

SECTION 01

TRENCH SAFETY

PART 1 - GENERAL

- 1.1** The work covered under this section of the specifications shall include all labor, tools, materials and equipment required for the trench safety under the contract.

PART 2 - PRODUCTS

- 2.1** OSHA standards for excavation & trench safety systems (29 CFR 1926, Subpart P) are hereby made a part of these specifications and the contractor is reminded that these regulations must be complied with at all times.

PART 3 - EXECUTION

- 3.1** Measurement shall be for the entire job and will cover all trench or excavation required by the project under a lump sum. The unit price stated in the proposal shall be full compensation for compliance with these regulations.

Sum shall include all labor and materials necessary to satisfactorily comply with the OSHA standards.

END OF SECTION

SECTION 02

EXCAVATION FOR WATER LINES

PART 1 - GENERAL

- 1.1** The work covered under this Section of the Specifications shall include trench excavation for water lines.

The Contractor shall, where required, clear the pipe line right-of-way; construct and maintain all approaches required for traffic control; brace and support adjoining ground or structures, where necessary to handle all drainage or ground water; guard the site; replace or repair all damaged drains, culverts, fences or other structures; restore all roadway surfaces over the trench until final acceptance of the completed project.

All excavation shall be carried accurately to the line and grade shown on the Plans or as may be established by the Engineer. When excavation is carried below or beyond that required, except upon authorization by the Engineer, that space shall be filled with sand or fine stone properly compacted or with concrete, in accordance with the Engineer's instructions. No claim for additional compensation shall be made for such backfilling or excess excavation unless the Contracting Authority or its agent is responsible for the error or unless the Engineer has so authorized the over-excavation in writing.

All excavation shall be de-watered before any construction is under taken therein. Concrete shall be placed only upon dry, firm, foundation material.

The Contractor's attention is called to his responsibility for determining, by boring or other means satisfactory to him, the trenching and excavating conditions expected to be encountered during the construction work. Pipe shall be laid only in dry ditches by using adequate and efficient de-watering methods.

PART 2 - PRODUCTS

- 2.1** Trenches shall be of the width and depth necessary for the proper installation of pipe. All pipes shall be laid in trenches of such depths as to provide a minimum thirty-six (36") inches over the top of the pipe unless otherwise noted on the Plans.

The bottom of the trench shall be accurately graded so that the pipe will be in continuous and uniform contact and have a longitudinal bearing on undisturbed soil for full length of the pipe, except for such distance as necessary for adequate bell holes or coupling and proper sealing of the pipe joints.

If the soil at the bottom of the trench is mucky or if the subgrade is too support the pipe, the Contractor shall excavate below the lower extremity of the pipe as directed by the Engineer, and a cushion of sand or fine stone thoroughly tamped into place to receive the pipe.

Trench excavation in rock shall be carried to a depth of no less than four (4) inches below the pipe grade. The pipe shall then be laid on the backfill of sand or fine stone no greater than ¾" diameter, which provides a firm and uniform bedding.

Ledge rock, boulders and large stones shall be removed to provide a clearance of not less than four (4) inches below and on each side of all parts of the pipe, valves and fittings. Excavation below subgrade in rock or boulders shall be refitted and tamped to subgrade using sand or fine stones as specified.

- 2.2** De-Watering Excavation. It is the intent of this Specification that the water lines be laid in dry, firm trenches. When water occurs in trenches, the excavation shall be carried below grade as directed by the Engineer and backfilled with gravel or crushed stone not larger than 3/4" to an elevation sufficient to prepare the subgrade.

Pumps shall then be kept operating, taking suction out of a pump below the gravel or crushed stone, so as to hold the water level well below the bottoms of all bells until the pipe has been satisfactorily jointed.

If, in the opinion of the Engineer de-watering and stabilizing of excavation as described above is not satisfactory for proper construction of water lines, the Contractor will be required to dewater excavation by the well point system. It shall be the Contractors responsibility to satisfy himself by test borings or other means, of the excavation conditions expected to be encountered.

PART 3 - EXECUTION

- 3.1** Trench excavation for water lines shall be included in the contract prices for water lines and will not be measured of paid for separately.

If rock is encountered the amount of rock removed from trench areas will be computed as the actual volume of rock measured in place prior to blasting. Payment shall be at the unit price stated in the proposal, which shall include blasting, jack hammering, removal and bedding necessary for the satisfactory laying of the pipelines. All quantities will be agreed upon each day by the contractor and the construction observer.

The gravel used for bedding of PVC water lines shall be included in the contract unit prices for water lines and will not be measured or paid for separately.

END OF SECTION

SECTION 03

HIGHWAY, STREET, AND RAILROAD CROSSINGS

PART 1 - GENERAL

- 1.1** The work covered under this Section of the Specifications consists of furnishing all plant, labor, equipment and materials and performing all operations in connection with the installation of pipe line crossings under highways and railroads, all in accordance with these Specifications and the applicable drawings.

PART 2 - CONSTRUCTION

- 2.1** The construction shall conform in all respects to the standards and requirements of the Arkansas State Highway Department and the applicable railroad company. It shall be specifically understood that where a conflict might exist between the installation details shown on the Plans and those required by the Highway Department or the Railroad Company shall govern and that the Contractor shall not be entitled to additional compensation on account of these requirements.

The Contractor's attention is specifically called to the fact that a disregard of the installation requirements furnished by the Highway Department and/or the Railroad Company and a disregard of the Engineer's instruction, or those of this representative, based on these requirements, shall be cause for rejection of the complete installation.

Permits for such crossings shall be obtained by the Owner and no crossing shall be undertaken until permits and requirements are obtained. The Contractor's Superintendent or foreman shall be required to have in his possession copies of the crossing details and requirements before commencing any work.

The encasement pipe shall be of the size, gage, and type of material shown on the Plans. The actual length installed shall be in conformance with the requirements of the Highway Department and/or the Railroad Company. After the encasement pipe has been installed, the pipe line shall be properly installed inside the encasement pipe and properly cushioned with sand as directed by the Engineer.

PART 3 - MATERIALS

- 3.1** Encasement pipe shall conform to the requirements as specified in the AASHO Specifications and/or the AREA Specifications, whichever is applicable.

PART 4 - EXECUTION

- 4.1** Pipe encasement will be measure as the actual linear feet of encasement pipe installed. Pipe encasement shall be paid for at the unit contract prices stated in the Proposal. The unit price stated shall include pipe, bands, and all other materials, labor, excavation, equipment, gravel subgrade material, backfill, maintaining backfill, sand cushioning and all other work necessary to the completed and accepted installation.

END OF SECTION

SECTION 04

HANDLING AND LAYING PVC PLASTIC PIPE & FITTINGS

PART 1 - GENERAL

1.1 The work covered by this Section of the Specifications shall include the furnishing and installation of PVC Plastic Pipe and Fittings for the water distribution system in strict accordance with these specifications and the applicable drawings.

PART 2 - PRODUCTS

2.1 MATERIALS:

PVC Plastic Pipe and Fittings shall be that manufactured and furnished by Johns-Manville, Capco, Corlon, Clow, U.S. Pipe, or an equal approved in writing by the Engineer. The pipe supplier shall be responsible for furnishing all fittings and shall certify, in writing to the Engineer, that fittings furnished are designed specifically for use with the pipe manufactured and furnished. Fittings shall be manufactured of the ductile iron and be mechanical joint of the size shown on the plans.

PVC Plastic Pipe shall conform to all requirements and criteria of Commercial Standards CS 256-63 and the manufacturer shall certify, in writing to the Engineer, that pipe furnished has been inspected and tested in strict accordance. Pipe shall be marked in accordance with CS 256-63. PVC pipe shall be manufactured from virgin unplasticized polyvinyl chloride Type I, Grade I resin. Pipe shall conform to CS 256-63, SDR 21, Type 1120 ASTM D2241-64T, ASTM D 1784-60T and NSF approved. Pipe shall have a working pressure rating of not less than 200 PSI at 73 degrees F. PVC pipe for use with gaskets shall be jointed with approved natural rubber rings.

PVC pipe shall conform to the following minimum requirements.

PRESSURE SIZE F	WALL THICKNESS	I.D. OF PIPE	WT. PER FOOT	WORKING RATING @73
¾"	0.062	0.926"	0.118	250 psi
1"	0.063	1.189	0.153	250 psi
4"	0.343	4.114		250 psi
6"	0.493	5.914		250 psi
8"	0.646	7.758		250 psi

Fittings, couplings, adapters, nipples and other pipe accessories shall be PVC Schedule 80. Fittings shall be pre-assembled and tested at the factory using PVC Schedule 80 deep socket adapters. Deep socket adapters shall be used at all bends, connections to valves & hydrants.

The PVC Pipe shall be in accordance with the Health Department's Policy Statement: Policy Statement: PVC Pipe for Public Water Systems, September 1987. All PVC pipe shall be PVC 1120 pressure pipe made from class 12454-B material as defined by ASTM D 1784 with out side diameter dimensions of steel or cast-iron pipe. The PVC compounds shall be treated and certified as suitable for potable water products by the National Sanitation Foundation Testing Laboratory.

2.2 CONSTRUCTION:

In the transportation, unloading and handling of PVC Plastic Pipe, the pipe shall not be dropped, let roll and collide with another pipe, or be subjected to any unnecessary jar, impact, or other treatment that might crack or otherwise damage the pipe. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

Before laying the pipe in trench, the bottom of the trench shall be carefully graded and prepared and bell holes excavated so that the pipe shall have a uniform support along its entire length except at bell holes, and shall not be allowed to rest on hard supports through a portion of its length only. A cushion of selected material, 4" minimum, uniformly graded shall be provided for all pipes. Pipe shall have not less than thirty-six inches (36") of cover over the top of the pipe, except as otherwise specified or directed.

All foreign matter or dirt shall be removed from the inside of the pipe before it is lowered in the trench and the pipe shall be kept clean during and after laying. Care shall be taken to prevent dirt from entering the joint space and at all times when pipe laying is not in progress the open ends of the pipe shall be closed by using a suitable cap or plug to prevent trench water, foreign matter and dirt from entering the pipe line.

Cutting of the pipe for inserting valves, fittings, or closure pieces shall be done in accordance with the manufacturer's recommendations in a neat and workmanlike manner without damage to the pipe. Prior to jointing the pipe and/or fittings, the plain ends of the pipe and bells of the pipe and/or fittings shall be thoroughly cleaned, removing all foreign matter from the bells.

Whenever necessary to deflect water pipe from a straight line, either in the vertical or horizontal plan to avoid obstructions, or where long radius curves are permitted, the degree of deflection at any joints shall not be greater than that which will allow a safe deflection at the joints. Allowable deflections shall be

established by the pipe manufacturer.

The Contractor shall arrange for a qualified representative of the pipe manufacturer to supervise and instruct the pipe line foreman and crews in the proper assembly and installation of the pipe, if the foreman and crews are not familiar with the pipe supplied.

Prior to jointing the pipe and/or fittings, the plain ends of the pipe and bells of the pipe and/or fittings shall be thoroughly cleaned, removing all foreign matter from the bells.

Regardless of the type of pipe used, joints shall be made in strict compliance with instructions and directions of the manufacturer. Lubricants used shall be that supplied by the manufacturer and no substitutes will be allowed. The Contractor shall be solely responsible for keeping sufficient supply on hand.

All cut pieces of pipe shall be beveled as required by the recommendations of the manufacturer.

Attention is called to the fact that only first-class materials and workmanship will be accepted.

All pipe and fittings shall be installed in accordance with the applicable drawings with tracer wire. A tracer wire (14 gauge bar copper) must be installed by wrapping the line once along each joint of pipe. The tracer wire will be connected to a "ground rod" with the rod being accessible in a 6" water valve box. This rod and valve box shall be installed adjacent to every marker sign.

Detectable metallic marking tape must be buried 18" above the pipe.

Thrust blocks shall be required at all bends and tees and shall be poured against undisturbed earth.

A ten (10) foot horizontal separation shall be maintained between water mains and sewer lines. Where water mains and sewer mains cross, sewer mains shall be laid to provide a distance of eighteen inches (18") between the outside of the sewer main and the outside of the water main. The water line shall be laid so that the center of a full joint of pipe will correspond to the point of crossing, thereby placing the joints of the water line their greatest possible distance from the water main. The water line shall cross above sewer lines.

PART 3 - EXECUTION

- 3.1** PVC Plastic pipe will be measured as the actual linear feet of pipe installed with no deductions for fittings.

(b) PVC Plastic fittings will not be measured or paid for separately, and will be included in the unit price for PVC pipe.

(c) The Contract Unit Prices stated in the Proposal will be used to adjust contract price for variation of actual quantities from those estimated.

(d) The unit prices for PVC pipe shall include pipe, bedding materials, excavation, backfill, testing and sterilizing, and all other work required for the completed and accepted installation.

END OF SECTION

SECTION 05

HANDLING AND LAYING DUCTILE-IRON PIPE & FITTINGS

PART 1 - GENERAL

- 1.1** The work covered by this Section of the Specifications shall include the furnishing and installation of Cast Iron or Ductile Iron Pipe and Fittings for the water distribution system in strict accordance with these specifications and the applicable drawings.

PART 2 - CONSTRUCTION

- 2.1** In the transportation, unloading and handling of Cast Iron or Ductile Iron Pipe, the pipe shall not be dropped, let roll and collide with another pipe, or be subjected to any unnecessary jar, impact, or other treatment that might crack or otherwise damage the pipe. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

Before laying the pipe in trench, the bottom of the trench shall be carefully graded and prepared and bell holes excavated so that the pipe shall have a uniform support along its entire length except at bell holes, and shall not be allowed to rest on hard supports through a portion of its length only. Pipe shall have not less than thirty-six inches (36") of cover over the top of the pipe, except as otherwise specified or directed.

All foreign matter or dirt shall be removed from the inside of the pipe before it is lowered in the trench and the pipe shall be kept clean during and after laying. Care shall be taken to prevent dirt from entering the joint space and at all times when pipe laying is not in progress the open ends of the pipe shall be closed by using a suitable cap or plug to prevent trench water, foreign matter and dirt from entering the pipe line.

Cutting of the pipe for inserting valves, fittings, or closure pieces shall be done in accordance with the manufacturer's recommendations in a neat and workmanlike manner without damage to the pipe.

Whenever necessary to deflect water pipe from a straight line, either in the vertical or horizontal plan to avoid obstructions, or where long radius curves are permitted, the degree of deflection at any joints shall not be greater than that which will allow a safe deflection at the joints. Allowable deflections shall be established by the pipe manufacturer.

The Contractor shall arrange for a qualified representative of the pipe manufacturer to supervise and instruct the pipe line foreman and crews in the

proper assembly and installation of the pipe, if the foreman and crews are not familiar with the pipe supplied. The Engineer's observer will be required to report, in writing, the actual location and deviations from the proper described assembly and installation. Unless such deviations are corrected by the Contractor within twenty-four (24) hours, the Engineer's observer shall have the authority and will be directed to suspend all pipe laying operations until such repairs are made to his complete satisfaction. Only then will the work be allowed to continue.

Prior to jointing the pipe and/or fittings, the plain ends of the pipe and bells of the pipe and/or fittings shall be thoroughly cleaned, removing all foreign matter from the bells.

Regardless of the type of pipe used, joints shall be made in strict compliance with instructions and directions of the manufacturer. Lubricants used shall be that supplied by the manufacturer and no substitutes will be allowed. The Contractor shall be solely responsible for keeping sufficient supply on hand.

All cut pieces of pipe shall be beveled as required by the recommendations of the manufacturer.

Attention is called to the fact that only first-class materials and workmanship will be accepted.

All pipe and fittings shall be installed in accordance with the applicable drawings.

PART 3 - MATERIALS

- 3.1** Cast Iron or Ductile Iron Pipe and Fittings shall be designed for not less than 150 psi working pressure with trench conditions "B", flat bottom, no blocks, tamped backfill, 2' to 5' cover. The pipe supplier shall be responsible for furnishing all fittings. Fittings shall be manufactured of ductile iron and be mechanical joint of the size shown on the plans.

Cast Iron or Ductile Iron Pipe shall conform to all requirements and criteria of the Federal Specifications WW-421 b and ANSI A 21.1 with iron strength of 21/45. All pipe shall be one-half (1/2) thickness cement lined and protected by means of a bituminous seal coat. Exterior surfaces of all pipes shall be coated with bituminous coating. All pipes shall be marked in accordance with CS 256-63.

Joints shall be of the single rubber type similar or equal to "Tyton Joint" as manufactured by United States Pipe and Foundry Company; "Fastite Joint" as manufactured by Lone Star Steel Company.

Ductile iron pipe shall conform to the following minimum wall thickness:

SIZE	CLASS	WALL THICKNESS
	D.I.	D.I.
6-inch	2	0.31
8-inch	2	0.33
10-inch	2	0.35
12-inch	2	0.37

Cast iron or ductile iron fittings shall be standardized short body, Class 250 for 12" and smaller and 150 for over 12", mechanical joint fittings, conforming to ANSI Specification S 21.10 (AWWA C 110-71, with latest revision) and shall have cast iron glands, cast iron bolts and nuts and plain rubber gaskets. Fittings shall be one-half (1/2) thickness cement lined and seal coated with bituminous coating. Cast iron or ductile iron fittings shall be designed for use with cast iron or ductile iron pipe as specified above.

Ductile iron pipe shall conform to AWWA Specifications C 151-71.

PART 4 - EXECUTION

- 4.1** Ductile iron pipe for water lines will be measured as the actual linear feet of pipe installed with no deductions for fittings and valves as the various pipe classifications shown in the proposal. Pipe shall be measured along the top of the pipe as laid. Ductile iron fittings will be measured and paid for separately. The contractor shall submit individual weights with accessories to the engineer.

END OF SECTION

SECTION 06

BACKFILL WATER LINES

PART 1 - GENERAL

- 1.1 The work covered under this Section of the Specifications shall include all work in backfilling and the maintaining of backfill for water lines.

PART 2 - PRODUCTS

- 2.1 All trenches shall be backfilled immediately after the pipe is laid and inspected, unless otherwise directed by the Engineers, using methods which will not disturb the pipe or structure. Material used for backfilling shall consist of the excavation or borrow of sand, gravel, or other materials approved by the Engineer and shall be free of trash, lumber, or other debris.

All PVC lines shall be bedded in gravel. Maximum rock size shall be $\frac{3}{4}$ inch and approved by the Engineer. Bedding gravel shall be a minimum of six inches (6") below the pipe and a minimum of six inches (6") above the pipe or as directed by the Engineer. The remaining depth is to be backfilled with material as described in this section.

In accordance with AWWA C605-94 and AWWA Manual M23 on PVC Pipe, Design and Installation, bedding and pipe zone materials within six (6) inches of PVC pressure pipe shall conform to ASTM D-2774 or to ASCE MANUAL 37, Class B, C, or D. Maximum rock size allowed next to the pipe ranges from $\frac{1}{2}$ inch to $1\frac{1}{2}$ inch depending on pipe size.

After pipe has been approved, trenches shall be backfilled with fine loose earth, free of clods or stones larger than three quarter inches ($\frac{3}{4}$ ") in any dimension and of the proper moisture content. The selected material for water pipe shall be carefully deposited by hand in layers of not to exceed four inches (4") in thickness on both sides of the water pipe and thoroughly and carefully rammed around and under the water pipe, until the backfill has been brought up to the top of the water pipe. During the backfilling and placing operations, care shall be taken to see that the pipes are not damaged.

In trenches within the limits of streets or other special surfaces the remaining portion of the backfill above the spring line of the pipe shall be carefully deposited in layers not to exceed 6" in thickness and mechanically compacted, as nearly as can be obtained, to the density of the adjacent soil throughout the depth of the trench.

In trenches outside the limits of the streets, the backfill, above the top of the pipe,

shall then continue without tamping but with the same material, placed by hand, to a point twelve inches (12") above the top of the pipe. The remainder of the backfill may then be placed by any approved method, which will not injure or disturb the pipe.

Trenches, outside the limits of streets or other special surfaces, shall be allowed to settle with natural settlement. No flooding of the trenches to produce maximum settlement will be required. Trenches shall be maintained and as settlement occurs, the trenches shall be filled and smoothed until all trench backfill permanently conforms to the surface of the ground.

It is the intent of this Specification that the Contractor shall be responsible for all settlement of backfill in trenches occasioned by the work covered herein. He shall refill trenches as often as necessary to bring them back to original grade and during the period when settlement is occurring shall refill them frequently enough to maintain traffic without hazard at all times except when trenches are actually flooded. Gravel used by the Contractor to maintain trenches, prior to actual replacement of the wearing surface, will not be considered or approved for payment unless specifically so authorized by the Engineer in writing.

All excavated material which is unsuitable or not needed for backfill shall be wasted or disposed of to the satisfaction of the Engineer. Surfaces shall be cleaned up, all hummocks and piles smoothed down and the surface left clean, neat, and workmanlike. Where existing drainage ditches, drains, and culverts, and structures are disturbed or obstructed with excavated material, such material shall be entirely removed and the ditch left true to original line and grade and drains and culverts and structures replaced or repaired to their original condition or better, street shoulders, if disturbed, shall be restored to their original contours.

Any deficiency in the quantity of suitable material for backfilling the trenches, or for refilling trenches and depressions caused by settlement, shall be supplied by the Contractor at no additional charge to the Owner.

PART 3 - EXECUTION

- 3.1** The cost of all backfill including handling of excavated material, tamping, maintenance of backfill, disposal of waste material and all other work incident thereto shall be included in the basic unit price for water lines.

END OF SECTION

SECTION 07

GATE VALVES, TAPPING SLEEVES AND VALVES AND VALVE BOXES

PART 1 - GENERAL

- 1.1 The work covered by this section of the specifications consist of furnishing and installing gate valves, tapping sleeves, valves and valves boxes in strict accordance with these specifications and applicable drawings.

PART 2 - PRODUCTS

- 2.1 **MATERIALS:** Gate valves shall be conform to the AWWA Standard Specifications, iron bodied, bronze mounted, non-rising stem, double disc, parallel seat type, two (2) inch square operating nut, with “O” ring seals, designed for working pressure of not less than 150 psi, with ring-type ends. Valves shall have a clear waterway of the full nominal diameter of the valve. Tapping sleeves and valves shall conform to the specifications set forth above. Valve boxes shall be Mueller Company No. H-10364, two (2) piece adjustable sliding type, or an approved equal. Valve boxes for 6” valves shall be Type 562-A. Valve boxes shall be cast iron with a minimum wall thickness of not less than three-sixteenths inch (3/16”) and shall be 5 ¼” shaft size. The valve shall have cast thereon the word “water”.
- 2.2 **CONSTRUCTION:** Gate valves and tapping sleeves and valves shall be installed as shown on the plans or as may be directed by the engineer. All valves outside the structures shall be provided with operating nuts and valve boxes which shall be adjusted so that the covers conform to the adjacent finished grade. All gate valves in structures shall be provided with hand wheels.

Valves shall be set with operating stems in true vertical positions, unless otherwise shown on the plans, for valves inside structures. Valves shall be set and jointed to the pipe in the same manner as called for in the handling and laying cast iron pipe, or ductile iron.

Cast iron valve boxes shall be firmly supported and maintained centered and plumb over the wrench nut of the gate valve or tapping and valve.

PART 3 - EXECUTION

- 3.1 Gate valves with boxes; tapping sleeves and valves with boxes shall include valves, boxes, materials, excavation, and all other work incident to the installation thereto and shall be included in lump sum price. Each will be measured as the size and actual number installed. Prices for gate valves or tapping sleeves and valves with boxes shall include valves, boxes, materials, excavation, and all other work incident to the installation thereto.

END OF SECTION

SECTION 08

FIRE HYDRANTS

PART 1 - GENERAL

- 1.1** The work covered under this Section of the Specifications consists of furnishing and installing fire hydrants in strict accordance with these Specifications and the applicable drawings.

PART 2 - CONSTRUCTION

- 2.1** Fire hydrants shall be installed in accordance with the details shown on the Plans or as directed by the Engineer. Hydrants shall be properly located with respect to property lines and streets, and shall be set at proper elevation, truly plumbed and properly oriented. The space immediately below the hydrant shall be excavated and backfilled with not less than four cubic feet (4') of crushed stone or gravel to serve as drainage. The hydrants shall then be set upon a slab precast concrete not less than four inches (4") thick and not less than fifteen inches (15") square. The space occupied by the hydrant shall then be backfilled with crushed stone or gravel to a point level with the bottom flange of the hydrant barrel before commencing the earth backfill. Hydrant shall be equipped with lugs on the hydrant shoe for strapping to the hydrant lead.

PART 3 - MATERIALS

- 3.1** Fire hydrants shall comply with the latest A.W.W.A. specifications for fire hydrants and shall be of the traffic model type with breakable rod coupling and barrel flange bolts at the ground line. Hydrants shall have not less than six inch (6") barrel; not less than five and one-quarter inch (5 - 1/4") valve opening, or an equivalent valve opening; six inch (6") hub-end connections with lugs; shall be equipped with "O" ring seals; and shall be of sufficient length for a least three and one-half foot (3-1/2') bury. Hydrants shall have two (2) two and one-half inch (2-1/2") hose nozzles and one (1) four and one-half inch (4 1/2") pumper nozzle, all with National Standard Threads. Hydrants shall open to the left, counter-clockwise, be provided with a proper drip valve, and be constructed so that they will not flood if the barrel is broken. Valves shall be removable without digging. Operating nuts shall be one and one-half inch (1-1/2") National Standard Pentagon. Hydrants shall be Mueller Company hydrants, Catalogue No.A-24015 compressive type, traffic model, or an approved equal.

PART 4 - EXECUTION

- 4.1** Fire hydrants shall be measured and the actual number of hydrants properly installed and accepted. The price for fire hydrants shall include hydrants, gate valve, valve box, tee, excavation, gravel or crushed stone base, concrete slabs, backfill, materials, and all other work incident to the completed and accepted

installation. Hydrant lead will be measured and paid for as pipe. Hydrant leads shall have swivel adapters.

END OF SECTION

SECTION 09

ANCHORAGE BLOCKS

PART 1 - GENERAL

- 1.1 The work covered by this section of the Specifications shall include all work in connection with installation of concrete anchorage or thrust blocks in strict accordance with these Specifications, Plans and the instructions of the Engineer.

PART 2 - PRODUCTS

- 2.1 **CONSTRUCTION:** Anchorage or thrust blocks of Class "B" Concrete shall be installed on all pipelines, other than pipe lines with screwed joints where ever there is an unbalanced thrust of water pressure to be resisted at dead ends, bends, tees, deflections or at other points directed by the Engineer.

where: Thrust = $2 \times A \times P \times \text{Sine } \frac{1}{2} \theta$

A = Area of pipe in square inches

P = Operating pressure + 50%

θ = Degree of Bend

The Engineer shall issue instructions, as required, for the installation of blocking.

Where the ground is unstable, the Contractor shall install blocking in accordance with one or more of the following means:

- (1) Thrust blocks shall be large enough to hold bend by weight alone.
- (2) Thrust blocks shall be dug to solid ground and reinforcing rods placed in block to prevent shearing below fitting.
- (3) Deadman and cables, tie rods and pipe clamps of adequate strength to prevent movement.
- (4) A combination of all the above.

No concrete blocking shall have less than five (5) inches thickness. The concrete shall not cover the face of the bell unless approved by the Engineer. Concrete for blocking shall be class "B".

Class "B" concrete shall contain not more than seven (7) gallons of water to the sack of cement, including the water in aggregates and not less than five (5) sacks of cement per cubic yard of concrete and have a twenty-eight (28) day compressive strength of at least twenty-five hundred pounds (2,500#) per square

inch.

The Class "B" concrete blocking shall be in place at least forty-eight hours before water is admitted to the new main.

Area of thrust blocks shall be cut square and into solid ground with hand tools. All holes left open for blocking shall be cleaned out and all loose material removed from the thrust area before pour is made. No pour shall be made in or under water. All pipes and fittings, where blocking is necessary, shall be washed and wire brushed to remove all dirt and mud.

Backfill shall not be made until the concrete has taken its initial set.

All thrust or anchorage blocks shall be made in the presence of the inspector. Otherwise, the Contractor will be required to uncover, take out, and re-pour the blocking.

Thrust blocks shall meet the Engineer's approval and the Contractor shall have the complete responsibility until the project is completed and accepted.

PART 3 - EXECUTION

- 3.1** The price for Class "B" concrete blocking shall include excavation, dewatering, materials, placing and all other work incident thereto. It shall be paid for at the unit price stated in the proposal for concrete blocking.

END OF SECTION

SECTION 10

SERVICE CONNECTIONS AND BOXES

PART 1 - GENERAL

- 1.1 The work included under this Section shall include all work required for the installation of Water Service Connections including service clamps, corporation stops, service pipe, meter stops, and meter boxes.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Service Clamps. Service clamps shall be installed on all PVC pipe.
- B. Three quarter inch (3/4") service clamps for 2" PVC pipe shall be Claw Velve Company, Style 3401, and 3/4" service clamps for 10", 8", and 6" PVC pipe shall be double strap Smith – Blair Company, Style 313, of the proper designation to fit the particular pipe furnished.
- C. Corporation Stops. Corporation stops for use with plastic service pipe shall be Mueller Company, H-15008, or an approved equal.
- D. Service Pipe. Service pipe shall be 3/4" as manufactured by Phillips Products Company and distributed by Arkansas Meter, North Little Rock, Arkansas, or an approved equal (ASTM D 2737 SDR 9 PE 3406).
- E. Curb Stop. Curb stop for use with plastic service pipe shall be Mueller Company, H-15172, or an approved equal.
- F. Wye Connection. Wye connectors shall be Ford, Wye-44243, packed joint wye-branch, or an approved equal.
- G. Meter Setter/Yoke. The meter shall be installed with a meter yoke Model No. H 14180 Mueller.
- H. Water Meter. The water meter shall be a 5/8" Rockwell or Badger of the same model and size presently being used by the Cabot water works.
- I. Meter Boxes. Meter boxes for 3/4" water meters shall be plastic body with lid, 12" x 20" meter box, supplied by Arkansas Meter, North Little Rock, Arkansas, or approved equal.
- J. Pressure Reducing Valve. Each meter service shall include a pressure reducing valve Mueller H 9300 or an approved equal.

2.2 CONSTRUCTION:

Service connections shall be installed in accordance with the details shown on the plans and at locations shown on the plans or as directed by the Engineer.

PART 3 - EXECUTION

3.1 Pipe shall be measured along the center line of the top of the trench.

Water service connection complete will be composed of the following items: service clamp, corporation stop, meter setter, meter box, and pressure reducing valve.

The price shall include materials, labor, equipment, excavation, backfill, and all other work incident thereto for the completed and accepted installation.

It shall be paid for at the unit price stated in the proposal for single meter service and double meter service and service line.

Backfill material used in service crossings will not be paid for separate but shall be incidental to the unit price for service lines.

END OF SECTION

SECTION 11

TESTING AND STERILIZING WATER MAINS

PART 1 - GENERAL

- 1.1 The work covered by this Section of the Specifications shall include all operations in connection with testing and sterilizing the water mains.

PART 2 - PRODUCTS

2.1 CONSTRUCTION:

- A. **Testing.** All newly laid pipe, or any valved section of the pipe line, shall be subjected to a hydrostatic pressure test.

After the pipeline has been filled and flushed and has been under working pressures for at least twenty-four (24) hours, the Contractor shall perform a hydrostatic and leakage test at pressures at least fifty percent (50%) greater than the normal working pressures, as specified by the Engineer, or in no case less than one hundred fifty (150) p.s.i. The hydrostatic test shall be for a duration of not less than four (4) hours.

The leakage test shall be performed at the same pressure as the hydrostatic test and the two may be performed concurrently. The leakage allowed shall be less than the amount calculated by the formula:

$$L = \frac{N * D * P (\text{Square Root})}{7400}$$

in accordance with AWWA Specifications C 605 where "L" is the allowable leakage in gallons per hour; "N" is the number of joints in pipeline tested; "D" is the nominal diameter of the pipe; and "P" is the test pressure during the leakage test in pounds per square inch.

Test pressures shall be maintained accurately throughout the test either manually by means of a valve in the pump bypass or by means of pressure regulating valve.

The Contractor shall furnish pump, pipe connections, pressure gauges, meters and all other necessary equipment and materials. All testing shall be done in the presence of the inspector.

The entire portion of the line under pressure test shall be carefully examined. All leaks shall be located and repaired. Any cracked or defective pipe, fittings, valves or other defective components of the water system discovered, regardless of the cause of the damage, shall be immediately removed and replaced with sound

material by the contractor, at no additional compensation. The test shall then be rerun.

All lateral mains shall be connected and subjected to pressure during the test.

Concurrently with or immediately after the hydrostatic test, the contractor shall perform a leakage test at the same pressure as the hydrostatic test. The leakage test shall be of long enough duration, as determined by the Engineer, to determine the actual leakage accurately, but not less than four (4) hours. In the event the leakage exceeds the allowable, the leaks shall be repaired and the test repeated until satisfactory. All known leaks shall be stopped regardless of the test requirements.

B. Sterilizing. All new water mains shall be sterilized by the contractor with chlorine prior to being placed in service. Sterilizing shall meet the requirements of AWWA C651. Following a contact period of not less than twenty-four (24) hours after the mains are filled, the chlorinated water shall be flushed from the lines and the samples taken and analyzed for bacterial purity. This process shall be continued until the samples indicate that the water is safe for domestic consumption. If other means are necessary for the adequate sterilization of the water mains, the contractor shall be solely responsible for the material, equipment and labor for obtaining approved samples.

Samples shall be obtained on 2 consecutive days (i.e. the afternoon of day 1 and the morning of day 2). The samples must be submitted within 24 hrs. to:

Arkansas Department of Health
Division of Public Health Laboratories, Slot 37
4815 West Markham St.
Little Rock, AR 72205

The sample submittal form shall indicate the following:

1. Date & Time
2. Definite Location of Sampling Point
3. Water System ID#

Check the Following Boxes:

Public/Community

Well (Source)

New Construction

All new water lines will be sterilized, pressure tested and tested for leakage after the service line connections are made. No connections or meter installations shall be made until all testing is completed and approved by the Water Department and the Arkansas Health Department.

All valves in the water mains being sterilized shall be opened and closed several

times during sterilizing period.

PART 3 - EXECUTION

- 3.1** The cost of all work under this section shall be included in the basic unit price for water line extension shown in the proposal. The price shall include all pumps, piping, valves, fittings, gauges, and chemicals required to complete the testing and sterilization of the waterline.

END OF SECTION

SECTION 12

SANITARY SEWER LINES

PART 1 - GENERAL

- 1.1** The work covered under this Section of the Specifications shall include trench excavation sanitary sewer lines.

All excavation shall be carried accurately to the line and grade shown on the Plans or as may be established by the Engineer. When excavation is carried below or beyond that required, except upon authorization by the Engineer, that space shall be filled with sand or fine stone, properly compacted, in accordance with the Engineer's instruction. No claim for additional compensation shall be made for such backfilling of excess excavation unless the Contracting Authority or its agent is responsible for the error or unless the Engineer has so authorized the over-excavation in writing.

All excavation shall be de-watered before any construction is undertaken therein. Concrete shall be placed only upon dry, firm foundation material.

The Contractor's attention is called to his responsibility for determining, by boring or other means satisfactory to him, the trenching and excavation conditions expected to be encountered during the construction work. Sewer lines shall be laid only in dry ditches by using adequate and efficient de-watering methods.

PART 2 - PRODUCTS

- 2.2** A. Sewer Lines. In order to avoid superimposed loading in excess of the designed and specified pipe strength and to provide sufficient room for proper installation and bedding of sewer pipe, the trench widths for the pipe sizes shall be kept within the limits specified below:

Inside Pipe Diameter	Maximum Width of Trench At Top of Pipe
8" – 10"	27"
12" – 15"	33"
18" – 21"	39"

Pipe bedding material for PVC sewer force mains will meet the requirements of AWWA C-605, maximum ¾-inch for angular rock and 1 ½-inch for rounded rock.

If it becomes necessary to reduce the earth load on trench banks to prevent sliding and caving, it will be permissible to cut the trench banks back on a slope above an

elevation two feet (2') above the top of the pipe.

The specified maximum width at the top of the pipe shall not be exceeded, except at points where the combined superimposed earth and live loads on the pipe are sufficiently low to permit an increase in trench width authorized by the Engineer.

Except where special bedding is required and except as specified herein, rough excavation for sewers shall be carried to a point 0.2' (+/-) above the finished grade as established by the Engineer. Immediately prior to installing the pipe the bottom of the trench shall be accurately graded and shaped to conform to the bottom quadrant of the pipe and to the exact grade requirements.

If the soil at the bottom of the trench is mucky or in such condition that it cannot be properly graded, or if the subgrade is too soft to properly support the pipe, or if instructed by the Engineer, the Contractor shall excavate below the normal subgrade elevation as directed by the Engineer. Wherever excavations carried below the specified subgrade, at the direction of the Engineer, the Contractor shall provide and install a fill of sand or fine stone, and thoroughly tamp into place up to an elevation sufficient to prepare the subgrade.

The Contractor will be required to keep the side of the excavation vertical, except as herein before specified. Shoring, if used, shall remain in place until the backfill has proceeded to a point where it can safely be removed, except that, if in the opinion of the Engineer, damage is liable to result from withdrawing sheeting and shoring, it shall remain in place. However, when sheeting or shoring is driven to a depth below the elevation for the top of the pipe, that portion of the sheeting or shoring below the elevation of the top of the pipe shall not be disturbed or removed. Whenever sheeting or shoring is driven for the protection of trench walls in water bearing soil, no portion of such sheeting or shoring below a point four feet (4') over the top of the pipe shall be removed.

Excavation for manholes and other appurtenances shall be sufficient to leave no less than twelve (12'') in the clear between their outer surfaces and the embankment or timber which may be used to protect them.

Sewer lines entering, or leaving manholes shall be laid on sand or fine stone backfill as directed by the Engineer. Tamped earth backfill at these locations will not be allowed.

A ten (10) foot horizontal separation shall be maintained between potable water mains and sewage mains. Where water mains and sewer mains cross, sewer mains shall be laid to provide a distance of eighteen inches (18'') between the outside of the sewer main and the outside of the water main. The water main shall be laid so that the center of a full joint of pipe will correspond to the point of crossing, thereby placing the joints of the water main their greatest possible distance from the sewer main. The water line shall cross above sewer lines.

The excavation of sewer trenches shall not advance more than three hundred feet (300') ahead of the completed work and backfill, except by written permission of the Engineer. A disregard of this instruction shall, at the discretion of the Engineer, result in written notification that further excavation will not be considered for payment, until the pipe laying and backfill operations have proceeded to a point where the above stated condition is satisfied. It is the intent of this Specification that the trenching, pipe laying, backfilling, repairing, and maintaining of special surfaces cut and the proper maintaining of other portions of the work as ditches and yards shall proceed in a proper and systematic manner. A disregard of the proper maintenance of the work following the backfilling operation, without just cause, shall at the discretion of the Engineer, result in a written notification to stop trenching operations until such conditions are satisfactorily attended to.

B. De-Watering Excavation. It is the intent of the Specification that all structures be constructed on dry, firm foundation and that sewer lines be laid in dry, firm trenches. When water occurs in trenches, the excavation shall be carried below grade as directed by the Engineer and backfilled with gravel or crushed stone not larger than ¾" to an elevation sufficient to prepare the subgrade.

Pumps shall then be kept operating taking suction out of a sump below the gravel or crushed stone, so as to hold the water level well below the bottoms of all bells until the pipe has been satisfactorily jointed.

If, in the opinion of the Engineer, de-watering and stabilizing of excavation as described above is not satisfactory for the proper construction of sewer lines and structures, the Contractor will be required to de-water excavation by the well point system.

It shall be the Contractor's responsibility to satisfy himself, by test boring or other means, of the excavation conditions expected to be encountered.

PART 3 - EXECUTION

- 3.1** The cost of all trenches for the construction of sewer lines shall be in the unit price bid for sanitary sewer lines. The unit price shall include all equipment, labor, and materials necessary for the work incident thereto shall be included in the basic unit price for trenching.

END OF SECTION

SECTION 13

SEWER LINE TESTING

PART 1 - GENERAL

- 1.1** This section covers the testing of pipe materials, joints, or other materials incorporated into the sanitary sewer line and leakage tests to determine water tightness.

PART 2 - PRODUCTS

2.1 SANITARY SEWER PIPE:

All pipe and pipe materials will be accepted on the manufacturer's certificate that the pipe meets with the specification requirements and has been tested in accordance with the latest ASTM standard procedure for testing pipe, pipe joints, or other material unless specific tests are requested by the Sewer Department. All pipe and pipe materials shall be subject to permeability and hydrostatic tests.

2.2 LEAKAGE TESTS OF GRAVITY SEWERS:

All sewers shall pass leakage tests as specified herein. The leakage test must be performed in the presence of a representative of the Sewer Department and/or an Engineer's representative. The contractor is required to provide 24 hours notice upon beginning testing procedures. Leakage tests for water tightness of gravity sewer lines shall be completed in accordance with one of the two following procedures described below.

2.3 INFILTRATION-EXFILTRATION TESTS:

- (1). Clay, PVC, and other Non-Ferrous Pipes:

The pipeline shall not leak under exterior ground water pressures in excess of 100 gallon per inch of nominal pipe diameter, per mile of pipeline, per 24 hours. If, in the opinion of the Sewer Department, the ground water table at the time of testing is too low to produce dependable results, EXFILTRATION tests shall be run. Allowable limits of EXFILTRATION shall be 100 gallons per inch of nominal pipe diameter, per mile of pipeline, per 24 hours. If the water table is too high, EXFILTRATION will not be used. The methods of testing for leakage shall be approved by the Sewer Department.

- (2). Ductile Iron Pipe:

Sewer mains constructed entirely (from manhole to manhole) of ductile iron pipe conforming to these specifications shall not be required to pass the "proof"

INFILTRATION - EXFILTRATION test required for non-ferrous pipe materials. Such sewer mains shall, however, be subject to the requirements requiring repair of **obvious** running leaks.

2.4 LEAKAGE TEST BY LOW PRESSURE AIR LOSS:

As an alternate to the water INFILTRATION-EXFILTRATION tests prescribed in this section, sanitary sewer main extensions and building sewers may be tested for water tightness by low pressure air loss, as described below:

Procedure:

- (1). Plug all pipe outlets with suitable test plugs. Brace each plug securely.
- (2). Pipe air supply to pipeline to be tested so that air supply may be shut off, Pressure observed, and air pressure released from the pipe without entering the manhole. A valved branch should be left in the supply line past the shutoff valve terminating in a 1/4" female pipe thread for installation of the Sewer Department's test gauge.
- (3). Add air slowly to portion of pipe under test until test gauge reads between 3.5 and 3.0 psi.
- (4). Shut air supply valve and allow at least two minutes for internal pressure to stabilize.
- (5). Determine time in seconds for pressure to fall 0.5 psi, and compare to the following table:

Pipe Size	TIME
4	2.5 minutes
6	4.0 minutes
8	5.0 minutes
10	6.5 minutes
12	7.5 minutes
15	9.5 minutes

- (6). Compare observed time with minimum allowable times as indicated in the above table.
- (7). Where ground water level is above the crown of the pipe being tested, test pressure should be increased accordingly.
- (8). Air testing of manholes shall conform to the standards of the industry.

2.5 SAFETY PROVISIONS FOR AIR TESTING:

Plugs used to close the sewer pipe for the air test must be securely braced to prevent the unintentional release of a plug which can become a high velocity projectile. Gauges, air piping manifolds, and valves shall be located at the top of the ground. No one shall be permitted to enter a manhole where a plugged pipe is under pressure. Four pounds (gauge) air pressure develops a force against the plug in a 12" diameter pipe of approximately 450 pounds. Pipes larger than 24" in diameter shall not be air tested because of the difficulty of adequately blocking the plugs.

2.6 FORCE MAIN LEAKAGE TESTS:

Leakage tests for force mains shall be made by filling the force main with water and increasing the pressure to testing pressure of 115%, of working pressure.

The duration of the leakage test shall be two hours or as specified by the Sewer Department.

The maximum leakage per hour for cast iron, ductile iron, PVC or concrete pipe shall be calculated by the following formulas:

All rubber gasket or o-ring joints (cast iron and concrete)

$$L = \frac{N * D * P \text{ (SQUARE ROOT)}}{7400}$$

L = Allowable Leakage (gallons per hour)

N = Number of Joints in Pipeline Tested

D = Nominal Diameter (inches)

P = Test Pressure (psi)

The force main will not be accepted until the actual leakage is equal to or less than the allowable. In addition, all obvious leaks shall be repaired.

2.7 LEAKS ENCOUNTERED IN FINAL INSPECTION:

In addition to passing the above-described leakage tests, all obvious running leaks which may be observed in the final inspection shall be satisfactorily repaired.

2.8 FLEXIBLE CONDUIT MANDREL TEST:

All flexible conduits shall be tested with a mandrel for deflection of no more than 5%. Pipe with a deflection of more than 5% will not be accepted. Mandrel tests shall not be performed within 30 days of the placement and backfilling of line to be tested.

PART 3 - EXECUTION

- 3.1** The cost of all testing shall be included in the unit price bid for sewer line and shall include all the equipment, materials, and labor incidental to the pressure

testing and acceptance of the operating authority (city or owner). No additional payments shall be made for repairs or corrections required by the testing process.

END OF SECTION

SECTION 14

SEWER SERVICE CONNECTIONS

PART 1 - GENERAL

- 1.1** The work covered under this Section of the Specifications shall include all materials and labor for the installation of the individual sewer services for each residence.

PART 2 - PRODUCTS

2.1 CONSTRUCTION

Tees shall be placed for each lot at locations designated by the Engineer. In shallow trenches, tees shall be laid horizontal, and installed as shown on the Plans. Care shall be taken in backfilling to support the branch so that tees will not be disturbed by backfilling. No tees shall be covered until they have been inspected and located by the Contractor.

Service connections shall be installed from the main to the easement line for all lots at locations designated by the Engineer. Connections to the tees shall be made with a bend of the proper degree to make the service connection run perpendicularly to the main, and pipe shall be laid to a uniform line and grade. No service connections shall be covered until they have been inspected and located by the Engineer. All service connections shall be plugged and sealed with a plastic cap. The end of each service connection shall be clearly marked with a green metal post for future access.

2.2 MATERIALS

Tees and service pipe shall be 4" PVC SDR-26 Class 200 with rubber gaskets and shall conform to and will be tested and inspected in accordance with the applicable specifications for sewer mains. Approved backfill material, such as donnafill, b stone, at all service crossings, compacted and filled to top of subgrade.

PART 3 - EXECUTION

- 3.1** Service line shall be measured along the top centerline of the pipe as laid.

The Contract Price shall include the quantities of tees, post, caps, and service schedule 40 pipe given in the contract unit prices for sewer service lines.

The price shall include materials, capping, pipe, fittings, common excavation for trench, backfill, and all other work incident thereto. Backfill material used in service crossings will not be paid for separate but shall be incidental to the unit

price for service lines.

END OF SECTION

SECTION 15

SANITARY SEWER MANHOLES

PART 1 - GENERAL

- 1.1** This section covers material to be used in the construction of manholes and the actual construction of the manholes, drop manholes, and sealed manholes.

PART 2 - PRODUCTS

2.2 CONCRETE:

Concrete used in the construction of manholes shall conform to the requirements of concrete supplied by an approved ready mix plant and it shall have a minimum compressive strength of 3,000 PSI at 28 days.

2.3 LIME:

Hydrated lime shall be first quality mason's hydrate composed of at least 95% calcium magnesium oxides (combined), and not more than 5% carbon dioxide. It shall be a known brand produced by an established manufacturer.

2.4 MORTAR:

Mortar shall be composed of one (1) part cement to two (2) parts fine aggregate, by volume, to which shall be added seven (7) pounds of hydrated lime with each sack of cement.

2.5 POURED IN PLACE MANHOLES:

Poured in place manholes shall be made with concrete forms similar to those manufactured by I.C.M. of Jacksonville, Arkansas.

2.6 DROP MANHOLES:

Materials used in the construction of drop manholes shall conform to the requirements of paragraph 10-05 above or other applicable parts of this specification. Associated piping, including one joint out of the manhole, shall be either cast iron or ductile iron with mechanical joints.

2.7 SEALED MANHOLES:

Materials used in the construction of watertight manholes shall conform to the requirements of paragraph 10-05 above or other applicable parts of this specification.

2.8 MANHOLE RING AND COVERS:

Cast iron manhole rings and covers shall be of the best quality cast iron and of such character that the metal will be strong, tough and of even grain. They shall be free from blowholes, scale, cracks and other defects which might make them unfit for the intended use. Standard manhole rings and covers shall be Type 250-24A Arkansas Standard as shown on standard details or approved equal. Watertight manhole rings and covers shall conform to the requirements of standard manhole rings and covers except as shown in the details for watertight manhole rings and covers.

PART 3 - EXECUTION

- 3.1** Manholes will be counted as the actual number constructed and accepted by the engineer and utility. The depths will be measured and paid for at the unit price bid in the proposal for the various depths shown. This shall be full compensation for equipment excavations concrete, ring & cover, and all incidentals to the construction of a manhole.

END OF SECTION

SECTION 16

TESTING OF MANHOLES

PART 1 - GENERAL

- 1.1** The work covered under this Section of the Specifications consists of the testing of manholes in strict accordance with these Specifications and the applicable drawings.

PART 2 - PRODUCTS

2.1 PRECAST MANHOLES:

Precast manholes shall be vacuum tested prior to backfilling.

All lift holes shall be plugged with an approved non-shrink grout.

All pipes entering the manholes shall be plugged, taking care to securely brace the plug from being drawn into the manhole.

The test head shall be placed at the inside of the cone section and the seal inflated in accordance with the manufacturer's recommendations.

A vacuum of (10) ten inches of mercury shall be drawn and the vacuum pump shut off. With valves closed, the time shall be measured for the vacuum to drop to (9) nine inches. The manhole shall pass if the time is greater than 60 seconds for 48 inch diameter, 75 seconds for 60 inch diameter and 90 seconds for 72 inch diameter.

If a manhole fails the initial test, necessary repairs shall be made on the exterior of the structure with an approved non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.

2.2 POURED- IN- PLACE MANHOLES:

Poured-in-Place manholes shall be vacuum tested prior to backfilling.

All pipes entering the manholes shall be plugged, taking care to securely brace the plug from being drawn into the manhole.

The test head shall be placed at the inside of the cone section and the seal inflated in accordance with the manufacturer's recommendations.

A vacuum of (10) ten inches of mercury shall be drawn and the vacuum pump shut off. With valves closed, the time shall be measured for the vacuum to drop

to (9) nine inches. The manhole shall pass if the time is greater than 60 seconds for 48 inch diameter, 75 seconds for 60 inch diameter and 90 seconds for 72 inch diameter.

If a manhole fails the initial test, necessary repairs shall be made with an approved non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.

PART 3 - EXECUTION

- 3.1** The cost of all testing shall be included in the unit price bid for manholes and it shall include all the equipment, materials, and labor incidental to the pressure testing and acceptance of the operating authority (city or owner). No additional payments shall be made for repairs or corrections required by the testing process.

END OF SECTION

SECTION 17

CLEARING AND GRUBBING

PART 1 - GENERAL

- 1.1** The work covered under this section of specifications consist of the clearing and grubbing of the project area, in strict accordance with these specifications and the details shown on the plans.

PART 2 - PRODUCTS

- 2.1** Clearing and grubbing shall consist of the entire removal and the satisfactory disposal of all trees, stumps, logs, and other vegetation and all debris, including removed culverts, within the grading area, as designated on the applicable drawings.

Satisfactory workmanship and materials shall be used in the relocation of fences, to ensure a finish quality, which meets or exceeds the existing fences.

PART 3 - EXECUTION

- 3.1** The lump sum price for clearing and grubbing shall include the clearing, grubbing, and disposal of all materials necessary to construct the proposed streets and utilities and land required to cut & fill lots. The price is also to include all materials, equipment, and labor necessary for the acceptance of said work by the Engineer and Owner. Also included shall be the relocation of signs, mailboxes, and other items as listed in the plans and detailed specifications.

END OF SECTION

SECTION 18

EXCAVATION & EMBANKMENT

PART 1 - GENERAL

1.1 DESCRIPTION:

This item shall consist of excavation, construction of embankment, disposal or compaction of all material not being removed under some other item which is encountered within the limits of the work necessary for the construction of the roadways and parking lot accordance with the specifications and in reasonable close conformity with the lines, grades, thicknesses and typical cross sections shown on the plans or established by the Engineer. All excavation will be classified as “unclassified excavation”.

1.2 UNCLASSIFIED EXCAVATION:

Unclassified excavation shall consist of the excavation and disposal of all materials of whatever character encountered in the work.

1.3 GENERAL:

The excavation and embankments for the shown improvements shall be finished to reasonable smooth and uniform surfaces. No materials shall be wasted without permission of the Engineer. Prior to beginning excavation, grading, and embankment operations in any area, all necessary clearing and grubbing in that area shall have been performed.

Where excavation to the finished graded section results in a subgrade or slopes of unsuitable materials, the Engineer may require the Contractor to remove the unsuitable materials and backfill to the finished graded section with approval material. The contractor shall conduct his operations in such a way that the Engineer can take the necessary cross-sectional measurements before the backfill is placed. The Engineer may designate as unsuitable those soils that cannot be properly compacted.

It is intended that the right-of-way be left in a neat and presentable condition at the completion of the grading work, especially that it be left in a condition to be economically mowed where terrain will permit. To that end, stump holes, piles of loose material and other scars on the surface shall be erased by use of a motor patrol or other suitable equipment. No direct payment will be made for this work but it shall be considered as subsidiary to the lump sum price.

Particular care and discretion shall be exercised in the location of haul lanes, where designated, through tree screens, in order to preserve existing growth.

PART 2 - PRODUCTS

2.1 EXCAVATION OPERATION:

All suitable material removed from the excavation shall be used, as far as practical, in the formation of the embankment, in the subgrade and back slope and at such other places as directed.

All excess or unsuitable excavated material, that cannot be used in embankments may be placed on the side slopes of the nearest fill, in a satisfactory manner, and shall be placed so as to maintain a distinct shoulder line by keeping all such waste material at least 24 inches below the subgrade elevation. Excavated material that cannot be utilized as described above shall be hauled away and disposed of by the contractor at locations approved by the engineer. Selection and procurement of sites for the disposal of waste material shall be the responsibility of the contractor, subject to engineer approval. Waste material shall not be left in unsightly piles but shall be leveled off and/or shaped so as to present a neat appearance and not obstruct drainage. The work involved in disposing of surplus, waste, or unsuitable material, including hauling, shall not be paid for directly.

2.2 EMBANKMENT CONSTRUCTION:

Embankment construction shall consist of constructing embankments, including preparation of the areas upon which they are to be placed; the placing and compacting of embankment material in holes, pits, and other depressions within the project area. Only approved materials shall be used in the construction of embankments and backfills.

When embankment is to be placed and compacted on hillsides, or when new embankment is to be compacted against existing embankments, or when embankment is built one-half (1/2) width at a time, the slopes shall be continuously benched as the work is brought up in layers. Benching shall be of sufficient width to permit operations of placing and compacting equipment. Each horizontal cut shall begin at the intersection of the original ground and the vertical sides of the previous cuts. Materials, thus cut out, shall be recompacted along with the new embankment materials at the contractor's expense.

Where embankment is to be placed and compacted, and end dumping is permitted, the slopes of the original ground or embankment shall be deeply plowed, or cut into, before starting end dumping.

Unless shown otherwise on the plans or special provisions, where an embankment of less than four (4) feet below subgrade is to be made, all sod and vegetable matter shall be removed from the surface upon which the embankment is to be constructed and later placed on the completed embankment slopes. The cleared surface shall then be completely broken up by plowing, scarifying, or stepping to

a minimum depth of eight (8) inches. This area shall then be recompacted. Sod, not required to be removed, shall be thoroughly disked before construction of embankment. Whenever a compacted road surface containing bituminous or granular material lies within three (3) feet of the subgrade, such old road surface shall be scarified to a depth of at least eight (8) inches. This scarified material shall then be recompacted, as directed.

Embankment shall be placed in parallel layers not exceeding eight (8) inches (loose measurement) and shall be compacted, as specified, before the next layer is placed. Effective spreading equipment shall be used on each lift to obtain uniform thickness prior to compacting. As the compaction of each layer progresses, continuous leveling and manipulating will be required to assure uniform density. Water shall be added or removed, if necessary, in order to obtain the required density. Construction equipment shall be routed uniformly over the entire surface of each layer.

Construction of the embankment by casting material directly into place with draglines, cableways, or other similar machines will not be permitted unless specifically authorized by special provisions.

The contractor shall be responsible for the stability of all constructed embankments and shall replace, at his own expense, any portions which have become displaced due to his carelessness or negligent work.

PART 3 - EXECUTION

- 3.1** Excavation shall be measured as the actual quantity in cubic yards and embankment, as select fill, shall be paid for by the cubic yard as stated in the proposal. These pay items shall include the placement, removal, transportation and storage of the material including all labor, equipment, and materials required to complete each task. This pay item shall also include all cost associated with place excavated material in fill areas and compacting fill to meet density requirements. No additional payment will be made for meeting compaction requirements or compaction testing. This includes, but is not limited to, the cost for performing compaction test and obtaining a compaction report for the streets and proposed lots which have 12" or more of fill material placed on the lot. There will be no compensation for failed compaction test and the reworking of the material and retesting.

END OF SECTION

SECTION 19

SUBGRADE

PART 1 - GENERAL

- 1.1** This item shall consist of shaping, compacting and otherwise preparing the completed roadbed for the placing of base and surface courses and pavements in accordance with these specifications and in substantial conformity with the line, grades, and cross sections shown on the plans.

PART 2 - PRODUCTS

- 2.1** The subgrade shall be prepared in such a manner as to insure the base and structure will be placed on a firm foundation that is stable and reasonably free from dust pockets, wheel ruts, or other defects.

The subgrade area shall be scarified as may be necessary for shaping, and shaped and compacted to the required grade and section. The top eight (8) inches of the subgrade shall be compacted to a density, as determined by AASHO T191, of not less than 95% of the maximum density obtained by AASHO T99. The compaction shall be accomplished by any satisfactory method or methods that will obtain the required density. The contractor shall bring the moisture content of the material to be compacted to substantially that of optimum moisture by the addition of water, or by manipulation and aeration as it may be necessary to increase or decrease the moisture content under the conditions encountered.

All soft and yielding material and other portions of the subgrade, which will not compact readily when rolled or tamped, shall be removed. Holes or depressions made by the removal of unsuitable material as directed above shall be filled with an approved material and the whole subgrade brought to the lines, grade and cross section shown on the plans and compacted in to the required density.

If the succeeding course is not placed immediately after the subgrade has been prepared and the subgrade becomes cut up, rough, or unsuitable, it shall be shaped and recompactd in accordance with the above requirements.

It shall be the responsibility of the contractor to obtain certified compaction test from certified geotechnical engineers. Testing procedures shall be a minimum of 1 (one) test every 300 feet of street or as outlined by the city.

It shall be the responsibility of the contractor to obtain certified compaction test from certified geotechnical engineers. Testing procedures shall be a minimum of 1 (one) test every 300 feet of street or as outlined by the city.

PART 3 - EXECUTION

- 3.1** Payment for subgrade preparation shall be included in the cost for related items listed in the proposal. No separate compensation will be granted for subgrade preparation or testing.

END OF SECTION

SECTION 20

CRUSHED STONE BASE COURSE

PART 1 - GENERAL

- 1.1** This item shall consist of a foundation course for structures or pavement. It shall be constructed on the prepared subgrade or other completed base course in accordance with these specifications, and in substantial conformity with the lines, grades, compacted thickness and typical cross section shown on the plans.

PART 2 - PRODUCTS

2.1 MATERIALS:

This material shall consist of crusher run stone or a mixture of crushed stone and natural fines uniformly mixed and so proportioned as to meet all the requirements hereinafter specified, with further provisions that a mixture of crushed stone and natural fines shall contain not less than 90 percent crusher produced material. The stone shall be hard and durable with a percent of wear by the Los Angeles Test (AASHTO T96) not greater than 45. For the purpose of this specification, shale and slate are not considered to be stone.

The class or classes of crushed stone base course materials that may be used on any particular job will be those called for on the proposal schedule and shall adhere to the Arkansas highway and Transportation Department Specifications.

GRADING REQUIREMENTS

Size of Sieve Total Retained	Percent by Weight Concrete Rock
1 1/2 "	0
1"	-
3/4 "	10-50
#4	50-75

When it is necessary to blend two or more materials, each material shall be proportioned separately through mechanical feeders to insure uniform production. Premising or blending in the pit to avoid separate feed will not be permitted.

2.2 CONSTRUCTION METHOD:

The base course material shall be placed on a completed and approved subgrade or existing base that has been bladed to substantially conform to the grade and cross section shown on the plans.

The subgrade shall be prepared as specified in Division 2, and shall be free from an excess or deficiency or moisture at the time of placing the base course. The subgrade shall also comply, where applicable, with the requirements of other items that may be contained in the contract that provide for the construction or shaping of the subgrade or the construction of the existing base course.

Base course material shall not be placed on a frozen subgrade or sub base.

The crushed stone shall be placed on the subgrade or other base course material and spread uniformly to such depth and lines that when compacted it will have the thickness, width and cross section shown on the plans.

If the required compacted depth of the base course exceeds 6 inches, the base shall be constructed in two or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed 6 inches. When vibrating or other approved types of special compacting equipment are used, the compacted depth of a single layer of the base course may be increased to 8 inches upon approval by the Engineer.

The spreading shall be done the same day the material is hauled, and it shall be performed in such a manner that no segregation of coarse and fine particles nor nests or hard areas caused by dumping the crushed stone on the subgrade will exist. To insure proper mixing, the crushed stone shall be bladed across the roadbed before being spread. Care must be taken to prevent mixing of subgrade or shoulder material with the base course material in the blading and spreading operation.

Each course shall be compacted by any satisfactory method that will obtain the density herein specified. The crushed stone shall be substantially maintained at optimum moisture during the mixing, spreading, and compacting operations, water being added or the material aerated as may be necessary. The specified grade and section shall be maintained by blading throughout the compaction operation. The density of the compacted material in each course, as determined by AASHO T191, shall not be less than 95 percent of the density obtained in the laboratory. The crushed stone shall be compacted across the full width of application.

The laboratory density shall be obtained as follows: the sample is prepared by removing the aggregate retained on the $\frac{3}{4}$ inch sieve and adding aggregate passing the $\frac{3}{4}$ inch sieve and retained on the #4 sieve in an amount equal to that removed. The sample so prepared is compacted at various water contents in five equal layers in a mold 6 inches in diameter and 7 inches high. Each layer is compacted by 55 blows of a 10 pound hammer 2 inches in diameter dropped from a height of 18 inches. The density used is the dry weight obtained at the optimum water content.

The compacted base course shall be tested for depth and any deficiencies corrected by scarifying, placing additional material, mixing, reshaping, and compacting to the specified density, as directed by the Engineer.

The contractor shall maintain the base course in a satisfactory condition until accepted.

PART 3 - EXECUTION

- 3.1** The completed base course compacted and accepted by the engineer shall be measured along the centerline of the roadway and the typical width shall be verified to the typical section provided on the plans. Work performed and material accepted under this item will be measured by the tons in place, with a minimum depth of eight (8) inches.

Quantity for tons of completed and accepted base course set forth in the proposal shall be fully compensated for preparing subgrade; furnishing and loading material; hauling and spreading, finishing, watering, manipulating, compacting, testing; and for all labor, equipment, tools, and incidentals necessary to complete the work. There will be no compensation for base that fails compaction testing and requires resetting up the base and all components associated with this task. Contractor shall warranty base course for one year after city approval and any failures shall be the responsibility of the contractor to replace at their cost.

END OF SECTION

SECTION 21

ASPHALTIC CONCRETE HOT MIX SURFACE COURSE

PART 1 - GENERAL

- 1.1** This item shall consist of an asphalt concrete wearing surface composed of a compacted mixture of mineral aggregate and asphalt cement, constructed on the completed and accepted base or binder course in accordance with these specifications and in reasonable close conformity with the lines, grades, compacted thickness and typical cross section shown on the plans.

PART 2 - PRODUCTS

2.1 COMPOSITION:

The wearing surface shall be composed of a mixture of mineral aggregate and asphalt cement in the following proportions by weight:

Mineral	Aggregate	Type 2	Type 3
Total retained on	¾ sieve	0%	0%
Total retained on	½ sieve	3% - 15%	0%
Total retained on	#4 sieve	25% - 45%	20% - 40%
Total retained on	#10 sieve	45% - 60%	45% - 60%
Total retained on	#40 sieve	8% - 20%	8% - 20%
Total retained on	#80 sieve	100%	4% - 10%

At least on half of the fraction passing the #200 sieve shall comply with the requirements for mineral filler and in no case shall the mineral aggregate contain less than 5 percent (5%) mineral filler.

The general composition limits set forth above are master ranges of tolerance to govern mixtures made from any raw materials meeting specification requirements, and are maximum and minimum for all cases. The engineer will specify or approve a job mixture for each project coming within the above limits, which, in his/her judgment, will be suitable, and the maximum permissible variations from the mixture shall be as follows:

Total retained on ¾ sieve	+7%
Total retained #4 sieve	+5%
Total retained on #10 sieve	+5%
Total passing #40 sieve	+4%
Total passing #20 sieve	+2%
Bitumen	+0.4%
Temperature of mixture on delivery	±200

Each day the engineer will take as many samples as he/she considers necessary for checking the uniformity of the mixture. When unsatisfactory results or changed conditions make it necessary, the engineer may establish a new job mix formula. Aggregate samples will be tested in accordance with AASHTO T11, T27, and Y30, as applicable. Extraction tests on bituminous mixtures shall be in accordance with AASHTO T164 or Arkansas Highway Department procedure for vacuum extraction. Density of compacted mixture shall be in accordance with AASHTO T166.

2.2 MATERIALS AND EQUIPMENT:

Materials and equipment used in this construction, in addition to the general requirements of these specifications, shall conform to Arkansas Highway Department standards.

2.3 CONSTRUCTION:

Construction methods followed in this construction, in addition to the general requirements of these specifications, shall conform to the Arkansas Highway Department standards.

PART 3 - EXECUTION

- 3.1** The completed hot mix asphalt surface course shall be measured along the centerline of the typical section and the width shall be verified at several places to assure compliance with the typical section of improvement.

Quantity for tons of completed and accepted hot mix asphalt set forth in the proposal shall full compensation for furnishing materials, for heating, mixing, hauling, placing, rolling, and finishing, and for all labor, tools, equipment and incidentals necessary to complete the work. Contractor shall warranty asphalt for one year after city approval and any cracking, separating, or any other failures shall be the responsibility of the contractor to replace at their cost.

END OF SECTION

SECTION 22

CONCRETE CURB AND GUTTER

PART 1 - GENERAL

- 1.1 This item shall consist of the construction of concrete curb and gutter in accordance with these specifications and in conformity with the location, lines, grades, shown on the plans, or as directed by the Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS:

Cement, aggregate and water used shall meet the requirements for materials for "Class "A" Concrete" as per the Standard Specifications for Highway Construction, Arkansas State Highway Commission.

2.2 CONSTRUCTION METHODS:

A. Excavation. The subgrade shall be excavated to the required depth. All soft and yielding material and the entire subgrade shall be thoroughly compacted.

B. Forms. Forms shall be metal or wood, free from warp and of sufficient strength to resist spring during the process of depositing concrete. It shall be securely staked, braced, set and held firmly to required line and grade.

All forms shall be cleaned and oiled before concrete is placed against them.

C. Concrete. The concrete shall be proportioned, mixed and placed in accordance without the requirements previously set forth under the section titled "Materials".

D. Placing and Finishing. Concrete shall be deposited in the forms, upon the wetted subgrade and vibrated and spaded until mortar entirely covers the surface, after which it shall be finished smooth and even by means of a wooden float. Edges shall be rounded as shown on the Plans while concrete is still soft. Base forms shall be removed from curbs within twenty-four (24) hours and the face finished by rubbing with a wetted cement mortar brick or wood float until it is smooth. Plenty of water shall be used, either by dipping the finishing block in water or throwing water on the surface with a brush. Plaster will not be permitted but minor defects shall be filled with a 1 to 2 cement mortar applied with a wood float.

When completed, the concrete shall be kept covered with wet burlap and shall be kept wet for a period of at least seventy-two (72) hours.

E. Joints. Joints shall be constructed at such intervals and placed as shown on the plans, or as directed by the Engineer. All joints shall conform to the dimensions and requirements shown on the plans.

F. Surface Tests. Before the concrete is given the final finishing, the surface of the gutter and the tip of the curb, shall be checked with a ten (10) foot straightedge. Ordinates measured from the straightedge to the surface of the curb or gutter, shall not exceed one-eighth inch (1/8") for the further provision that maximum variation in ten (10) feet shall not exceed one-quarter inch (1/4").

G. Backfilling. After the concrete has set sufficiently the space behind the curb shall be required to the required elevation an approved mechanical tamper and neatly graded.

PART 3 - EXECUTION

- 3.1** Completed and accepted concrete curb and gutter will be measured by the lineal foot constructed within the limits shown on the Plans, or as designated by the Engineer.

Work completed and accepted under this item and measured as provided above shall be paid for at the contract unit price bid per lineal foot for the respective concrete curb and gutter. Payment shall be full compensation for furnishing all materials, forms, mixing, placing, finishing; for all excavation and backfilling; and for an equipment, tools, labor and incidentals necessary to complete the work. Any cracking, separating, or other failures shall be removed, disposed, and replaced, as set forth above, by the contractor for a period of up to one year after city approval at no additional cost to the owner.

END OF SECTION

SECTION 23

CUTTING AND REPLACING SPECIAL SURFACES

PART 1 - GENERAL

- 1.1 The work covered under this section of the specifications shall include all work involved in cutting and replacing special surfaces, including gravel and bituminous and concrete roads, driveways, walks, or parking areas and fences, shrubbery, lawn sod, masonry walls and culverts.

PART 2 - PRODUCTS

- 2.1 Whenever it becomes necessary in excavating to disturb special surfaces such as paved or gravel roadways, drives, walks or parking areas, the original surface shall be restored after completion of the backfill. In these instances, care shall be used in making the backfill to eliminate future settlement and the surface shall be restored using the same type of materials that were used in the original surface.

Immediately prior to cutting concrete or bituminous surfaces, a chalk line shall be made along both sides of the trench at the proper width and the pavement trimmed along a straight and vertical line. No claims will be allowed for additional width of pavement cut and replaced occasioned by this requirement.

In gravel-surfaced streets and other areas, the gravel will be disturbed in excavating for trenches. After the backfill has been so placed that no further appreciable settlement will occur, gravel over the trench shall be replaced to the same compacted thickness as the original surfacing. During construction, also, the gravel on the remainder of the street not occupied by the trench may be covered with dirt from the excavation. After completion of the backfill, such dirt shall be removed or additional gravel shall be placed on the street until the surfacing is as weather-resistant and traffic resistant as the original surfacing.

Wherever it becomes necessary in excavating to cut fences or disturb lawns, shrubbery, masonry walls, etc., these surfaces shall be restored to their original condition immediately after completion of the backfill.

Fences shall be restored to their original condition using the same type of materials that were used in their original construction.

Trenches where lawn sod has been disturbed shall be backfilled in accordance with applicable provisions of these specifications and compacted by hand, if necessary. After replacing the sod, it shall be covered loosely with earth, tamped lightly to protect the roots, and sprinkled with water.

Shrubbery shall be taken up ahead of construction, stored, and replanted after completion of the backfill. Damaged shrubbery shall be replaced by the contractor at his expense.

PART 3 - EXECUTION

- 3.1** All cost associated with the cutting and replacing special surfaces shall be included in the various unit price proposal items as stated in the bid document. No separate compensation will be granted for the work covered in this specification.

END OF SECTION

SECTION 24

PIPE CULVERTS

PART 1 - GENERAL

- 1.1** The work covered under this section of the specifications shall include all labor, tools, materials and equipment required for the furnishing and installing of pipe culverts for the various items listed in the proposal. The pipe used for drainage purposes shall be ADS N-12, unless otherwise indicated by the plans, and meet all specifications required by the manufacturer.

PART 2 - PRODUCTS

2.1 ADS N-12 & REINFORCED CONCRETE PIPE:

ADS N-12 Pipe and Fittings shall conform to specifications supplied by manufacturer.

Reinforced concrete pipe shall consist of Portland cement concrete in which steel has been embedded in such manner that the concrete and steel act together.

2.2 DESIGN:

Pipe shall be circular or arch in shape as indicated on the plans.

The shell thickness and amount of reinforcing shall be not less than that prescribed in the current A.S.T.M. Standards, C 76. The class of pipe to be furnished will be shown on the proposal.

Ends of the pipe shall be of such design that the pipe, when laid, shall form a continuous conduit with a smooth and uniform interior surface.

2.3 WORKMANSHIP AND FINISH:

Pipe shall be substantially free from fractures, large or deep cracks and surface roughness. The planes of the ends of the pipe shall be perpendicular to the longitudinal axis. Variation of the internal diameter shall not exceed one percent (1%) of pipe of thirty-six (36) inch diameter or less, nor exceed three-quarters (3/4) of one (1) percent of larger pipe. The shell thickness shall not be less than that intended in the design by more than five percent (5%) at any point.

The under run in length of pipe from that specified shall be not more than one-eighth inch (1/8") per foot with a maximum of one half inch (1/2") in any length of pipe.

2.4 MARKING:

The date of manufacture and the name or trademark of the manufacturer shall be clearly stenciled on the inside of each section of pipe.

2.5 INSPECTION:

The pipe shall be inspected for defects resulting from poor manufacture or handling, and may be rejected on account of any of the following: (1) Injurious cracks or fractures passing through the shell; (2) Defects that indicate imperfect mixing and molding; (3) Surface defects indicating honeycombed or open texture; and (4) Spalls deeper than one-half (1/2) the depth of the joint or extending more than four inches (4") around the circumference.

2.6 CONSTRUCTION METHODS:

In other sections of these specifications, the preparation of the subgrade and the gravel base has been described. It is important that the details for the preparation of the subgrade and base be followed so the finished drainage structure will properly function.

Pipe culverts shall comply with the appropriate section of the Arkansas Highway and Transportation Department's latest standard specifications. These components shall be laid to the lines and grades shown on the plans. All joints shall be made according to the manufacturer's recommendation. Care shall be used in backfilling to prevent misalignment both horizontally and vertically.

A. Depth of Excavation. All excavation shall be carried to a depth where foundation materials are satisfactory to the Engineer regardless of the elevations shown on the Plans and all foundations shall be inspected and approved by the Engineer previous to placing any part of the structure.

B. Forming Bed for Pipe. Where the pipe is to be laid below the ground line, a trench shall be excavated to the required depth and to the minimum width practical for working conditions. The bottom of the trench shall be shaped as shown on the Plans to conform to the bottom of the pipe to afford uniformly firm bed throughout its entire length. Recesses shall be excavated to receive the bells where bell and spigot pipe is used. Any soft or yielding material shall be removed or replaced with gravel or other suitable material which shall be compacted thoroughly into place with mechanical tampers. Where rock is encountered, the trench shall be excavated to the minimum depth as shown on the Plans and backfilled with suitable material which shall be tamped thoroughly with mechanical tampers.

Where pipe is not laid in a trench, a uniformly firm bed shall be made as specified above for the bottom of the pipe.

C. Laying pipe. Concrete pipe shall be laid with hubs or bells upgrade, spigot ends fully entered into the adjacent hub or bell, and true to lines and grades given. Any pipe which is not in true alignment or which shown any settlement after laying, shall be taken up and re-laid by the Contractor without extra compensation.

When corrugated metal pipe sections are joined on the work, the ends shall be butted together and the sections joined with a bank made of the same material as the pipe. The pipe shall be laid in the trench with the separate sections firmly joined together, with outside laps of circumferential joints pointing upstream and with longitudinal laps on the sides. Any metal in joints, which is not thoroughly protected by galvanizing, shall be coated with a suitable asphaltum plant.

D. Backfilling. Backfilling around the pipe shall be done with select material which is free from large lumps or clods and the material shall be placed along side the pipe in layers not to exceed four inches (4") in depth and thoroughly compacted by hand tamping with mechanical tampers for the full depth of the pipe. Special care shall be taken to compact the full under the haunches of the pipe. The fill shall be brought up evenly on each side for the full length of the pipe to avoid displacement. The berm of thoroughly compacted material on each side of the pipe shall be as wide as the outside diameter of the pipe.

PART 3 - EXECUTION

3.1 Completed and accepted pipe culverts shall be measured by the lineal foot in place and not through box inlets.

Work completed and accepted under this item and measured as provided above shall be paid for at the contract unit price bid per lineal foot for "Pipe Culverts" of the several sizes, which price shall be full compensation for furnishing, hauling, and installing the pipe; for all excavation and backfilling; and for all materials, equipment, tools, labor and incidentals necessary to complete the work. The price shall include headwalls, forming and matching of existing culverts, and appurtenances

Excavating, preparing the bed and backfilling will not be paid for directly but will be considered as subsidiary work pertaining to "Pipe Culverts".

END OF SECTION

SECTION 25

DROP INLETS AND JUNCTION BOXES

PART 1 - GENERAL

- 1.1 This item shall consist of the construction of drop inlets and junction boxes in accordance with these specifications, and in conformity with locations, lines, and grades, shown on the Plans, or as directed by the Engineer.

PART 2 - PRODUCTS

- 2.1 Cement, aggregates, and water shall conform to the requirements for materials for "Class "A" Concrete" as per the Standard Specifications for Highway Commission.

Rings and covers, grates and frames, and other appurtenances shall be made from cast iron of good quality and of such character as shall tank-the metal of the casing strong, tough and of even grain. The casting shall be smooth, free from scale, and from cracks or other defects that might make them unfit for the use for which they are intended.

Concrete shall be proportioned, mixed, placed, finished and cured in accordance with the above state specifications under "Materials".

Floor of drop inlets or junction boxes shall be poured at least twenty four (24) hours before beginning construction of the walls. The Engineer may require a longer period between the pouring of the floors and the construction of the walls, if, in his/her judgment, weather conditions made a longer period necessary. Floors shall be constructed to full outside dimensions.

Wall shall be constructed upon the floor and shall form a tight joint with the floor and around the inlet and outlet. Inlet and outlet pipe shall be cut flush with the inside surface of the wall. If it is necessary to carry sanitary sewer or other utility lines through the masonry, they shall be so formed about that they will not be damaged in any way. Faces of drop inlet shall be poured as part of the curb, as shown on the Plans, in order to preserve the proper alignment.

All casting shall be set accurately to the finished elevation so that no subsequent adjustment will be necessary. They shall be set in full mortar beds with firm bearing on the walls or securely fastened to the form so no movement will occur when concrete is poured around them.

No concrete shall be poured until the Engineer has inspected the forms, the placing of reinforcing steel and casting and has given his permission to proceed with the pouring.

Backfill shall be thoroughly compacted by tamping in not more than four inch layers by means of mechanical hand tamps.

Pre-cast inlets and boxes are allowed with the approval the City and Engineer.

ADS drain basins and junction boxes shall conform to ADS specifications and shall be approved by the City and Engineer.

PART 3 - EXECUTION

- 3.1** Completed and accepted drop inlets or junction boxes will be measured by the drop inlet or junction box.

The price will be full compensation for constructing the drop inlets or junction boxes; for all excavation and backfilling; and for all materials, equipment, tools, labor, and incidentals necessary to complete the work.

END OF SECTION

SECTION 26

SEEDING

PART 1 - GENERAL

- 1.1 This item shall consist of furnishing and applying lime, seed, mulch cover, and emulsified asphalt and water in accordance with these specifications at locations shown on the plans, or as directed.

PART 2 - PRODUCTS

2.1 MATERIALS

(a). Lime shall be agricultural grade ground limestone as approved by the Arkansas State Plant Board for agricultural use.

(b). Fertilizer shall be commercial grade, uniform in composition, free flowing and suitable for application with mechanical equipment, delivered to the site in labeled containers, conforming to the current Arkansas fertilizer laws and bearing the name, trademark and warranty to the producer.

(c). The seed shall be labeled in accordance with current rules and regulations of the Arkansas State Plant Board and shall have a minimum of 98% pure seed and 85% germination by weight and noxious weed seeds shall be the maximum amount allowed per pound of seed with the following exception: Johnson grass seed, wild onion seed, wild garlic seed, field bindweed seed or nut grass seed will not be allowed in any amount whatsoever. Seed shall be furnished in sealed, standard containers. Seed which have become wet, moldy or otherwise damaged in transit, or in storage, will not be acceptable.

March 1 – April 15

Variety	Weight, Lbs per Acre
White clover (common)	5
Lespedeza (Kobe)	35

April 1 – June 15

Variety	Weight, Lbs per Acre
Bermuda Grass (common)	10
Lespedeza (Kobe)	35

September 1 – October 31

Variety	Weight, Lbs per Acre
Rye Grass (Annual)	20

(d). Mulch cover shall consist of straw from threshed rice, oats, wheat, barley or rye; or of wood excelsior. Mulch which contains an excessive amount of noxious weeds, is excessively brittle, or is an advanced state of decomposition, shall be considered unacceptable.

(e). Emulsified asphalt shall conform to the requirements of Grade SS-1.

(f). Water shall be of irrigation quality and free of impurities that would be detrimental to plant growth.

2.2 CONSTRUCTION METHODS

(a). Seedbed Preparation. Areas to be seeded shall be dressed to the shape and section shown on the plans. If the plans call for replacing topsoil, this shall be done prior to any preparations form seeding. Before beginning the seedbed preparation, soil samples shall be obtained from each major soil area (such a cut back slope or fill fore slope) by the engineer for pH analysis. Each major soil areas should have approximately three samples per acre. The samples should be approximately five inches (5") combined and thoroughly mixed and approximately a five-pound sample removed for the pH test that major soil area.

Based on the soil test, lime shall be applied at the following rates.

1. pH of 5.0 or below – three (3) tons per acre.
2. pH of 5.1 to 5.5 – two (2) tons per acre.
3. pH of 5.6 to 6.0 – one (1) ton per acre.
4. pH above 6.0 – none required.

Lime at the rate of application indicated above, shall be uniformly spread on areas to be seeded prior to their being roughened or scarified. The seedbed shall be thoroughly pulverized by means of disk harrows or other approved methods, thoroughly mixing lime and soil to a depth of not less than four inches (4") (2 inches for slopes 4:1 or steeper) below finish slope elevation. Regardless of the pulverizing method used, the soil shall be

broken with the contour of the slope. Objectionable foreign matter shall be removed and the soil left in a suitable horticultural condition to receive the fertilizer and seed. Water, as a pay item, may be applied before, during and after seedbed preparation, as directed by the engineer, in order to maintain the desired moisture content in the soil.

When no lime is required, seedbed preparation shall be accomplished as specified above, regardless of the method used in the distribution of fertilizer, seed and mulch cover.

(b). Fertilization. Fertilization shall be applied at the rate of 800 pounds per acre of 10-20-10, or the equivalent amount of plan food. Fertilization shall be uniformly incorporated into the soil to a depth of at least two inches (2"). It may be worked into the soil alone or in conjunction with the required lime. If the contractor so elects, the fertilizer may be drilled into the soil combined with the seed in the hydro-seeding operation. If the fertilizer is incorporated in the hydro-seeding operation, the depth requirements will be waived.

(c). Seeding.

Broadcasting. Broadcast sowing may be accomplished by hand seeders or by approved power equipment. Either method shall result in uniform distribution and no work shall be performed during high winds. The area shall be lightly firmed with a cultpacker immediately after broadcasting.

Mulch Cover. Mulch cover shall be applied at the rate of 4000 pounds per acre immediately after seeding and shall be spread uniformly over the entire area by approved mulching equipment. If the contractor so elects, an approved mulching machine may be used whereby the application of mulch cover and asphalt may be combined into one operation. If this method is used, no change in application rates will be allowed.

Emulsified Asphalt. Immediately following or during the application of the mulch cover on seeded areas, emulsified asphalt shall be applied at the rate of 1.05 gallons per square yard. Application shall be made from a pressure distributor, so equipped to insure constant and uniform distribution.

(d). Water. After application of the mulch cover, water shall be applied in sufficient quantity to thoroughly moisten the soil to a depth of pulverization and then as necessary to germinate the seed and maintain growth at the end direction of the engineer for a period of at least three weeks. The time required for application of water will not be included in the computations of contract time for completion of the project provided all other work under the contract has been completed.

(e). Restoration. The contractor shall maintain seeded area from the time of completion until final acceptance of the project. Additional work and materials required because of loss through erosions will be paid for under the pertinent contract items. Additional work

and materials required due to the contractor's negligence in maintaining completed work shall be accomplished at the contractor's expense.

PART 3 - EXECUTION

3.1 Method of Measurement.

(a). Lime. Agricultural grade ground limestone accepted and used will be incidental to the unit price bid for erosion control.

(b). Seeding. Seeding will be measured by the square yard or acre of the actual area covered and accepted.

(c). Mulch cover. Mulch cover will be incidental to the unit price.

(d). Water. Water will be incidental to the unit price.

3.2 Seeding completed and accepted and measured as provide above will be paid for at the contract unit price per lump sum for erosion control, which prices shall be full compensation for seedbed preparation; for furnishing and applying fertilizer, lime, mulch cover, water and seed; and for all equipment, tools, labor and incidentals necessary to complete the work.

END OF SECTION

SECTION 27

SOLID SODDING

PART 1 - GENERAL

- 1.1** This item shall consist of furnishing and placing approved Bermuda sod, fertilizer and water, in accordance with these specifications, at locations shown on the plans, or as directed.

PART 2 - PRODUCTS

2.1 MATERIALS

(a). The sod field shall consist of a densely rotted growth of Bermuda grass substantially free from noxious weeds and undesirable grasses. The grass shall be cut to a height of approximately 2 inches and then raked free of debris. The sod shall be cut in uniform strips a minimum of 2 inches in depth, approximately 12 inches in width, and not less than 12 inches in length but not longer than can be conveniently handled and transported. The depth of the cut shall be varied as necessary in order to recover as much of the dense root system of the grasses as possible.

(b). Fertilizer shall be a commercial grade, uniform in composition, free flowing and suitable for application with mechanical equipment, delivered to the site in labeled containers, conforming to Arkansas fertilizer laws and bearing name, trademark and warranty of the producer.

(c). Water shall be irrigation quality, free of impurities that would be detrimental to plant growth.

2.2 CONSTRUCTION METHODS

(a). Preparation of Bed. The area to be sodded shall be dressed to the shape and section shown on the plans and the top and bottom of slopes shall be rounded to a radius of approximately 4 feet unless otherwise directed. The finished slopes shall be rounded to a radius of approximately 4 feet unless otherwise directed. The finished slopes shall be free of objectionable foreign matter and the top 1-inch of soil shall be loosened roughly and covered with a layer of topsoil not less than 2 inches compacted depth. Water, as a pay item, may be applied before, during and after slope preparation, as directed by the engineer, in order to maintain the desired moisture content in the soil.

(b). Fertilization. Immediately prior to placement of sod, fertilization shall be broadcast at the rate of 250 pounds per acre (approx. 1 lb. per 19 sq. yds.) of 10-

20-10, or the equivalent amount of plant food, and incorporated in the top 1 inch of soil.

(c). Placement of Sod. The bed shall be in a firm but uncompacted condition with a relatively fine texture at the time of sodding. Sod shall be moist and shall be placed on a moist earth bed. Sod strips shall be laid along contour lines, by hand, commencing at the base of the area to be sodded and working upward. The transverse joints of sod strips shall be broken, and the sod carefully laid to produce tight joints. At the top of slopes the sod shall be turned into the embankment slightly and a layer of earth placed over it and compacted in order to conduct surface water over it and compacted in order to conduct surface water over and onto the sod. The sod shall be firmed, watered, and refirmed immediately after it is placed. The firming shall be accomplished by use of a lawn roller or tamper, with care being taken to avoid tearing end strips of sod.

When sodding is completed, the sodded areas shall be cleared of loose sod, excess soil, or other foreign material, and a thin application of topsoil shall be scattered over the sod as a top dressing, and the areas thoroughly moistened. Water shall be applied as necessary at the direction of the engineer for a period of at least 3 weeks. The time required for application of water will not be included in the computations of contract time for completion of the project provided all other work under the contract has been completed.

(d). Restoration. The contractor shall maintain sodded areas from the time of completion until final acceptance of the project by the engineer. Additional work and materials required because of the contractor's negligence in maintaining the work shall be accomplished at the contractor's expense.

PART 3 - EXECUTION

3.1 Method of Measurement.

(a). Sodding. Solid sodding will be measured by the square yard of actual area covered.

(b). Water. Water will be incidental to the unit price

3.2 (a). Sodding. Solid sodding completed and accepted and measured as provided above will be paid for at the contract unit price under Erosion Control, which price shall be full compensation for bed preparation; for furnishing and applying fertilizer, topsoil and sod; and for all equipment, tools, labor and incidentals necessary to complete the work.

(b). Water. Water applied at the direction of the Engineer and measured as provided above will be incidental to the unit price bid.

END OF SECTION

SECTION 28

EROSION CONTROL

PART 1 - GENERAL

- 1.1** The work covered under this section of the specifications shall include all labor, tools, materials and equipment required for the installation and maintenance of the erosion control structures, and the upkeep of the storm water pollution prevention plan.

PART 2 - PRODUCTS

- 2.1** Before any construction is to begin the NPDES permit must be obtained by the contractor from Arkansas Department of Environmental Quality, and then all erosion control structures must be established and set in place according to the plans and to the satisfaction of the engineer.

Silt fences and hay bales shall conform to Arkansas Highway and Transportation specifications.

The storm water pollution prevention plan shall be kept up to date as specified by the NPDES permit inside a mailbox specifically designated for the compliance of the NPDES permit. This includes but is not limited to, daily inspection sheets, weekly reports, updated site maps. The mailbox shall also contain a rain gauge.

The contractor shall be responsible for the maintenance and upkeep of all erosion control structures and BMP's as outline in the SWPPP. This includes but is not limited to the replacement of any torn or broken silt fences, broken apart hay bales, washed out levees, silt migration, removal of silt from streets and/or drainage pipes, repair construction entrance, etc. The engineer can request additional erosion control structures and/or the replacement of any structures he/she deems to be defective.

Refer to the landscape specifications section 26 and 27 for seeding and sodding.

PART 3 - EXECUTION

- 3.1** The cost of all work under this section shall be included in the basic unit price for the maintenance of erosion control infrastructure and shall include all the equipment, materials, and labor incidental to erosion control and in compliance with the SWPPP and ADEQ permit.

END OF SECTION

SECTION 29

CLEANING UP

PART 1 - GENERAL

- 1.1** The work covered under this section of the specifications shall include all labor, tools, materials and equipment required for the complete and satisfactory cleaning up and dressing up of the work areas under this contract.

PART 2 - PRODUCTS

- 2.1** After the construction work is completed, all refuse and debris resulting from the work shall be cleaned up and disposed of to the satisfaction of the engineer. Structures shall be washed or swept out and left neat and clean. All excess excavation, waste concrete, wiring, piping, lumber or other refuse shall be removed from the site of the work and the site leveled, graded, and dressed up until it is neat, smooth and workmanlike.

PART 3 - EXECUTION

- 3.1** The cost of all work under this section shall be included on the basic unit price for the various items and no portions of the required work will be paid for separately.

END OF SECTION