockpile areas of objectionable material to the ground surface except for trees and stumps.

B. Cut trees and stumps to within six inches of ground surface or low water level in swampy areas where embankments are to be constructed provided undercutting or other corrective measures are not stipulated.

C. Cut trees and stumps outside the construction area marked for removal by the Owner to within six inches of the ground surface.

D. Remove low hanging, unsound or unsightly branches on trees or shrubs designated to remain.

E. Trim branches of trees extending over the roadbed to a clear height of twenty feet above the roadbed surface.
F. Grub construction area of protruding obstructions except sound undisturbed stumps and roots six inches or less above the ground which will be a minimum of 5 feet below subgrade or embankment slope provided undercutting, topsoil stripping or other corrective measures are not stipulated.

G. Grub borrow pit and stockpile areas of all objectionable material.

H. Perform clearing and grubbing well in advance of construction or material removal activities.

3.03 Debris Removal

A. No cleared or grubbed material shall be used in backfills or embankment fills.

B. Promptly remove cleared debris from site unless property owner gives written permission for onsite disposal.

C. Obtain permission from applicable regulatory authority for disposal of debris to waste disposal site.

END OF SECTION
PART 1 - GENERAL

1.01 Work Included

A. This work shall consist of erosion control on all cut and fill operations, excavation, backfill, or other construction activities within the limits of the construction site, within any temporary or permanent easements, and within any borrow site used during the period of construction. The protection of these sites shall continue throughout the construction period.

B. During flood seasons, protect the sites by sandbagging, the pumping of water, and any other means appropriate to restrain flooding. During dry weather, sprinkle the sites with water or use other means as necessary to provide dust control. In case of abnormally cold weather, any construction such as excavation work may be delayed until warmer weather or covered to prevent freezing.

C. Either permanent stabilization or temporary seeding and mulching shall occur as soon as practical after final grade is achieved, but under no circumstances shall disturbed ground be exposed for longer than 14 days.

D. The Contractor shall continuously maintain temporary erosion prevention and sediment control measures until permanent stabilization is established. The temporary pollution control provisions contained herein shall be coordinated with the permanent erosion control features, to ensure economical, effective, and continuous erosion control throughout the construction and post-construction period.

1.02 Related Work

A. Section 02410: Cleanup and Restoration

B. Section 02485: Lawn and Grass Landscaping

PART 2 - PRODUCTS

2.01 Temporary Berms

A. A temporary berm is constructed of compacted soil, with or without a shallow ditch, at the top of fill slopes or transverse to centerline on fills.

B. These berms are used temporarily at the top of newly constructed slopes to prevent excessive erosion until permanent controls are installed or slopes stabilized.

2.02 Temporary Slope Drains

A temporary slope drain is a facility consisting of stone gutters, fiber mats, plastic sheets, concrete or asphalt gutters, half round pipe, metal pipe, plastic pipe, sod, or other material that may be used to carry water down slopes to reduce erosion.

2.03 Sediment Structures

Sediment basins, ponds, dewatering structures and traps are prepared storage areas constructed to trap and store sediment from erodible areas in order to protect properties and stream channels below the construction areas from excessive siltation.

2.04 Check Dams

Check dams are barriers composed of large stones, sandbags, or other non-erodible materials placed across or partially crossing a natural or constructed drain way.

2.05 Temporary Seeding and Mulching

Temporary seeding and mulching are measures consisting of seeding, mulching, fertilizing, and matting utilized to reduce erosion. All cut and fill slopes including waste sites and borrow pits shall be seeded when and where necessary to eliminate erosion. Either permanent stabilization or temporary seeding and mulching shall occur as soon as practical after final grade is achieved, but under no circumstances shall disturbed ground be exposed for longer than 14 days.
2.06 **Baled Hay or Straw Checks**

A. Baled hay or straw checks are temporary measures to control and prevent erosion.

B. If approved, baled hay or straw checks may be used where the existing ground slopes toward or away from the embankment and shall follow the contour along the toe of slopes, in ditches, or other areas where siltation erosion or water runoff is a problem.

C. Baled hay or straw checks can only be used in conjunction with silt fence or other approved methods as temporary control measures.

2.07 **Temporary Silt Fences**

Silt fences are temporary measures utilizing woven wire or other approved material attached to posts with filter cloth composed of burlap, plastic filter fabric, etc., attached to the upstream side of the fence to retain the suspended silt particles in the runoff water.

**PART 3 - EXECUTION**

3.01 **Planning and Permitting**

A. Unless otherwise provided, it shall be the basic responsibility of the Contractor to develop an erosion prevention and sediment control plan, including a Storm Water Pollution Prevention Plan (SWPPP), acceptable to the Engineer and the State of Tennessee.

B. The Contractor shall submit a spill prevention plan to the Engineer for review. The contents of this spill prevention plan shall depend on what types of chemicals, lubricants and fuels will be used and if these will be stored on site. As a minimum, if fuel or lubricants or other chemicals are stored on site, either temporarily in vehicular tanks or in skid or trailer mounted tanks, a plan shall be supplied which directs all employees of the Contractor in the proper procedures to be followed should a spill occur. Under no circumstances shall spent oil wastes be discharged on the site. For more complex chemical storage requirements, a more complex plan will be required.

C. The Contractor shall be responsible for filing the Notice of Intent (NOI) with the State. The complete application must be submitted at least 30 days prior to commencement of construction activities. Land disturbing activities shall not start until a Notice of Coverage is prepared and written approval by TDEC Division of Water Pollution Control is obtained.
D. The Contractor shall be responsible for twice-weekly field inspection and documentation, and inspection after any storm event (0.5 inches or greater) of all erosion prevention and sediment control devices to ensure that all devices are in fully operable condition. Copies of completed forms shall be made available to the City Engineer’s Office upon request.

E. Upon completion of construction, the Contractor shall be responsible for filing Notice of Termination (NOT) with the State.

F. The project drawings and SWPPP indicate the minimum erosion prevention and sediment control measures required for this job. If the Contractor desires to stockpile construction materials, stone, earth, etc., the location of it and protection thereof shall be outlined in an Erosion Prevention and Sediment Control Plan to be submitted to the Engineer for review.

G. The Contractor shall ensure that all erosion prevention and sediment control documents, including the SWPPP and any permits obtained, shall be available at the project site at all times.

3.02 Pre-Construction Conference

At the Pre-Construction Conference, the Contractor shall meet with the Engineer and go over in detail the expected problem areas in regard to the erosion prevention and sediment control work. The Contractor shall submit for acceptance his schedule for accomplishment of temporary and permanent erosion control work. He shall also submit for acceptance his proposed method of erosion control on haul roads and borrow pits and his plan for disposal of waste materials. No work shall be started until the erosion control schedules and methods of operations have been accepted by the Engineer.

3.03 Construction Requirements

A. The Engineer has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, the surface of erodible earth material exposed by excavation, borrow and fill operations, and to direct the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of adjacent streams or other watercourses, lakes, ponds, or other water impoundment. Such work may involve the construction of temporary berms, dikes, dams, sediment basins, slope drains, and use of temporary mulches, mats seeding or other control devices or methods as necessary to control erosion. Cut and fill shall be seeded and mulched as the excavation proceeds to the extent directed by the Engineer. Under no conditions shall the erodible earth material exposed at one time by clearing and grubbing exceed 5,000 linear feet for utility line work or one (1) acre without approval of the Engineer.
B. The Contractor shall be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in his accepted schedule. Temporary pollution control measures not associated with permanent control features shall be used to correct conditions that develop during construction that were not foreseen during the pre-construction stage, prior to the installation of permanent pollution control features, or as needed to temporarily control erosion during normal construction practices.

C. Where erosion is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion control features can follow immediately thereafter if the project conditions permit; otherwise erosion control measures may be required between successive construction stages.

D. The Engineer will limit the area of excavation, borrow, and embankment operations in progress commensurate with the Contractor’s capability and progress in keeping the finish grading, mulching, seeding, and other such permanent pollution control measures current in accordance with the accepted schedule. Should seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified.

E. Either permanent stabilization or temporary seeding and mulching shall occur as soon as practical after final grade is achieved, but under no circumstances shall disturbed ground be exposed for longer than 14 days.

F. In the event of conflict between these requirements and pollution control laws, rules or regulations, or other Federal, State or Local agencies, the more restrictive laws, rules, or regulations shall apply.

3.04 Construction of Structures

A. Temporary Berms

1. A temporary berm shall be constructed on compacted soil, with a minimum width of 24 inches at the top and a minimum height of 12 inches, with or without a shallow ditch, constructed at the top of fill slopes or transverse to centerline on fills.

2. Temporary berms shall be graded so as to drain to a compacted outlet at a slope drain. The area adjacent to the temporary berm in the vicinity of the slope drain must be properly graded to enable this inlet to function efficiently and with only minimum ponding in this area.

3. All transverse berms required on the downstream side of a slope drain shall extend across the grade to the highest point at approximately a ten (10) degree angle with a perpendicular to centerline. The top width of
these berms may be wider and the side slope flatter on transverse berms to allow equipment to pass over these berms with minimal disruptions.

4. When practical and until final roadway elevations are approached, embankments should be constructed with a gradual slope to one side of the embankment to permit the placement of temporary berms and slope drains on only one side of the embankment.

B. Temporary Slope Drains

1. Temporary slope drains shall consist of stone gutters, fiber mats, plastic sheets, concrete or asphalt gutters, half round pipe, metal pipe, plastic pipe, flexible rubber, or other materials which can be used as temporary measures to carry water accumulating in the cuts and on the fills down the slopes prior to installation of permanent facilities or growth of adequate ground cover on the slopes.

2. Fiber matting and plastic sheeting shall not be used on slopes steeper than 4:1 except for short distances of 20 feet or less.

3. All temporary slope drains shall be adequately anchored to the slope to prevent disruption by the force of the water flowing in the drains. The base for temporary slope drains shall be compacted and formed to create a concave channel for the water or to hold the slope drain in place. The inlet end shall be properly constructed to channel water into the temporary slope drain. Energy dissipated will be accomplished at the discharge point using riprap or a small sediment basin which would slow the water as well as pick up some sediment. All temporary slope drains shall be removed when no longer necessary and the site restored to match the surroundings.

C. Sediment Structures

1. Sediment structures shall be utilized to control sediment at the foot of embankments where slope drains outlet; at the bottom as well as in the ditch lines atop waste sites; and in the ditch lines of borrow pits. Sediment structures may be used in most drainage situations to prevent excessive siltation of pipe structures. All sediment structures shall be at least four times as long as they are wide.

2. Dewatering structures shall be used to remove sediment from water pumped during dewatering operations. The dewatering structure must be sized to allow pumped water to flow through the filtering device without overtopping the structure. Portable sediment tanks, straw bale/silt fence pits and sediment filter bags are types of dewatering structures recommended in the TDEC Erosion and Sediment Control Handbook.

3. When use of temporary sediment structures is to be discontinued, all sediment accumulation shall be removed, and all excavation backfilled and properly compacted. The existing ground shall be restored to its natural and intended condition.
D. Check Dams
1. Check dams shall be utilized to reduce the velocity of storm water in areas of concentrated flow, and to capture larger soil particles. Materials utilized to construct check dams are varied and should be clearly illustrated or explained in the Contractor’s erosion control plan.
2. All check dams shall be keyed into the sides and bottom of the channel. A geotextile shall be set into soil to separate soil and rock.
3. The center of check dams should be at least 9-inches lower than either edge.
4. Check dam structures shall be designed and installed to prevent flooding of adjacent property, buildings and residences.

E. Temporary Seeding and Mulching: Seeding and mulching shall be performed in accordance with the Section 02485. Seeding and mulching shall occur as soon as practical after final grade is achieved, but no later than 14 working days.

F. Baled Hay or Straw Erosion Checks
1. Hay or straw erosion checks shall be embedded in the ground four (4) to six (6) inches to prevent water flowing under them. The bales shall be installed turned upon the side of the bale. The bales shall also be anchored securely to the ground by wooden stakes driven through the bales into the ground. Bales can remain in place until they rot, or be removed after they have served their purpose, as determined by the Engineer. The Contractor shall keep the checks in good condition by replacing broken or damaged bales immediately after damage occurs. Normal debris cleanout will be considered routine maintenance.
2. Baled hay or straw checks can only be used in conjunction with silt fence or other approved methods as temporary control measures.

G. Temporary Silt Fences
1. Temporary silt fences shall be placed on the natural ground, at the bottom of fill or cut slopes, below soil stockpiles, or other areas where siltation is a problem. Silt fences are constructed of wire mesh fence with a covering of burlap or some other suitable material on the upper grade side of the fence and anchored into the soil. Temporary silt fence serves small drainage areas (maximum ¼ acre per 100 feet of silt fence length).
2. The Contractor shall be required to maintain the silt fence in a satisfactory condition for the duration of the project or until its removal is requested by the Engineer. The silt accumulation at the fence may be left in place and seeded or removed, as directed by the Engineer. The silt fence remains the property of the Contractor whenever the fence is removed.
3. Silt fences should not be installed across streams, ditches, waterways, or other concentrated flows. All silt fences should be installed along the
contour, never up or down a slope. The bottom 4 inches of the silt fence must be entrenched and backfilled to be effective.

3.05 Maintenance and Removal

The temporary erosion prevention and sediment control features installed by the Contractor shall be satisfactorily maintained by the Contractor until no longer needed or permanent erosion control methods are installed. The Contractor shall be responsible for removing silt fences and check dams after the permanent cover is established. Any materials removed shall become the property of the Contractor.

3.06 Erosion Control Outside Project Area

Temporary erosion prevention and sediment control shall include construction work outside the project area where such work is necessary as a result of construction such as borrow pit operations, haul roads, and equipment storage sites.

END OF SECTION
PART 1 - GENERAL

1.01 Work Included

A. Excavation of all materials encountered in trench excavation, including earth, rock or other materials, whether wet or dry.

B. Provide necessary sheeting, shoring and bracing.

C. Dewater excavation as required.

D. Undercut unsuitable materials and replace as required.

E. Prepare a stable, satisfactory trench bottom.

F. Place and compact granular beds, check dams, and backfill as appropriate.

G. Dispose of any unsuitable or excess materials.

1.02 Related Work

A. Section 02110: Clearing and Grubbing

B. Section 02200: Erosion Prevention and Sediment Control

C. Section 02410: Cleanup and Restoration

1.03 Precautions

A. In accordance with the Tennessee State Law (Tennessee Underground Utility Damage Prevention Act), the Contractor shall properly notify underground utility owners prior to beginning excavation activities. Tennessee State Law requires notification to the statewide one-call center, Tennessee One-Call, at least three (3) working days prior to excavation, but not more than ten (10) working days in advance of beginning the work. Locate requests, including emergency locate requests, to Tennessee One-Call shall be processed in accordance with Tennessee State Law. Contact Tennessee One-Call at 811 or 1-800-351-1111 to process a locate ticket. The City of Clarksville will not locate its natural gas, water and sewer utilities without a locate ticket from Tennessee One-Call.
B. Protect all structures, utilities, sidewalks, pavements, fences, vegetation and other features to remain.

C. Protect all benchmarks, property pins, survey points and similar items. If disturbed or damaged by construction operations, the Contractor shall pay the cost of restoration by a registered surveyor.

D. Follow all Federal, State, County, TVA, TDOT, and Railroad regulations when working in Rights-of-Way not owned by City or in utility easement.

E. Establish all erosion prevention and sediment control devices.

F. Precautions shall be taken to eliminate tracking of soil, mud, rock and gavel onto streets and roadways.

1.04 Dust Control

A. When ordered by Engineer or his representative, furnish and distribute over traveled road surfaces which have not been fully restored an application of regular flake calcium chloride having a minimum calcium chloride content of 77 percent, or a brine solution consisting of 1.5 pound of calcium chloride and one pound of sodium chloride per 100 gallons of water applied by a pressure distributor. Rate of application shall be 3 pounds/square yard for the flake calcium chloride, and 0.48 gallon/square yard for brine solution.

B. Whenever dust control is necessary, it shall be considered an integral part of the work, and no separate payment shall be made for it.

1.05 Maintenance of Traffic and Closing of Streets

A. Carry on the work in a manner which will cause a minimum of interruption to traffic, and do not close to through travel more than two consecutive blocks, including the cross street intersected. Where traffic must cross open trenches, provide bridges at street intersections and driveways. Post signs indicating that a street is closed and necessary detour signs for the proper maintenance of traffic. Before closing any streets notify responsible municipal, state, county, emergency, transit and school system authorities.

B. Place and maintain barricades, fences, construction signs, lights and flagmen as required during the progress of the construction work and until it is safe for traffic to use the roads and streets. The rules and regulations of OSHA, TDOT and other appropriate authorities respecting traffic safety provisions shall be observed.
PART 2 - PRODUCTS

2.01 Bedding and Backfill Materials

A. Class I Material: Angular, 1/4 to 1 inch graded stone.

B. Class II Material: Coarse sands and gravels with a maximum particle dimension of 1-1/2 inch 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.

E. In rock cuts, paved areas, roadways or other areas where free drainage bedding or backfill material is required, use Class I angular material.

F. Flowable Fill: See requirements described in Section 02575, Part 2.

PART 3 - EXECUTION

3.01 Preparation

A. Pre-construction photographs and video shall be taken by the Contractor, with special attention to improved areas, to aid in restoring landscaping and other items to their initial condition.

B. Where controlled blasting is required for rock removal, the Contractor shall perform a pre-blast survey and have a blasting program prepared as specified in Paragraph 3.04 of this Section.

C. Clear and grub as specified in Section 02110.

D. Establish erosion prevention and sediment controls as specified in Section 02200.

E. Protect all features to remain.

F. Put in place all traffic and other safety provisions as required.
3.02 Excavation

A. Unless specifically shown otherwise on the Bid Form, all excavation is unclassified, and includes excavation to subgrade elevations regardless of the character of materials and obstructions encountered. It is to be understood that any reference to rock, earth or any other material on the drawings is not to be taken as an indication of classified excavation or the quantity of either rock, earth or any other material involved.

B. The Bidder should make such investigations as deemed necessary to determine existing conditions and shall draw his own conclusions as to the conditions to be encountered. When rock borings, soundings or test pit data are provided, they are for information only and do not guarantee existing conditions.

C. Align the trench as shown on the Contract Drawings. Deviations due to obstructions are discussed in Paragraph 3.08 of this Section.

D. Perform excavation in such a manner as to form a suitable trench in which to place the pipe and so as to cause the least inconvenience to the public.

E. The Contractor shall be responsible for stripping, storing and protecting topsoil that is to be removed prior to excavation. This topsoil is to be reused during the cleanup and restoration. The Contractor is responsible for obtaining and providing other topsoil as may be necessary to restore the excavated area to its original topsoil quantity and quality.

F. Pavement cuts shall be made along neat, straight lines with either a pavement breaker or pavement saw prior to the excavation. Cut pavement to be a minimum of 6 inches outside of trench cut. Coordinate all street cuts with the State, County and City Street Departments as applicable.

G. Trenches shall be excavated to the depths indicated on the Contract Drawings. Trench depth shall be sufficient to provide a minimum cover of 36 inches over the top of the pipe in non-traffic areas and 48 inches in areas subject to vehicular traffic. Depth of cover is measured from finished grade to top of the pipe. Where approved by the Owner, additional pipe protection such as use of ductile iron pipe or concrete encasement may be used where minimum cover is not possible. Increased depth may be required as noted on the Contract Drawings to avoid obstructions, avoid requiring an air release valve and other reasons.

H. Excavated material shall be placed a minimum of two feet back from the edge of the trench.
I. When unstable soil or other unsuitable material is encountered at the trench bottom, undercut these materials to a depth required to assure support of the pipeline or as directed by the Engineer and backfill to the proper grade with compacted crushed stone. The top 6 inches shall be Class I angular material. Crushed stone for backfilling undercut unsuitable material will be a pay item under crushed stone for undercut replacement as set forth in Section 01026, Paragraph 3.04.

J. Remove rock encountered in trench excavation to a minimum depth of 6 inches below the bottom of the pipe barrel, backfill with Class I angular material, and compact to uniformly support the pipe. **In no case shall solid rock exist within six inches of the finished pipeline.**

K. Maximum width at the crown of the pipe shall be 2 feet plus the nominal diameter of the pipe, unless specifically approved otherwise by the Engineer due to unusual bracing and shoring requirements. Trenches constructed by mechanical trenching are allowed only with prior approval of Engineer. Over-excavation will be required at locations for fittings and valves.

L. Trenches 4 feet or more in depth should be provided with a means of egress. Spacing between ladders or other means of egress must be such that a worker will not have to travel more than 25 feet laterally to the nearest means of egress.

M. Open excavations shall be barricaded when the Contractor is not at the site. At a minimum, this shall consist of orange polyethylene barricade safety fence. See Paragraph 1.05 of this section for additional requirements for excavations in traffic areas.

3.03 **Sheeting, Shoring and Bracing**

A. Furnish, put in place, and maintain such sheeting, shoring and bracing, as may be required to support the sides of the excavation and to prevent movement as required by OSHA. Damages resulting from improper shoring or failure to shore shall be the sole responsibility of the Contractor.

B. Comply with all OSHA standards in determining where and in what manner sheeting, shoring and bracing are to be accomplished. The sheeting, shoring and bracing system shall be designed by a professional engineer licensed in the State of Tennessee and shall be subject to approval by the Engineer. However, such approval does not relieve the Contractor of the sole responsibility for the safety of all employees, the effectiveness of the system, and any damages or injuries resulting from the lack or inadequacy of the sheeting, shoring and bracing.

C. The Contractor may use a trench box, which is a prefabricated movable trench
shield composed of steel plates welded to a heavy steel frame. The trench box shall be designed to provide protection equal to or greater than that of an appropriate shoring system.

D. Do not leave sheeting, shoring or bracing materials in place unless called for in the Contract Drawings, ordered by the Engineer, or deemed necessary or advisable for the safety or protection of new or existing work or features. Remove these materials in such a manner that the new structure or any existing structure or property, whether public or private, will not be endangered or damaged and that cave-ins and slides are avoided.

3.04 Rock Removal

A. Controlled blasting may be used as an alternative to non-explosive methods of rock removal at the approval of the Owner. Controlled blasting shall be performed by a qualified explosive specialist, employed by the Contractor. The contractor shall have a Registration Certificate and each employee engaged in the blasting activity shall carry a valid identification card issued by the Division of Fire Prevention.

B. All blasting shall be performed in accordance with the Tennessee Blasting Standards Act of 1975. Conduct all blasting operations in accordance with prevailing municipal, state or other agency regulations, codes, ordinances, or laws.

C. The Contractor assumes all liability for all personal injury, any damage to real or personal property, or interference with the use or enjoyment of any property by reason of blasting or the resulting vibration or concussion. The Contractor assumes full responsibility for operating all equipment and performing all blasting in accordance with Federal and State laws, and regulations prescribed by any other Governmental authority limiting the amount of vibration or concussion.

D. The Contractor shall prepare or retain a consultant to prepare the blasting program and to supervise and assist in monitoring the blasting. The blasting program shall include, but not be limited to, data on the locations, hole size, depth, over-depth, pattern and inclination of the blast holes, the type, strength, amount, distribution and powder factor for the explosives used, per hole and per blast, the sequence and pattern of delays, maximum amount of explosives in any one period, depth of rock, and depth of overburden, if any, and the description and purpose of special methods to be used. This data shall be submitted to the Engineer upon request.

E. The Contractor or his consultant shall conduct a pre-blast survey of the surrounding structures within 300 feet of any blasting operation and document their condition prior to any blasting. Documentation shall include written
descriptions, videos and/or photographs of the structures, and measures of obvious signs of structural distress such as cracks. Gauge marks shall be located over existing cracks at selected locations to be measured before and after blasting to determine if widening or displacement has taken place.

F. All blasts shall be designed to prevent fly rock. The Contractor shall use adequate, good quality stemming material and cover the blasts with blasting mats or an adequate soil cover.

G. If structures or pipelines are damaged, promptly replace or repair them at no expense to Owner.

H. Seismographic monitoring shall be done by the Contractor or his consultant and a record made of the peak particle velocities caused by the blasting. This data shall be included in the blasting report.

I. Air blast shall be monitored with an approved instrument having the required frequency response and capable of providing a permanent record of the air blast effects. These records, identified by time and recording location, shall be included in the blasting report.

J. The Contractor shall maintain a daily log on ready inspection by the Engineer. A completed blasting report shall be submitted to the Engineer at the conclusion of all blasting.

3.05 Disposal of Materials

A. Whenever practicable, all materials removed by excavation that are suitable for backfilling pipe trenches or for other purposes shown on the drawings or directed by the Engineer shall be used for those purposes.

B. Any materials not so used shall be considered waste materials and disposed of by the Contractor. Waste materials may be deposited in spoil areas at locations approved of by the Engineer or shall be properly disposed of off-site if there is no approved spoil area.

3.06 Unauthorized Excavation

A. Unauthorized excavation is defined as all excavation outside or below the proposed lines and grades shown on the Contract Drawings or that which is directed by the Engineer.

B. Backfill areas of unauthorized excavation with the type of material necessary to ensure the stability of the structure or construction involved.
C. Unauthorized excavation and/or backfill to replace same shall not be a pay item.

3.07 Dewatering

A. The Contractor shall furnish, install and operate all necessary equipment to keep excavated areas free of water while work is in progress. Dewatering equipment shall be of adequate size and quantity to assure maintaining proper conditions for installing pipe, concrete, bedding, backfill or other material or structure in the excavation.

B. Well-pointing shall be performed if required.

C. Take particular precautions to prevent the displacement of structures or pipelines as a result of accumulated water. Any pipe displaced due to accumulated water shall be replaced by the Contractor at his expense.

D. Dewatering operations shall be performed in a manner so as not to cause injury to public or private property or nuisance to the public nor contribute to pollution to surface water. The Contractor’s dewatering operations shall be in full compliance with Section 02200 of these Specifications.

3.08 Obstructions

A. Obstructions shown on the Contract Drawings are for information only and do not guarantee their exact locations nor that other obstructions are not present. The crossing of existing mains and services, which are approximately perpendicular to the proposed ditch line, is considered normal construction practice. The Contractor shall have the responsibility of making these crossings and repairing any damages to such crossings without additional reimbursement.

B. Whenever unknown obstructions are encountered during the progress of the work that directly interfere with the vertical or horizontal alignment of the pipeline, the Engineer shall have the authority to order a deviation from the grade or alignment or for the removal, relocation or reconstruction of the obstructing utility or structure. Likewise, the Contractor may request to relocate the proposed line or request reimbursement for relocating the existing line or performing unusual shoring beyond what is normally required for trench stabilization.

C. When utilities or obstructions are not shown on the Contract Drawings but are present off the roadway at the location of the proposed pipeline route, the Contractor may request to relocate the pipeline in the roadway if necessary to avoid disturbing the utility or obstructions. If the relocation is approved by the Engineer into a paved area, the Contractor shall receive compensation for
additional granular backfill and pavement replacement as measured and paid for as set forth in Section 01026, Paragraph 3.07.

D. Exercise due care in excavating adjacent to existing obstructions and do not disturb same unless absolutely necessary.

E. In the event existing utilities are disturbed, repair or replace as quickly as possible to the condition existing prior to their disturbance at no cost to the Owner. If required by the Owner, pay for the repair or replacement work performed by the forces of the utility company or other appropriate party.

F. If replacement or repair of disturbed obstructions is not performed after a reasonable period of time, the Owner may have the necessary work done and deduct the cost of same from payments to the Contractor.

3.09 Bedding of Natural Gas Lines

A. Natural gas mains may be laid on a stable earth bed in a trench cut in natural ground. Excavate the trench in such a manner as to form a suitable bed on which to place the pipe. Where unstable soil or other unsuitable material is encountered at the trench bottom, undercut and replace these materials as discussed in Paragraph 3.02 of this Section.

B. Where natural gas lines are laid within a rock cut, completely encapsulate each pipe section with a minimum of 6 inches of Class I angular material on the top, both sides and the bottom of the pipe.

C. Dig bell holes so that the barrel of the pipe will rest for its entire length upon the natural earth trench bed or prepared bedding to assure uniform support of the pipe.

3.10 Initial Backfilling

A. Do not begin backfilling before the Engineer or his representative has inspected or approved the grade and alignment of the pipe, the bedding of the pipe, and the joints between the pipes. If backfill material is placed over the pipe before an inspection is made, the Engineer or his representative may require the Contractor to reopen the trench for an inspection to be made at no cost to the Owner.

B. Perform initial backfilling by hand or by carefully dumping small quantities of fill from a loader bucket, until fill has progressed to 6 inches above the top of the pipe.
3.11 Final Backfilling

A. Final backfilling shall be performed as soon as practicable after inspection and initial backfilling is complete. Adequate precautions shall be taken to insure proper placement and compaction of backfill without disturbing or damaging pipe. Fill shall be properly compacted and suitable precautions shall be taken to insure permanent stability for pipe. Utilities shall be provided with adequate cover or additional protection as described in Paragraph 3.02 of this Section.

B. Backfilling in unimproved areas:
   1. Dispose of all soft, yielding or organic material that is unsuitable for trench backfill and replace with suitable material. The maximum dimension of individual stones and broken rock within the backfill should not exceed 6 inches.
   2. Deposit, spread and compact backfill in even layers no greater than 12 inches deep to the surface with suitable equipment in such a manner so as not to disturb the pipe. If earth material for backfill is, in the opinion of the Engineer or his representative, too dry to allow thorough compaction, the Contractor shall add enough water so that the backfill can be properly compacted.
   3. Neatly round sufficient surplus excavated material over the trench to compensate for settlement of the backfill.
   4. The top 12 inches of backfill material shall consist of fine loose earth free from large clods, vegetable matter, debris, stone and/or other objectionable materials.
   5. Properly dispose of all excess excavated material.
   6. Prior to final acceptance, finish grade, restore topsoil and reestablish landscaping as specified in Sections 02410 and 02485.

C. Backfilling beneath flexible and rigid pavements:
   1. Use Class I angular material of either crushed limestone or crushed gravel of high weight and density.
   2. Carefully deposit in uniform layers, not to exceed 6 inches thick.
   3. Compact each layer thoroughly by rolling, ramming and tamping with tools suitable for that purpose in such a manner so as not to disturb the pipe.
   4. Flowable fill may be used at the Contractor’s request with approval of the Engineer, when specified on a particular project, or when required by the Clarksville Street Department. Payment for flowable backfill will be included as a separate pay item.

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 State, County or City departments maintaining the particular roadway or
TRENCHING, BEDDING, & BACKFILLING

highway.

2. Replace with similar materials, all shoulders that may be damaged or destroyed as a result of pipe trenching.

3. Backfilling of shoulders shall not be directly measured for payment.

4. Where shoulders along state highways have seal coat surfaces, replace with double bituminous seal in accordance with TDOT requirements.

5. Where TDOT 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 unless provided for specifically on the Bid Form.

6. Backfill in state highways may also be performed utilizing flowable fill. Refer to Section 02575, Paragraph 3.08 for installation requirements.

E. Crushed stone for pavement 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 measured for payment.

END OF SECTION
SECTION 02410

CLEANUP & RESTORATION

PART 1 - GENERAL

1.01 Work Included

A. Work included in this section consists of finish grading, site cleanup, patching of pavement, repairing and/or reinstalling all public and private improvements disturbed by the construction.

B. Cleanup shall follow in close succession to other construction activities and shall be a daily function. Allowances will be made for time of settling of backfilled trenches before final grading and landscaping is attempted; however, drainage ditches are not to be left obstructed. The concept of leaving cleanup until the other construction is completed is not acceptable.

C. The City reserves the right to withhold payments (in part or in whole) if cleanup and restoration does not meet with the approval of the City.

1.02 Related Work

A. Section 02200: Erosion Prevention and Sediment Control

B. Section 02575: Pavement Repair

C. Section 02485: Lawn and Grass Landscaping

PART 2 - PRODUCTS

All materials and products used for repair and/or replacement of disturbed areas shall meet or exceed the type and quality of the original.

PART 3 - EXECUTION

3.01 Pre-Construction Photographs

The Contractor shall use the photographs and/or video taken prior to construction to aid in cleanup and restoring landscaping and other features, public or private, to their original condition or better.
3.02 Finish Grading and Topsoil Restoration

A. After allowing backfill adequate time to settle, finish grade all areas to produce a uniform, satisfactory finish with rounded surfaces at the top and bottom of abrupt changes in grade.

B. Refill areas where noticeable settlement has occurred.

C. Finish grading shall be performed such that the area will drain satisfactorily and will not hold or collect standing water.

D. Restore topsoil as specified in Section 02485, Paragraph 3.02.

E. Dress for final inspection such that the surface is free of large clods, debris, stone and/or other objectionable material.

F. Restore lawn and grass landscaping in accordance with Section 02485. Final stabilization by lawn and grass landscaping shall occur within 14 days of completion of finish grading to begin establishment of ground cover to prevent erosion.

3.03 Pavement Maintenance and Replacement

A. All excavation in traffic areas, whether bituminous, concrete, or gravel, shall be backfilled with compacted crushed stone. The stone shall be brought to the grade of the surrounding pavement to provide a temporary surface for traffic. The Contractor is responsible for grading and maintaining the gravel surface until the final pavement is in place.

B. Throughout the duration of the project, pavements shall be kept free of mud, gravel and other construction debris to avoid unnecessary tracking of mud and spreading of dust. If conditions warrant, the Contractor shall be responsible for arranging for street washing to remove unnecessary amounts of mud from the pavement and also to control dust. This will not be a pay item but will be a responsibility of the Contractor when conditions warrant.

C. Damaged pavement, whether concrete or asphalt, shall be properly replaced with the corresponding same equal material. In some cases, the City Street Department will assume the responsibility for the final paving after the Contractor has properly cut, trimmed and backfilled the utility trench. The Contractor shall assume the total responsibility for repaving unless stated specifically otherwise in the Contract Documents. Pavement repair shall be in accordance with Section 02575.
3.04 **Curbs, Sidewalks, Steps, Etc.**

A. All curbs, sidewalks, steps, etc. which are damaged or disturbed shall be replaced by squarely cutting or removing at the nearest sound joint or section and re-pouring the new structure to match or exceed the quality and appearance of the original.

B. All repairs shall be compliant with the City Street Department and the Americans with Disabilities Act (ADA). Any new curbs, sidewalks, steps, etc. shall be designed and installed to meet requirements of the ADA.

3.05 **Fences**

All fences and posts, which are damaged or removed, shall be re-erected. Posts shall be firmly set and tamped. Wire fences shall be tightly stretched. New materials shall be used when it is obvious that the existing material cannot be reinstalled to its condition prior to being disturbed.

3.06 **Shrubs, Flowers and Ornamentals**

Where noted on the plans or as directed by the City, all attempts shall be made to protect, preserve and reset shrubs, flowers and ornamentals disturbed by the construction.

3.07 **Mailboxes, Etc.**

A. Mailboxes that are disturbed by the construction shall be reinstalled or relocated immediately in a serviceable condition and location. After backfilling and re-grading, the mailbox shall be permanently and properly erected.

B. All other public or private improvements disturbed by the construction shall be repaired or replaced to original condition unless specifically exempted in the Contract Documents.

3.08 **Erosion and Sediment Control**

A. The Contractor shall maintain all areas where excavating and backfilling operations are being performed or have been performed in order that siltation and bank erosion will be kept to a minimum during construction. This requirement includes construction of temporary erosion barriers and use of special methods to control erosion.
B. The Contractor shall be responsible for removing all temporary erosion protection and sediment control devices, including silt fences and check dams, after the permanent cover is established.

C. All erosion and sediment control must be done in accordance with Section 02200 of this specification.

END OF SECTION
SECTION 02485

LAWN & GRASS LANDSCAPING

PART 1 - GENERAL

1.01 Work Included

A. All activities necessary to restore areas disturbed by construction, or other designated areas, to their original landscaped condition and quality.

B. Preparation of landscape area including loosening, pulverizing and fertilizing.

C. Placement of seed, sprigging, sod and topsoil including mulch, where required.

D. Watering of landscaping.

1.02 Related Work

A. Section 02110: Clearing and Grubbing

B. Section 02200: Erosion Prevention and Sediment Control

C. Section 02410: Cleanup and Restoration

PART 2 - PRODUCTS

2.01 Seed Materials

A. Inspect and test seed for germination and purity prior to mixing.

B. Uniformly mix by Group:

<table>
<thead>
<tr>
<th>Seed Name</th>
<th>Quantity % by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP “A”</td>
<td></td>
</tr>
<tr>
<td>Lespedeza (common or Korean)</td>
<td>20%</td>
</tr>
<tr>
<td>Sericea Lespedeza</td>
<td>15%</td>
</tr>
<tr>
<td>Kentucky 31 Fescue</td>
<td>40%</td>
</tr>
<tr>
<td>English Rye</td>
<td>25%</td>
</tr>
</tbody>
</table>
### Seed Mixes

<table>
<thead>
<tr>
<th>Seed Name</th>
<th>Quantity % by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GROUP “B”</strong></td>
<td></td>
</tr>
<tr>
<td>Kentucky 31 Fescue</td>
<td>55%</td>
</tr>
<tr>
<td>Redtop</td>
<td>15%</td>
</tr>
<tr>
<td>English Rye</td>
<td>30%</td>
</tr>
<tr>
<td><strong>GROUP “C”</strong></td>
<td></td>
</tr>
<tr>
<td>Sericea Lespedeza</td>
<td>50%</td>
</tr>
<tr>
<td>Kentucky 31 Fescue</td>
<td>30%</td>
</tr>
<tr>
<td>English Rye</td>
<td>20%</td>
</tr>
</tbody>
</table>

- Use Group “A” seed from February 1 to August 1.
- Use Group “B” seed from August 1 to December 1, with the exception that either Group “A” or “B” may be used during the month of August.
- Use Group “C” seed from December 1 to February 1, but only when specified on the Contract Drawings or otherwise approved.
- All seed shall meet the requirements of the Tennessee Department of Agriculture.
- Upon request, furnish the Engineer a certified laboratory report showing the analysis of the seed to be furnished. The report shall bear the signature of a senior seed technologist.
- Inoculant for Legumes:
  1. Nitrogen fixing bacteria cultures adapted to the particular seed to be treated.
  2. Furnish in containers of a size sufficient to treat the specified quantity of seed to be planted.

### Mulch Materials

- Hay composed of approved stalks from grasses, sedges or legumes; or straw composed of stalks from rye, oats, wheat, or other approved grains.
- Air dried and reasonably free from noxious weeds, weed seeds, and other detrimental plant growth.
- Suitable for spreading with mulch blower machinery.
- Wood fiber mulch, when used, shall meet the following specifications:
Moisture Content  10.0 % ± 2.0%
Organic Matter    99.4 % ± 0.2%
Ash Content       0.6 % ± 0.2%

Water Hold Capacity (per hundred ... 1050 grams minimum grams of oven dry fiber)

E. Mulch Binders:
   1. Cut back asphalt, Grade RC-70 or RC-250 conforming to AASHTO M-81, M-82, M-141, for the type and grade specified.
   2. Emulsified asphalt, Type SS-1 conforming to AASHTO M-140. In addition to Type SS-1, a special mixing material AE-3 or a special priming material AE-P may be specified.

2.03 Jute Mesh
   A. Open plain weave of single jute yarn or photodegradable straw-filled mesh blankets and non-toxic to vegetation.
   B. Tag jute rolls for identification with 58 warp ends per yard, 41 weft ends per yard and weighing approximately 0.9 pounds per square yard with an acceptable tolerance of 5 percent.

2.04 Staples

New and unused, machine-made of No. 11 gauge steel wire formed into a "U" shape.

2.05 Sod Materials

A. Live, dense, well-rooted growth of permanent grasses, free from Johnson grass, nut-grass, and other undesirable grasses or weeds and well-suited for the proposed application to particular soils.
   B. Cleanly cut in strips having a reasonably uniform thickness of not less than 2-1/2 inches, a uniform width of approximately 8 inches, and a minimum length of 12 inches.

2.06 Commercial Fertilizers

A. Unless otherwise specified, inorganic 10-10-10 nitrogen, phosphoric acid, and potash for seeding and 15-15-15 or 10-10-10 for sodding.
   B. Furnish in standard containers with the brand name, weight and guaranteed analysis of the contents clearly marked.
   C. Comply with Federal, State, and local laws.
D. Ammonium Nitrate shall be a standard commercial product, having a minimum of 33.5 percent nitrogen.

E. Agricultural limestone shall contain a minimum of 85% of calcium carbonate and magnesium carbonate combined, and be of particular size that 85% will pass a No. 10 mesh sieve.

2.07 Water

Ensure that water is free of harmful organisms or other objectionable materials.

2.08 Topsoil

A. Natural, friable, fertile, fine sandy loam possessing characteristics of representative top soils in the vicinity, which produce heavy growths of vegetation.

B. Free from subsoil, noxious weeds, stones larger than one inch in diameter, lime, cement, ashes, slag, or other deleterious matter.

C. Well drained in its original position and free from toxic quantities of acid or alkaline elements.

PART 3 - EXECUTION

3.01 General

A. All unpaved or non-graveled areas disturbed by the construction of project or any other areas as specified shall have a stand of grass developed by one of the following methods: Seeding will generally be acceptable; however, if repeated seeding fails due to continued erosion or other unsatisfactory conditions, sprigging or sodding shall be used. If the imported topsoil or seeds result in Johnson grass or other undesirable weeds, the Contractor shall eliminate this growth with herbicides and reestablish an acceptable growth.

B. Before beginning seeding, sprigging or sodding operations in any area, complete finish grading and restoration of topsoil and have work approved by the Engineer or his representative.
3.02 **Topsoil**

A. The Contractor shall save and stockpile the topsoil removed from the excavation area or otherwise obtain topsoil to restore the area and reestablish an acceptable stand of grass.

B. Prepare landscape area to receive topsoil in close conformity to the lines and grades shown on the drawings.

C. Place topsoil at depths and locations shown on the drawings. Otherwise, topsoil shall be restored to its original quantity and quality, but no less than necessary to establish and promote an acceptable stand of grass.

3.03 **Seeding**

A. Scarify, disc, harrow, rake or otherwise work each area to be seeded until it has been loosened and pulverized to a depth as directed by the Engineer.

B. Uniformly incorporate fertilizer into the soil to a depth of approximately 1/2" at the rate of:
   1. Not less than 40 lbs. per 1000 square feet for grade 10-l0-10 or equivalent.
   2. Not less than 100 lbs. per 1000 square feet for agricultural limestone.

C. Fertilizer need not be incorporated in the soil as specified above when mixed with seed in water and applied with power sprayer equipment.

D. Sow seed of the specified group as soon as preparation of the seedbed has been completed.

E. Sow uniformly by means of a rotary seeder, hydraulic equipment, or other satisfactory means at the rate of 1½ pounds per 1000 square feet, unless otherwise specified.

F. Inoculate Group "C" seed and seeds of legumes, when sown alone, before sowing in accordance with the recommendations of the manufacturer of the inoculant.

G. Do not perform seeding during windy weather, or when the ground surface is frozen, wet or otherwise non-tillable. No seeding shall be performed during December through February unless otherwise permitted by Engineer.

H. When specified, provide seeding with mulch:
   1. Spread hay or straw mulch evenly over the seeded area at an approximate rate of 75 pounds per 1000 square feet immediately following the seeding operations. This rate may be varied by the Engineer depending on the
2. Hold hay or straw mulch in place by the use of a mulch binder applied at the approximate rate of 4 gallons per 1000 square feet as required.
3. Cover bridges, guardrails, signs and appurtenances, if the mulch binder is applied in such a way that it would come in contact with or discolor the structures.
4. When wood fiber mulch is used, uniformly apply at the rate of 28 to 35 pounds per 1000 square feet with hydraulic mulching equipment.

3.04 Sprigging

A. Lightly incorporate fertilizer into the soil to a depth of approximately 1/2" at the rate of:
   1. 15 lbs. per 1000 square feet for grade 0-20-20 or equivalent.
   2. 40 lbs. per 1000 square feet for agricultural limestone.

B. Perform sprigging during September-November or April-May and only when the soil is in tillable or workable condition.

C. Do not set crowns during windy weather or when the ground surface is frozen.

D. Set crowns as soon as preparation of the sprig bed has been completed.

E. Set crowns at the rate of three sprigs per square yard by means of a tree-planting bar or equal.

F. When specified, perform mulching before sprigging:
   1. Spread mulch material evenly over the area to be planted at the rate of 100 lbs. per 1000 square feet. This rate may be varied by the Engineer depending upon the texture and condition of the mulch material and the ground surface.
   2. Cover with a uniform layer of mulch so that 20 to 25 percent of the ground is visible. The mulch shall be loose enough to allow sunlight to penetrate and air to circulate slowly, but thick enough to partially shade the ground and to reduce erosion.
   3. Hold the mulch in place with mulch binders applied at the rate directed by the Engineer, not to exceed 0.1 gallon per square yard, as required to hold the mulch in place.
3.05 **Sodding**

A. Place sod at all locations shown on the Contract Drawings or where directed.

B. Loosen the surface of the ground to be sodded to a depth of not less than one inch with a rake or other device.

C. If necessary, sprinkle with water until saturated for a minimum depth of one inch and keep moist until the sod is placed.

D. Immediately before placing the sod, fertilize the prepared surface uniformly at the rate of:
   1. 12 lbs. per 1000 square feet for grade 10-10-10 or equivalent.
   2. 100 lbs. per 1000 square feet for agricultural limestone.

E. Place sod as soon as practical after removal from the point of origin, and keep in a moist condition during the interim.

F. Carefully place, by hand, on the prepared ground surface with the edges in closed contact and, as far as possible, in a position to break joints.

G. Each strip of sod laid shall be fitted and pounded into place using 10 inch wood tramps, or other satisfactory implements.

H. Immediately after placing, thoroughly wet and roll with an approved roller or hand-tamp as approved by the Engineer.

I. On slopes of two to one (2:1) or steeper, pinning or pegging may be required to hold the sod in place.

**END OF SECTION**
SECTION 02550

NATURAL GAS DISTRIBUTION

PART 1 - GENERAL

1.01 General Requirements

A. Laboratory Services: All materials and equipment used in the construction and installation of the project shall be subject to adequate inspection and testing in accordance with accepted standards. The laboratory or inspection agency shall be selected by the Contractor and approved by the Owner. Contractor shall be responsible to pay for all required laboratory inspection services.

B. Permits: If applicable, the Owner will secure any permits and provide bond as required by the regulatory agencies for the installation of permanent facilities. Contractors shall comply with all permit requirements.

C. Use of Explosives: Contractor shall not bring explosives onto the site or use in performance of the Work without prior written permission from the authorities having jurisdiction. Contractor is solely responsible for handling, storage and use of explosive materials when their use is permitted.

D. Contractor shall maintain erosion prevention and sediment control measures in accordance with the Tennessee Department of Environment and Conservation (TDEC) Erosion and Sediment Control Handbook.

1.02 Submittals

A. Prior to construction, Contractor shall submit for review and approval:

1. A work plan detailing the procedure and schedule to be used to execute the project. The work plan shall include:
   i. Description of all equipment to be used;
   ii. Description of down-hole tools;
   iii. List of personnel and their experience (including back-up personnel in the event that an individual is unavailable);
   iv. List of subcontractors;
   v. If applicable, drilling contractor’s qualifications showing a minimum of two (2) years of experience involving work of similar
nature, such as geology, pipe size and length of piping, to the work required of this project;

vi. Schedule of work activity;

vii. Safety plan (including MDS of any potentially hazardous substances to be used);

viii. Traffic control plan (if applicable);

ix. Environmental protection plan and contingency plans for possible problems.

The work plan shall be comprehensive, realistic and based on actual working conditions for the project. Plan shall document the thoughtful planning required to successfully complete the project.

2. Detailed bore profile, if applicable, including depths every ten feet (10’) or each rod length.

3. Drilling Crew Qualifications

i. All personnel shall be fully trained in their respective duties as part of the directional drilling crew and in safety. Contractor must submit each crew worker’s job history and reference list of equal or greater size and length of piping involved.

ii. Contractor shall provide name and qualifications of a competent and experienced supervisor representing the drilling contractor. This drilling crew supervisor shall always be present during the actual drilling operations. The drilling crew supervisor must have at least two (2) years directional drilling experience.

iii. Contractor shall submit name of the responsible representative, who is thoroughly familiar with the equipment and type work to be performed, and who is always in direct charge and control of the drilling operation.


i. A “Qualified Module Report” or other form of list showing all qualified tasks or operator qualifications (OQs) for each employee to be on job site.

5. Drug and Alcohol Plan.
6. **Welder’s Certification**

   i. Welder’s certification shall be submitted along with qualification documentation of all welders or joiners to be used in the performance of the Work, which shall include a detailed statement of qualifications demonstrating compliance with the requirements of this Specification.

   ii. All welders employed in the construction of the welded steel pipeline shall have previous pipeline welding experience and have complete working knowledge regarding welding equipment and preliminaries necessary for preparing to weld. They shall also be familiar with the preliminaries necessary to ensure good results with a maximum amount of safety.

   iii. Each welder shall be qualified in accordance with Subpart “E”, Part 192 Transportation of Natural Gas and other Gas by Pipeline: Minimum Federal Safety Standards, of Title 49 of the Code of Federal Regulations, and in accordance with all specifications and requirements of the Tennessee Public Utilities Commission or any other authority having jurisdiction over this project including the latest edition of API Standard 1104.

   iv. Any welder who is qualified to weld under a procedure that differs on any essential variable (as they are stated in Section 5 of API 1104) from the standard Clarksville Gas welding procedures will be required to perform a welding test or tests following said procedure. This qualification will be done by an independent test laboratory or other such agency that must be approved by the Owner. A certificate of all test results shall be furnished to the Owner for each welder before any work is to be performed by welder.

7. **Fusion Certifications**

   i. Fusion certifications shall be submitted along with qualification documentation of all joiners of plastic pipe to be used in the performance of the Work, which shall include a detailed statement of qualifications demonstrating compliance with the requirements of this Specification.

   ii. Each joiner of plastic pipe shall be qualified in accordance with Subpart “F”, Part 192 Transportation of Natural Gas and other Gas by Pipeline: Minimum Federal Safety Standards, of Title 49 of the Code of Federal Regulations, and in accordance with all specifications and requirements of the Tennessee Public Utilities Commission.
Commission or any other authority having jurisdiction over this project. A certificate of such test results shall be furnished to the Owner for each joiner of plastic pipe before any work is to be performed by such person.

8. Proposed material specifications, which shall at a minimum include specifications for:

   i. Pipe (provide coating submittal for steel pipe);
   
   ii. Valves and fittings;
   
   iii. Regulators and overpressure relief devices (if applicable);
   
   iv. Tapping fittings;
   
   v. EFVs, risers, and lock wings (if applicable);
   
   vi. Locating tape;
   
   vii. Tracer wire;
   
   viii. Test stations;
   
   ix. Anodes (if applicable);
   
   x. Paint products (if applicable);
   
   xi. Coating repair wraps or tapes for steel welds (if applicable);
   
   xii. Drilling fluids appropriate for the geology of the soils (if applicable);
   
   xiii. Drilling additives (if applicable); and
   
   xiv. Any other item, which is to be an installed component of the project or used during construction

Each submittal should include at a minimum the full name of each product, descriptive literature, and, if applicable, directions for use, its generic type and its nonvolatile content by volume. Mill test reports and mill certificate issued by the fabricating mill on all pipe material proposed to be used. The certificate must state that minimum requirements of these specifications have been met.
B. Prior to completion of construction, Contractor shall submit for review and approval:

1. Written guarantees and warranties.

2. Test charts with pertinent information, names of individuals responsible, date, media used in testing, time, weather, test pressure, etc.

3. Catalog Data for Owners: Contractor shall provide duplicate, complete bound sets of a compilation of catalog data of each manufactured item of mechanical and electrical equipment used in the work and present this compilation to the Owner before payment of more than 90% of the billing is made. This compilation shall include descriptive data and printed installation, operating and maintenance instructions (including a parts list for each piece of equipment). Contractor shall provide a complete double index as follows:

   i. List of products alphabetically by name;

   ii. Listing alphabetically the names of manufacturers whose products have been included in the work, together with their addresses as well as names and addresses of the local representative.

1.03 **Fire Protection**

A. At all times during the work under this contract, maintain suitable approved fire extinguishing equipment near the locations where work is in progress and especially in the vicinity of hot taps and purging operations. Use every possible safety precaution to prevent fire and explosions and comply with all applicable safety and fire prevention codes.

B. Portable fire extinguishing equipment shall conform to National Fire Protection Associations Standard Section 10.

C. The storage and use of flammable and explosive liquids, solids, and devices shall be in accordance with the applicable section of the National Fire Protection Associations Codes, Standards, and Recommended Practices.

D. Section 1 of the NFPA Standards shall be abided by at all times.

**PART 2 - PRODUCTS**

2.01 **Manufacturers Qualifications:** The manufacturers of all materials and equipment used must be reputable and regularly engaged in the manufacture of the particular material or equipment for the use and service to which it will be subjected.
2.02 Steel Pipe

A. Steel Pipe Specifications

1. Gas pipes extending from connections at the tie-in points of the existing system must meet all applicable specifications as called out in 49 CFR 192.55 and shall be, unless otherwise noted, API-5L, X-52, Electric Resistance Welded (ERW) line pipe for below ground installation or Seamless line pipe for above ground installation, mill coated, in at least twenty-foot (20’) section lengths and fabricated for butt welding.

2. Minimum wall thickness:

   i. Twelve-inch diameter (12” Ø) pipe shall have minimum wall thickness of 0.312 inches.

   ii. Ten-inch diameter (10” Ø) pipe shall have minimum wall thickness of 0.279 inches.

   iii. Eight-inch diameter (8” Ø) pipe shall have a minimum wall thickness of 0.250 inches.

   iv. Six-inch diameter (6” Ø) pipe shall have a minimum wall thickness of 0.250 inches.

   v. Four-inch diameter (4” Ø) pipe shall have a minimum wall thickness of 0.219 inches.

   vi. Two-inch diameter (2” Ø) pipe shall have a minimum wall thickness of 0.154 inches.

   vii. One-inch diameter (1” Ø) pipe shall have a minimum wall thickness of 0.133 inches.

   viii. Three Quarter-inch diameter (3/4” Ø) pipe shall have a minimum wall thickness of 0.113 inches.

3. Directional Drilling

   i. Pipe used for directional drilling shall meet the requirements of ASTM D3350 (PE) or ASME B31.8 (Steel), respectively, and shall be High Density Polyethylene (HDPE) PE 4710, SDR 11 or lower for plastic or API 5L, X-52 steel pipe coated with Powercrete multi-layer coating forty to fifty (40-50) mils thick, or as specified by the Owner. Wall thickness for horizontal directional drilled steel pipe shall meet all minimum requirements stated in section 2.02, A, 2 in this specification.
ii. The “Weak Link” used during pullback of PE carrier pipe shall be Medium Density Polyethylene (MDPE) PE 2406 Pipe or a breakaway swivel device rated below the “Allowable Tensile Load” for pipe size to be pulled.

4. A mill certificate issued by the fabricating mill will be required on all pipe stating that the minimum requirements of these specifications have been met.

B. Steel Pipe Coating

1. All underground pipe, main line or service piping shall be externally coated for the purpose of external corrosion control. All coatings must be applied on a properly prepared surface and have sufficient adhesion to the metal surface to effectively resist under film migration of moisture. The coating for trenched steel pipe shall be 3M Scotchkote 6233 FBE (fusion bonded epoxy) multi-layer coating, twelve to fourteen (12-14) mils minimum thickness unless otherwise specified or shown on the plans. The coating for all HDD or Boring applications shall be Powercrete multi-layer coating, forty to fifty (40-50) mils minimum thickness unless otherwise specified or shown on the plans. The coating for pipe to be hung on the side of a bridge or installed in any manner which exposes the pipeline to UV radiation shall be Carboline Carbomastic 615 with a Carboline 133 UV Finish.

2. The coating must be sufficiently ductile to resist cracking and have sufficient strength to resist damage due to handling and soil stress.

3. All weld joints shall be protected utilizing Canusa shrink fit sleeves.

4. Service tee welds, or any weld on any attached appurtenances that cannot be protected with Canusa shrink fit sleeves shall be coated with Powercrete R-65/F1, Carboline 615 or approved equal.

5. All pipe air-to-soil interfaces shall be coated with Denso fiberglass polyurethane wrap, or approved equal, a minimum of 12” below and above the surface.

2.03 Polyethylene Pipe

A. Polyethylene (PE) Pipe Specifications

1. All polyethylene pipe and fittings shall conform to the standards put forth in API 15LE, ASTM D2513, ANSI/ASTM D2104, ANSI/ASTM D2447 and ASTM D3350.

2. All polyethylene shall have a Standard Dimensions Ratio (SDR) of 11.
3. All polyethylene pipe shall be manufactured from resin qualifying for a Plastic Pipe Institute material designation of PE 4710.

4. All main line improvements using polyethylene pipe shall require the use of Driscopipe 8100.

5. All service line improvements which require the use of polyethylene pipe shall be installed using ¾” diameter IPS, Driscopipe 8100 conforming to ASTM D2513 standard unless otherwise approved by engineer.

2.04 Casing Pipe

A. All steel casing pipe shall be API-5L, Grade B or higher, ERW line pipe, mill coated, in at least twenty-foot (20’) lengths and fabricated for butt welding.

2.05 Fittings

A. Steel Pipe Weld Fittings

1. All welded fittings for steel piping shall be Weldbend, or as approved, steel butt weld, Schedule STD, API 5L, X-52 fittings, conforming to ANSI/ASME 16.9, ANSI/ASME 16.9a, ANSI/ASME 16.25, MSS-SP-25, and manufactured in the United States of America.

2. All steel ninety-degree (90⁰) elbows, forty-five-degree (45⁰) elbows, tees, concentric reducers, etc. shall be wrought carbon steel, X-52, Schedule 40, and shall conform to the ASA 16.9 Standards. The wall thickness of the steel weld fitting must be equal to or thicker than that of the pipe to which it is to be welded.

3. All high pressure (HP) and low pressure (LP) steel tapping fittings 4” and above shall be T.D. Williamson Inc., ANSI 300 for HP and ANSI 150 for LP

4. All HP and LP steel tapping fittings 1” and below shall be Mueller Co., ANSI 300 and ANSI 150 respectively.

5. All 2” HP steel tapping fittings shall be Mueller Co., ANSI 300.

6. All 2” LP steel tapping fittings shall be T.D. Williamson Inc., ANSI 150.

B. PE Fusion Fittings

1. All PE fittings shall be manufactured from resin qualifying for a Plastic Pipe Institute material designation of PE 4710 conform to ASTM D2513, MSS-SP-25, and ASTM D3350 and be ASTM D2513 PE 4710, or approved equal.

2. All PE fittings shall be butt fusion type of fittings OR electrofusion type of fittings unless otherwise noted and/or approved by the Owner.
3. All electrofusion or bolt-on electrofusion tapping tees used on plastic piping shall be manufactured by GF Central Plastics, LLC or approved equal.

4. All butt fusion type fittings used on plastic piping shall be manufactured by GF Central Plastics, LLC or approved equal.

5. All steel to plastic transition fittings to be manufactured by GF Central Plastics, LLC or approved equal.

C. Line Stopper Fittings
   1. All line stopper fittings shall be of the welding type.
   2. Line stoppers shall be capable of totally stopping the flow of gas in the line.
   3. Line stops and fittings shall be manufactured by T.D. Williamson Inc.

D. PE Mechanical Fittings
   1. All compression type fittings used on steel piping shall be manufactured by Dresser Industries.
   2. All compression type fittings used on plastic piping shall be R.W. Lyall “Lycofit” or approved equal.
   3. All fittings shall conform to MSS-SP-25.

E. Threaded Fittings
   1. All threaded fittings shall be as manufactured by Grinnell or as approved. Black malleable iron conforming to ANSI/ASME B16.3, MSS-SP-25, and manufactured in the United States of America.
   2. All threaded fittings shall have national pipe tapered threads (NPT) and conform to ANSI/ASME B2.1.
   3. All unions shall be of the non-insulating type and conform to ANSI/ASME B16.39.
   4. All plugs, bushings and locknuts shall conform to ANSI/ASME B16.14.
   5. Threaded pipe shall conform to API 5B.

F. Control Piping, Tubing and Hose Fittings (half-inch (1/2”) or smaller)
   1. All tubing fittings shall be as described in “Stainless Steel Fittings” in this subsection.
2. All threaded control piping fittings including valves shall be forged steel with a minimum working pressure rating of 2,000 psi. All nipples shall be extra heavy.

3. Only when authorized and under special conditions shall flare-nut type fittings be used.

4. Brass Fittings may be used only when there are no stainless steel or steel fittings available and must be approved by the Owner.

5. Under no conditions shall aluminum, nylon, polyethylene, PVC, or Teflon tubing or hose fittings be used.

6. All hose clamps shall be stainless steel worm drive.

7. All hose fittings, unless otherwise noted, shall be Parker Parflex Series 50 fittings.

8. All threaded fittings shall conform to API 5B, ANSI/ASME 2.1, and ANSI/ASME 16.11.

9. All fittings shall conform to MSS-SP-25.

G. Stainless Steel Fittings

1. All stainless-steel tubing shall be joined by means of compression type connectors except where threaded adaptors are required.

2. All stainless-steel tubing fittings shall be manufactured by Parker or as approved.

3. All fittings shall conform to MSS-SP-25.

2.06 Bolts, Nuts, etc.

A. Bolts and Studs

1. All bolts shall be threaded to within half of an inch (1/2”) of the bold head.

2. All studs shall be threaded the entire length.

3. All bolts and studs shall be UNC male cut threads.

4. All bolts shall have regular hex heads.

5. All bolts and studs shall be Grade 7 steel.

6. All bolts and studs shall be manufactured in the United States and of steel manufactured in the United States.
7. All above ground flanged regulators, filters, relief valves, strainers, etc. except valves shall have stud type bolts of the proper diameter and length.

8. All bolts shall have at least $\frac{3}{4}$ to $\frac{7}{8}$ inch exposed at end of nuts.

9. All bolts, screws and nuts shall conform to ASME 18.2.1, and ASME 18.2.2.

10. All studs shall conform to ANSI/ASME A687.

B. Nuts

1. All nuts shall be UNC female cut threads.

2. All nuts shall be regular hex.

3. All nuts shall be Grade 7 steel.

4. All nuts shall be made in the United States and of steel made in the United States.

5. All nuts shall conform to ASME B18.2.2 and ANSI/ASME B1.1.

C. Washers

1. All washers shall be circular flat washers of the appropriate size and manufactured from Grade 7 steel.

2. All washers shall be made in the United States and of steel manufactured in the United States.

3. All washers shall conform to B18.21.1 or 18.21.2.

D. Weldolets and Threadolets

1. Weldolets shall be as manufactured by the Bonney Forge Company or as approved.

2. Threadolets shall be as manufactured by the Bonney Forge Company or as approved. Threadolets and weldolets shall conform to ANSI/ASME B16.11 and MSS-SP-2.07-25.

2.07 Tracer Wire & Locating Tape

A. All direct bury tracer wire installed shall be Copperhead Industries “1230Y-HS-500” or approved equal, and shall be made of 12 gauge copper clad steel wire with a minimum 30 mil polyethylene coating designated specifically for natural gas.

B. All horizontal directional drilling (HDD) tracer wire installed shall be Copperhead Industries “SoloShot 1245-EHS” or approved equal, and shall be made of 12 gauge
copper clad steel wire with a minimum 45 mil polyethylene coating designated specifically for natural gas.

C. Separate sections of the tracer wire may be joined using King Industries 90120 direct bury lugs.

D. All tracer wire shall be installed to riser with a Tracer Snap, Part # T-S1.

E. The tracer wire shall begin at the transition to the plastic main adjacent to, but not touching, the steel fitting. At locations where plastic pipe is transitioning from steel pipe, the end of the wire shall be cad weld to existing steel pipe. Connections of wire to pipe shall be made using Cadweld #15 type cartridges for steel piping. Proper shrink sleeves shall be used on the wires in accordance with the manufacturer’s recommendations.

F. Locating tape shall be T Christy Enterprises or approved equal and shall be detectable, a minimum of 2” wide, yellow, and printed with the phrase “Caution Gas line Buried Below”.

2.08 Anodes

A. Anodes shall be 17lb, Hi-Potential packaged magnesium anodes from Stuart Steel Protection Corp. or approved equal.

B. Should the anode lead not be of sufficient length to connect the anode directly to the piping, then additional length of Copperhead Industries “1230Y-HS-500”, or approved equal, 12 gauge copper clad steel wire should be used.

C. Connection shall be covered by a cross-linked polyolefin backing coat with adhesive as manufactured by DSG-Canusa.

D. Coating material for the pipe connections shall be cold applied coal tar enamel, Bitumastic #50 or an approved equal.

2.09 Cathodic Test Stations / Tracer Wire Stations

A. Above grade test stations shall be “T3” test stations as manufactured by Tinker and Rasor, or an approved equal. All test stations to have at least 4 terminal lugs, be 3.5” in diameter, and yellow in color.

B. At grade test stations shall be “AG-1” test stations as manufactured by Tinker and Rasor. At grade test stations shall have at least 4 terminal lugs and have a yellow cap for identification. At grade test station shall have a two-foot by two-foot by four-inch (2’ X 2’ X 4”) pre-cast concrete collar set around the test station for additional protection.
2.10 Insulators
   A. All in line insulators shall be weld by weld type, monolithic type insulators as
      manufacture by Isojoint, or approved equal.
   B. All flange type insulators shall include an insulating face gasket, as well as
      insulating bolt sleeves, and shall be manufactured by Fluid Sealing Products, LTD
      or approved equal.

2.11 Pipe Connection Coating
   A. Pipe connections must be coated prior to burial. A suitable coating material such
      as Bitumastic #50 or a cold application of tar enamel may be used.

2.12 Valves and Valve Boxes
   A. Polyethylene Valves
      1. All polyethylene (PE) valves shall be manufactured from resin qualifying for
         a Plastic Pipe Institute material designation of PE 4710.
      2. All polyethylene ball valves shall conform to ANSI/ASTM standard B16.40
         and MSS-SP25.
      3. All polyethylene ball valves shall be HDPE butt fusion ball valves
         manufactured by Kerotest or approved equal.
   B. Steel Valves
      1. All above ground and below ground high pressure valves between six
         inches (6”) and twelve inches (12”), shall be gear operated ball valves.
      2. All below ground high pressure valves between eight inches (8”) and
         twelve inches (12”) shall be Cooper Cameron, ANSI 300, Full Port, welded,
         gear operated, trunion mounted, valves with a vertical stem and 2” nut
         or approved equal. All valves must meet all applicable specifications as
         called out in 49 CFR 192.145. All valves shall have an ANSI rating of 300.
         Valves shall be welded to the pipe at valve locations in the main line as
         shown in the Drawings.
      3. All above ground and below ground high pressure valves between two
         inches (2”) and six inches (6”), shall be Broen Ballomax, ANSI 300, Full Port,
         welded, floating ball type valves or approved equal. These valves shall be
         quarter turn valves with a 2” operating nut, or approved equivalents. All
         valves must meet all applicable specifications as called out in 49 CFR
         192.145.
4. All above ground and below ground low pressure valves between two inches (2"") and six inches (6"") shall be Broen Ballomax, ANSI 150, Full Port, welded, floating ball type valves or approved equal. These valves shall be quarter turn valves with a 2” operating nut, or approved equivalents. All valves must meet all applicable specifications as called out in 49 CFR 192.145.

5. All lock wings, both high pressure and low pressure, between two inches (2"") and three-quarters of an inch (¾") shall be Mueller, A.Y. McDonald, or approved equal.

6. All high-pressure curb valves to be Mueller H-17800 or approved equal

7. Companion flanges shall be American Standard steel, weld neck, furnished and welded to the pipe at valve locations in the main line. All flanges must meet all applicable specifications as called out in 49 CFR 192.147. Gasket material should be capable of withstanding the maximum pressure and maintaining its physical and chemical properties at any temperature to which it might reasonably be subjected in service. For all flange joints, the bolts or stud bolts used should extend completely through the nuts. Manufacturer will provide factory body test verifications.

C. Valve Boxes

1. Valve boxes shall be manufactured by Sigma, or approved equal, telescopic or screw valve box with an extension range of 36” to 46”. The diameter of the valve box shall be not less than five and one quarter inches (5-1/4") and be manufactured to fit twelve-inch (12") valves and smaller. Lids shall read “Gas”.

2. Valve boxes shall have a two-foot by two-foot by four-inch (2’ X 2’ X 4’”) pre-cast or cast in place concrete collar. See VALVE AND VALVE BOX DETAIL in plans.

2.13 Regulator Stations

A. District Regulator Stations shall be built in accordance with the construction plans. All meters, reliefs, and other regulator station appurtenances to be specified in project construction plans.

B. Farm Taps, or high-pressure services, shall consist of a Mueller high pressure curb valve, Mueller high pressure lockwing, Fischer regulator, Meuller low pressure union, and Meuller low pressure lockwing.
2.14 **Meters**
   A. All meters and associated appurtenances to be specified in project construction plans.

2.15 **Services Excess Flow Valve (EFV)**
   A. A tapping tee from GF Central Plastics, LLC or approved equal and Permasert EFV are required for residential services.

2.16 **Above Ground Piping and Equipment Paint**
   A. The paint and paint products used in painting the various surfaces shall be of the highest quality obtainable, acceptable for the intended purpose, and the product of a reputable manufacturer.
   
   B. Shop Primer and Intermediate Coat: Shop intermediate coats shall be polyamidoamine epoxy coating, Series 69 Hi-Build Epoxylene II as manufactured by Tnemec Company, Inc. of Kansas City, Missouri. Primer and intermediate coats shall be similar to finish coat to assure maximum hiding and aesthetics.
   
   C. All above ground piping and appurtenances shall be mechanically cleaned by shot blasting to remove all rust and scale utilizing Amasteel MG50 cast steel shot and grit to near white blast cleaning prior to N69 prime coat.
   
   D. Shop Finish Coat: Finish coats shall be aliphatic acrylic polyurethane, Series 73 Endura-Shield and manufactured by Tnemec Company, Inc. Finish coat color shall be IN05, Gray – ASNSI No. 61 (ANSI Z55.1-R73).
   
   E. Clear Coat: Shop clear coat shall be aliphatic acrylic polyurethane, Series 76 Endura Clear as manufactured by Tnemec Company, Inc.

2.17 **Highway Crossing Signs**
   A. "Notice", "Danger", and "Warning" signs for road and railroad crossings and at other locations along the pipeline as designated in the plans shall be metal with black lettering and yellow background as required by 49 CFR Part 192.
   
   B. All markers shall be Carsonite fiberglass markers or approved equal.

**PART 3 - EXECUTION**

3.01 **General**
   A. Contractor shall be familiar with and follow the installation instructions for any and all piping, related components, pipe fittings, tapping tees and valves purchased for installation on any and all service installations.
B. The Contractor shall take custody of the pipe at the delivery point. The Contractor shall carefully inspect the pipe for the following defects and shall make appropriate remedies.

1. Bevel Damage: Bevels which have been damaged during handling, such that they cannot be repaired by grinding, shall be cut off with a beveling machine at no cost to the Owner.

2. Pipe Wall Defects: The pipe wall shall contain no dents, nicks, gouges, or any other noticeable defects. All defects shall be completely removed by cutting from line at no cost to the Owner.

3. The pipe to be used will be unloaded and stored in a manner so that the pipe will not be damaged and in such a manner that dirt, trash, or debris cannot get in the pipe.

C. Contractor shall keep the interior of all pipes, fittings and other accessories free from dirt and foreign matter at all times.

D. Protect excavation bottoms against freezing when atmospheric temperature is less than 35°F.

E. If gas lines are laid adjacent to and/or across existing utility lines, Contractor shall keep a minimum distance of eighteen inches (18") between the gas pipe and other utilities.

F. In the event it becomes necessary to rack pipe to be used on the project, the Contractor shall do so at his expense and in a manner that will prevent damage to the pipe.

G. The Contractor shall string pipe on Right-Of-Way, streets, and highways so as to cause the least interference possible. Gaps shall be left at intervals, if necessary.

3.02 Concrete for Utility Lines

A. Contractor shall furnish and install concrete blocking, cradles, anchors, caps, pipe protection and/or encasement at the locations specified on the Drawings or as directed by the Owner.

B. Concrete work shall be performed in accordance with the recommended methods set forth in ACI-301, and shall meet ACI-301 or the following supplemental requirements, whichever is more stringent:

1. Strength: The strength of concrete shall be 3,000 psi unless otherwise shown on the Drawings.

2. Durability: All concrete exposed to weather shall be air entrained.
3. Slump: Concrete shall be proportional and produced to have a slump of three inches (3”) with a one-inch (1”) tolerance.

4. Admixtures: Air entrainment, mandatory for concrete exposed to weather, may be used. A water reducing admixture (retarding, normal, or accelerating, depending on placing temperature) may be used if approved by the Owner.

5. Reinforcing Steel: Yield strength of reinforcing steel shall be 60,000 psi.

3.03 Rocks and Boulders

A. Rock removal shall be performed with the aid of rock saws or trenching machines.

B. Any material that is encountered within the limits of the required excavation that cannot be removed except by drilling and/or blasting, including rock, boulders, masonry, hard pan, chert, shale, street and sidewalk pavements and/or similar materials, shall be considered as unclassified excavation and no separate payment will be made therefore.

C. Without special prior written permission from the authorities having jurisdiction granting the use of explosives, including prior approval from the Owner, blasting and/or drilling and blasting will not be permitted.

D. Should Owner and authorities having jurisdiction grant the use of explosives, rock may be removed by blasting or otherwise. Where blasts are made, Contractor shall cover the excavation with enough excavation material and/or timber or steel matting to prevent danger to life and property. The Contractor shall secure, at his own expance, all permits required by law for blasting operations and the additional hazard insurance required. Contractor shall observe all applicable laws pertaining to blasting operations.

E. If blasting is approved:

1. Contractor shall excavate rock to dimensions in conformance with the Drawings and Specifications.

2. Contractor shall comply with all laws, ordinances, and regulations governing blasting and the use, handling and storage of explosives. Conduct operations with due regard for the safety of persons and property in the vicinity by providing care, protection, notice and warning.

3. Existing underground facilities shall be located and protected in advance of any blasting and the Contractor shall be responsible for the protection of all existing utilities, water wells or structures and for any damage resulting thereto. Any damage shall be promptly restored by the Contractor.
4. If the rock below grade is shattered due to holes having been drilled too deep or excess charges of explosives used for any other reasons due to blasting by the Contractor, and if the Owner deems the shattered rock is unfit for foundation, the shattered rock shall be removed and the overexcavation refilled as specified.

5. Prior to blasting, the Contractor will be responsible for contacting any residence or facility within a distance of one half (1/2) mile of the blasting site.

6. Blasting shall be conducted only during daylight hours. The appropriate blasting signal shall be given before any blasting operation commences.

7. Steel cable mats or approved equal shall be used when covering a section of the trench to be blasted in or near cultivated fields or congested areas. The Owner or its representative has the right to request jackhammers as a means of solid rock removal.

F. Contractor shall excavate rock over the horizontal limits of excavation to a depth of not less than six inches (6”) below the bottom of the pipe. Then the Contractor shall backfill the space below grade with No. 67 (TDOT) crushed stone or other approved material, tamp to the proper grade and make ready for construction. See backfilling specifications for the definition of No. 67 crushed stone.

3.04 Excavation of Trenches

A. Refer to Section 02221 of this specification for all information of trenching, bedding, and backfilling.

3.05 Sheeting, Shoring and Bracing

A. Refer to Section 02221 of this specification for all information of trenching, bedding, and backfilling.

3.06 Highway Crossings

A. The Contractor shall install a pipeline marker at all highway and street crossings in strict accordance with the specifications required by state highway engineers, county highway engineers, Chief Utility Engineer or any other authority having proper jurisdiction over such installations after the Owner shall have first secured necessary permits for said work.

B. If casings are required, they shall be installed by the Contractor. Casing spacers and end seals shall be installed with the insulators spaced at proper intervals on the pipe between the pipe and casing. Vents are to be installed at required locations. All casing installations must pass electric resistance tests. Casings will
be paid for per linear foot of casing at bid price and includes the cost of the carrier pipe.

C. All necessary barricades, safety signs, lights, etc., required by federal, state, city, county, or other governmental authority shall be furnished and maintained by the Contractor.

D. The pipe at all road crossings shall be buried to a depth to ensure that the top of the pipe or casing shall be at least thirty-six inches (36") below the lowest point in the bottom of the drainage ditch. However, on roads other than federal or state highways, when in consolidated rock, less cover may be acceptable, at the option of the Owner, but in no case will less than twenty-four inches (24") of cover in drainage ditches be acceptable.

E. The Contractor shall install "Notice", "Danger", and "Warning" signs at road and railroad crossings and at other locations along the pipeline as designated in the plans.

3.07 Water Crossings

A. The creek crossings are to be directionally bored. All water crossings are to be a minimum of six feet (6’) and a maximum of twelve feet (12’) below the bed surface.

3.08 Directional Drilling and Boring

A. All boring and jacking shall be completed in accordance with Section 02725 of this specification.

B. All horizontal directional drilling (HDD) shall be completed in accordance with Section 02727 of this specification.

C. It shall be noted that Sections 02725 & 02727 in the Standard Gas Specifications are different than Sections 02725 & 02727 in the Standard Water and Sewer Specifications. Sections 02725 & 02727 in the Standard Gas Specifications shall always be referenced when working on the City of Clarksville’s natural gas system.

3.09 Bending and Laying Pipe

A. The pipe shall be laid in a workmanlike manner in accordance with the best modern pipeline practice. Plastic pipe shall be joined in accordance with manufactures specific guidelines, including use of different types of equipment for joining. It is intended that the word, "laying", as used herein, includes bending, insertion of slack, and lowering. The Owner may instruct the Contractor to leave "open ends" at various points during construction, which open ends shall be connected and welded at such time and in such manner as directed by the Owner, but prior to the final test of the line. Open ends shall be provided at the points...
where the Owner or its representative has reasons to believe that leaving the line with open ends for a period before the open ends are welded together will tend to relieve strains from contraction which may develop after the line has been placed in the ditch and its temperature lowered.

B. Contractor shall make all necessary field pipe bends required in the construction of the pipeline, but the Owner may, at its option, provide fabricated bends (weld ells) for installation at points where, in his judgment, the use of such bends is preferable. If such bends are used, the arc length, as measured along the crotch, must be at least one inch (1"").

C. All bending shall be done by the cold stretch method. Bends shall be made by using a type of bending machine approved by the Owner. Pipe with buckles, wrinkles, or flat spots will not be permitted in the pipeline.

D. The distance between center lines of bending points shall be one (1) pipe diameter. The maximum degree of bending at each bending point shall be one-and one-half degrees (1-1/2°). An accurate method of measurement shall be used. No bend shall be made nearer than four feet (4’) to the end of the joint of pipe. When pipe is double jointed before bending, bend shall not be closer to the weld than three feet (3’). Departure from pipe roundness (the difference between the long and short diameters of the pipe) in any bend shall not exceed two-and one-half percent (2-1/2%) of the nominal diameter of the pipe. On pipe containing a longitudinal weld, the longitudinal weld must be as near as practicable to the neutral axis of the bend.

E. All pups five feet (5’) and over shall be moved ahead daily and installed in line. There shall be a full joint of pipe installed between pups.

F. Any pipe that is buckled, wrinkled, flattened, or distorted shall be cut out and replaced at the Contractor’s expense.

G. The Contractor shall lay all pipe so that it conforms to the contour of the ditch. Overbends shall be made in such a manner that the middle of the bend shall clear the high point of the bottom of the ditch.

H. Contractor’s pipeline operations shall be schedule so that not over one-half (1/2) mile of completed pipeline will be open at any one time before lowering in and backfilling is done. Trenching shall not be performed in advance of pipe work in excess of the amount of pipe that can be laid the following day.

I. Where pipe is laid within the right-of-way limits of highways, roads, or railroads, the amount of open trench at any one time shall not exceed that specified or designated in the permit issued by the proper authority controlling said right-of-way should said open trench be less than that specified herein.
J. Sag bends shall fit the bottom of the ditch. Side bends shall conform to the outside of the ditch. There shall be no points in the ditch where it is necessary to scrub or force the pipe into the ditch to obtain proper depth or lineup. Pipe shall fit the ditch without the use of external force to hold it in place until the backfill is completed.

K. Contractor shall make a detailed inspection of the coating for holidays and imperfections immediately preceding the lowering in of the pipe in accordance with the Steel Pipe Coating section. There shall be no holidays or imperfections in the coating at the time the pipe is lowered.

L. All pipe shall be lowered slowly and carefully. The Contractor shall repair any coating damaged in the handling, lowering, or moving of the pipe in the ditch so as to leave it in a condition equal to that of the undamaged coating. In lowering coated pipe in rock areas, a four-inch (4") limestone dust or sand shall be placed in the bottom of the ditch, and the ditch shall be thoroughly padded above the pipe with eight inches (8") of limestone dust or sand for protection.

M. All mains shall have a minimum cover of thirty-six inches (36"). State regulations on amount of cover will apply along State rights-of-way.

N. The pipeline must be installed with at least twelve inches (12") of clearance from any other underground structure not associated with the pipeline. If this clearance cannot be attained, approval must be obtained from the Owner's representative before installing the pipeline with less clearance. The pipeline must be protected from damage that might result from the proximity of the other structure.

O. Plastic mains shall be handled carefully to avoid excessive stress or cracking. Pipe shall be snaked from side to side within the trench to provide an excess length of pipe to offset contraction.

3.10 Joining Polyethylene Pipe

A. All polyethylene pipe shall be joined by the butt fusion method. Heat fusion joints and joining equipment shall be made by qualified personnel and in accordance with all applicable sections of 49 CFR Part 192 of the Minimum Federal Safety Standards.

3.11 Steel Pipe Coating

A. The coating must be applied on a properly prepared surface and have sufficient adhesion to the pipe’s metal surface to effectively resist under-film migration of moisture. The coating must be sufficiently ductile to resist cracking and have sufficient strength to resist damage due to handling damage or soil stress.

B. All external protective coating must be inspected just prior to placing the pipe into the ground and backfilling. Contractor shall furnish and check pipe coating with a
high voltage electric holiday detector. Immediately preceding the lowering in of the pipe, Contractor shall make a detailed inspection of the coating for holidays and imperfections with the electric holiday detection equipment. All holidays and any damage detected in the coating that is detrimental to effective corrosion control must be repaired by the Contractor. All pipe shall be jeeped and repaired until no further damage detrimental to effective corrosion control is present and until the detector is passed over the entire pipe without disclosing any holidays or imperfections in the coating.

C. If the coated pipe is installed by boring, driving or another similar method, precautions must be taken to minimize damage to the pipe coating during the installation process.

D. The Contractor must furnish a means for an Owner representative to inspect the pipeline during coating and testing.

3.12 Valves, Valve Boxes and Valve Pits

A. Valve boxes shall be installed plumb and extending above finished grade so that no water will accumulate around the valve box top.

B. Valve boxes shall be of sufficient length so that no box extensions are required. In the event a valve box extension is required, the PVC valve box extension shall be placed on the bottom section of the valve box.

C. Contractor shall provide a valve box for every valve. The valve box shall not transmit shock or stress to the valve or pipeline and shall be centered and plumb over the wrench nut of the valve with the box cover flush with the surface of the finished pavement and/or grade or such other level as may be directed by the Owner.

D. Gas main valves and valve boxes shall be located in easements on street property lines extended where possible unless otherwise shown on the Drawings or directed by the Owner.

E. Set valves, fittings, plugs, caps and joints to the pipe and to other appurtenances in a manner heretofore described for handling, laying and joining pipe.

3.13 Locating Tape and Tracer Wire

A. All installations of plastic polyethylene pipe must be identified using locating tape, and a tracer wire.

B. A detectable locating tape, identifying the line as a gas line, shall be placed above the actual pipe installation a maximum of twelve inches (12") from top of finished grade in accordance with the Detail provided at the end of this section.
C. To facilitate locating of the pipe, a tracer wire shall be strung along the entire length of the plastic pipe and services. The tracer wire shall be installed in bottom of ditch with six inches (6”) of cover between pipe and wire.

D. The tracer wire shall begin at the transition point from steel pipe to plastic pipe in the gas main. The tracer wire must be installed adjacent to the steel fitting but not in contact with the steel fitting or steel pipe. At pipe transition points from steel to plastic, the end of the wire shall be cad weld to existing steel pipe. Connections of wire to pipe shall be made using Cadweld #15 type cartridges for steel piping. Proper sleeves shall be used on the wires in accordance with the manufacturer’s recommendations.

E. In all cases, the tracer wires are to be installed in the top of any valve box in the pipe run.

F. The tracer wire shall not be looped or attached to the plastic pipe. All tracer wire shall be installed to the riser with a Tracer Snap or as otherwise specified.

G. All connections shall be wrapped to prevent corrosion if separate sections of the tracer wire are joined.

H. Pipe connections must be coated prior to burial.

I. Tracer wire shall be brought with ample slack into valve boxes and boxes over PE end caps.

J. All residential services shall be installed with a tap tee and an EFV (excess flow valve).

3.14 Anode Installation Procedures

A. Packaged magnesium anodes shall be installed at intervals of approximately four hundred feet (400’) and between the test stations. Each anode shall be installed on a vertically augured hole to a depth of three feet (3’) to five feet (5’) and also three feet (3’) to five feet (5’) from the gas main. The hole diameter shall be such as to easily accommodate the size of the anode.

B. After the hole is augured, the packaged anode shall be lowered into the hole, and soil shall be firmly tamped around the package so that it is in intimate contact with the package. Anodes shall then be “charged” saturating the anodes and surrounding soil in water. If it is considered to be necessary by the Owner, anodes may be installed horizontally.

C. Lead wires from the anodes shall be run underground and shall be connected to the pipeline being protected. Where determined by the Owner, the lead wire shall be connected to the pipe by way of a test box. The depth of the anode lead wire shall be a minimum of eighteen inches (18”). At those locations where the anode
lead is not of sufficient length to connect the anode directly to the piping, an additional length of 12 gauge copper clad steel wire with Type TW insulation shall be used. The splice between the anode lead wire and the additional wire shall be made in accordance with the specifications for splices below. The electrical connection of the lead wire to the piping shall be made by the thermite brazing method, cadweld, or equivalent as specified below. Connections to the pipe shall be made by the thermite brazing method, cadweld, or an approved equal. Before the connection is made, the pipe shall be cleaned to bare metal by means of scraping, filing, or other approved methods. After the connection has been made, it shall be covered by a cross-linked polyolefin backing coat with adhesive.

D. Connections of wire to pipe shall be made using specified cartridges. Proper sleeves shall be used on the wire in accordance with the manufacturer’s recommendations. Pipe connections shall be coated with the specified coating material.

3.15 Cathodic Test Stations / Tracer Wire Stations

A. Test stations shall be located approximately fifteen hundred feet (1,500’) apart or as determined by the Owner. Care should be taken to place the test stations away from areas of possible damage by activity. Flush mount test stations shall be placed in twenty-four inches (24”) of concrete in order to be safe from mower damage.

B. Connections of wire to pipe shall be made using specified cartridges. Proper sleeves shall be used on the wire in accordance with the manufacturer’s recommendations. Pipe connections shall be coated with the specified coating material.

C. All test stations which are installed shall have two (2), 12-gauge copper clad steel tracer wires cadwelded to pipe and brought up into test station for redundancy purposes.

D. In the event a test station is installed over an insulator, two (2), 12-gauge copper clad steel tracer wires shall be cadwelded to the pipe on both the upstream and downstream side of the insulator, and all four wires shall be brought up into test station.

3.16 Above Ground Piping and Equipment Paint

A. All materials shall be brought to the job site in the manufacturer’s original sealed and labeled containers and shall be subject to inspection.

B. All painting shall be done by skilled and competent painters by conventional air or airless spray. Each coat shall be carefully applied in a manner that will provide uniform coverage with complete shading of the previous coat and shall be carefully worked around joints and other irregularities in the surface. Deficiencies
in the film thickness shall be corrected by the application of an additional coat (s) of paint. Each coat shall be allowed to dry before the next coat is applied.

C. All above ground piping and appurtenances shall be mechanically cleaned by shot blasting to remove all rust and scale prior to prime coat. Care shall be taken to mask all manufacturer’s and specification labels and vents. Gauges, electronic correctors and stainless-steel tubing shall not be installed until all painting has been completed.

### Dry Film Thickness

<table>
<thead>
<tr>
<th>Coat</th>
<th>Acceptable Thickness Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shop Primer Coat</td>
<td>3.0 – 5.0 mils</td>
</tr>
<tr>
<td>Intermediate Coat</td>
<td>4.0 – 6.0 mils</td>
</tr>
<tr>
<td>Shop Finish Coat</td>
<td>3.0 – 5.0 mils</td>
</tr>
<tr>
<td>Shop Clear Coat</td>
<td>1.0 – 2.0 mils</td>
</tr>
<tr>
<td>Total System</td>
<td>11.0 – 18.0 mils</td>
</tr>
</tbody>
</table>

D. Immediately upon completion of the job, submit to the Owner certification from the manufacturer indicating that enough coating was purchased to coat all surfaces properly. Such certification shall make reference to square footage figures provided to the manufacturer by the Contractor.

E. Drying time shall be construed to mean “under normal conditions”. When conditions are other than normal because of the weather or because painting must be done in confined spaces, longer drying times will be necessary. Do not apply additional coats of paint or return units to service until paints are thoroughly dry.

3.17 **Borrow Excavation**

A. Whenever backfill of excavated areas or the placement of embankments requires more material than is available from authorized excavations or whenever the backfill material from the excavations is unsuitable, then Contractor shall obtain additional material from other sources. This may require the opening of borrow pits at points accessible to the Work. In such cases, Contractor shall make suitable arrangements with the property owner and pay all incidental costs, including any royalties, for the use of the borrowed material. Before a borrow pit is opened, the quality and suitability of its material shall be approved by the Owner.
B. Contractor shall excavate borrow pits in such a way that the remaining surfaces and slopes are reasonably smooth and that adequate drainage is provided over the entire area. Drainage ditches shall be constructed whenever necessary to provide outlets for water to the nearest natural channel, thus preventing formation of pools in the pit area. Contractor shall leave the sides of the borrow pit cuts at a maximum slope of 2:1 unless otherwise directed by the Owner.

C. Borrow pits shall be properly cleared and grubbed, and all objectionable matter shall be removed from the borrow pit material before placing in the backfill.

D. Taking materials from borrow pits for use in the construction of backfill, fills or embankments shall be considered an incidental part of the Work.

3.18 Backfilling

A. After pipe has been lowered in but before backfilling, the ditch will be inspected to be sure no skids, boulders, cans, debris, or other foreign materials are in the ditch. The pipe, when lowered in, shall rest firmly on the bottom of the trench throughout its length.

B. Contractor shall begin backfilling after the line construction is completed, inspected and approved by the Owner. The line shall be enveloped as shown on the bedding material detail in the plans. Rock, gravel, or like materials shall not be backfilled directly onto the pipe. The Contractor shall provide eight inches (8") of compacted dirt, limestone dust, or sand over the pipe before backfilling when such conditions exist. Backfill shall not include debris such as stumps, brush, large rock, etc.

C. When shown on Drawings, this backfill shall, at locations beneath or closely adjacent to pavement, consist of No. 67 (TDOT) crushed stone. No. 67 crushed stone is defined as stone that 100% is smaller than 1” nominal diameter, 90% - 100% is smaller than ½” nominal diameter, 40-70% smaller than 3/8” diameter, 0-15% smaller than 3/16” nominal diameter and 0-5% smaller than 3/32” diameter as can be measured in standard sieve tests.

D. From the sand envelope around the pipe upward, the backfill material may contain broken stones that make up approximately ¾ of the total remaining backfill volume. However, if this type of backfill is used, there must be enough pass fine fill and earth materials to completely fill all voids. The maximum dimension of individual stones shall not exceed six inches (6”) and the backfill material shall be placed and spread in even layers not more than twelve inches (12”) deep. At locations beneath or closely adjacent to pavement or at locations subject to damage or displacement, Contractor shall tamp and thoroughly compact the backfill layers that, before compaction are six inches (6”) deep. In other areas, the backfill for the upper portion of the trenches may be placed without tamping, but shall be compacted to a density equivalent to that of the
adjacent earth material as determined by laboratory tests. Contractor shall use special care to prevent operation of backfilling equipment from causing any damage to the pipe.

E. Compaction of the backfill material for the lines to be constructed shall meet the requirements of the permit in effect and shall follow good industry practice. Wheel rolling or multi-lift mechanical compaction may be used, depending on locations and requirements. The Contractor shall repair any sinkage immediately at the Contractor's expense. A crown eight to twelve inches (8" - 12") in height may be left on cross-country backfill. However, after the last clean-up, the crown shall not exceed two inches (2") in height. The crown left on highway right-of-way shall not exceed two inches (2") in height. State regulations on backfill will apply along state right-of-way if in conflict with the above.

F. If the earth material for backfill is, in the opinion of the Owner, too dry to allow thorough compaction, then Contractor shall add enough water so that the backfill can be thoroughly compacted. Contractor shall not place earth material that the Owner considers too wet or is otherwise unsuitable.

G. Wherever excavation has been made within easements across private property, the top one foot (1') of backfill shall consist of fine loose earth, free from large clods, vegetable matter, debris, stones and/or other objectionable materials.

H. Whenever trenches have been cut across or along existing pavement, temporarily pave the backfill of such trenches by placing Class A, Grade D, crushed stone as the top twelve inches (12") of the backfill. Contractor shall maintain this temporary pavement either until the permanent pavement is restored or until the project is accepted by the Owner, whichever comes last.

I. Wherever pipes have diameters of fifteen inches (15") or less, Contractor shall not use power operated tampers to tamp that portion of the backfill around the pipe within one foot (1') above the pipe.

J. Backfilling shall be performed so as to not disturb or injure any pipe and/or structure against which the backfill is being placed.

K. Backfilling and clean-up operations shall closely follow pipe laying. Failure to comply with this provision will result in the Owner requiring the Contractor’s other activities to be suspended until backfilling and clean-up operations catch up with the pipe laying.

L. Compaction Requirements: Under buildings and for two (2) times the depth of the pipe and from the surface two (2) times beyond the shoulder under roads, Contractor shall compact to 95% maximum density in accordance with ASTM D698. At least one (1) compaction test shall be conducted every three feet (3') of trench in these areas. In all other locations, test compacted material every fifty
feet (50’), or fraction of fifty feet (50’) under roads below the two (2) diameter depth limit, and conduct at least one (1) compaction test for every one hundred feet (100’) or fraction of one hundred feet (100’) in all other locations.

3.19 Slopes

A. Contractor shall neatly trim all open cut slopes and finish them to conform either to the slope lines shown on the Drawings or as directed by Owner. Finished surfaces of bottom and sides shall be left in reasonably smooth and uniform planes like those normally obtainable with hand tools, though the Contractor will not be required to use hand methods if he is able to obtain the required degree of evenness with mechanical equipment. Grading operations shall be conducted so that material is not removed or loosened beyond the required slope.

3.20 Testing of Pipeline

A. The Contractor shall furnish all necessary labor, equipment, compressors, and any other supplies required to complete the pressure testing of the pipeline.

B. The Contractor shall give the Owner ample advance notice (minimum of 3 working days) of all proposed tests, and conduct all pressure tests in the presence of the Owner.

C. The test pressure during the tests shall be measured on an accurate recording type pressure gauge with a minimum twenty-four (24) hour chart, furnished by the Contractor and installed by the Contractor. The recording pressure gauge shall be calibrated before beginning of test with a dead weight tester, furnished by the Contractor. Additional calibrations with a dead weight tester will be required as instructed by the Owner.

D. All constructed steel pipelines must be internally cleaned prior to testing while following the “Internal Cleaning” procedure found in section 3.24, B below.

E. Factors for testing:

1. All plastic pipelines will be pressure tested to 1.5 times MAOP with a minimum test pressure of 100 pounds per square inch gauge (psig). Maximum test pressure shall not exceed 150 pounds per square inch gauge (psig). All external fittings or hoses used for pressurizing line shall be rated for test pressure. All test durations shall be in accordance with the charts below unless otherwise specified by Owner.

2. All steel pipelines will be pressure tested to a minimum of 750 psig for a MAOP of 500 psig. All external fittings or hoses used for pressurizing line shall be rated for test pressure. All test durations shall be in accordance with the charts below unless otherwise specified by Owner.
### Service Lines

<table>
<thead>
<tr>
<th>Line Length</th>
<th>Test Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 150 ft.</td>
<td>10 minutes</td>
</tr>
<tr>
<td>Over 150 ft.</td>
<td>Proportionate time in relation to 150 ft. requirement. (ex. 300 ft. = 20 minutes)</td>
</tr>
</tbody>
</table>

### Mains

<table>
<thead>
<tr>
<th>Line Length</th>
<th>Test Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>2” &amp; Under, Less Than 100 ft.</td>
<td>15 minutes</td>
</tr>
<tr>
<td>2” &amp; Under, 100 ft. through 1000 ft.</td>
<td>1 hour</td>
</tr>
<tr>
<td>2” &amp; Under, over 1000 ft.</td>
<td>24 hours plus a recording chart</td>
</tr>
<tr>
<td>3” &amp; Over</td>
<td>24 hours plus a recording chart</td>
</tr>
</tbody>
</table>

*Owner may adjust if needed.*

F. Test medium shall be air or nitrogen, no hydro-testing will be allowed. If air is to be used, contractor shall have a water filter or other type of water/air separation system in place between compressor and pipeline to be tested.

G. The Contractor shall fill the test sections with nitrogen or air and measure the test pressure with an accurate, digital, recording type pressure gauge. The test gauge shall show no drop in pressure for minimum of eight (8) hours after the source of test pressure has been disconnected from the pipeline section involved in the test and the temperature of the test medium has been allowed to equalize. The Contractor shall locate and repair all leaks that may be disclosed by the tests, and repeat the tests as required for approval.

H. All recording type pressure gauges shall be digital, with a minimum twenty four (24) hour recording chart. Contractor shall provide proof of calibration within the last calendar year prior to the test to be completed. All test charts shall be twelve inches (12”), twenty-four (24) hour, recording charts. All pressure recording charts used in the tests shall be identified with the test date, section of pipeline involved, test pressure, and the Contractor’s signature. Upon completion of test, contractor shall provide both a hard copy of the test results, as well as a digital copy.
I. Contractor shall also provide an analog dial pressure gauge along with the digital chart recorder for redundancy and verification. All test gauges shall be a minimum of four- and one-half inches (4-1/2") in diameter or bigger depending on the accuracy required from the test.

J. Piping shall, in no case, show any drop in pressure during the test except what may occur due to temperature changes. It is strongly recommended that once the pipe has been pressurized to the proper pressure that it sit for a period of time to allow pressure and temperature to stabilize. The pipeline should stand the test pressure without leakage for the amount of time stated above as required by Owner. The Owner shall approve or reject the test.

K. Compressors, used in pumping the line up in the case of using air as a test medium, shall in no way, inject any type of lubricant, or any foreign matter into the line. As stated above, all air compressors shall have water filters or some other water/air separation systems between the compressor and the line to be tested.

L. All road crossings, railroad crossings, body of water crossings, in-line fittings, tapping fittings, tie-ins, and meter/regulator stations shall be nondestructively tested at 100%, regardless of line size or design pressure. Line pipe shall be nondestructively tested at 50% unless otherwise specifically noted by the Owner on that job’s construction plans. X-ray shall be used for all nondestructive testing except in applications where x-ray is not possible (e.g. fillet welds such as spherical or split tee tapping fittings). In these instances, magnetic particle testing shall be used. The Owner will determine location of welds that are to be X-rayed without prior notice and paid for by the Contractor.

M. Underground valves shall not be tested against. Contractor shall test pipeline before valves are installed or shall open all valves in subject pipeline prior to testing.

N. All tie in welds shall be nondestructively tested prior to bringing new segment into service unless otherwise approved by Owner. Once line pressure has been introduced, all tie in welds shall be soap tested.

3.21 Pipeline Tie-Ins

A. The Contractor shall make a tie-in to the existing piping as shown on the plans. However, should the underground piping be discovered to be different than shown on the plans, the Contractor will make a tie-in at the direction of the Owner. All tie-ins to the existing system will be made by the contractor with a minimum of seventy-two (72) hours prior notice.

B. If possible, connecting new lines to existing mains shall be accomplished without interrupting normal gas service. Connections shall be in accordance with the American Standard Code for Pressure Piping, B31.8.
C. Ties to existing main shall be made only during the time specified by the Owner.

D. Should, for any reason, gas service be discontinued during the tie-in operation, it shall be the responsibility of the Contractor to close each existing gas service affected. When gas service is returned, it shall be the responsibility of the Contractor to reopen all gas services and ignite all pilots for all gas-operated appliances, at his expense, unless otherwise noted by the Owner.

E. All hot taps made on system shall be made by qualified personnel while following the manufacturers procedure for the specific fitting being used to make the hot tap.

F. All tie in welds shall be non-destructively tested prior to bringing new segment into service unless otherwise approved by Owner. Once line pressure has been introduced, all tie in welds shall be soap tested.

3.22 Purging

A. New Lines: Before placing in service, purge all new lines with gas to remove all air and explosive mixtures, using proper safety precautions. Purging gas will be furnished by the Owner. The Contractor shall not waste gas unnecessarily. All purging operation shall be verified with a gas measuring instrument.

B. In the event of hydrostatic testing, all tested lines shall be dewatered by moving displacement pigs, furnished by the contractor, through the line with compressed air, until all liquids cease to flow from the line. Upon initial dewatering of the line, all lines shall be dehydrated following the “Dehydrating Lines” procedure found in section 3.24, A below.

C. Existing Piping: Before temporarily or permanently taking existing piping out of service, purge all pipe with air to remove all gas and explosive mixtures, using proper safety precautions. All purging operation shall be verified with a gas measuring instrument.

3.23 Cleaning of Lines

A. Internal Cleaning:

1. Prior to Testing: Internally clean all new piping with a suitable pig type cleaner forced by air pressure through the pipe line three (3) or more times until the line is thoroughly cleaned.

   i. Steel Pipe:

      a. The first two cleanings may be performed with a wire brush type pig.
b. All subsequent cleanings may be performed with a polyurethane or polyethylene type pig.

c. Should a large amount of water be present during pigging, the line shall be dried in accordance with "Dehydrating Lines" herein, using a suitable squeeze type pig.

2. Provide a suitable barrier in front of the open ends of the pipe to catch the cleaners and present injury to personnel.

3. There shall be no pigging through valves. All pigging shall be done prior to valve installation.

4. The line shall be pigged a minimum of three times or until the line is thoroughly cleaned.

5. After pigging the line air shall be forced through the line to ensure all smaller particles and dust are removed.

6. The compression used in forcing the pig through the line or blowing air through the line shall in no way inject any type of oil, lubricant or any foreign matter into the line.

7. Lines smaller than two inch (2") shall be pigged only if the Owner requires it: however, all lines smaller than two inch (2") shall be blown out in accordance with this article’s paragraph A.5. above.

B. If a contractor chooses to pressure test using air as the testing medium, contractor shall verify that there is no moisture in the pipe after testing with moisture indicator.

C. In the event an unacceptable level of moisture is found in the pipe, contractor shall dehydrate the line in accordance with the “Dehydrating Lines” section.

3.24 Dehydrating Lines:

A. At all points of entry for pigging pour ten (10) gallons or as required of methanol into line in front of the pig.

B. At all purging entry points on new lines pour twenty (20) gallons or as required of methanol into line.

C. The methanol shall be pushed through the line during pigging by a suitable squeeze type pig when required.

D. The contractor shall dehydrate the pipeline to a dew point of -30°F before purging and putting the line into service. Contractor shall utilize dryers to remove all excess moisture from the pipeline. Dew point monitoring equipment shall be used.
to verify the final dew point with written certification of dew point with signature by Owner’s representative.

3.25 Static Electricity

A. Static electricity charges can build up when plastic pipe lines are purged. Static electric charges are caused by particle matter in the gas contacting the pipe’s inside wall and fittings of high flow rates. This static electric charge will “flow” down the pipe wall with the gas and collect on metal fittings or at the end of the pipe. The static electric charge must be conducted to the ground to remove any potential danger. The grounding method used shall be, at a minimum, to wrap a water/soap saturated cloth around the pipe and in contact with wet earth or ground rod. If squeeze-off tools are necessary, all units and metal fittings shall also be grounded.

3.26 Welding, Joining of Materials

A. All welder qualifications shall be reviewed by the Owner prior to any work on the pipeline. If owner determines that the procedures which the welders are qualified do not meet the standards of the Clarksville Gas Welding Procedures, Owner may request contractor to have welders qualify on specific Clarksville Gas Welding Procedures.

B. Line-up clamps will be used whenever practical. If an external line-up clamp is used, as much as possible of the root bead shall be completed and uniformly spaced around the circumference of the pipe and shall have an accumulative length of not less than fifty percent (50%) of the circumference before the clamp may be removed.

C. The adjoining lengths of pipe shall be accurately aligned so that all welding shall be at right angles to the axis of the pipe and accurately spaced before applying the stringer bead. Pipe shall be supported so that there is no strain on the joint, and so the pipe will be supported until the weld is complete and has cooled.

D. Before placing a joint of pipe in alignment, all dirt, mill scale, and foreign materials shall be removed from the inside of the pipe swabbing.

E. Preparatory to aligning pipe, all point, rust, scale, dirt, or other foreign materials that might affect the welding operation shall be removed by machine buffing the entire circumference of the pipe joint. The Contractor shall recut, trim, or re-bevel all pipe ends as may be necessary to maintain correct alignment and spacing of the pipe using an approved type beveling machine.

F. The welding operation shall be protected from weather conditions that would impair the quality of the complete weld.
G. Welding when done by the shielded metal arc process shall be performed in the vertical down direction. The current used for depositing the filler metal shall be DC+ polarity. The pipe material shall be on the negative side of the line. The stringer bead shall be deposited, using a drag technique, so as to completely fuse the abutting edges of the lands and beveled parts of the joint, there shall be complete penetration with a minimum inside buildup. Stringer bead shall be made with a three thirty seconds of an inch (3/32”) or one eighth of an inch (1/8”) AWS E-6010 (Fleetweld 6, 6P or equivalent). The stringer bead shall be thoroughly cleaned before starting the Hot Pass. Power brushing may be sufficient, however, disc grinding may be required.

H. The Hot Pass shall be started immediately after completion and cleaning of the stringer bead before the stringer bead can cool - always within five minutes. The one eight of an inch (1/8”) Hot Pass shall be made with AWS Class E-6010 (Fleetweld 6, 6P or equivalent) or AWS Class E-7010 (Shield-Arc 85 or equivalent). The Hot Pass shall be cleaned by power brushing or disc grinding. Stripper passes may be used if required. The Cover Pass shall be made using 5/32” AWS Class E-6010 (Fleetweld 6, 6P or equivalent) or AWS Class E-7010 Shield Arc 85 or equivalent, using a weaving motion and should be 1/32” to 1/16” higher than the pipe wall and overlay the groove by one sixteenth of an inch (1/16”) on each side. The completed weld shall be thoroughly brushed and cleaned. At the completion of the day’s work, all welds that have been started shall be finished.

I. If more than one welder is used, then all welds shall be stenciled on the top quarter of the pipe by the Contractor, according to numbers assigned to the welders by the Contractor, and the Contractor shall furnish the Owner with a record of all numbers assigned. No numbers shall be reassigned. Metallic dies shall not be used to mark the pipe.

J. The Owner shall be privileged to have the Contractor cut out any questionable weld. The Owner reserves the right to have any and all questionable welds checked by x-ray or non-destructive testing. Nondestructive testing shall be furnished by the Contractor. The Contractor shall repair or replace any unsatisfactory weld at his own expense.

K. The intent and purpose of these specifications is to insure a one hundred percent (100%) weld strength, ductility, fusion, and penetration. Each completed weld shall be free of scale, oxides, gas pockets, air pockets, pin holes, non-metallic inclusions, rivers, undercutting, dirt, slag, or other foreign inclusions or any other defects.

L. Arc burns outside the area of the finished weld shall be cause for the rejection of the weld. Weld splatter from the welding process shall not be considered an arc burn. Cracked welds shall be rejected. Pin holes, cold laps, rivers, undercutting or
any defects whatsoever occurring in any weld shall be repaired or cut out and completely re-welded at no expense to Owner.

M. If a weld is repairable, the defective area will be completely removed and the area preheated before re-welding. If a defect is then observed in the repaired area, the entire weld shall be cut out and replaced. Replacement shall be made by welding into the line a pup joint having a minimum length of two feet (2’). Replacement shall be at the expense of the Contractor.

N. At the end of each day’s work, or at the end of sections of pipe not tied in, pipe shall be quickly capped, in order to keep out foreign matter and shall remain capped until work is resumed or pipe sections are tied in.

3.27 Pavement Repair or Replacement

A. Unless otherwise specified, whenever pipe trenches are cut across or along existing pavement or shoulders, Contractor shall backfill pipe trenches and restore traffic over such cuts as quickly as possible by construction of a temporary twelve-inch (12”) surface of Class A, Grade D crushed stone, topped with a minimum of one-inch (1”) cold mix paving or hot mix asphalt to improve traffic surface until permanent repair can be accomplished.

B. Temporary surfaces shall be adequately compacted to prevent deterioration of repair during the temporary period. Any temporary surface that fails to provide a non-deteriorating riding surface shall be removed and replaced by the Contractor. Temporary surface shall be maintained until the permanent pavement is restored or until the entire project is accepted.

C. Permanent pavement replacement shall be completed in accordance with Clarksville Gas & Water Department Standard Water & Sewer Specifications Section 02575 – Pavement Repair within thirty (30) days from the completion of backfilling or, in case of work being performed during the seasonal closure of asphalt plants, asphalt pavements shall be permanently replaced within thirty (30) days of the reopening of the asphalt plants.

3.28 Operation and Maintenance Instruction to Owner

A. Where the specifications for specific equipment require that a factory service representative provide operation and maintenance instructions to the Owner for that equipment, Contractor shall coordinate and schedule this service to be performed by prior arrangement with the Owner for that equipment after and in addition to the manufacturer’s instructions to the Contractor for installation and start-up. Any expense associated with operation and maintenance instruction shall be paid by the Contractor.

B. The individual performing the instructions to the Owner is to be trained and/or certified by the manufacturer as its authorized operation, maintenance and
service specialist. If the said specialist is not a regular full-time employee of the manufacturer, the specialist’s qualifications shall be submitted to the Owner for review prior to scheduling the site visit for instructions to the Owner.

END OF SECTION
PART 1 - GENERAL

1.01 Work Included

A. The work specified by this section shall consist of repairing or replacing all damaged pavement, whether public or private. Dirt shoulders, roads, streets, drives, and walks shall be restored to their original condition as an incidental part of the installation of utilities. Repair damaged base on either side of a trench wherever necessary. Trim the pavement surface to neat lines outside of the trench wall, and repave the entire area as specified below and as shown on the drawings or on the standard details.

B. These specifications make reference to the current edition of the standard specifications of the Tennessee Department of Transportation (TDOT). Even though the weather limitations, construction methods, and materials specifications contained in the TDOT specifications may not be explicitly repeated in these specifications, they shall, wherever applicable to the work called for by this section, be considered as implied and therefore adhered to. However, the various subsections “Basis for Payment” contained in the TDOT specifications shall not be considered applicable.

C. All pavement repair work shall be in compliance with the requirements of the State, County or Clarksville Street Department.

1.02 Related Work

Section 02410: Cleanup and Restoration

PART 2 – PRODUCTS

Pavement materials shall conform to TDOT specifications as listed below.

2.01 Mineral Aggregate Base: Class A, Grading D crushed stone (TDOT specifications, Section 303, subsection 903.05).

2.02 Bituminous Prime Coats: Cutback asphalt, Grade RC-250, or emulsified asphalt, Grade AE-P (Section 402, subsections 904.02 and 904.03).
2.03 **Crushed Stone Chips**: Size 6 or Size 7 (Subsection 903.14)

2.04 **Double Bituminous Surface**: For both courses, either cutback asphalt, Grade RC-800, or RC-3000, or emulsified asphalt, Grade RS-2 (Subsections 904.02 or 904.03).

2.05 **Asphaltic Concrete Binder**: Grading B or C, as directed by the Engineer (Section 307).

2.06 **Bituminous Tack Coat**: Grade AE-3 (Section 403, Subsection 904.03).

2.07 **Asphaltic Concrete Surface**: Grading E (Section 411).

2.08 **Quick Dry Traffic Marking Paint (White and Yellow)**: Subsection 910.05.

2.09 **Flowable Fill**
   A. Portland Cement: Section 901.01
   B. Fine Aggregate: Section 903.01
   C. Fly Ash, Type C or F: AASHTO M295
   D. Water: Section 918.01
   E. Chemical Additives: Section 918.09
   F. Air Entraining Mixtures: Section 918.09

### PART 3 - EXECUTION

3.01 **general**

All paving shall be completed using appropriate equipment and machinery. All work must be coordinated with and approved by the City or County Street Department, TDOT or other governing authority. The Contractor shall perform all work in accordance with the governing authority and shall make all repairs as directed by that authority at no expense to the Owner.

3.02 **Subgrade**

   A. Before any base material is installed, compact the sub-grade of the area to be paved to 95% of optimum density as determined by ASTM D698 (Standard Proctor).
B. The backfill material shall contain no topsoil or organic matter. For all areas where sub-grade has been prepared, test for uniformity of support by driving a loaded dump truck at a speed of two (2) to three (3) miles per hour over the entire surface. Make further improvements on all areas that show a deflection of one (1) inch or more. When completed, the finished sub-grade shall be hard, smooth, stable, and constructed in reasonably close conformance with the lines and grades that existed prior to beginning construction.

C. When a base course is compacted, cut back the surface course of the existing pavement a minimum of one (1) foot beyond the limit of the joint between the old and new base course or as shown on the standard drawings. Take special care to ensure good compaction of the new base course at the joint. Apply and compact the surface to conform to the existing pavement so that it will have no surface irregularity.

D. No separate payment shall be allowed for sub-grade preparation. Cost for sub-grade preparation shall be included in the applicable pay item for the proposed work related to pavement replacement.

3.03 **Base**

A. Install a mineral aggregate base of the type specified above in accordance with Section 303 of the TDOT specifications. The maximum compacted thickness of any one layer shall be six (6) inches and total thickness of the base shall be that indicated by the standard drawings or as shown on the Contract Drawings.

B. No separate payment shall be allowed for base stone. Costs for additional make-up base stone shall be included in the pavement replacement unit prices.

3.04 **Seal Coat Surface**

Uniformly apply a bituminous prime coat of emulsified asphalt, Grade AE-P, or cutback asphalt, Grade RC-250, over the entire width of the area to be surfaced at a rate of 0.3 gallon per square yard. Immediately after application, uniformly cover the entire area with Size 7 crushed stone chips at a rate of 12 pounds per square yard.

3.05 **Double Bituminous Surface**

A. Apply the first course at a rate of 0.38 to 0.42 gallon per square yard with emulsified asphalt, Grade RS-2, or cutback asphalt, Grade RC-800 or RC-3000, and then immediately cover the Size 6 crushed stone chips at a rate of 33 to 37 pounds per square yard. After this is rolled, apply the second course at a rate of 0.30 to 0.35 gallon per square yard, and at once uniformly cover the Size 7 chips at a rate of 20 to 25 pounds per square yard. Then roll the entire area.
B. After the application of the cover aggregate, lightly broom or otherwise maintain the surface for a period of four (4) days, or as directed by the Engineer. Maintenance of the surface shall include the distribution of cover aggregate over the surface to absorb any free bitumen and cover any areas deficient in aggregate. Sweep excess material from the entire surface with rotary brooms. Sweep the surface at the time determined by the Engineer.

3.06 Asphaltic Concrete Binder

A. Apply a bituminous prime coat of emulsified asphalt, Grade AE-P, or cutback asphalt, Grade RC-250, at a rate of 0.38 to 0.42 gallon per square yard. Take care to prevent the bituminous material splashing on exposed faces of curbs and gutters, walls, walks, trees, etc.; if such splashing does occur, remove it immediately. After the prime coat has been properly cured, apply an asphaltic concrete binder to the thickness shown on the standard drawings or the Contract Drawings.

B. Carefully place the material to avoid segregation of the mix. Broadcasting of the material will not be permitted. Remove any lumps that do not readily break down.

3.07 Asphaltic Concrete Surface

A. If the asphaltic concrete surface course is to be placed directly on the mineral aggregate base, place a bituminous prime coat as described above. If, however, the surface course is to be placed on a binder course, then apply a bituminous tack coat of the sort specified above under PRODUCTS at a rate of 0.05 to 0.10 gallon per square yard.

B. Take care to prevent the bituminous material splashing on exposed faces of curbs, gutters, walls, walks, trees, etc.; if such splashing does occur, remove it immediately. After the prime or tack coat has been properly cured, apply the asphaltic concrete to the thickness shown of the drawings or standard drawings. Apply the surface course as described above for the binder course.

3.08 Flowable Fill

A. Flowable fill shall be used where designated on the Contract Drawings and on any crossing of a State Highway or as required by City Street Department or the County Highway Department.

B. Flowable fill shall be covered or otherwise protected while in the flowable state. No embankment or fill shall be placed on the flowable fill prior to final set or hardening as determined by the Engineer.
C. All sections of pipe shall be securely braced or anchored both horizontally and vertically, if necessary, to prevent movement of the pipe during placement of the flowable fill. Pipe sections shall be joined so as to prevent the influx of flowable fill around the joints. The Contractor shall replace at his expense any pipe or sections of pipe which do not conform to the above requirements.

D. Flowable fill shall be proportioned as follows:
   1. Portland Cement Type 1, 100 lbs./c.y.
   2. Fly Ash, 250 lbs. (minimum)/c.y.
   3. Fine Aggregate, 2,800 lbs./c.y.
   4. Water, 60 gal/c.y.
   5. Proportions may be adjusted by the Engineer to achieve a consistency for satisfactory flow.

3.09 Smoothness

The finished surfaces shall conform to the lines and grades that existed prior to construction. No deviations, variations, or irregularities exceeding 1/4 inch in any direction when tested with a 12-foot straightedge shall be permitted in the finished work, nor will any depressions that will not drain. Correct all such defects.

3.10 Sampling and Testing

A. Submit to the Engineer test reports made by an independent testing laboratory on the crushed stone aggregate, bituminous materials, and asphaltic concrete design mixes, and obtain his approval of these reports before starting paving operations.

B. Tests shall be made of the completed elements of the pavement to ascertain the compacted thickness of the base and surface courses. If sections with deficient thicknesses are found, the full section for a reasonable distance on each side of the deficiency shall be refused. Remove and reinstall all such sections. Patch all test holes in connection with thickness test.

C. When making surface tests, furnish one (1) man to mark all surface defects for corrections.

3.11 Pavement Striping

All disturbed pavement markings including stop bars shall be replaced to match existing striping.
SECTION 02725
BORING & JACKING

PART 1 - GENERAL

1.01 Work Included
   A. All gas mains installed in a bore under major interstates & railroads must be cased as specified herein unless otherwise specified by the Owner.
   B. Gas lines shall only be bored and jacked in situations where horizontal directional drilling is not allowed or feasible.
   C. It is the preference of the City of Clarksville not to install gas lines inside of a casing due to the possible safety issues associated with encasing a gas line. Instead, the preferred trenchless technology is horizontal directional drilling which can be found in Section 02727 of this specification.
   D. Gas lines which are cased shall be vented on both ends of the case to prevent buildup of gas in casing pipe in the event of a leak on the carrier pipe.

1.02 Regulations and Permits
   A. Permits for crossing highways or railroads will be obtained by the Owner. Engineer shall provide the Owner with any and all documents required by the Owner to obtain the necessary permit(s), including a profile of the road or railroad bore and completed TDOT Pipeline Encroachment Form. The Contractor shall verify that such permits have been obtained before construction commences.
   B. For highway crossings, the Contractor shall satisfy TDOT to the extent of the Owner’s posted Surety Bonds.

PART 2 - PRODUCTS

2.01 Steel Casing Pipe
   A. Encasement pipe shall be smooth wall welded steel with minimum yield strength of 35,000 psi. A protective bituminous coating shall be applied to the outside of the pipe.
   B. Steel casing pipe shall be of sufficient strength to meet the loading conditions of H-20 loading for highway crossings and Cooper E-80 loading for railroad crossings, and shall have the minimum pipe diameter and wall thickness shown in Table 1. Where mechanical joint pipe requires a larger diameter casing pipe than push-on joint pipe, a separate line item for MJ pipe has been provided in the following table. Where bell restraint harnesses have been specified for the carrier pipe, an appropriately sized casing pipe shall be specified to accommodate the restraints and required casing spacers.
Table 1

<table>
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<tr>
<th>Carrier Pipe Nominal Diameter (in.)</th>
<th>Minimum Casing Pipe Diameter (in.)</th>
<th>Minimum Wall Thickness Casing (in.)</th>
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2.02 **Carrier Pipe**

A. Carrier pipe installed in the casing pipe shall be as indicated on the Contract Drawings.

2.03 **Casing Spacers**

A. Casing spacers shall be provided so that the carrier pipe is in a centered/restrained position. The casing spacers shall be constructed of circular stainless-steel bands that bolt together to form a shell around the carrier pipe and shall be lined with PVC or EPDM to protect the carrier pipe and prevent slippage. The spacer shall be designed with risers and runners to support the carrier pipe within the casing.

B. The shell shall be minimum 14-gauge T-304 stainless steel and shall be manufactured in minimum widths of 8 inches and twelve inches (12”). The riser shall be constructed of minimum 10-gauge T-304 stainless steel and shall be sized to support all loads and shall support the carrier pipe within the casing in the centered/restrained position. The runners shall be a minimum width of two inches (2”) and be constructed of glass-reinforced polymer with beveled ends.

C. The spacers shall at a minimum be positioned at one to two feet (1’ – 2’) on either side of the joint and at the midpoint. Additional spacers may be required where recommended by the manufacturer and/or Engineer.

D. Casing spacers shall be Models CSS8 and CSS12 by CCI Pipeline Systems or S8G-2 and S12G-2 by Pipeline Seal and Insulator, Inc.

2.04 **End Seals**
A. A wrap-around self-curing rubber end seal shall be applied to each end of the casing pipe. End seals shall be Model ESW by CCI Pipeline Systems or Model “W” by PSI, Inc.

2.05 Casing Vents

A. Casing vents shall always be installed when boring and jacking natural gas line. Casing vents shall be 2” nominal diameter minimum and must have gooseneck above ground with a screened inlet in order to avoid water intrusion and foreign buildup which may prevent proper operation of casing vents.

PART 3 - EXECUTION

3.01 General Requirements

A. Perform all crossings according to the requirements of the governing highway department.

B. Notify the appropriate authorities involved and request their supervisory services during construction.

C. Provide necessary safeguards to protect the crossing.

D. Where bored highway installations are not shown on the Contract Drawings, open cut the crossing and provide a casing pipe only if required by the governing highway department or Engineer.

E. All uncased roadway punches shall be approved by the City Engineer prior to construction.

F. Excavation shall be unclassified and no distinction shall be made between rock and other materials excavated.

G. No extra payment will be provided for tunneling through rock. The contractor shall provide whatever means necessary to complete road bores even if rock is encountered. All line items referencing road bores shall include boring or tunneling as required. No change orders shall be issued if rock is encountered during road boring.

3.02 Installation

A. Perform all crossings in the manner shown on the drawings, except as otherwise directed by the governing highway department or railroad company.

B. Dry bore an opening under the crossing.

C. Jack the casing pipe, of the type and size specified, into the bored opening.

D. Install the appropriate carrier pipe into the casing pipe.

E. Test the carrier pipe according to the Section 02550.

F. Alignment and grade shall be installed and maintained per the Contract Drawings.
G. Bores which are not on horizontal or vertical alignment shall be re-bored. Abandoned bore holes shall be filled with flowable fill.

H. Install carrier pipe with casing spacers to maintain alignment inside casing pipe. Casing spacers shall be installed one (1) foot from each end of the pipe joint and at the midpoint.

I. Install casing end seals and casing vents upon completion of installation of carrier pipe.

END OF SECTION
SECTION 02727

HORIZONTAL DIRECTIONAL DRILLING

PART 1 - GENERAL

1.01 This section contains guidelines and specifications applicable to the installation of pipelines using horizontal directional drilling (HDD). It includes minimum requirements for design, materials and equipment used for the horizontal directional drilling for the substantially trenchless construction of pipelines. The section also includes materials, dimensions and other pertinent properties of pipe and required accessories. These properties provide minimum performance requirements for various components including joints.

1.02 Installation of pipelines below wetlands and roadways shall be carried out by HDD, where shown on the drawings and elsewhere by approval of the Engineer. The bore path shall be designed by the drilling contractor to ensure that pipe joints do not deflect more than 50% of manufacturer’s recommended maximum deflection.

1.03 HDD is the trenchless technology of choice of Clarksville Gas & Water as it pertains to natural gas installation. When trenchless installation is chosen as the installation method of choice in a natural gas application, all efforts shall be made to install the line via HDD as opposed to other technologies. In some cases, “Boring & Jacking” may be required for a natural gas line installation, in which case, Section 02725 of this specification shall be followed.

PART 2 - PRODUCTS

2.01 Pipe and Fittings

   A. Pipe and fittings shall meet the requirements of ASTM D3350 (PE) or ASME B31.8 (Steel), respectively. Pipe used for directional drilling shall be High Density Polyethylene (HDPE) PE 4710 SDR 11 or lower for plastic, or API 5L X-52, steel pipe, or as specified by the engineer in the contract Drawings. Refer to Section 02550, part 2.02, A, 2 in this specification for minimum wall thicknesses for steel pipe.

   B. Butt Fusion Fittings: HDPE fittings shall be PE 4710, HDPE, Cell Classification of 346464C as determined by ASTM D3350-02. Butt fusion fittings shall have a manufacturing standard of ASTM D3261. Molded and fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans. Fabricated fittings are to be manufactured using data loggers. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the Quality Control records.
C. Steel pipe shall have a Powercrete Coating, forty to fifty (40-50) mils thick for all HDD applications.

2.02 Drilling Systems

A. The directional drilling machine shall consist of a hydraulically powered system to rotate, push and pull hollow drill pipe into the ground at variable angles down to 8 degrees above horizontal, while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall have a capacity to adequately complete the drilling and piping installation. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the crossing. The hydraulic power system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor the maximum pull-back load during the pull-back operations. There shall be a system to detect electrical current from the drill string and an audible alarm, which automatically sounds when an electrical current is detected.

B. Rig should have some form of overload protection device to be used during pullback in order to ensure that the “Allowable Tensile Load” (ATL) of the pipe is not exceeded during pullback. This is especially important in plastic pipe installation.

C. The drill head shall be a steerable type and shall provide the necessary cutting surfaces and drilling fluid jets

D. Mud motors shall be adequate power to turn the required drilling tools.

2.03 Guidance System

A. A conventional electromagnetic sound walkover system, Magnetic Guidance System (MGS) probe or proven gyroscopic probe and interface shall be used to provide a continuous and accurate determination of the location of the drill head during the drilling operation. The guidance shall be capable of tracking at the maximum depth required and in any soil condition, including hard rock. It shall enable the driller to guide the drill head by providing immediate information to the tool face, azimuth (horizontal direction), and inclination (vertical direction). The guidance system shall be accurate to ± 2% of the vertical depth of the borehole at sensing position at depths up to one hundred feed and accurate within 1.5 meters horizontally.

B. The Guidance System shall be of a proven type and shall be setup and operated by personnel trained and experienced with this system. The Operator shall be aware of any geo-magnetic anomalies and shall consider such influences in the operation of the guidance system if using a magnetic system.
2.04 Drilling Fluid (Mud) System

A. A self-contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid composed of bentonite clay, potable water and appropriate additives. Mixing system shall be able to molecularly shear individual bentonite particles from the dry powder to avoid clumping and ensure thorough mixing. The drilling fluid reservoir tank shall be a minimum of 500 gallons. Mixing system shall continually agitate the drilling fluid during drilling operations.

B. Additives to drilling fluid such as drill soap, polymers, etc., shall be “environmentally safe” and be approved for such usage. No diesel fuel shall be used.

2.05 Other Equipment

A. Pipe rollers shall be of sufficient size to fully support the weight of the pipe while being hydro-tested and during pull-back operations. Sufficient number of rollers shall be used to prevent excess sagging of pipe. Rollers shall be used as necessary to assist in pull back operations and in layout/jointing of piping.

B. Hydraulic or pneumatic pipe rammers may only be used if necessary and with the authorization of Owner.

C. Other devices or utility placement systems for providing horizontal thrust other than those previously defined in the preceding sections shall not be used unless approved by the Owner prior to commencement of the work. Consideration for approval shall be made on an individual basis for each specified location. The proposed device or system shall be evaluated prior to approval or rejection on its potential ability to complete the utility placement satisfactorily without undue stoppage and to maintain line and grade within the tolerances prescribed by the particular conditions of the project.

PART 3 - EXECUTION

3.01 Scope of Work

A. Fabricate, directionally drill, and install pipe as called for on the Contract Drawings.

B. Provide complete copies of as-built drawings for the pipeline crossing. As-built drawings shall include plan view and profile view.

C. Clean up all affected sites, and restore all areas to pre-construction condition.

3.02 Submittals

A. Prior to beginning work, the Contractor shall submit to the Engineer a workplan detailing the procedure and schedule to be used to execute the project. The work plan shall include a description of all equipment to be used, down-hole tools, a list of personnel and their qualifications and experience (including back-up personnel
in the event that an individual is unavailable), list of subcontractors, a schedule of work activity, a safety plan (including MSDS of any potentially hazardous substances to be used), traffic control plan (if applicable), an environmental protection plan and contingency plans for possible problems. Work plan shall be comprehensive, realistic and based on actual working conditions for this particular project. Plan shall document the thoughtful planning required to successfully complete the project.

B. Contractor shall submit detailed plans on the following:
   1. Pipe delivery.
   2. Rig mobilization and setup.
   3. Proposed bore path.
   4. Pipe assembly.
   5. Pilot hole drilling.
   6. Pre-reaming.
   7. Pre-testing and pigging before installation.
   8. Pipe pulling (including description of overload protection devices in the case of plastic install)
   9. Pre-testing and pigging pipe after reinstallation.
   10. Restoration and demobilization.

3.03 Equipment and Materials to be Furnished by the Contractor

A. The Contractor shall furnish all equipment and material required to complete the Scope of Work that shall include but not be limited to the following:
   1. Drilling equipment.
   2. Water pumps, hoses, fittings, storage tanks, filters, and erosion prevention and sediment control measures as required.
   3. Drilling fluids containment, collection, cleaning and disposal equipment, and materials.
   4. Fuel and lubricants.
   5. Bentonite and related mixing equipment.
   6. Carrier pipe
   7. All fusion equipment for HDPE as required.
   8. All pneumatic or hydrostatic testing equipment and materials.
   9. Side booms, cranes, backhoes, trucks, and other equipment and materials necessary to load and unload and to support and smoothly transition the pipe while being pulled into the reamed hole.
10. All equipment and materials necessary to restore project areas to pre-existing condition or better.

3.04 Installation

A. The Owner’s Representative or Engineer must be notified 48 hours in advance of starting work. The directional bore shall not begin until the Owner’s Representative is present at the job site and agrees that proper preparations for the operation have been made. The Representative’s approval for beginning the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work as authorized under the Contract.

B. The drawings show existing utilities that are believed to be near the directional drill alignment. There is no guarantee that these utilities are located as shown or that the other utilities may not be present. The contractor is required to notify Tennessee One-Call by Dialing 811 or 800-351-1111 at least three (3) days prior to the start of boring. The Contractor is required to field locate existing utilities in advance of the work so as not to delay work and avoid conflict or disruption of utility services.

C. All work under this specification affecting the Tennessee Department of Transportation (TDOT) property, right-of-way or facilities shall be carried out to the full satisfaction of the TDOT authorized representative. The CONTRACTOR shall fully inform himself of all requirements of the TDOT as pertains to specific project and shall conduct all his work accordingly.

D. Site as indicated on Drawings, within right-of-way, shall be graded or filled to provide a level working area. No alterations beyond what is required for operations are to be made. Contractor shall confine all activities to designated work areas.

E. Entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on drawings. If Contractor is using a magnetic guidance system, drill path shall be surveyed for any surface geomagnetic variations or anomalies.

F. Pipe lengths shall be connected together in one length, if space permits. Pipe shall be placed on pipe rollers before pulling into bore hole with rollers spaced close enough to prevent excessive sagging of pipe.

G. The pilot hole shall be drilled on bore path with no deviations greater than 5% of depth over a length of 100’. In the event that pilot hole does deviate from bore path more than 5% of depth in 100’. Contractor shall notify Engineer, and Engineer may require Contractor to pull-back and re-drill from the location along bore path before the deviation.

1. A smoothly drilled pilot hole shall follow the design centerline of the pipe profile and alignment indicated on the Contract Drawings. At no point in
the bore will the combined radii in the plan and profile exceed the allowable minimum radius recommended by the pipe manufacturer.

2. The course of the pilot hole must stay within the given right-of-way at all points along the drilled route. Contractor shall provide and use a separate steering system employing a ground survey grid system, such as “Tru-Tracker”.

H. Upon successful completion of pilot hole, Contractor shall ream bore hole to a minimum of 25% greater than outside diameter of pipe being bored for straight pulls and 50% greater for curved or radius pulls using the appropriate back-reamers. Contractor shall have the option to pre-ream or ream and pull back pipe in one operation if conditions allow. Contractor shall not attempt to ream at one time more than the drilling equipment and mud system are designed to safety handle

I. After successfully reaming bore hole to the required diameter, Contractor shall pullback the pipe through the bore hole. In front of the pipe shall be a swivel. In the case of pulling back PE pipe, a breakaway swivel must be used to ensure the maximum Allowable Tensile Load is not exceeded. Once pull-back operations have commenced, operations must continue without interruption until pipe is completely pulled into bore hole. In the event that pipe becomes stuck, Contractor shall notify Engineer. Engineer, Contractor, and/or the maintaining agency shall discuss options and then work shall proceed accordingly.

3.05 Drilling and Mud Cuttings

A. The horizontal directional drilling operation is to be operated in a manner to eliminate discharge of water, drilling mud and cuttings into the creek or land areas involved during the construction process. Contractor shall immediately contain and clean up any inadvertent returns, spills or releases. Contractor shall also provide equipment and procedures to maximize the re-circulation and reuse of drilling mud to minimize waste disposal. In the event of a drilling fluid fracture, Contractor shall cease operations and shall discuss corrective options with the Owner and/or maintaining agency, then work shall proceed accordingly.

B. Disposal of drilling fluids shall be the responsibility of the Contractor and shall be conducted in strict compliance with all applicable environmental regulations and permit requirements. All costs related to disposal shall be borne by the Contractor.

C. Water supply is the Contractor’s responsibility, whether purchased locally, hauled in, or pumped from the creek. If pumped from the creek, the Contractor must comply with the rules and regulations of the Tennessee Department of Environment and Conservation.

D. Drilling fluids must be free of all additives that will adversely affect the environment.
3.06 Ream and Pullback

A. Pre-reaming: Pre-reaming operations shall be conducted at the discretion of the horizontal drilling Contractor. All provisions of this specification relating to simultaneous reaming and pulling back operations shall also pertain to pre-reaming operations.

B. Pulling Loads: Contractor shall be responsible for determining the Allowable Tensile Load (ATL), or safe pulling load required for proper installation. In order to prevent exceeding the ATL, contractor must use a breakaway swivel, or other overload protection device when pulling back plastic pipe. “Table 1” below shows as list of ATLs for PE 4710, DR 11 pipe. This table is solely for informational purposes. It is the responsibility of the contractor to verify and/or calculate the ATLs for the specific pipe chosen as per the contract Drawings.

<table>
<thead>
<tr>
<th>Nominal Size</th>
<th>Allowable Tensile Load (ATL) PE 4710, DR 11</th>
</tr>
</thead>
<tbody>
<tr>
<td>¾”</td>
<td>400 lbs</td>
</tr>
<tr>
<td>1”</td>
<td>630 lbs</td>
</tr>
<tr>
<td>1.25”</td>
<td>1000 lbs</td>
</tr>
<tr>
<td>2”</td>
<td>2050 lbs</td>
</tr>
<tr>
<td>3”</td>
<td>4450 lbs</td>
</tr>
<tr>
<td>4”</td>
<td>7,360 lbs</td>
</tr>
<tr>
<td>6”</td>
<td>15,950 lbs</td>
</tr>
<tr>
<td>8”</td>
<td>27,040 lbs</td>
</tr>
<tr>
<td>10”</td>
<td>42,000 lbs</td>
</tr>
<tr>
<td>12”</td>
<td>59,090 lbs</td>
</tr>
</tbody>
</table>

C. Torsional Stress: A properly sized and fully operational swivel will be installed between the reaming assembly at the end of the drill pipe and the pipeline to restrict torsional stress from being transmitted to the pipeline.

D. Pull Section Support: The pull section shall be supported as it proceeds during pull back so that it moves freely and the pipe material is not damaged.

E. The Owner may require the Contractor to periodically pot hole newly directionally bored main at Contractor’s expense in order to verify main depth.
Without written notification or design, the Contractor shall not install the main outside the “top of pipe” range of thirty-six inches (36”) to sixty inches (60”).

3.07 Cleanup, Repairs and Restoration

A. The Contractor is responsible for leaving all areas affected by his construction activities in a condition equal to or better than the condition before construction.

B. The Contractor shall fully restore all area around entry and exit pits as soon as work is completed. Fill to previous existing ground elevation and grade any areas where settlement occurs due to subsidence.

3.08 Record Keeping

A. Contractor shall maintain a daily record of the drilling operations and a guidance system log with a copy given to Engineer at completion of boring. As-built drawings shall be certified by the Contractor for accuracy.

B. Readings shall be recorded after advancement of each successive drill pipe (no more than 10’) and the readings plotted on a scaled drawing of 1” = 2’ vertical and 1” = 20’ horizontal. Access to all recorded readings and plan and profile information shall be made available to the Engineer or his representative, at all times. At no time shall the deflection radius of the drill pipe exceed the deflection limits of the carrier pipe as specified herein.

END OF SECTION
SECTION 02821
CHAIN-LINK FENCES AND GATES

PART 1 – GENERAL

1.01 Work Included

Construct chain link fences, gates and appurtenances in accordance with the Contract Drawings and these specifications.

1.02 Submittals

A. Product Data: For each product indicated

B. Shop Drawings: Show locations, components, materials, dimensions, sizes, weights, finishes of components, installation and operational clearances, gate swings, and details of post anchorage and attachment and bracing.

1.02 Related Work

Section 03300: Cast-In-Place Concrete

PART 2 – PRODUCTS

2.01 Chain-Link Fence Fabric

A. Steel Chain-Link Fence Fabric: Comply with Chain Link Fence Manufacturers Institute’s “Product Manual” and AASHTO M181.

B. Mesh and Wire Size: 2-inch (50-mm) mesh, 0.120-inch (3.05-mm) diameter. Vinyl coated, Type 1, Class D, color as specified by Owner.

C. Fabric Selvage: Twisted at top selvage and knuckled at bottom.

2.02 Line Posts

A. The line posts shall be one of the following types, and of the lengths shown on the Contract Drawings. They shall be 1.5 inch (1.900 O.D.) galvanized steel pipe meeting the requirements of ASTM A53, or (1.875 inch by 1.625 inch) galvanized rolled form steel Standard C-Section meeting the requirements of ASTM A570 Grade E, or (1.875 inch by 1.625 inch) galvanized H-Section or O.D. (1.5 inch (1.900...
O.D.)) aluminum-alloy standard (ANSI Schedule 40) pipe meeting the requirements of ASTM B241, Alloy 6063, Temper T6, or 1.5 inch (1.900 O.D.) triple coated steel pipe with a (0.120 inch) minimum wall thickness.

B. The pipe shall be manufactured by cold rolling and electric resistance welding of steel strip conforming to ASTM A569, ASTM A607 or ASTM A446, Grade D. All tubing shall be given corrosion protection by in-line application of hot-dip galvanizing, followed by a chromate conversion coating and an electrostatically applied clear acrylic or polyester coating on the outside surface. The inside surface shall be given corrosion protection by hot-dip galvanizing or by in-line application of a zinc rich paint after fabrication.

C. External Protective Coatings:
   1. Hot-Dipped Zinc Coating per ASTM B6 high grade and special high grade. The weight of the hot-dipped zinc coating shall be a minimum of 245 grams per square meter (0.8 oz/s.f.). The weight of zinc coating shall be determined in accordance with ASTM A90.
   2. The electrostatically applied clear acrylic or polyester coating thickness shall be at least 2.5 µm (0.1 mils).

D. Internal Protective Coatings: The interior surface shall be hot-dipped galvanized with a minimum of 25 grams (0.9 ounce) of zinc, or painted after welding with a 7.5 µm (0.3 mil) thickness of zinc rich paint. The coating shall be not less than 80% zinc powder by weight and capable of providing galvanic protection.

2.03 End Posts, Corner Posts, Gate Posts and Braces

A. The end and corner posts shall be 2.5 inch galvanized standard steel pipe meeting the requirements of ASTM A53, or 2.5 inch, aluminum alloy standard (ANSI Schedule 40) pipe, meeting the requirements of ASTM B241, Alloy 6063, Temper T6, or 2.5 inch triple coated steel pipe with a (0.130 inch) minimum wall thickness and meeting the specified requirements as set forth under Paragraph 2.02. End and corner post length shall be 9’-6”.

B. End and corner post braces shall be 1.25 inch (1.660 O.D.) galvanized standard steel pipe meeting the requirements of ASTM A53, or 1.25 inch (1.660 O.D.) aluminum-alloy standard (ANSI Schedule 40) pipe, meeting the requirements of ASTM B241, Alloy 6063, Temper T6, or 1.25 inch (1.660 O.D.) triple coated steel pipe with a 2.8mm (0.111 inch) minimum wall thickness and meeting the specified requirements as set forth in Paragraph 2.02.

C. Gate Posts shall be 3.0-inch galvanized standard steel pipe meeting the requirements of ASTM A53, or 3-inch aluminum-alloy standard (ANSI Schedule 40)
pipe meeting the requirements of ASTM B241, Alloy 6063, Temper T6. Gate post length shall be 10’-0”.

2.04 Barbed Wire

A. The barbed wire shall consist of three (3) No. 12-1/2-gauge twisted steel line wires with No. 14 gauge four-point barbs spaced not more than 125 mm (5 inches) apart. It may be either galvanized or aluminum coated. The galvanized wire shall meet the requirements of ASTM A121, chain link fence grade.

B. At the option of the Contractor, high tensile strength barbed wire may be used. If the Contractor elects to furnish high tensile strength barbed wire, it shall meet the requirements of ASTM A121 with the following exceptions:
   1. The coated line wires shall have a nominal diameter of 1.70mm (0.067 inch). The coated barbed wires shall have a nominal diameter of 1.45mm (0.057 inch).
   2. The minimum weight of zinc coating shall be 230 grams per square meter (0.75 ounce/s.f.) for the line wire and 215 grams per square meter (0.70 ounce/s.f.) for the barbed wire.
   3. The line wire shall have a minimum tensile strength of 2.10 kN (475 pounds) per individual strand.

C. Aluminum alloy barbed wire shall consist of three (3) twisted strands of 2.8mm (0.110 inch) line wire with 2mm (0.080 inch) diameter four-point barbs spaced not more than 125mm (five inches) apart. The wire and barbs shall meet the requirements of ASTM B211 alloys of 5052-0 for the wire and 5052-H38 for the barbs.

2.05 Miscellaneous Fittings and Hardware

A. Zinc-coated miscellaneous fittings and hardware shall be commercial grade steel or better quality, pressed, wrought or cast as appropriate to the article, and sufficient in strength and other properties to provide a balanced design when used in conjunction with fabric, posts and wires of the quality specified herein. All steel fittings and hardware shall be galvanized in accordance with AASHTO M111.

B. Aluminum alloy miscellaneous fittings and hardware shall be wrought or cast aluminum to the requirements of AASHTO M181, Table I.

2.06 Wire Ties

Wire ties shall be No. 9 gauge and shall be zinc-coated steel, aluminum-coated steel, or aluminum alloy, sufficient in strength and other properties to provide a balanced design when used in conjunction with fabric, posts and wire of the qualities specified herein.
2.07 **Tension Wire**

Tension wire shall meet the requirements of AASHTO M181.

2.08 **Truss Rods and Turnbuckle**

Truss rods shall be 9.5mm (3/8 inch) diameter, shall be equipped with a turnbuckle having a take-up of not less than 100mm (four inches) and shall be galvanized in accordance with AASHTO M111.

2.09 **Post Tops and Extension Arms**

A. Posts shall be fitted with ornamental tops or extension arms as shown on the Contract Drawings. The post tops shall fit over the outside of posts and shall exclude moisture from posts.

B. Extension arms shall be vertical or extend out from the fence line at approximately 45 degrees as shown on the Contract Drawings. The extension arms shall be suitably notched or slotted to support and space the barbed wire.

C. Fabrication of all materials shall be within reasonably close conformity to the sizes, shapes and dimensions and other factors set out in these specifications or shown on the Contract Drawings, and shall display careful, finished workmanship.

D. The weights specified for steel posts, braces and rails are nominal weights, and a tolerance of +/- 5% will be permitted.

2.10 **Gates**

A. Fence gates shall be of the types and sizes shown on the Contract Drawings. They shall be swing-type, complete with latches, stops, keepers, hinges, and fabric. The latch shall have a provision for fastening with a padlock. The gates shall be covered with fabric matching the fence. The hinges shall be of adequate strength to support the gate and shall not twist or turn under action of the gate. The gates, gate posts and braces shall be of the same kind and finish as the adjoining fence. All gate posts and rails shall be furnished with ball caps and rail ends.

B. Posts, braces and framing members for chain-link fence gates shall be standard weight pipe meeting the requirements of Paragraph 2.03.

C. Fabric for chain-link fence gates shall meet the requirements of Paragraph 2.01.

D. Barbed wire for chain-link fence gates shall meet the requirements of Paragraph 2.04.
E. Miscellaneous fittings and accessories for chin-link fence gates shall meet the applicable requirements of Paragraphs 2.05, 2.06, 2.07, 2.08, and 2.09. The hinges shall be of such design to allow the gate to swing back 180 degrees, parallel with the fence line.

2.11 Cast-In-Place Concrete

A. General: Comply with ACI 301 for cast-in-place concrete. Use materials consisting of Portland cement complying with ASTM C150, aggregates complying with ASTM C33, and potable water.

B. Concrete Mixes: Class A as set forth in Section 03300.

PART 3 – EXECUTION

3.01 Installation

A. General: Install chain-link fencing to comply with ASTM F567 and more stringent requirements if indicated on the Contract Drawings or required by the Engineer. Do not begin installation before final grading is completed, unless otherwise permitted by Engineer. All fence installers shall carry insurance coverage as required by the City.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacing indicated, in firm, undisturbed or compacted soil.

C. Post Setting: Hand-excavate holes for post foundations in firm, undisturbed or compacted soil.
   1. Concrete Footings: Place concrete around posts and vibrate or tamp for consolidation. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during placement and finishing operations until concrete is sufficiently cured. Set the following post types in concrete footings and protect portion of posts above ground from concrete splatter:
      a) Terminal.
      b) Line; using mechanical devices to set line posts per ASTM F567 is permitted.
      c) Gate.
      d) Gate operator mounting.
   2. Pull shall not be applied to posts set in concrete until the concrete has cured for a minimum of 72 hours.
D. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment. Terminal and gate posts shall be set in a minimum of 30” of concrete.

E. Line Posts: Space line posts uniformly at 10 feet (3.05m) o/c. Line posts shall be set in a minimum of 24” of concrete.

F. Intermediate Rails: Install in one piece at post-height center span, spanning between posts, using fittings, special offset fittings, and accessories.

G. Bottom Rails: Install, spanning between posts, using fittings and accessories.


I. Tie Wires: Attach wire to chain-link fabric per ASTM F626. Tie fabric to line posts at maximum interval of 12 inches (304 mm) o/c. and to braces at maximum interval of 24 inches (609mm) o/c.

J. When aluminum-alloy fabric is used, a tension wire shall be attached to the bottom of the fabric by means of a hog-ring type fastener at a maximum of 600mm (2 foot) intervals and secured at the terminal posts by means of a brace band.

K. Gate Installation: Install gates level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust gate to operate smoothly, easily, and quietly throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

L. Electrical grounds shall be constructed at each corner. A No. 6 solid copper conductor shall be clamped to the nearby ground system and to the fence in such a manner that each element of the fence is grounded. Installation of ground rods shall not constitute a pay item and shall be considered incidental to fence construction.

END OF SECTION
SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 Work Included

This work shall consist of all labor, materials, equipment, and incidentals required to install all concrete work, whether plain or reinforced, as shown on the Contract Drawings.

1.02 Related Work

A. Section 02221: Trenching, Bedding, and Backfilling

1.03 Submittals

Submit concrete mix design for each mix proposed for use identifying constituent quantities per cubic yard, including admixtures, water-cement ratio, and type of cement.

1.04 Quality Assurance

A. Measuring, batching, mixing, and transporting concrete shall conform to ASTM C94.

B. Perform work in accordance with ACI 301.

C. Conform to ACI 305 when concreting during hot weather.

D. Conform to ACI 306 when concreting during cold weather.

E. All detailing, fabrication, and erection of reinforcing steel shall conform to ACI 315.

F. Reinforced concrete shall conform to ACI 318.

PART 2 – PRODUCTS

2.01 Materials

A. Water: Water used in mixing concrete shall be reasonably clean and free from objectionable substances such as oils, acids, alkalis, organic matter, clay and silt, or other deleterious substances.
B. Portland Cement: Cement shall be domestic Portland cement and shall conform to ASTM C150. Cement shall be Type I or Type II unless otherwise specified by the Engineer. Fly ash is not an acceptable substitute for Portland cement.

C. Fine Aggregate: Fine aggregate shall be washed, inert natural sand conforming to ASTM C33.

D. Coarse Aggregate: Coarse aggregate shall be well-graded crushed stone or gravel conforming to ASTM C33 and shall be size No. 57.

E. Admixtures:
   1. Air entraining admixtures, mandatory for concrete exposed to weather, shall comply with ASTM C260. Proportioning and mixing shall be in accordance with manufacturer’s recommendations.
   2. Water reducing admixtures shall comply with ASTM C494, Type A. Proportioning and mixing shall be in accordance with manufacturer’s recommendations.
   3. The use of admixtures to retard setting of concrete during hot weather and to accelerate setting of concrete during cold weather shall not be used without approval of the Engineer. Where approved, these admixtures shall comply with ASTM C494. Proportioning and mixing shall be in accordance with manufacturer’s recommendations.


G. Steel Reinforcing Bars: Steel reinforcing bars shall be deformed, intermediate grade steel conforming to ASTM A615 Grade 60.

H. Tie Wires: Tie wires for reinforcing steel shall be 16 gauge or heavier, black annealed wire.

2.02 Classes of Concrete Mixes and Uses

A. Select proportions of constituents to meet the design strength and material limits specified in Table I and to produce concrete having proper placability, durability, strength, appearance, and other required properties.
Table 1

<table>
<thead>
<tr>
<th>Class</th>
<th>Design Strength psi (1)</th>
<th>Cement Type (2)</th>
<th>Cement Content (3)</th>
<th>W/C (4)</th>
<th>Slump Range Inches (5)</th>
<th>Air Content % (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4000</td>
<td>II</td>
<td>564</td>
<td>0.45</td>
<td>3-5</td>
<td>5-7</td>
</tr>
<tr>
<td>B</td>
<td>3000</td>
<td>I</td>
<td>470</td>
<td>0.56</td>
<td>3-5</td>
<td>5-7</td>
</tr>
</tbody>
</table>

(1) Minimum compressive strength at 28 days in accordance with ASTM C39
(2) In accordance with ASTM C150
(3) Minimum cement content is lbs/cu. yd. of concrete
(4) Water-to-cement ratio
(5) In accordance with ASTM C143
(6) Where concrete is exposed to freeze-thaw conditions, the concrete shall be air-entrained with air content of 6% +/- 1% according to ASTM C231. Otherwise, air entrainment is not required.

B. Concrete shall be as follows:
   1. Class A concrete shall be used for all concrete work except as noted below. All reinforced concrete shall be Class A.
   2. Class B concrete may be used for thrust blocks, concrete cradles, concrete anchors, concrete caps, concrete encasement, fill concrete, and where directed on the Contract Drawings.

C. Pumping of concrete will be permitted when approved design mix and aggregate sizes, suitable for pumping, are used.

PART 3 – EXECUTION

3.01 Forms

A. Construction:
   1. Forms shall be mortar-tight and sufficiently rigid to prevent distortion due to the pressure of the concrete and other stresses incidental to the construction operations, including vibration.
   2. The forms shall be built true to line and grade and shall be held in place by means of studs or uprights, and whaling, which shall be sufficiently and substantially braced and tied.

B. Form Lumber: Form lumber for all exposed concrete surfaces shall be dressed at least on one side and two edges, and shall be so constructed as to produce mortar-tight joints and smooth, even concrete surfaces.

C. Metal Ties: Metal ties or anchorages within the forms shall be so constructed as to permit the removal to a depth of at least one inch for the face without injury to the concrete.
D. Walls: Sufficient openings shall be provided at intervals along the bottom of wall forms to permit thorough cleaning prior to concrete placement. Such openings shall be closed before placing concrete in the forms.

E. Surface Treatment: Prior to placing reinforcement, all forms shall be treated to prevent the adherence of concrete. Forms not provided with a special treatment shall be treated with an approved oil. Any material that will adhere to or discolor the concrete shall not be used.

F. Metal Forms: The metal used for forms shall be of such thickness that the forms will remain true to shape. All bolt heads shall be countersunk on the face forming the concrete surface. Clamps, pins or other connecting devices shall be designed to hold the forms rigidly together and to allow removal without injury to the concrete.

G. Removal of Forms: Forms shall be removed in such a manner as not to impair safety and serviceability of the structure. Concrete to be exposed by form removal shall have sufficient strength not to be damaged by removal operation.

3.02 Reinforcement

A. All reinforcement shall consist of deformed steel bars meeting the requirements of ASTM A615 Grade 60, unless otherwise indicated or directed.

B. Steel welded wire fabric may be furnished in rolls or sheets.

C. Reinforcing steel shall be stored above the ground surface upon platforms, skids or other supports.

D. Reinforcing steel, where indicated, shall be accurately bent, without heating, to the forms and dimensions indicated on the plans.

E. All reinforcement shall be furnished in the full length shown on the plans, unless otherwise approved in writing by the Engineer.

F. Steel welded wire fabric shall be spliced by overlapping of the sheets by not less than 1-1/2 courses or 12 inches, whichever is greater, and tied together with wire ties spaced no more than 24 inches on center.

G. All reinforcing steel, before being placed, shall be thoroughly cleaned of mill scale, rust, dirt, paint, oil, or other foreign substances or coating of any character that will reduce the bond. When there is a delay in depositing concrete after the reinforcement is in place, bars shall be re-inspected and cleaned when necessary.
H. Unless otherwise shown, splices in reinforcing steel shall be lapped in conformity with ACI 318, but no less than 24 bar diameters. All bar splices shall be staggered where possible. When splicing bars of different diameters, the length of lap is based on the larger bar.

I. Reinforcement shall be accurately placed and firmly held in position with metal clips or tie wire at each intersection as indicated on the plans or as directed by the Engineer.

J. Supports for reinforcement when in contact with the foundation material shall be pre-cast concrete block bar supports or steel chairs. Maintain minimum concrete cover of 3 inches or as indicated on the plans. In no case shall reinforcement be in contact with ground or formwork.

3.03 Drainage and Weep Holes

Drainage openings and weep holes shall be constructed using materials in the manner, and at the locations shown on the plans or established by the Engineer.

3.04 Expansion Joints

Expansion devices shall be as indicated on the plans.

3.05 Measuring, Batching, Mixing, And Transporting Concrete

A. Measuring, batching, mixing, and transporting concrete shall conform to ASTM C94.

B. Concrete shall be placed within 1-1/2 hours of the time at which water was first added. Otherwise, it shall be rejected.

C. Concrete, which has been re-tempered by adding water to a ready-mix truck, is the sole responsibility of the Contractor. In no case shall more than 1 gallon per cubic yard of concrete be added.

3.06 Placing Concrete

A. No concrete shall be placed until forms, reinforcing steel, condition of sub-grade and method of placement has been approved by the Engineer or the Engineer’s representative. The Contractor shall advise the Engineer at least 24 hours prior to each concrete placement so that any necessary inspection or testing can be scheduled in a timely manner.
B. Concrete shall be placed as soon as practicable following excavation for footings, slabs, and other structural components. If an extended period of time will elapse between excavation and the placement of concrete, a thin “mud mat” at least 2 inches thick consisting of low strength concrete shall be placed to protect the sub-grade from degradation due to exposure. The mud mat shall not be placed prior to sub-grade approval by the Engineer.

C. All debris, foreign matter, loose soil, and standing water shall be removed prior to placement of concrete. Concrete shall not be placed on frozen ground.

D. Deposit concrete as near to its final position as possible to avoid segregation due to re-handling or flowing. Movement of concrete by use of mechanical vibrators is not allowed.

E. Concrete shall be placed so as to avoid segregation of the materials and the displacement of the reinforcement. Concrete shall not be dropped more than six feet. Tremies shall be used where drop exceeds six feet.

F. Pumping of concrete will be permitted when an approved design mix and aggregate sizes, suitable for pumping, are used.

G. All concrete shall be thoroughly consolidated by suitable mechanical vibrators during placement and shall be thoroughly worked around reinforcement and embedded fixtures and into corners of form.

H. Concrete within any unit of work between construction joints shall be placed continuously so as to prevent “cold joints.”

I. If the forms show bulging or settlement while concrete is being placed, the placing shall be stopped until correction has been made.

3.07 Curing and Protection

A. Protect all concrete work against injury from the elements and defacements of any nature during construction operations.

B. All concrete shall be cured in conformity with ACI 301. Reinforced concrete shall additionally conform to ACI 318.

C. Concrete placed during cold weather shall be batched, delivered, placed, cured, and protected in compliance with the recommendations of ACI 306.

D. Concrete placed during hot weather shall be batched, delivered, placed, cured, and protected in compliance with the recommendations of ACI 305.
3.08 Testing

A. Field-testing of fresh concrete shall be performed by an independent testing laboratory where required by the Engineer.

B. Unless otherwise specified, the field-testing program shall, at a minimum, consist of the following activities.
   1. Fresh concrete shall be sampled not less than once for each concrete mix placed each day, nor less than once each 100 cubic yards of each concrete mix placed each day. Sampling shall be performed in accordance with ASTM C172.
   2. Ambient and concrete temperature shall be measured at the time of sampling.
   3. Slump tests shall be performed in accordance with ASTM C143.
   4. Tests for air content shall be performed in compliance with either the pressure method complying with ASTM C231 or the volumetric method complying with ASTM C173.
   5. A set of four compressive strength cylinders shall be molded and cured in accordance with ASTM C31.

C. Unless otherwise specified, the break schedule for sets of four compressive strength cylinders shall be as follows: one at 7 days, two at 28 days, and one reserve. The compressive strength test shall be performed in accordance with ASTM C39.

3.09 Defective Concrete

Concrete shall be placed, completed, finished, and cured so as to form a dense, compact, impervious artificial stone with smooth exposed faces. Any part of the work found to be honeycombed, porous, or otherwise defective that cannot be satisfactorily repaired, in the opinion of the Engineer, or does not meet strength requirements, shall be removed and replaced in whole or in part at the expense of the Contractor.

END OF SECTION