Section VI - Technical Specifications

ITEM I - EXCAVATION

1.01 Shoring and Shielding

(a) The Contractor shall comply with OSHA trenching and excavation regulations as revised in "Subpart P" of Part 1926 in the Federal Register. Shoring and/or shielding shall be used as specified in "Subpart P" to prevent caving of trench banks and to provide a safe excavation.

(b) **The Contractor will be responsible for excavation safety and shall designate his "competent person" (as defined in Subpart P) for the determination of proper shielding/shoring systems.**

1.02 Site Grading or General Excavation

(a) Sites for pumping stations and access roads shall be graded by mechanical equipment within the areas and to the elevations shown on the plans. Grading operations shall be conducted so that material shall not be removed or loosened beyond the required limits. The finished surfaces shall be left in reasonably smooth and uniform planes such as are normally obtainable from the use of hand tools; but if the Contractor is not able to obtain the required degree of evenness by means of mechanical equipment, he will be required to use hand labor methods. Slopes and ditches shall be neatly trimmed and finished to conform to the slope lines shown on the plans or as staked by the Engineer.

(b) Topsoil from the surface of the ground to be excavated or occupied by fills, within the general area specified to be planted with grass, shall be "stripped" or removed before site grading or other excavation work is started. Topsoil so removed shall be stockpiled at a suitable location on the site of the work so that it can be reused later for planting grass as specified in these specifications. This "stripping" operation shall remove all leaves, loam, and loose topsoil which are unsuitable for foundations. The depth to which topsoil is removed shall be determined by the Engineer, but will be generally between the limits of two and six inches.

1.03 Structural Excavation

(a) Excavation for structures shall be sufficiently large for the proper placing of forms and concrete and for dewatering purposes, but shall not be excessively large in horizontal area. Banks may be sloped at a safe angle provided that such excavation does not endanger or damage existing or proposed structures, pipelines, etc. The bottom of the excavation shall be true to the required shape and elevations shown on the plans. No earth backfilling will be permitted under structures unless specifically shown on the plans. Should the Contractor excavate

below the elevations shown or specified, he shall fill the void made with thoroughly compacted Class I pipe embedment materials or with Class B concrete at his own expense.

(b) When muck, quicksand, soft clay, swampy or other material unsuitable for foundations are encountered which extend beyond the limits of the excavation, such materials shall be removed and replaced with thoroughly compacted crushed stone acceptable to the Engineer or with Class B concrete.

(c) In all cases where materials are deposited along open excavation, they shall be placed so that in the event of rain, no damage will result to the work or adjacent property.

1.04 Trench Excavation

(a) Trench excavation or excavation for pipelines shall consist of excavation necessary for the construction of water and sewer lines, conduits and other pipelines and all appurtenant facilities thereof, including manholes, inlets, outlets, pipe embedment materials, and pipe protection as called for on the plans. It shall include site preparation, backfilling and tamping of pipe trenches and around structures and the disposal of waste materials, all of which shall conform to the applicable provisions of these specifications.

(b) Trench excavation shall be made in open cut and true to the lines and grades shown on the plans or established by the Engineer, unless tunneling or boring is shown or specified. When practical the banks of the trenches shall be cut in vertical, parallel planes equidistant from the pipe centerline. The horizontal distance between such planes, or the overall width of trench, shall vary with the size of the pipe to be installed. The overall width of trench shall be of the dimensions shown on the plans. When vertical banks for trench excavation are not practical to construct or create dangerous conditions to workmen, the banks may be sloped provided that such excavation does not damage adjacent structures. When trench banks are sloped, such banks shall be cut to vertical planes as specified above for that part of the ditch below the level of 12 inches above the top of the pipeline. The bottom of the trench shall be level in cross section and shall be cut true to the required grade of the pipe except where concrete cradles or pipe embedment materials are shown on the plans, specified or authorized by the Engineer, in which case the excavation shall extend to the bottom of the cradle or pipe embedment materials.

(c) Bell holes for bell and spigot pipe shall be excavated at proper intervals so that the barrel of the pipe will rest for its entire length upon the bedding. Bell holes shall be large enough to permit proper installation of joints in the pipe.

(d) Excavation for manholes and other pipeline structures shall be as specified for

structural excavation.

(e) When muck, quicksand, soft clay, swampy or other material unsuitable for foundations or subgrade are encountered which extend beyond the limits of the excavation, such material shall be removed and replaced with pipe foundation material as specified elsewhere in these specifications.

(f) All work shall be performed so as to cause the least possible inconvenience to the public. Temporary bridges or crosswalks shall be constructed where necessary to maintain vehicular or pedestrian traffic. Crosswalks and bridges shall have handrails or other features necessary for safe use by the public.

(g) In all cases where materials are deposited along open trenches, they shall be placed so that in the event of rain, no damage will result to the work or adjacent property.

1.05 Dewatering Excavated Areas

(a) The Contractor shall provide and maintain ample equipment with which to remove all water from every source which enters excavations for structures and pipelines. Dewatering operations shall ensure dry excavations and the preservation of the elevations of the bottoms of the excavations shown on the plans.

(b) Surface drainage shall not be allowed to enter excavated areas.

(c) Where the areas to be excavated are located under water surfaces or near the banks of flowing streams or other bodies of water, the Contractor may adopt and carry out any method of dewatering he may deem feasible for the performance of the excavation work and for protection of the work thereafter; provided that the method and equipment to be used results in completed work which complies with the specifications and is acceptable to the Engineer. In such cases, the excavation area shall be effectively protected from water damage during the excavation period and until all contemplated construction work therein has been completed.

(d) Prior to beginning excavation for structures which are to be constructed at or below the groundwater table, groundwater levels shall be lowered and maintained at workable levels. For structures other than manholes this level must be at least three (3) feet below the bottom of such structures until construction and backfilling operations have been completed.

(e) The Contractor shall be responsible for damage to structures caused by hydrostatic displacement during construction operations.

(f) The Special Conditions may contain additional requirements for dewatering excavated areas.

1.06 Borrow Excavation

(a) Wherever the backfill or embankment requires a volume of material that is in excess of the volume of suitable material available from the authorized excavations, such excess volume shall be obtained from other sources. Where borrow pits on the construction site are specifically designated on the plans, borrow excavation shall be obtained therefrom; otherwise, the Contractor shall provide suitable borrow material from areas accessible to the work. Before a borrow pit is opened the quality and suitability of the material to be obtained therefrom shall be approved by the Engineer.

(b) Borrow pits shall be properly cleared and grubbed and all objectionable matter shall be removed from the borrow pit material prior to its placement in the backfills.

(c) Borrow shall be excavated so that the remaining surfaces and slopes will be reasonably smooth and even and will provide adequate drainage over the entire area. Drainage ditches shall be constructed where necessary to provide outlets of water to the nearest natural channel so that the formation of pools in the borrow pit area will be avoided. Sides of borrow pit cuts shall be left at two to one slope unless otherwise authorized by the Engineer.

(d) The contractor shall furnish to the City written approval for the use of the Borrow Pit site. Upon completion of work the Borrow Pit shall be restored to a condition acceptable to the landowner.

1.07 Rock Excavation

(a) The removal of sound, solid rock of whatever nature which occurs in its original position in ledges, bedded deposits or stratified and unstratified masses within the excavation limits shown on the plans, and which is of such hardness or texture that it cannot be loosened, or broken down and removed without resort to drilling and blasting methods, shall be classified as rock excavation.

(b) The removal of hardpan, chert, clay, soft or disintegrated shale, and of other rock materials and boulders , shall not be classified as rock excavation although the Contractor may elect to excavate same by drilling and blasting methods. The excavation and removal of all such materials shall be classified as common excavation.

(c) The removal of existing pavements, sidewalks, driveways, manholes and

similar structures called for on the plans shall be performed under these specifications and shall not be classified as rock excavation.

1.08 Rock in Pipe Trenches

(a) Rock encountered in trench excavation for sewers and other pipelines shall be removed for the overall width of trench which shall be as shown on the plans. It shall be removed to a minimum depth of six (6) inches below the bottom of the pipe. Where pipelines are constructed on concrete cradles, rock shall be excavated to the bottom of the cradle as shown on the plans.

(b) After the Engineer has examined the completed excavation, and has taken the necessary measurements for volume determination, the space below the ultimate pipe grade shall be filled with pipe embedment materials as required, compacted to proper grade and made ready for pipe laying.

1.09 Drilling and Blasting

(a) Prior to commencing any blasting operations the Contractor shall notify the Engineer, and notify the official from the list below (if applicable) and obtain blasting permits as required. The Contractor must furnish certification of insurance specifically covering any and all obligations assumed pursuant to the use of explosives.

BLASTING PERMITS:

City of Cayce - BUILDING OFFICIAL (803) 796-9020
State - FIRE MARSHAL (803) 896-9800

(b) Drilling and blasting methods used in rock excavation shall be optional with the Contractor but shall be conducted with due regard to the safety of persons and property in the vicinity of the work and in strict conformity with all laws, ordinances or regulations governing blasting and the use of explosives. Rock excavation near existing structures of all types shall be conducted with the utmost care, and every precaution shall be taken to prevent damage to such structures. Any damage or injury of whatever nature to persons or property caused directly or indirectly by blasting operations shall be promptly repaired, replaced or compensated for by the Contractor at his own expense and to the entire satisfaction of the persons injured or the owners of the property damaged.

(c) Where future units or pipe trenches are adjacent to structures requiring rock excavation, the rock shall be drilled and blasted (not excavated) for a distance of approximately 10 feet from the present construction, as shown on the plans or as authorized by the Engineer.

(d) The Contractor shall not be allowed to blast within any rights-of-way maintained by any Public agency without specific approval of the controlling agency and only in accordance with their respective requirements.

1.10 Pre-Blast Survey and Vibration Monitoring

(a) Prior to conducting any blasting operations, the Contractor shall conduct a preblast survey of all structures within 300 feet of the proposed sewer line, along the entire route of the proposed sewer.

(b) The pre-blast survey shall consist of 35 mm color photographs of all observable exterior and interior surfaces. The photographs shall be bound in a notebook, with a photo index describing the location of each photograph to facilitate easy comparison of a given structures condition. Existing defects in structures shall be photographed and appropriately documented. The Contractor shall furnish a copy of the survey results, including photographs, to the City, prior to beginning blasting operations.

(c) All blasting operations conducted within 300 feet of existing structures shall be monitored. In areas where several structures are located adjacent to blasting a sufficient number of seismic units shall be deployed to allow for comprehensive documentation of blasting operations. The resultant seismic data shall be provided to the blasters to allow for blast design changes based on the location of the next blast and the resultant vibration levels for the previous shot. A copy of all resultant seismic data shall be provided to the City.

(d) The pre-blast survey, vibration and over pressure monitoring shall be conducted by a professional seismic consultant.

(e) All photographs and/or negatives shall be kept on file by the Seismic Consultant and shall be available to the City upon request.

(f) No separate payment will be made for the pre-blast survey, vibration and over pressure monitoring, nor the post-blast survey, nor any other work related to the blasting or excavation of rock, but this work shall be considered incidental to, and included in, the unit bid prices for water or sewer pipe, as listed in the bid schedule.

1.11 Backfilling Trenches

(a) The backfilling of pipeline trenches shall be started immediately after the pipe work has been installed. The initial backfill material (above pipe embedment materials), shall be placed to a height of one (1) feet above the top of the pipe.

(b) Where the trench extends along or across streets, roadways, usable alleys, or sidewalks the trench shall be completely backfilled (above pipe embedment materials) with either compacted earth, Class I pipe embedment material, Compacted Aggregate Base Course or Screenings. Unless otherwise specified in the Special Conditions or shown on the plans, such trenches shall be backfilled with compacted earth. Backfill materials shall be deposited in 6 inch layers (before compaction) and thoroughly compacted with power tools to 95% standard proctor.

(c) Where excavation has been made within the limits of easements across private property, the top one (1) foot of backfill material shall consist of fine loose earth free from large clods, vegetable matter, debris, stones, and/or other objectionable materials. Backfill material shall be carefully placed and compacted to 85% standard proctor.

(d) Any deficiency in the quantity of materials for backfilling the trenches, or for filling depressions caused by settlement, shall be supplied by the Contractor.

(e) The Engineer may provide the services of a field technician of a recognized commercial testing laboratory during the compaction of the trench backfill to make density determinations. The field technician shall report the test results to the Contractor and Engineer on the project site as soon as these results are known. The results of all density tests shall be reported in writing and shall include the date of test, test location, depth below finished grade, wet density, moisture content, dry density, percent compaction of test sample, and maximum dry density used for comparison. Should any test fail, the cost of any subsequent test will be at the expense of the contractor.

(f) Where pipe trenches are cut across or along pavement the Contractor shall construct a temporary surface over the cut which will not disintegrate under traffic and which shall be maintained in good condition under traffic until the permanent pavement has been constructed.

(g) Backfilling around structures shall be done in the manner specified above for pipe trenches by power tamping for the full depth of cut from the bottom of the trench to finished grade.

(h) All backfilling shall be done in such manner as will not disturb or injure the pipe or structure over or against which it is being placed. Any pipe or structure injured, damaged or moved from its proper line or grade during backfilling operations shall be opened up and repaired and then re-backfilled as herein specified.

(i) The Contractor shall replace all surface materials and shall restore paving,

curbing, sidewalks, gutters, shrubbery, fences, sod, and other surfaces disturbed, to a condition equal to that before the work began, furnishing all labor and materials incidental thereto as provided elsewhere in these specifications.

1.12 Disposal of Materials

(a) All materials removed by excavation which are suitable for the purpose shall be used whenever practicable for fills, embankments, backfilling pipe trenches, and for such other purposes as may be shown on the plans or authorized by the Engineer. All materials not used for such purposes shall be considered as waste materials and disposed of by the Contractor.

(b) Waste materials may be deposited in spoil banks on the site of the work if space is available. Such "on site" spoil bank locations shall be authorized by the Engineer. Waste materials shall not be left in unsightly piles but shall be spread in uniform layers and neatly leveled and shaped. Spoil banks shall be provided with adequate openings to permit surface drainage of adjacent lands. Where "on site" disposal is not practical, the Contractor shall be responsible for "off site" disposal. See Special Conditions – Disposal of Unusable Materials.

(c) On completion of any part of the work proper disposal shall be made of all surplus or unused materials within the construction limits of such work and the surface of the work left in a neat and workmanlike condition.

1.13 Maintenance

(a) All excavated areas, backfills, embankments, trenches, access roads, grading, and ditches shall be maintained by the Contractor in good condition at all times until final acceptance by the City. Where trench backfill has settled, trenches shall be re-excavated and compacted.

1.14 Special Conditions

(a) The Special Conditions may contain specifications regarding the use of crushed stone, payment for rock excavation, and construction methods for any unusual excavation work not included in the above specifications.

1.15 Soils Classifications-for Pipe Embedment Materials and Backfill

(a) Class I Soil**:**

Graded, angular, crushed granite (Grade No. 67). Materials under ¼" shall be limited to no more than 3% by weight.

(b) Class II Soil:

Coarse sand and gravel with maximum particle size of ¾" inch, including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil types GW, GP, SW, and SP are included in this class.

(c) Class III Soil:

Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures. Soil types GM, GC, SM, and SC are included in this class.

1.16 Pipe Embedment Materials

(a) Pipe embedment materials shall be **Class I material for PVC or ductile iron gravity sewer lines and sewer services.**

(b) Pipe embedment materials shall be **Class I, II, or III material for water lines and sewer force mains. Class III material is suitable only in dry trench conditions.**

(c) Pipe embedment materials shall be placed to support the full length of the barrel of the pipe at exact line and grade. Pipe embedment materials include bedding and haunching.

(d) Pipe embedment materials shall be placed in the pipe trench to the trench width and depth shown on the plans. Where rock has been removed from the pipe trench, it shall be placed to a minimum depth of six (6) inches below the bottom of pipe.

(e) Class IA pipe embedment materials may not require compaction. Class IB pipe embedment materials may require compaction. Shovel slice Class I materials to eliminate any voids.

(f) Class II pipe embedment materials require hand or mechanical tamping and compaction to a minimum of 85% Standard Proctor Density. Take care to avoid excessive moisture in Class II material.

(g) Class III pipe embedment materials require hand or mechanical tamping and compaction to a minimum of 90% Standard Proctor Density. Take care to avoid excessive moisture in Class III material.

1.17 Backfill Material

(a) Backfill material shall be of a suitable material removed from excavation except where other material is specified. Backfill material shall be of a relatively non-plastic nature and shall be sufficiently close to optimum moisture content to achieve specified compaction requirements. Backfill material shall exhibit no tendency to flow or behave in a plastic manner under blows of a mechanical tamp. Material which does not meet these requirements shall be removed from the site and replaced with suitable backfill materials.

(b) No debris, frozen material, large clods, rocks, boulders, or stones shall be included in the backfill material for at least two (2) feet above the top of the pipe.

(c) The remainder of the backfill shall be as described above except that a broken stone content of not more than fifty (50) percent by volume will be allowed provided that

the stones are thoroughly mixed with earth. Maximum individual stone size shall not exceed 6 inches in any direction. The top one foot of backfill material shall be as described in Section 1.11 Backfilling Trenches and as shown on the plans.

1.18 Pipe Foundation Material

(a) Pipe foundation material shall be quarry run crushed limestone or granite ranging in size from fines to a maximum size of six (6) inches. The material shall be power tamped in six (6) inch layers.

(b) Pipe foundation material shall be used in local areas where unsuitable materials such as muck, quicksand, soft clay, or swampy material make it necessary to provide a satisfactory pipe foundation.

(c) Pipe foundation material used as described above will be measured for payment only in specific locations where its use is authorized in writing by the Engineer before this work is performed.

1.19 Rip-Rap

(a) Dumped rip-rap shall be Type I or Type II as shown on the plans. All rip-rap shall be shot rock, field stone, or rough unhewn quarry stone. The stone shall be sound, tough, dense, resistant to the action of air and water, and suitable in all other respects for the purpose intended. Where shot rock from blasting is available, it may be used in place of stone provided that such meets with the approval of the Engineer. Rip-rap shall be graded to meet requirements as specified. Shot rock from the job site shall be general graded to prevent concentrated areas of rip-rap that is too large or too small.

(b) Type I Rip Rap stone shall vary in weight from 5 to 200 pounds. At least 30 percent of the total weight of the rip rap shall be in individual pieces weighing a minimum of 60 pounds each. Not more than 10 percent of the total weight of the rip rap may be in individual pieces weighing less than 15 pounds each.

(c) Type II Rip Rap stone shall vary in weight from 25 to 250 pounds. At least 60 percent of the total weight of the rip rap shall be in individual pieces weighing a minimum of 100 pounds each. Not more than 5 percent of the total weight of the rip rap may be in individual pieces weighing less than 50 pounds each.

1.20 Aggregate Base Course

(a) Aggregate base course shall be Macadam Base Course which meets all requirements of Section 305 of the SCDOT Standard Specifications for Highway Construction.