

SECTION 312333 – TRENCH EXCAVATION AND BACKFILL

Scope:

The work under this Section consists of furnishing all labor, equipment and materials and performing all operations in connection with any trench excavation and backfilling required to install the pipe and appurtenances shown on the Drawings and as specified.

Quality Assurance:

The Contractor shall perform all excavation and backfilling operations in such a manner as to ensure a proper installation of the pipe and appurtenances shown in the Drawings and specified herein.

- A. **Density:** All references to “maximum dry density” shall mean the maximum dry density defined by the “Maximum Density – Optimum Moisture Test”, ASTM D 698. Determination of the density of foundation, bedding, haunching, or backfill materials in place shall meet with the requirements of ASTM D 1556, ASTM D 2937 or ASTM D 2922.
- B. **Sources and Evaluation of Testing:** Testing of materials to certify conformance with the Specifications shall be performed by an independent testing laboratory at no cost to the Owner. The Contractor’s testing laboratory shall perform tests upon change of source materials and at sufficient intervals to certify conformance of the materials used for backfill with the Specifications.

Safety:

Perform all trench excavation and backfilling activities in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596), as amended. The Contractor shall pay particular attention to the Safety and Health Regulations Part 1926, Subpart P “Excavation, Trenching & Shoring” as described in OSHA publication 2226.

Products and Implementation:

The Contractor shall perform the work in accordance with the following sections:

- A. **Removing and Resetting Fences, Mailboxes and Property Pins:** At all locations where existing fences, mailboxes, property pins or other appurtenances exist, the Contractor shall restore these items to preconstruction conditions as follows:
 - (1) At all locations where existing fences must be removed to permit construction of the utility line, the Contractor shall remove the fences and, as the construction progresses, reset the fences in their original location and to their original condition. During construction, the Contractor shall provide temporary fencing, or employ other safeguards, which will prevent livestock from wandering to other property.
 - (2) All mailboxes removed during construction operations shall be replaced immediately after construction has passed these conflicts. Or, if construction progress is limited the mailboxes shall be temporarily reset until construction operations require the removal of such interferences.
 - (3) Any property pins excavated during construction operations will be the responsibility of the contractor to reset the pin to its exact location. Any costs associated with replacing the pins shall be the responsibility of the contractor. Wherever possible, contractor should avoid removing property pins.

- (4) Payment: No extra payment will be made for removing and resetting fences, the cost thereof to be included in the prices bid for utility installations.

B. Protection of Other Utilities and Structures: Damage to existing utility lines, services, poles, and structures shall be repaired or replaced by the Contractor at his own expense.

- (1) The approximate positions of certain known underground lines are shown for information. The Contractor shall call the Utilities Protection Center (UPC) (800-282-7411) as required by Georgia Law (Code Section 25-9-1 through 25-9-13) and all utilities, agencies, or departments that own and/or operate utilities in the vicinity of the construction work site at least 72 hours prior to construction to verify the location of existing utilities.
- (2) Contractor shall have available and utilize an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipe lines or other obstructions.
- (3) A minimum clearance of ten feet (10') horizontal and eighteen inches (18") vertical must be maintained between new water mains and existing sewer lines. If a water main must be installed below a sewer line, it shall be encased in concrete with a minimum 6" concrete depth to the first joint in each direction. Where water mains cross the sewer, the pipe joint adjacent to the pipe crossing the sewer shall be cut to maximize the distance between the sewer and the joints of the pipe crossing the sewer.
- (4) Water mains shall not come into contact with or cross any sewer manholes.
- (5) Existing small lines are not shown. The Contractor shall locate existing small lines, and other possible existing unknown utility lines, with an electronic pipe finder and shall excavate and expose all existing underground lines in advance of trenching operations.
- (6) Removing and relaying of those lines and appurtenances which constitute an obstruction to the completed line and grade of the new work, in the opinion of the Owner, will be made at the expense of the Owner, unless otherwise shown on Drawings to be altered by the Contractor.

D. Protecting Trees, Shrubbery, and Lawns: Trees and shrubbery along trench lines crossing developed private property shall not be disturbed unless absolutely necessary, subject to approval by the Owner.

- (1) Trees and shrubbery to be removed shall be properly heeled-in and replanted. Heeling-in and replanting shall be done under the direction of an experienced nurseryman.
- (2) Where utility trenches cross private property through established lawns, sod shall be cut removed, stacked and maintained in suitable condition until replacement is approved by the Owner. Topsoil underlying lawn areas shall likewise be removed and kept separate from general excavated materials and shall be replaced at the surface of the trench in back filling. In lieu of removing and replacing sod, the Contractor may, if approved by the Owner, re-grass lawns by seeding or sprigging with grass of the same type as the established lawn. Before planting, lime and fertilizer will be applied in accordance with permanent grassing requirements in Section 312500 Erosion and Sedimentation Control. All of the other requirements for permanent grassing in Section 312500 shall be followed including acceptable dates for seeding, mulching, watering and preparation of the soil.

- (3) Payment: All cost of equipment, labor and materials required for the work shall be included in the price bid for same. The removal and replacing of sod or re-grassing by seeding and all other related work will be paid for on a linear foot basis of pipe lines and shall include, in addition to the pipe trench width, all areas adjacent to the pipe trench where existing grass has been disturbed or destroyed by the Contractor's operation
- E. **General Trench Excavation:** Excavation is unclassified. Perform all excavation of every description and of whatever substance encountered to the depth and width shown on the Drawings or specified, or both, for all utility lines, manholes, piers, conduits, and other appurtenances. Excavation shall be accomplished by open cut, unless otherwise directed. No tunneling shall be done, except that approved by the Owner; if approved, the tunnel shall be of the height, width, and cross section approved by the Owner.
- (1) The top portion of the pipe trenches may have sloping or vertical sides to widths which will not cause damage to adjoining structure, roadways, pavements, utilities, and private property.
 - (2) For untimbered trenches and trenches held by stay bracing only, the width of the lower portion of the trench to a height of two feet (2') above the top of the pipe shall not exceed the trench widths specified in the "Trench Widths" paragraph. Where skeleton and solid sheeting is used, trench width may be increased to dimensions approved by the Owner, but shall not be greater than that necessary to clear the walers when lowering pipes into the trench.
 - (3) Where, in the opinion of the Owner, trench excavation may damage adjoining poles, roadways, utilities and private property, the Owner may order the Contractor to install suitable sheeting for their protection. Such order shall in no way relieve the Contractor from his responsibility of protection of the facilities, nor shall the lack of those orders relieve the Contractor from that responsibility.
 - (4) No extra payment for sheeting will be made, except for the sheeting which the Owner orders to remain in place. If trenches are excavated to widths in excess of the above limitations, or collapse because of insufficient bracing and sheeting, the Contractor will be required to use special methods of constructing pipe foundations and backfilling as specified herein at his own expense.
 - (5) Trench excavation shall not advance more than five hundred feet (500') ahead of pipe laying, unless approved by the Owner.
 - (6) Excavation in excess of depth required for proper bedding shall be corrected by one of the special methods specified herein, as directed by the Owner. Bell holes shall be excavated in a manner which will relieve pipe bells of all load, but holes shall be small enough to insure that support is provided throughout the length of the pipe barrel. Excavation in excess of the depths required for manholes and other structures shall be corrected by placing a sub-foundation of Class "C" concrete or crushed stone, at no additional expense to the Owner.
- F. **Excavation in Solid Rock:** Solid rock is defined as those materials in the original bed and in well-defined ledges which, in the opinion of the Owner, cannot be removed with pick, shovel ditching machine, backhoe, and other similar devices, and which requires drilling, blasting, jack hammering, and bullpointing. Concrete and masonry structures to be removed which require drilling and blasting for removal, shall be considered rock unless otherwise provided for herein. Boulders, and detached pieces of rock, having volumes of more than 8 cubic feet, shall be considered as rock.

- (1) Ledge rock, boulders, and large stones shall be removed to provide a clearance of not less than six inches (6") in every horizontal direction from all parts of pipe, fittings, and other appurtenances.
 - (2) Where rock is encountered at grade in trenches, the trench shall be excavated not less than six inches (6") below the bottom of the pipe bell, refilled with crushed stone thoroughly tamped in-place, and shaped to the pipe.
 - (3) No additional payment will be made for crushed stone bedding in rock excavation, the cost shall be included in the unit price bid for water and/or sewer mains and service lines.
 - (4) Excavated rock shall not be mixed with material selected for tamped backfilling under and around the pipe up to a level at least two feet above the pipe.
 - (5) Where utility lines are constructed across streets, pastures, and cultivated fields, excavated rock shall not be mixed with backfill material used to complete the final twelve inch (12") layer of backfill at the original ground surface.
 - (6) Surplus rock shall be removed and wasted at locations approved by the Owner.
Payment: No separate payment will be made for rock excavation.
 - (7) The cost of such work, and all cost incidental thereto, shall be included in the unit prices bid for water mains.
- G. **Excavation for Vaults or Manholes:** Excavate to a minimum of 12-inches below the planned elevation of the base of the vault or manhole. Place or compact crushed stone bedding material to the required grade before placing the vault or manhole.
- H. **Blasting:** Blasting operations shall be conducted in strict accordance with all applicable ordinances and regulations. All exposed structures shall be carefully protected from the effects of blast and all blasts shall be covered with heavy timbers or other suitable material. The Contractor shall limit amounts of explosives and timing of blasts to minimize noise and concussion and to prevent damage to existing structures, pavements and utilities. The blasting shall be done only by experienced men. Damages shall be promptly repaired by the Contractor at his own expense. No blasting will be permitted adjacent to existing buildings and structures. Rock at those locations shall be removed with jack hammers and bull-points. If rock is encountered that requires removal by blasting the Contractor shall retain and employ a qualified blasting consulting Engineer, approved by the owner, to supervise the work. The Blasting Engineer's duties shall be to advise the blaster of hole spacing and loading and to make seismic and concussion measurements. The Contractor shall cooperate with the Blasting Engineer by uncovering and exposing pipe and structures for instrument mounting. The contractor shall also advise the Owner when each shot is ready and how it is loaded. No loaded holes shall be left unattended at any time for any reason. All blasting shall be done during daylight hours.
- (1) **Blasting and Ordinances:** All blasting operations shall be conducted in strict accordance with existing ordinances and regulations, and shall be done only with the Blasting ENGINEER'S APPROVAL AND UNDER ENGINEER'S SUPERVISION.
 - (2) **Protection of Surroundings:** All exposed structures shall be protected from the effects of blasts and all blasts shall be covered with blasting mats, dirt, heavy timbers, or other suitable material. They shall be restricted to the extent that no appreciable shock will be transmitted to existing structures, pipe lines, sewers, or

other public or private facilities. The blasting shall be done by experienced personnel. Any damage done shall be promptly repaired by the Contractor at the Contractor's expense.

- (3) **Storage of Blasting Supplies:** All blasting supplies shall be stored in a magazine which complies with all Local, State, and Federal Laws, and a watchman shall be stationed at all times at the place of storage. In no case shall caps or other exploders be kept at the place where dynamite or other explosives are kept.
- (4) **Delay of Shots:** All shots shall be delayed so as to minimize ground vibrations with a maximum peak particle velocity, as measured to the nearest structure (embankment, pipes, etc.) not to exceed 2 inches per second. The overpressure noise or concussion shall be minimized and stemming and matting shall be used to prevent over pressure in excess of 120 db. Precautions shall be taken to minimize flying rock and sufficient matting used to prevent rocks from striking any person or structure.
- (5) **Vibration Recording instruments:** Vibration recording instruments shall be used on all shots. These shall be of type which records on direct reading tape the three (3) components of velocity. The analysis of these recordings is to be signed by a Registered Professional Engineer in Georgia. Blasting is not to be conducted which will produce a Scaled Distance less than previously recorded for at least three (3) different shots deemed to be safe. The scaled distance is to be determined by the distance from the shot to the nearest structure subject to potential damage from ground vibration.
- (6) **Overpressure: (Concussion)** Overpressure is to be recorded on direct recording tape, preferable on the same recording as the vibration. The instrument used for measuring concussion shall be the type specifically designed for impact-type overpressure from blasting.
- (7) **Record of Shots:** The blaster is to maintain an accurate log of each shot, listing as a minimum the following: date, time, weather conditions including temperature and humidity, station number, manufacture and type of explosive, method of detonation, total weight of explosive per shot, number of delays, number of holes, hole depth, maximum weight of explosives per delay, amount of explosives per hole number, amount of stemming, type and amount of blast matting, and a sketch of the hole pattern with hole number for each shot.

H. De-watering Trenches: All excavations shall be dewatered properly before laying pipe.

- (1) Where running sand is encountered, dewatering shall be done by well pointing whenever possible.
- (2) Where soil conditions are not favorable for use of well points, french drains of graded stone shall be constructed to suitably locate sumps and the water removed by bailing or pumping.
- (3) No extra payment will be made for dewatering. All costs of equipment, labor, crushed stone and other materials required for dewatering shall be included in the price bid for water mains.

I. Trench Stabilization: Wherever the subgrade is, by nature, too soft and mucky, in the opinion of the Owner, for the proper installation of the water or sewer main, the Owner may order the Contractor to undercut the ditch and backfill with crushed stone conforming to the

latest revision of ASTM C 33, as amended to date, gradation #67 (ASTM #67) varying in sizes ¼" through ¾". The stone shall be brought to grade and compacted. Payment for crushed stone backfill, only where ordered by the Owner, will be made at the unit price bid, measured before placing, and shall include the removal of unsuitable subgrade materials.

- J. **Bracing and Sheeting:** The sides of all trenches and excavation for water and sewer mains and structures shall be securely held by stay bracing, or by skeleton or solid sheeting and bracing, as required by the soil conditions encountered. Examples of soil or site conditions requiring bracing and sheeting include where sloping of the trench walls does not adequately protect persons within the trench from slides or cave-ins; in caving ground; in wet, saturated, flowing or otherwise unstable materials; where necessary to protect adjoining buildings, roadways, structures, utilities or trees; and where necessary to maintain the top of the trench within the available construction easement or right-of-way.
- (1) **Timber:** No timber for shoring, bracing, or sheeting exceeding that size customarily used, will be paid for unless the use of larger sizes shall have been ordered by the Owner, in writing. Timber sheeting near the bottom of trenches over ten feet (10') deep, for water mains 15-inch size and larger shall remain in place and shall be cut off not less than two feet (2') above the top of the completed water main. When, in the opinion of the Owner, sheeting and bracing cannot be safely removed above this level, it shall be left in place. Sheeting so left in place shall be cut off at least two feet (2') below the surface. Payment will be made for timber sheeting ordered to be left in place in accordance with the unit bid price for the item.
 - (2) **Steel Sheeting:** Continuous interlocking steel sheeting may be substituted for timber bracing or sheeting, when approved by the Owner. Steel sheeting may be removed without cutting, provided the rate of removal is kept in pace with tamping and backfilling operations to assure complete filling of the void created by the withdrawal of the sheeting. Complete withdrawal of the sheeting in advance of tamping and backfilling will not be permitted. Sheeting, where ordered to be left in place by the Owner for reasons of safety, shall be cut off where directed. No payment will be made for the general use of steel sheeting where it is used in lieu of timber sheeting and where it is not ordered to be cut off. Where ordered to be left in place and cut off, steel sheeting will be paid for in accordance with the unit bid for the item.
- K. **Selected Backfilling:** All trenches shall be backfilled immediately after pipes are laid therein and joints have been inspected, unless other protection of the pipe line is directed. Selected backfill material shall consist of finely divided earth, stone dust, sand, crushed stone, or other approved material carefully placed about the pipe and up to a height of at least eighteen inches (18") above the top of the pipe barrel, in uniform layers not exceeding six inches (6") in thickness. Each layer shall be uniformly placed and tamped with proper hand tools in a manner which will not disturb or injure the pipe. Backfilling shall be carried on simultaneously on both sides of the pipe in a manner which will prevent injurious side pressures from occurring. If suitable select materials are not available from trench excavation, the Contractor will be required to obtain them elsewhere. No extra payment will be made for selected backfill, the cost thereof to be included in the prices bid for pipelines.
- L. **General Backfilling:** After selected backfill material has been placed and tamped, the remainder of the trench may be backfilled with general excavated material, except that no rock, unless in small shattered fragments, will be permitted to be mixed with other backfill material.
- (1) **Street and Road Right-of Ways, Yards, and Other Traveled Areas:** In street and road right of ways, yards and other traveled areas open to vehicular or pedestrian travel the ditch shall be backfilled and each layer shall be tamped to a density equivalent to

at least 95% of the Standard Proctor maximum dry density in accordance with ASTM D 698, as amended to date.

- a. Backfill material shall be placed in uniform layers not exceeding six inches (6") in thickness, with each layer thoroughly compacted with heavy duty tampers ("Whacker" or equal) to a height of at least thirty six inches (36") or forty eight inches (48") above the top of the pipe barrel.
 - b. The remainder of the ditch may be backfilled and tamped in the same manner or if the Contractor so elects he may place backfill in layers not exceeding twelve inches (12") and use wheel loading or heavy duty power tamping equipment ("Hydro-Hammer" or equal).
 - c. Pipe shall have at least thirty six inches (36") of cover before wheel loading and at least forty-eight inches (48") of cover before using heavy duty tamping equipment ("Hydro-Hammer" or equal).
- (2) Areas Requiring Pavement Replacement: Mechanical tamping will be required of all backfilling of excavated portions. After backfilling and tamping as described above is completed, the top ten inches (10") of the ditch shall be backfilled with Compacted Crushed Stone, ASTM C 33, as amended to date, Gradation #67 or #57, with sufficient fines for compaction. Further compaction shall be accomplished by leaving the backfilled trench open to traffic while maintaining the surface with stone. Settlement in trenches shall be refilled with stone and such maintenance shall continue until replacement of pavement is authorized by the Owner. The cost of the ten inches (10") of stone and any additional stone used shall be included in unit price bid for replacing pavement.
- (3) Other Areas: Other areas, including woodland, fields, pastures and areas not open to vehicular travel, the remainder of the ditch may be backfilled by placing fill in ditch and "walking-in" with wheel loaded equipment. Backfill material may be windrowed and maintained in a suitable manner so as to concentrate and pond rainfall runoff over the trench. After sufficient settlement has been obtained the Contractor shall complete surface dressing, remove surplus material and clean up in accordance with these Specifications. Wherever trenches have not been properly filled, or if settlement occurs, they shall be refilled, smoothed and finally made to conform to the surface of the ground. Backfilling shall be carefully performed and the original surface restored as specified herein. Surplus material shall be disposed of by the Contractor. No extra payment will be made for general backfill, the cost thereof to be included in the prices bid for pipelines.
- L. Construction Along Highways, Streets, and Roadways**: The Contractor shall install pipe lines and appurtenances along highways, streets, and roadways in accordance with the applicable regulations of the Georgia State Department of Transportation, Whitfield County and permits obtained by the Owner with reference to construction operations, safety, traffic control, road maintenance, and repair.
- (1) Protection of Traffic: The Contractor shall provide suitable signs, barricades, and lights for protection of traffic in locations where traffic may be endangered by construction operations. All signs removed by reason of construction shall be replaced as soon as the condition which necessitated their removal has been cleared. No highway, street, or roadway shall be closed without first obtaining permission from the proper authorities.
 - (2) Construction Operations: The Contractor shall construct all work along highways, streets, and roadways using the following sequence of construction operations so as to least interfere with traffic.

Trench Excavation and Backfill

- a. Stripping: Where the pipe line is laid along road shoulders, all sod, topsoil, and other material suitable for shoulder restoration shall be stripped and stockpiled for replacement.
 - b. Trenching, Laying, and Backfilling: The Contractor shall open trenches, install pipe line, and backfill. The trench shall not be opened ahead of pipe laying operations any further than is necessary for proper laying operations. Trenches shall be progressively backfilled and consolidated; excess material shall be removed immediately behind laying operations.
 - c. Shaping: The Contractor, immediately after completing back-filling operations, shall re-shape damaged cut and fill slopes, side ditches, and ditch lines. Topsoil, sod, and other materials removed from shoulders shall be replaced. This work shall be done in accordance with the requirements, and to the full and complete satisfaction, of the proper Highway personnel and the Owner. The Contractor, when installing pipe lines and appurtenances, shall provide sufficient personnel and equipment so as to simultaneously carry out all of the above operations.
- (3) Excavated Material: Excavated material shall not be placed along highways, streets, and roadways in a manner which would cut off traffic. No scattered excavated material shall be allowed to remain on the pavement; all such material shall be kept swept away.
 - (4) Drainage Structures: All pipe, side ditches, culverts, cross drains, and other drainage structures shall be kept clear of excavated material and be free to drain at all times.
 - (5) Maintaining Highways, Streets, Roadways and Driveways: The Contractor shall furnish proper construction equipment, which shall be available for use at all times, for maintaining highways, streets, and roadways upon which work is being performed. All such highways, streets, and roadways shall be maintained in suitable condition for movement of traffic until completion and final acceptance of the work.
 - (6) Payment: No separate payment will be made for the above work. The cost of such work, and all costs incidental thereto, shall be included in the unit prices bid for the item to which the work pertains. Permits for such work will be obtained by the Owner. The Contractor shall be responsible for fully informing himself with regard to all regulations relating to pipeline installation along roadways.

END OF SECTION