

## **SECTION 204: TRENCH EXCAVATION AND BACKFILL**

### **204.1 DESCRIPTION**

This work consists of trench excavation, placing and compacting bedding material and backfill, and disposing of material related to construction of underground utilities and minor structures, including sanitary sewers, water lines, storm drains, pipe culverts, box culverts, cattleguards, and other minor drainage structures.

### **204.2 MATERIALS**

Prior to bidding the project, the Contractor shall perform all work necessary to fully understand the type of materials to be excavated in the trenches, the extent of unsuitable or unstable materials, the type and amount of backfill material required to perform the work, and the costs associated with excavating, stockpiling, backfilling, hauling, and disposing the materials, along with any other operations pertaining thereto.

Any geotechnical investigation or pavement investigation results provided in the Contract documents or otherwise, when available, shall be considered as reference information only by the Contractor.

#### **204.2.1 Material Classifications – Trench Excavation**

Trench excavated materials shall be considered all types of materials except those requiring specialized equipment or blasting. The term “trench excavation” shall comprise and include the satisfactory removal and utilization or disposal of all materials excavated regardless of the nature of the materials encountered, the conditions of the material at the time it is excavated, the location of the material excavated, or the means and methods by which it is excavated.

#### **204.2.2 Material Classifications – Backfill and Bedding**

Refer to City of Rio Rancho Standard Drawing No. S-04, Pipe Bedding, for sanitary sewer, and Standard Drawing No. W-07, Pipe Bedding, for water lines, in regards to the pipe embedment zone material classification requirements.

The following sub-sections shall pertain to backfill of sanitary sewer and water line pipes above the pipe embedment zones, storm drains, pipe culverts, box culverts, cattleguards, and other minor drainage structures.

##### **204.2.2.1 Select Backfill**

The Contractor shall furnish a suitable, well-graded, compactible material free of Recycled Asphalt Pavement (RAP), organic matter, clay balls, lumps, rock fragments that may degrade with time such as shale or gypsum, and other Deleterious Materials. Select backfill material shall conform to the following and be placed in accordance with the Contract:

1. For structures and pipes other than plastic pipe:
  - a. Maximum particle size: 2 inch
  - b. Soil classification, AASHTO M 145 A-1 or A-2-4
2. For plastic pipe:
  - a. Maximum particle size: 1½ inch
  - b. Soil classification, AASHTO M 145 A-1 or A-2-4

All backfill material shall meet the electrochemical criteria where specified in the Contract.

#### **204.2.2.2 Flowable Fill**

The Contractor may substitute flowable fill for utility pipe backfill, including the pipe embedment zones for sanitary sewer and waterlines, in accordance with New Mexico Department of Transportation's Specifications for Highway and Bridge Construction, Current Edition, Section 516, Flowable Fill, at no additional cost to the City. The Contractor shall secure all utilities, culverts and minor structures to prevent flotation.

#### **204.2.2.3 Bedding**

The Contractor shall furnish a suitable, well-graded, non-plastic, free-draining material, free of Recycled Asphalt Pavement (RAP), organic matter, clay balls, lumps, rock fragments that may degrade with time such as shale or gypsum, and other Deleterious Materials. Bedding Material shall conform to the following and be placed in accordance with the Contract:

1. Maximum particle size: one-half (½) inch or half the corrugation depth, whichever is smaller; and,
2. Material passing No. 200 (75-µm) sieve: ten percent (10.0%) maximum AASHTO T 27 and AASHTO T 11.

All bedding material shall meet the electrochemical requirements where specified in the Contract.

#### **204.2.2.4 Suitable and Unsuitable Material**

Refer to Section 202, "Excavation, Embankment, and Borrow," for requirements related to suitable and unsuitable materials.

### **204.3 CONSTRUCTION REQUIREMENTS**

#### **204.3.1 General**

Perform trench excavation and backfill operations within the construction plan limits, lines and grades as required by the contract.

It is the Contractor's responsibility to maintain drainage so trenches are not used as storm water conveyance systems or that the backfill does not block normal storm water runoff patterns. As needed, the Contractor shall provide and maintain temporary drainage facilities until the permanent facilities are complete and operational. The Contractor will not receive any additional time or compensation related to their failure to maintain proper drainage causing their trenches to be inundated with water.

**204.3.1.1 Erosion Control**

All erosion control requirements and all necessary temporary sediment and erosion control protection (TESCP) devices shall be installed prior to initiating trench excavation and backfill activities on the construction site. The TESCP items would be paid for under the SWPPP pay item.

Provide and maintain temporary erosion and sediment control on trench excavation stockpiles until finishing operations are complete.

**204.3.1.2 Public Notification**

Prior to the start of trenching operations, including pavement cutting and removal, the Contractor shall coordinate with the City Engineer or designee to identify any problem areas involving traffic control, access to private properties, stockpiling of excavated materials, and/or utility conflicts. See the Notice to Contractor section of the contract for more information regarding specific public notification requirements.

**204.3.1.3 Line and Grade**

For trench installations of utilities, no deviation from the required line and grade in the plans shall be made without the consent of the City Engineer or designee. Grades for underground utility lines are the invert (inside bottom of the pipe) unless the Contract specifies otherwise.

**204.3.1.4 Existing Utilities**

The Contractor shall comply with NM 811 requirements when requesting utility locates. The Contractor shall be responsible for protecting any existing utility from damage caused by or occurring during their operations, including service connections.

No existing public utility lines shall be disturbed by the operations of the Contractor, except those which are specifically designated in the construction plans, without the express permission of the City Engineer or designee. If public utilities are broken or damaged in any way by the Contractor's operations, the owner of the utility shall be notified and damage repaired without delay. The cost of such repairs shall be paid by the Contractor or, for City-owned utilities, deducted from any estimates due at the discretion of the City.

The locations of existing underground facilities shown on the plans are approximate and are shown only for the Contractor's general information. The City does not assume responsibility for showing all utilities on the plans. The Contractor shall use suitable precautions to prevent damage to pipes, conduits, and other underground or overhead structures.

**204.3.1.5 Protection of Surface Structures**

All City-owned surface structures and features located outside the trench excavation limits for underground installations, together with those within the construction areas which are indicated in the construction plans as being preserved, shall be properly protected against damage and shall not be disturbed or removed without approval of the City Engineer or designee.

In the event of damage to any surface improvements, either privately or publicly owned, in the absence of construction necessity, the Contractor will be required to restore or rebuild the damaged property to at least the condition that existed before the construction operations, or to the satisfaction of the City Engineer or designee, at the Contractor's expense and without cost to the owner.

## **204.3.2 Trench Excavation**

### **204.3.2.1 General**

Trench excavation must conform to all local, state, and federal requirements. All installations shall be accomplished by open trench, except where boring, jacking, and tunnel construction methods are specifically required by the plans.

All work must be confined to the limits of the construction and to easements and right-of-way boundaries as indicated on the plans. Any excavation beyond the authorized trench widths or depths shall be filled with suitable compacted material at the Contractor's expense.

All construction activity must conform to all environmental requirements, including the Environmental Protection Agency (EPA) Construction General Permit for Storm Water discharge when applicable.

During trench excavation, materials suitable for trench backfilling shall be stockpiled in an orderly manner far enough away from the banks of the trench to avoid overloading and to prevent slides or cave-ins. Materials unsuitable for trench backfilling shall be removed and disposed at an off-site permitted facility. When trench excavation materials are stockpiled adjacent to a trench, the locations of the stockpiled materials shall be in accordance with Occupational Safety Hazards Act (OSHA) requirements for trench slope stability.

The Contractor shall perform trenching far enough in advance of pipe laying to accommodate necessary grade changes as directed by the City Engineer or designee. Unless otherwise specified in the Contract, the Contractor shall begin backfilling immediately after laying pipe and keep pace with pipe-laying operations. All open trenches shall be completely covered, fenced, or barricaded to keep people out of the work area.

The trench shall be drained to provide stable excavation and permit the utility pipe or drainage element to be laid in a dry trench. All grading near trench excavations shall be controlled to prevent surface water from flowing into the trenches or damaging other property. Any water accumulated in the trenches shall be removed by pumping or by other approved method. Should the trench bottom become unstable from the entrance of surface water into the open excavation, the saturated soil shall be removed and suitable backfill placed and compacted to grade with no additional compensation therefore.

Trench excavating operations shall proceed only so far in advance of pipe laying or drainage element construction as will satisfy the needs for coordination of work and permit advance verification of unobstructed line and grade as planned, consistent with the Contractor's methods and scheduling.

Where interference with existing utilities or structures is possible or in any way indicated, including any connections to in-place utilities or structures, the excavation at those locations shall be performed in advance of the main operation so actual conditions will be exposed in sufficient time to adjust without resorting to unnecessary delay. Refer to General Conditions 12.03.F of the Contract for the Contractor's responsibility to coordinate with utility owners in advance of excavation.

The excavating operations shall be conducted to carefully expose all existing underground structures without damage. Wherever the excavation extends under or approaches so close to an existing structure as to endanger it in any way, precautions and protective measures shall be taken as necessary to preserve the structure and provide temporary support. Hand methods of excavating shall be utilized to probe for and expose such critical or hazardous installations as gas pipe, power and communication cables, water lines, gravity and pressure sewers, and respective service pipes.

#### **204.3.2.2 Trench Safety and Shoring / Sheeting / Bracing**

The Contractor shall be responsible for maintaining all trenches in a safe condition. The Contractor shall be aware of current OSHA requirements concerning trenching and perform the work accordingly for the protection of the public and employees of the Contractor and Owner.

When additional trench support is deemed necessary by the Contractor, the Contractor shall install the necessary trench support to meet the varying soil conditions and to protect existing structures and property at the Contractor's expense. In these instances, the Contractor shall submit a trench support plan signed by a Registered Professional Engineer in the State of New Mexico prior to the start of the trenching operations.

It is the Contractor's responsibility to properly shore, sheet, or brace trenches. Any damage incurred to shoring, sheeting, or bracing shall be immediately restored and corrected at the Contractor's expense. The Contractor will not be reimbursed for the replacement of curb and gutter, sidewalk, pavement, structures, underground utilities, or other items that are damaged or fail due to failure of providing proper shoring, bracing, or sheeting. Shoring, bracing, or sheeting shall not be removed after the installation of the utility pipe until sufficient backfill is in place to protect the adjacent pavement, structures, or underground utilities from damage by caving.

The Contractor shall leave sheeting in place if necessary and approved in writing by the City Engineer or designee. The Contractor shall cut off sheeting left in place at least one (1) foot below the ground surface.

**204.3.2.3 Trench Widths**

The Contractor shall ensure that trenches are wide enough to properly lay, align, grade, and joint the pipe. The Contractor shall dig trenches to at least 24 inches wide, but in no case, should they exceed 1.4 times the outside diameter of the pipe, plus 24 inches, plus twice the thickness of shoring structures, at the level of the top of the pipe.

Trench widths shall have neat vertical lines to permit the utility pipe or drainage element to be placed, backfilled, compacted, and testing performed. Except where alterations are specifically authorized by the City Engineer or designee, should the Contractor excavate a trench wider than the maximum allowed width or flatten the neat vertical lines, the Contractor shall be responsible for any additional costs including: added excavation, backfill, removal and replacement of surface features, and any other costs associated with the added impacts. This includes added trench width to accommodate placement of shoring, bracing, or sheeting.

If trenching is behind a curb, in lawns, or adjacent to sidewalks or walls, the Contractor shall ensure that the trench is not wider than the outside diameter of the pipe plus 24 inches at the trench top. The Contractor shall provide sheeting or bracing as necessary.

**204.3.2.4 Shaping Trench Bottoms**

The Contractor shall accurately grade trench bottoms for pipe six (6) inches or smaller to provide uniform bearing and support throughout the length of each section of pipe. The Contractor shall finish the bottom of the trench by excavating a shallow concave groove at the line of the pipe and shape it approximately to fit the pipe.

The Contractor shall excavate trench bottoms for larger pipe to below the grade line, as necessary, to allow the installation of granular embedment foundation material for the pipe.

The Contractor shall dig bell holes and depressions for joints after grading the trench bottom so that the full length of the pipe rests on the prepared bottom. The Contractor shall make these depressions the length, depth, and width necessary to properly fit the joint type.

The Contractor shall not excavate below the specified final trench bottom elevation, unless the Contract requires granular embedment foundation material.

**204.3.2.5 Utility Pipe and Drainage Element Foundations**

Foundation preparations shall produce a stable foundation and provide continuous and uniform support of the utilities.

Trench excavations shall be extended below the bottom of utility pipes and drainage elements as necessary to accommodate the required bedding or foundation material indicated in the construction plans. The Contractor shall remove wet or otherwise unstable soil, incapable of properly supporting the pipe, and backfill the trench to grade with granular embedment foundation material or other suitable material.

If the Contractor excavates deeper than the specified grade, the Contractor shall backfill the trench to grade with granular embedment foundation material or other approved material at the Contractor's expense. The Contractor shall thoroughly tamp the replacement foundation material to provide a solid bed for the pipe. The City Engineer or designee will determine if material from the trench is acceptable.

When unsuitable or unstable materials are encountered, the Contractor shall contact the City Engineer or designee before proceeding. The removal of unsuitable material or an alternate treatment shall only be performed as authorized by the City Engineer or designee.

When utilities or drainage elements are placed on unsuitable or unstable materials without notification of the City Engineer or designee, the Contractor shall be responsible for all corrective work without compensation therefore.

#### **204.3.2.6 Dewatering**

Unless specifically approved in writing by the City Engineer or designee, the Contractor shall not proceed with trench foundation preparation work where water is present and the foundation is saturated.

Trenching and pipe laying operations and drainage element construction may encounter standing water or groundwater which would preclude the proper placement of bedding, backfilling, and laying pipe. The water shall be removed by pumps and associated equipment, such as well points, to lower the water level. Dewatering shall continue for a minimum of 24 hours after placement of any concrete.

Dewatering operations shall remove the water to achieve a stable foundation for pipe embedment and drainage element backfilling. The City Engineer or designee shall determine if adequate foundation has been attained. The groundwater shall be lowered to a minimum depth of six (6) inches below pipe and drainage element grades. Should over-excavation be necessary due to unsuitable foundation conditions, the groundwater shall be additionally lowered as necessary.

A dewatering plan shall be submitted for approval by the City Engineer or designee at the Preconstruction conference, including how and where the dewatering system wastewater will be disposed. Wastewater shall not be discharged into traffic and pedestrian lanes or onto private property.

Obtain all necessary permits prior to commencing dewatering operations. Arrange dewatering operation in a neat and orderly manner such that access to adjacent properties is maintained, the discharge system does not leak, and that any power generation complies with applicable noise limit regulations.

The Contractor is responsible for any adverse effect their dewatering operation has on private property, including providing temporary water to residences and/or businesses necessitated by the effect on private wells.

**204.3.3 Trench Backfilling****204.3.3.1 General**

Backfilling of the trench shall begin as soon as the pipe or drainage element is installed and inspected to verify proper line, grade and joint seal. The Contractor shall backfill all trenches at the end of each work day, or upon written authorization of the City Engineer or designee, shall provide another approved method of protecting the trench area while work is not being performed.

Do not place backfill on frozen earth or with frozen materials. Suspend operations until the material is thawed and dried.

Do not place backfill against new masonry or concrete structures until the concrete has reached its specified design strength. The Contractor shall remove sheeting and bracing before placing backfill.

**204.3.3.2 Sanitary Sewer and Water Lines**

Backfill of all trenches for sanitary sewer and water lines shall be performed by carefully placing suitable loose backfill materials on both sides of and above the pipe, and compacting to the required density up to a point at least twelve (12) inches above the top of the pipe as per applicable City Standard Drawings S-04 and W-07, Pipe Bedding. The remainder of the trench shall be backfilled as per 204.2.2 of these specifications.

All backfill material shall be placed in lifts not to exceed eight (8) inches of loose material, and shall be compacted to 95% for paved areas and 90% for unpaved areas, standard modified proctor, per ASTM D 1557. In addition, no backfill materials shall be placed along the sides of the pipe above the springline until the haunch area is adequately filled and no voids remain, and passing density tests are obtained at the springline location.

**204.3.3.3 Storm Drains, Pipe Culverts, Box Culverts, Cattleguards, and other Minor Drainage Structures**

The Contractor shall remove unsuitable foundation material below the specified bottom-of-structure elevation and replace with approved material. The Contractor shall use backfill material to backfill culverts in accordance with Section 204.2.2.1, "Select Backfill," or Section 204.2.2.2, "Flowable Fill," unless otherwise shown on the construction plans. The Contractor shall ensure the moisture content of the soil, at the time of compaction, is not less than five percent (5%) below optimum moisture content or greater than optimum moisture content. The Contractor shall compact the top six (6) inches of existing ground to 95% for paved areas and 90% for unpaved areas, standard modified proctor, per ASTM D 1557. The Contractor shall maintain the density, approved surface elevation, and shape of the foundation immediately before placing structures and forms.

The Contractor shall distribute backfill material in uniform layers, each no more than eight (8) inches thick (loose measurement) and compact to 95% for paved areas and 90% for unpaved areas, standard modified proctor, per ASTM D 1557. At the time of compaction, the Contractor shall ensure that the in-place moisture content of the soil is not less than three percent (3%) below optimum moisture content or greater than three percent (3%) above optimum moisture content in accordance with AASHTO T 180



(Modified Proctor), Method A or D (TTCP Modified). The Contractor shall test field density and moisture content using nuclear methods in accordance with AASHTO T 310 and Section 204.3.3.4.3, "Testing."

Concrete Box Culverts (CBC) and CBC wingwalls shall not be backfilled until specified design compressive strength has been achieved. The Contractor shall submit a concrete placement schedule to the City Engineer or designee upon request. The Contractor shall plan and schedule concrete placement to prevent damage to previously placed concrete or to the curing or protection systems of previously placed concrete. The Contractor shall maintain structure alignment and integrity during backfill compaction.

#### **204.3.3.3.1 Pipe Culverts and Storm Drains**

For preparation and installation of pipe culverts and storm drains, the Contractor shall remove rock and other unyielding foundation material a minimum of four (4) inches (maximum 12 inches) below the bottom of the structure. The Contractor shall backfill this added depth with an approved material as identified in the Contract.

The Contractor shall excavate trenches as described in the Contract to allow for pipe joining and compaction of the bedding and backfill material under and around the pipe. The Contractor shall ensure that the trench width for pipes and culverts conforms to the trench widths requirements in Section 204.3.2.3, "Trench Widths." The Contractor shall uniformly compact the trench for its full length and width. If specified in the Contract, the Contractor shall provide the longitudinal camber of the specified magnitude for cross drains.

#### **204.3.3.3.2 Box Culverts and Other Drainage Structures**

For preparation and installation of box culverts and other drainage structures, the Contractor shall excavate material to the elevations established by the Contract. The Contractor shall not remove material, except unsuitable material, below the final grade, if placing footings on excavated surfaces other than rock. The Contractor shall remove rock and other unyielding foundation material a maximum of twelve (12) inches below the bottom of the structure. The Contractor shall clean rock seams and cavities, and fill with concrete or grout. If the Contractor's excavation extends beyond the neat lines shown in the Contract, the Contractor shall use concrete (of the same class as the footing) to backfill these areas, at no additional cost to the City.

The Contractor shall notify the Project Manager after each footing excavation. The Contractor shall not place footings until the excavation depth and foundation materials are approved by the City Engineer or designee. The Contractor shall maintain the moisture and density, and the approved surface elevation and shape of the foundation, before installing reinforcing steel.

#### **204.3.3.4 Trench Compaction**

The Contractor shall maintain the alignment and integrity of the installed utility pipes and drainage elements during backfill compaction operations. Compaction of materials placed within the pipe and drainage element bedding and embedment zones shall be accomplished with portable or hand

equipment methods to achieve thorough consolidation under and around the pipe and to avoid damage to the pipe. Above this the use of heavy roller type compaction equipment shall be limited to safe loading of the utility pipes.

#### **204.3.3.4.1 Testing**

Contractor and Agency testing for trench backfilling shall be as per the New Mexico Transportation Department Minimum Testing Requirements at:

[http://www.dot.state.nm.us/content/dam/nmdot/Construction/INDEPENDENT\\_ASSURANCE\\_PROGRAM\\_5-29-13.pdf](http://www.dot.state.nm.us/content/dam/nmdot/Construction/INDEPENDENT_ASSURANCE_PROGRAM_5-29-13.pdf).

Section 206 of the testing schedule shall be used for storm drains, pipe culverts, box culverts and minor drainage structures, Section 610 for cattleguards, and Section 660 shall be used for sanitary sewer and water line installations. In areas where field testing fails, the area must be re-worked or material replaced and a passing test performed before placement of any subsequent materials.

The Contractor is required to submit potential borrow sources to the City Engineer or designee at the Preconstruction conference to ensure any necessary testing is performed prior to placement of trench backfill materials on the project.

### **204.4 METHOD OF MEASUREMENT**

#### **204.4.1 Sanitary Sewer Trench Excavation, Backfill, and Compaction**

Sanitary Sewer trench excavation, backfill, and compaction shall be measured by the linear foot of pipe per specified pipe diameter and depth as shown in the construction plans and Contract.

All depths shall be measured from the invert of the pipe to the top of existing ground elevation rounded to the nearest foot. The existing ground elevation shall be the elevation of the surface that exists along the centerline of the pipe at the time of construction staking for said trenching.

Whenever a special pipe embedment detail is specified on the plans, the trench depth shall be measured from the bottom of the embedment to the top of existing ground elevation. However, no additional trench depth shall be measured because of inadvertent over-excavation nor to accommodate trench dewatering.

#### **204.4.2 Water Line Trench Excavation, Compaction, and Backfill**

Water line trench excavation, compaction, and backfill shall be included in the unit price per linear foot of water line pipe; by type, size and depth of the water line pipe.

#### **204.4.3 Storm Drain, Pipe Culvert, Box Culvert, Cattleguard, and Minor Drainage Structure Trench Excavation, Backfill, and Compaction**

These items shall be measured by length or area of the new construction based on the respective method of measurement for the permanent work elements of each item. Also, refer to Section 204.5.3.

**204.5 BASIS OF PAYMENT**

**204.5.1 Sanitary Sewer Trench Excavation, Backfill, and Compaction**

Payment for trench excavation, backfill, and compaction for sanitary sewer construction shall be per the New Mexico American Public Works Association (NMAPWA) Standard Specifications Division 701 pay items, and shall be considered all-inclusive of the costs of the work including: excavation, disposal of unsuitable and unstable materials at an off-site facility, bedding material, backfill materials for the entire trench, placement and compaction of backfill materials, shoring and sheeting, dewatering, and any other costs related thereto. It includes all materials excavated that do not require specialized equipment or blasting. For example, the removal of cobbles using standard construction equipment would be included in the trench excavation, backfill, and compaction item.

<b>Pay Item</b>	<b>Pay Unit</b>
Trenching, Backfilling, and Compaction for Sanitary Sewer:	Linear Foot *
* Specify Pipe Diameter and Depth Increment	

**204.5.2 Water Line Trench Excavation, Compaction, and Backfill**

Payment for trench excavation, compaction, and backfill for water line construction shall be included in the NMAPWA Standard Specifications Division 801 pay items and no separate payment shall be made.

**204.5.3 Storm Drain, Pipe Culvert, Box Culvert, Cattleguard, and Minor Drainage Structure Trench Excavation, Backfill, and Compaction**

Trench excavation, backfill, and compaction for storm drain pipes, pipe culverts, box culverts, cattleguards, and minor drainage structures is included in the measurement of each item and no separate payment shall be made. Trench excavation and backfill includes disposal of unstable material, bedding material, backfill and select backfill material for the entire trench, placement and compaction of select backfill, dewatering, pumping, bailing, draining, sheeting, bracing, and incidentals required for proper execution of the work.

**204.5.4 Unstable or Unsuitable Utility Pipe Foundation Materials**

If the City Engineer or designee orders the removal of any unstable or unsuitable utility pipe or drainage element foundation materials by the Contractor beyond the work included in the contract, payment shall be made as covered in Section 202, "Excavation, Embankment, and Borrow," of these specifications by increasing the amount paid for Unclassified Excavation and Borrow based on the volume of material removed.