

STANDARD SPECIFICATIONS FOR DESIGN AND CONSTRUCTION OF WATER IMPROVEMENTS

2023 EDITION



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TABLE OF CONTENTS

SECTION 1000 11

GENERAL REQUIREMENTS AND PROCEDURES 11

 PART 1 – GENERAL 11

 1.01 WORK INCLUDED 11

 1.02 DEFINITIONS 12

 1.03 LAWS, REGULATIONS AND ORDINANCES 12

 1.04 PERMITS AND LICENSES 12

 1.05 PLANS AND SPECIFICAITONS SUBMITTALS AND APPROVAL 13

 1.06 EASEMENTS 13

 1.07 UTILITY COORDINATION 14

 1.08 TRAFFIC MAINTENANCE 14

 1.09 CONSTRUCTION LAYOUT 15

 1.10 INSPECTION, OBSERVATION AND TESTING 15

 1.11 MAINTENANCE BOND 16

 1.12 FINAL ACCEPTANCE 16

 1.13 NO-LEAD MATERIALS 17

SECTION 1100 18

DRAFTING STANDARDS 18

 PART 1 – GENERAL 18

 1.01 GENERAL 18

 1.02 RECORD DRAWINGS 19

SECTION 1200 21

GENERAL DESIGN STANDARDS FOR WATER IMPROVEMENTS 21

 PART 1 – GENERAL 21

 1.01 GENERAL 21

 1.02 PROTECTION OF EXISTING WATER SYSTEM 21

 1.03 WATER LINE MATERIALS 21

 1.04 REQUIREMENTS TO EXTEND WATER SERVICE 21

 1.05 MINIMUM SIZE OF WATER LINES 22

 1.06 WATER SERVICE LINES 23

 1.07 WATER METER SIZE 23

 1.08 BACKFLOW PREVENTION 23

1.09	EASEMENTS	23
1.10	LOCATIONS OF WATER METERS	24
1.11	WATER LINE DEPTH.....	24
1.12	WATER PRESSURE.....	24
1.13	VALVES	24
1.14	AIR RELEASE VALVES.....	25
1.15	STEEL ENCASEMENTS.....	25
1.16	PLANNED WATER OUTAGES	25
1.17	PROTECTION OF WATER SUPPLIES.....	25
1.18	STREAM AND CREEK CROSSINGS.....	26
SECTION 2000		27
TRENCH SAFETY		27
PART 1 – GENERAL		27
1.01	WORK INCLUDED	27
SECTION 2100		28
EROSION AND SEDIMENT CONTROL.....		28
PART 1 – GENERAL		28
1.01	WORK INCLUDED	28
PART 2 – PRODUCTS.....		28
PART 3 – EXECUTION.....		28
3.01	TEMPORARY EROSION CONTROL.....	28
3.02	OTHER CONTROLS.....	29
3.03	PERMANENT EROSION CONTROL	30
SECTION 2200		31
SITE PREPARATION.....		31
PART 1 – GENERAL		31
1.01	WORK INCLUDED	31
1.02	PROTECTION	31
PART 2 – MATERIALS.....		31
PART 3 – EXECUTION.....		31
3.01	GENERAL	31
3.02	SITE PREPARATION.....	31
SECTION 2300		35
EXCAVATION, BACKFILLING, AND COMPACTING.....		35

PART 1 – GENERAL	35
1.01 WORK INCLUDED	35
1.02 QUALITY ASSURANCE	35
1.03 PROTECTION	35
1.04 DUST CONTROL.....	36
1.05 SEDIMENT CONTROL.....	36
PART 2 – PRODUCTS.....	36
2.01 FOUNDATION MATERIAL	36
2.02 EMBEDMENT MATERIAL	36
2.03 GRIT EMBEDMENT MATERIAL.....	37
2.04 AGGREGATE BACKFILL MATERIALS	37
2.05 SELECT NATIVE BACKFILL MATERIAL	37
PART 3 – EXECUTION.....	37
3.01 EXCAVATION – GENERAL	37
3.02 DISPOSAL OF EXCAVATED MATERIALS	37
3.03 EXPLOSIVES	38
3.04 TRENCH DEWATERING	38
3.05 EXCAVATION – TRENCHES	38
3.06 EMBEDMENT AND BACKFILLING – GENERAL.....	39
3.07 BEDDING AND BACKFILLING PIPE	39
SECTION 3000	41
STEEL ENCASEMENT PIPE.....	41
PART 1 – GENERAL	41
1.01 WORK INCLUDED	41
PART 2 – PRODUCTS.....	41
2.01 MATERIALS	41
2.02 MINIMUM THICKNESS	42
2.03 MINIMUM DIAMETER	42
PART 3 – EXECUTION.....	43
3.01 EXCAVATION.....	43
3.02 INSTALLATION, ENCASEMENT PIPE.....	43
3.03 INSTALLATION, CARRIER PIPE	44
3.04 BACKFILL	44
3.05 CLEANUP.....	44

SECTION 3001	45
PVC ENCASEMENT PIPE	45
PART 1 – GENERAL	45
1.01 WORK INCLUDED	45
PART 2 – PRODUCTS	45
2.01 MATERIALS	45
2.02 MINIMUM DIAMETER	46
PART 3 – EXECUTION	46
3.01 EXCAVATION	46
3.02 INSTALLATION, ENCASEMENT PIPE	46
3.03 INSTALLATION, CARRIER PIPE	47
3.04 BACKFILL	47
3.05 CLEANUP	47
SECTION 3100	48
CAST-IN-PLACE CONCRETE	48
PART 1 – GENERAL	48
1.01 WORK INCLUDED	48
1.02 SUBMITTALS	48
PART 2 – PRODUCTS	48
2.01 CONCRETE	48
2.02 REINFORCEING STEEL	49
PART 3 – EXECUTION	50
SECTION 4000	51
WATER PIPE, FITTINGS, AND MATERIALS	51
PART 1 – GENERAL	51
1.01 WORK INCLUDED	51
1.02 SUBMITTALS	51
1.03 LEAD-FREE BRASS	51
PART 2 – PRODUCTS	51
2.01 POLYVINYL CHLORIDE (PVC) PIPE FOR WATER LINES	51
2.02 DUCTILE IRON PIPE FOR WATER LINES	52
2.03 HIGH DENSITY POLYETHYLENE (HDPE) PRESSURE PIPE AND TUBING	53
2.04 POLYETHYLENE ENCASEMENT (PIPE WRAP)	54
2.05 DUCTILE IRON FITTINGS	54

2.06	SWIVEL ADAPTERS AND HYDRANT TEES	54
2.07	MECHANICAL JOINT RETAINER GLANDS	54
2.08	PIPE RESTRAINTS.....	55
2.09	RESTRAINED FLANGED COUPLING ADAPTERS.....	55
2.10	RESTRAINED COUPLINGS.....	55
2.11	BOLTS AND NUTS	55
2.12	GATE VALVES.....	55
2.13	BUTTERFLY VALVES	56
2.14	VALVE BOXES	57
2.15	OPERATING NUT EXTENSIONS	58
2.16	FIRE HYDRANTS.....	59
2.17	BLOW-OFFS	60
2.18	AIR RELIEF VALVES.....	60
2.19	SERVICE SADDLES	60
2.20	TAPPING SLEEVES.....	60
2.21	SERVICE CONNECTION MATERIALS	60
2.22	TRACER WIRE.....	62
2.23	MARKING TAPE.....	62
2.24	WATER LINE MARKERS	62
PART 3 – EXECUTION.....		63
3.01	INSTALLATION.....	63
SECTION 4100		64
INSTALLATION OF WATER PIPE, FITTINGS, AND MATERIALS		64
PART 1 – GENERAL		64
1.01	WORK INCLUDED	64
1.02	SUBMITTALS.....	64
1.03	PROTECTION	64
PART 2 – PRODUCTS.....		64
2.01	BEDDING AND BACKFILL.....	64
2.02	PIPE, FITTINGS, AND MATERIALS	64
2.03	CONCRETE.....	64
PART 3 – EXECUTION.....		64
3.01	EXCAVATION – GENERAL	64
3.02	LAYOUT.....	65

3.03	PIERS	65
3.04	COLD WEATHER INSTALLATION	65
3.05	PIPE INSTALLATION – PUSH ON JOINTS	65
3.06	PIPE INSTALLATION – MECHANICAL JOINT CONNECTIONS.....	66
3.07	SOLID SLEEVE INSTALLATION	67
3.08	VALVE INSTALLATION	68
3.09	FIRE HYDRANT INSTALLATION.....	68
3.10	METER SETTINGS.....	70
3.11	BLOW-OFF INSTALLATION	70
3.12	TAPPING SADDLE INSTALLATION	71
3.13.	TAPPING SLEEVE INSTALLATION	72
3.14	INSTALL OF POLYETHYLENE PROTECTION MATERIAL	73
3.15	CONCRETE THRUST BLOCKS AND ANCHOR COLLARS.....	75
3.16	BACKFILLING AND INSPECTION	76
3.17	WATER LINE INSTALLATION - AERIAL CROSSINGS.....	77
3.18	SEWER LINE CROSSING.....	77
3.19	STORM SEWER CROSSING.....	77
3.20	CUT AND CAP.....	78
3.21	ABANDON CORPORATION STOP.....	78
SECTION 4200		79
WATERLINE PRESSURE REDUCTION PROCEDURES.....		79
PART 1 – GENERAL		79
1.01	WORK INCLUDED	79
1.02	PROCEDURES.....	79
1.02	CONSTRUCTION REQUIREMENTS	79
SECTION 4300		80
HORIZONTAL DIRECTIONAL BORING		80
PART 1 – GENERAL		80
1.01	WORK INCLUDED	80
1.02	SUBMITTALS.....	80
1.03	PROTECTION	80
PART 2 – PRODUCTS.....		80
2.01	BEDDING AND BACKFILL.....	80
2.02	PIPE, FITTINGS, AND MATERIALS	80

2.03	CONCRETE.....	80
PART 3 – EXECUTION.....		80
3.01	HEAT FUSION JOINTS.....	80
3.02	ANCHOR FITTINGS	81
3.03	CONCRETE ANCHOR.....	81
3.04	PIPE INSTALLATION.....	81
SECTION 5000		83
INSPECTION AND TESTING OF WATER LINES AND SERVICE LINES		83
PART 1 – GENERAL		83
1.01	WORK INCLUDED	83
1.02	SCOPE OF WORK	83
1.03	DELIVERABLES	84
PART 2 – PRODUCTS.....		84
PART 3 – EXECUTION.....		84
3.01	VISUAL INSPECTION DURING INSTALLATION AND BEFORE BACKFILL 84	
3.02	PRESSURE TEST FOR TAPPING SLEEVES.....	84
3.03	PRESSURE TEST FOR WATER PIPELINES AND SERVICE LINES	84
3.04	DISINFECTION	86
3.05	BACTERIOLOGICAL SAMPLES	87
3.06	FINAL VISUAL INSPECTION	87
3.07	TRACER WIRE CONTINUITY TESTING.....	87
SECTION 6000		88
ASPHALT PAVEMENT REPAIR.....		88
PART 1 – GENERAL		88
1.01	WORK INCLUDED	88
1.02	REGULATIONS AND STANDARDS	88
1.03	TESTING, OBSERVATION, AND INSPECTION REQUIREMENTS	88
PART 2 – PRODUCTS.....		89
2.01	BASE COURSE MATERIALS	89
2.02	ASPHALT MATERIALS	89
PART 3 – EXECUTION.....		89
3.01	EXECUTION	89
3.02	EXCAVATION AND BACKFILL.....	89

3.03	SUBGRADE PREPARATION	89
3.04	BASE COURSE FOR ASPHALTIC PAVING	90
3.05	ASPHALT PAVEMENT REPAIRS	90
3.06	HOT-MIX SURFACING FOR ASPHALTIC PAVING	92
3.07	TEMPORARY SURFACING.....	92
3.08	TRAFFIC CONTROL.....	92
SECTION 6001		94
CONCRETE PAVEMENT REPAIR.....		94
PART 1 – GENERAL		94
1.01	WORK INCLUDED	94
1.02	REGULATIONS AND STANDARDS	94
1.03	TESTING, OBSERVATION, AND INSPECTION REQUIREMENTS	94
PART 2 – PRODUCTS.....		95
2.01	BASE COURSE MATERIALS	95
2.02	FORMS	95
2.03	CURB FORMS.....	96
2.04	SIDEWALK FORMS.....	96
2.05	EXPANSION JOINTS AND JOINT FILLER.....	96
2.06	CONCRETE.....	96
2.07	CURING COMPOUND.....	98
2.08	REINFORCEMENT	98
2.09	ACCEPTANCE OF MATERIALS.....	99
PART 3 – EXECUTION.....		99
3.01	GENERAL	99
3.02	EXCAVATION AND BACKFILL.....	100
3.03	PREPARATION OF SUBGRADE.....	100
3.04	PLACING CRUSHED STONE BASE.....	101
3.05	SETTING FORMS.....	101
3.06	PLACING CONCRETE.....	101
3.07	SIDEWALK CONSTRUCTION	102
3.08	FLAT SURFACES.....	103
3.09	COLD WEATHER REQUIREMENTS.....	103
3.10	HOT WEATHER REQUIREMENTS	104
3.11	TEMPORARY SURFACING.....	104

3.12	TRAFFIC CONTROL.....	104
SECTION 6002		106
GRAVEL SURFACE REPAIR.....		106
PART 1 – GENERAL		106
1.01	WORK INCLUDED	106
1.02	RELATED WORK.....	106
1.03	REGULATIONS AND STANDARDS	106
1.04	TESTING, OBSERVATION, AND INSPECTION REQUIREMENTS	106
PART 2 – PRODUCTS.....		107
2.01	BASE COURSE MATERIALS	107
PART 3 – EXECUTION.....		107
3.01	PLACING GRAVEL SURFACING.....	107
3.02	TRAFFIC CONTROL.....	107
SECTION 6100		109
LAWN AND GRASS RESTORATION.....		109
PART 1 – GENERAL		109
1.01	WORK INCLUDED	109
1.02	SCOPE OF WORK	109
PART 2 – PRODUCTS.....		109
2.01	TOPSOIL.....	109
2.02	FERTILIZER.....	109
2.03	SOD	110
2.04	MULCH.....	112
2.05	LIME	112
2.06	WATER.....	112
PART 3 – EXECUTION.....		112
3.01	SEQUENCE	112
3.02	FINISH GRADING.....	113
3.03	CLEARING.....	113
3.04	FERTILIZER AND LIME APPLICATION	114
3.05	APPLICATION OF SEED.....	114
3.06	HYDROSEEDING.....	114
3.08	APPLICATION OF MULCH	115
3.09	PROTECTION	115

3.10 SOD PLACEMENT 115
3.11 WATERING..... 116
3.12 MAINTENANCE..... 117
3.13 COMPLETENESS 117
3.14 INTERMITTENT CLEANUP 118

SECTION 1000

GENERAL REQUIREMENTS AND PROCEDURES

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. These Specifications for water improvements are provided to outline procedures and criteria for the design and construction of water facilities within Washington Water Authority's service area boundary.
- B. In addition, all rules, regulations, and requirements of the Arkansas Department of Health are the minimum standard for all plan requirements, construction, and development practices to be approved by Washington Water Authority. In cases where the Specifications set forth exceeds the Arkansas Department of Health requirements, then this Specification shall govern.
- C. Additionally, this Specification includes the requirement that the minimum standards of design and construction specified herein, that directly affects health and safety, must further comply with the recommendations of both (1) the 10 State Standards (GLUMRB) and (2) the American Water Works Association (AWWA). Any conflict that directly affects health and safety between these Specifications and the recommendations from 10 States Standards, or the recommendations from AWWA, must be resolved to provide the greatest protection of health and safety.
- D. All rules, regulations and requirements of the Arkansas Board of Licensure for Professional Engineers and Professional Surveyors shall be the minimum standard for professional surveying and for professional engineering.
- E. The Engineer of Record is responsible for design and compliance with the latest edition of local Ordinances and Specifications, Arkansas Department of Health minimum Standards and State of Arkansas Rules, Regulations and Laws, or any Federal Law, Rule, or Regulation.
- F. These Specifications do not replace the Engineer of Record's specifications and contract documents, however these specifications set forth the minimum requirements for design and construction of all water and sanitary sewer with the jurisdiction of Washington Water Authority. These specifications may be included by reference only in the Engineer of Record's documents.
- G. The Engineer of Record for any project designed and constructed under the requirements of these Specifications, shall provide to Washington Water Authority a sealed (PE) letter report stating that the design and construction of the water improvements met the minimum requirements of these Specifications. This sealed letter report will also contain

documentation of any special conditions or additions to these Specifications for the specific project.

- H. Comprehensive, full time construction observation services shall be provided by, or under the direction of, the Engineer of Record.
- I. Washington Water Authority shall not be responsible, nor bears any liability for the Contractor's means, methods, techniques, sequences and procedures of construction, or safety precautions and programs incident thereto in performing or furnishing any of the work. Washington Water Authority shall not be responsible for any actions resulting from the direction of the Engineer of Record.
- J. Special conditions may arise on projects that are not covered in these Specifications. Such special conditions, complete detail as to design, materials, method of construction, testing, and/or other procedures shall be submitted to Washington Water Authority for review and approval.

1.02 DEFINITIONS

- A. Engineer of Record – A qualified Professional Engineer licensed in the State of Arkansas, for the Owner, City of Government agency.
- B. Owner – Any Individual, partnership, firm, corporation, or other entity who, as property owner, initiating work.
- C. Provide – Furnish and install, complete in place, operating, tested and approved.
- D. Products – The materials, systems, and equipment provided by the Contractor.
- E. Washington Water Authority – Division of the Rural Development of Authority Washington County Arkansas, having full and complete authority to manage, operate, improve, extend, and maintain water works and water distribution.

1.03 LAWS, REGULATIONS AND ORDINANCES

- A. All Federal, State, County and Municipal Laws, Regulations, or Ordinances shall be complied with on all projects. Where the requirements of another jurisdictional authority having influence on work outside the purview of Washington Water Authority are greater than that provided by these Specifications, the work shall conform to the greater requirement of that respective jurisdictional authority.

1.04 PERMITS AND LICENSES

- A. All permits required to accomplish the work shall be the responsibility of the Engineer of Record. Such permits may include but are not limited to permits for work within Arkansas

Department of Transportation R/W, railroad crossing permits, Arkansas Department of Environmental Quality “Notice of Intent”, and or U.S. Army Corps of Engineers. Work shall not be started without appropriate permit(s) in place.

1.05 PLANS AND SPECIFICATIONS SUBMITTALS AND APPROVAL

- A. Detailed plans and specifications shall be required for all water extensions, facilities, or modifications and shall be prepared by a qualified professional engineer registered to do business in the State of Arkansas. These detailed plans and specifications shall be submitted to Washington Water Authority for review and approval.
- B. For initial review, the Engineer of Record shall submit two (2) sets of all plans and specifications and one (1) digital version in .pdf format.
- C. The plans and specifications shall be first approved in writing by Washington Water Authority as applicable for the project and then shall be forwarded to the Arkansas Department of Health by the Engineer of Record for approval. In no case shall any water be allowed before Washington Water Authority has written approval from the Arkansas Department of Health.
- D. Washington Water Authority must approve all material prior to installation.
- E. The Owner of the project is responsible for acquiring and recording all easements and giving all notices necessary and incidental to the work.
- F. For projects which require formal erosion control plans per Arkansas Department of Environmental Quality regulations, the construction may not begin without an approved Storm Water Pollution Prevention Plan (SWPPP) on file with Washington Water Authority. Minimum erosion control measures are required for all projects. It is the responsibility of the Contractor to comply with the Arkansas Department of Environmental Quality requirements.
- G. A pre-construction conference involving the Engineer of Record, Contractor, and Washington Water Authority is required prior to beginning construction. Two (2) full sets and two (2) half size sets shall be provided to Washington Water Authority prior to the pre-construction meeting.
- H. The Engineer of Record shall provide legible, professional documents meeting the requirements of Ten States Standards and as follows to Washington Water Authority for review and approval.

1.06 EASEMENTS

- A. The Owners of the project are responsible for acquiring and recording all easements and giving all notices necessary and incidental to the work. PDF copies of recorded easements

shall be provided to Washington Water Authority prior to construction.

1.07 UTILITY COORDINATION

- A. The plans shall show the location of existing overhead and underground utility lines including electric, gas, and communications, existing water and sewer lines and the proposed water and/or sewer improvements according to the best information presented and available.
- B. It is responsibility of the Owner or his authorized representative to coordinate with and get approval from the various utilities, including other departments within the County. Further, it is the responsibility of the Owner to get authorization to encroach upon any other utilities' easement(s) and secure such recorded encroachment as a requirement for dedication of the water lines and system.
- C. It is the responsibility of the owner or his authorized representative to comply with the "Arkansas Underground Facilities Damage Prevention Act".

1.08 TRAFFIC MAINTENANCE

- A. The Contractor will plan and execute the work to assure minimal interference with normal flow of traffic and pedestrians. Traffic control shall also comply with the latest edition of the Manual of Uniform Traffic Control.
- B. The Contractor will be responsible for making provisions for the safe and free passage of persons and vehicles over or around the construction site, both during and after working hours. Such provisions will be satisfactory to Washington Water Authority, County or State authority having jurisdiction within the work area.
- C. The Contractor will notify and obtain applicable approvals and permits from local Municipality, County, or State authorities before closing or obstructing any public highway, street, trail, or sidewalk.
- D. The Contractor will provide and maintain necessary barricades, signs, lights, roadway trench covering, fencing, personal safety equipment and markers around or at the construction area to avoid any property damage or personal injury. The contractor will provide qualified flagmen to direct traffic while working upon or in a highway, street or road over which traffic must pass.
- E. Excavated area within traffic lanes of highways, streets, roads, trails, and walks will be backfilled with Compacted Class 7 Aggregate Base Course immediately following pipe installation and the area opened to traffic. Excavated areas shall be brought to the adjacent/contiguous paved surface elevations and constantly maintained by the contractor.

1.09 CONSTRUCTION LAYOUT

- A. The layout and staking of the construction work shall be by trained and qualified survey personnel under the supervision of the Engineer of Record. Construction layout shall consist of staking necessary to determine alignment and elevations to properly construct the proposed facilities.

1.10 INSPECTION, OBSERVATION AND TESTING

- A. Comprehensive, full-time construction observation services shall be provided by the Engineer-of-Record.
- B. Only authorized personnel from Washington Water Authority are permitted to operate valves on the existing water system. Under no circumstances shall the Contractor operate any valve on the existing water system.
- C. All field test required for a project shall be witnessed by Washington Water Authority in the presence of the Engineer-of-Record or his authorized representative and the Contractor.
- D. Washington Water Authority representative will be determined at, or prior to, the pre-construction meeting.
- E. Washington Water Authority requires 24-hour working day notice on all tests. Contractor shall pre-test the installation prior to notifying Washington Water Authority of the test.
- F. Tests delayed by weather or other factors will be rescheduled on the same basis. If a test cannot be reasonably scheduled so that a representative of Washington Water Authority can be present, the Engineer-of-Record will witness the test and certify to Washington Water Authority the results.
- G. In no case shall a test be made without the presence of the Engineer-of-Record's representative and the Contractor. It is the responsibility of the Engineer-of-Record and/or the Contractor to coordinate the scheduling of test with Washington Water Authority and with other parties involved.
- H. All equipment, materials, and labor required for testing shall be furnished by the Contractor at his expense.
- I. Generally, no Contractor or Engineer-of-Record involvement is required in the taking of samples for the Bac-T test except that the Contractor is responsible for the proper flushing of the line prior to samples being taken by Washington Water Authority. However, Washington Water Authority may require the presence of the Contractor or Engineer-of-Record when questions have been raised as to the methodology or techniques used the sampling process.

- J. Bac-T samples are sent to the Arkansas Department of Health for testing. Results are available on-line at the ADH website. Results obtained by Washington Water Authority may be forwarded to the Engineer-of-Record either by email, fax, or mail upon request of the contractor.
- K. Lines failing the Bac-T tests shall be re-sampled as soon as practicable. If a line fails two (2) consecutive Bac-T test, the line must be re-chlorinated before Bac-T samples can be taken again, Washington Water Authority shall not be responsible for rescheduling Bac-T tests.
- L. The hydrant test shall consist of checking the operation of the hydrant valve and flowing the hydrant. This test will be performed jointly by the Contractor and Washington Water Authority representative. This test will be done after the pressure test has been completed. The hydrant valve shall be left in the open position during the test and after the test is complete.

1.11 MAINTENANCE BOND

- A. Once Washington Water Authority accepts the project for ownership, the Owner shall be responsible for the provision to Washington Water Authority of a one (1) year maintenance bond for 50 percent of the construction cost of water improvements, which shall cover defects in materials and workmanship. A walk-through shall be performed at the end of the one-year period and all deficiencies corrected prior to the release of the bond. Utility maintenance shall begin after expiration of the one (1) year Maintenance Bond.

1.12 FINAL ACCEPTANCE

- A. Washington Water Authority will be deemed to have accepted water lines and appurtenances for ownership upon completion of the following.
 - 1. Acceptable Final Inspection by the following:
 - a. A representative of Washington Water Authority
 - b. The Engineer-of-Record
 - c. The Contractor
 - 2. Acceptable walk-through by Washington Water Authority for location, grade, and condition of water meter settings
 - 3. Construction Cost received by Washington Water Authority and subsequently approved in writing
 - 4. Record Drawings are received by Washington Water Authority

5. Engineer-of-Record Certification is received by Washington Water Authority
 6. Letter of Final Acceptance is provided by the Washington Water Authority to the Engineer-of-Record.
- B. No water meter shall be set until all final acceptance requirements are met and the line is accepted by WWA.

1.13 NO-LEAD MATERIALS

- A. All subsequent parts, materials, components found with the Specifications and/or Plans are to be “No-Lead” where applicable, even if not explicitly stated.

SECTION 1100

DRAFTING STANDARDS

PART 1 – GENERAL

1.01 GENERAL

- A. These standards have been established for the purpose of ensuring uniformity in the design and drafting techniques of projects to be submitted for review and acceptance. Plans shall meet the standards set forth herein.
- B. All projects submitted shall have a title sheet which shall include:
 - 1. General overall area map;
 - 2. Vicinity location map;
 - 3. A site plan map detailing the project;
 - 4. Name/title of project including section number, if applicable;
 - 5. Owner and Engineer's name; and
 - 6. Professional Engineer's seal and signature.
- C. All plan and profile sheets are to be certified and dated by a Professional Engineer of the State of Arkansas
- D. All sheets are to be numbered
- E. Include detail sheet(s)/specification sheet(s), as applicable
- F. Design drawings shall be 22-inch by 36-inch, or 24-inch by 36-inch.
- G. The following scales are not to exceed 1"=50' horizontal, 1"=5' vertical
- H. All plan sheets shall include the following information when applicable:
 - 1. A north arrow;
 - 2. The scales used;
 - 3. Project name and number, sheet number, date drawn, date and nature of revisions;

4. All topography in the area affected by construction;
 5. Right-of-way lines, property lines and easements;
 6. Locations of benchmarks and their descriptions;
 7. Locations of all existing and proposed utilities in the project area; and
 8. Match lines shall be easily identified.
- I. All profiles shall include the following:
1. Existing and finished grade lines;
 2. Size and type of pipe;
 3. Elevations to USGS datum;
 4. Profile of existing and proposed utilities; and
 5. Special construction required due to unfavorable soil conditions.
- J. Water plans shall be prepared using standard symbols and notations commonly used in the practice of civil engineering. If necessary, legends shall be provided to define the symbols used. At a minimum, the following symbols shall be used:
1. FH – Fire Hydrant
 2. WM – Water Meter
 3. GV – Gate Valve
 4. BFV – Butterfly Valve
 5. WV – Water Valve (other)
 6. WL-x – Water Line where x identifies diameter in inches
 7. FL-x – Fire Lines where x identifies diameter in inches
 8. BO – Blow Off Assembly

1.02 RECORD DRAWINGS

- A. Upon completion of the project, the Engineer shall provide to Washington Water Authority for record purposes “as-built” or “record drawings”. A final inspection will not be scheduled until record drawings have been submitted to Washington Water Authority for review.
- B. Datum requirements include:
 - 1. Horizontal Datum: NAD83 Arkansas State Plane, North Zone, US foot
 - 2. Vertical Datum: NAVD88 (feet)
- C. Water drawings submitted as record (“as-built”) drawings shall indicate the location where the water line was installed and have the following items surveyed during/after construction and shown on the drawings:
 - 1. Fire Hydrant, location
 - 2. Water valves, location, type, diameter
 - 3. Water fittings, location, size
 - 4. Water service saddle, location
 - 5. Water meters, location
 - 6. Water pipe, material, diameter, thickness class / pressure class
 - 7. Tapping sleeves, location
 - 8. Steel encasements, location, material, size
 - 9. Details shall be provided for all vertical offset water lines, if applicable
- D. All sheets shall have the phrase "as-built" or "record drawing" boldly printed on them with the as constructed date and shall be stamped and signed by a professional engineer registered in the State of Arkansas. Record drawings shall be submitted in hard copy, .dwg electronic format, and .pdf electronic format.

SECTION 1200

GENERAL DESIGN STANDARDS FOR WATER IMPROVEMENTS

PART 1 – GENERAL

1.01 GENERAL

- A. Construction of water lines with Washington Water Authority's service area boundary shall be designed and installed in accordance with these Specifications.

1.02 PROTECTION OF EXISTING WATER SYSTEM

- A. Only authorized personnel from Washington Water Authority are permitted to operate valves on the existing water system. Under no circumstance shall the Contractor operate any valve on the existing water system.

1.03 WATER LINE MATERIALS

- A. Unless specified or detailed otherwise, materials for water line mains up to and including 18-inch diameter shall be PVC or Ductile Iron.
- B. Ductile Iron Pipe (DIP) shall be used for water mains at certain fittings and valves, and for all pipe greater than 12-inches in diameter.
- C. All buried DIP, valves, and fittings shall be double poly wrapped.

1.04 REQUIREMENTS TO EXTEND WATER SERVICE

- A. All new development of any kind shall be required to extend water services to that development at the owner's expense. Water lines shall be extended to each property to be served by Washington Water Authority. This includes all new developments, infill projects, subdivisions, and lot splits of 4 or more lots. Water service shall include providing adequate domestic water flows.
- B. Water service lines shall extend perpendicular to the water main and extended to the property being served where an appropriately sized water meter will be installed.
- C. On subdivision water systems, water lines shall be extended through all the development to the property line so that future developments(s) can tie on without disrupting the service to or property of any existing customers or owners. Dead end lines shall be avoided whenever possible.

- D. All water lines with dead ends shall be installed with an upstream valve, one full joint of pipe with a MJ restraining gland, concrete anchor collar, a MJ cap with restraint, and a blow off assembly. The seat of the MJ restraining gland on the pipe shall face the valve.
- E. Developments shall tie to the existing water system at a minimum of two locations to maintain water quality and maintain water service in the event of a water line break in the immediate vicinity, unless directed otherwise by Washington Water Authority. An inline valve shall be installed on the existing water line between the two points of connection if one is not currently installed. Water line extensions shall be required off the development to loop with the existing water distribution system. Construction of such extensions shall be at the expense of the Owner.
- F. At other locations easements may be required to facilitate future extension of lines to adjacent properties.

1.05 MINIMUM SIZE OF WATER LINES

- A. The minimum sized water line that may be installed in the water system as a “Water System Improvement” shall be eight (8) inch diameter. Unless documented and approved otherwise by WWA, the minimum size water main installed by development shall be eight (8) inch diameter.

Minimum water line sizes less than eight (8) inch diameter will receive special consideration will be based upon engineering calculations for domestic and fire flow demands if required, existing infrastructure, water modeling, water age and water quality and as follows.

Four (4) inch diameter lines shall be the minimum water line size that may be approved for special conditions such as “short” cul-de-sacs as determined by the City or rural water extensions, provided such lines could not be reasonably extended in the future to provide service to adjacent property and where a larger line is not needed to provide either fire protection or adequate domestic flows.

All water lines less than eight (8) inches in diameter require approval from the General Manager and subsequently the ADH.

- B. Should fire protection be required for new development as determined by the local Fire Marshal, the minimum line size requirement for the provision of fire protection shall be based upon fire flow calculations including the flow for the private fire line/sprinklers in addition to the flow required at fire hydrants, water modeling calculations and as follows. The minimum line size requirement for the provision of fire protection shall a looped six (6) inch line or, in the event of a dead-end line, an eight (8) inch. This minimum requirement shall apply regardless of the theoretical flow capacities existing in the system. Lines larger than six (6) inch looped and eight (8) inch dead end may be required if larger

lines are needed to provide domestic and/or fire flow demands based upon engineering calculations and/or water modeling.

1.06 WATER SERVICE LINES

- A. Water service connections shall be made on 12-inch and smaller water lines, unless directed by Washington Water Authority.
- B. Service lines shall be a minimum of 1-inch HDPE tubing, unless directed by Washington Water Authority.
- C. Water service lines installed across municipal streets shall be encased R/W to R/W, or State Highway R/W to R/W. Service lines shall be encased in 2-inch PVC tubing.

1.07 WATER METER SIZE

- A. Water meters serving flow up to 10 gpm continuous (15 gpm intermittent) shall be 5/8-inch water meter.
- B. Water meters serving flow up to 25 gpm continuous (40 gpm intermittent) shall be 1-inch water meter.
- C. Water meters serving flows greater than 25 gpm continuous shall be approved by the Utility during the plan review process.

1.08 BACKFLOW PREVENTION

- A. Washington Water Authority's water distribution system shall be protected from the possibility of backflow by the use of a reduced principal backflow prevention assembly (RPZ), a double check valve assembly (DC), or an air gap in accordance with the Arkansas State Plumbing Code (ASPC), latest edition.
- B. Washington Water Authority shall review and sign off on all proposed backflow prevention installations.

1.09 EASEMENTS

- A. For water lines that are up to 10 feet deep, easements shall be at least 20 feet in width with the water line in the center of the easement. For water lines that are greater than 10 feet deep, easements shall be 1 foot per foot of depth to the bottom of the pipe on each side of the water line. The easement may be designated specifically for water line purposes or it may be a general utility easement.
- B. Line sized 12-inches through 18-inches shall not be placed in easements of less than 25 feet. Wider easements may be required, depending on the specific circumstances involved.

- C. New developments that contain existing water lines must modify the existing easements as necessary to meet the above requirements for widths in relation to pipe location and size, including increasing the size of the easement if proposed fill will cause depth of bury to exceed 10 feet.
- D. Easements of lesser width will be considered when adjacent to another easement under other special circumstances.

1.10 LOCATIONS OF WATER METERS

- A. Water meters shall be located in non-paved areas and readily accessible to Washington Water Authority without going through fences or gates.
- B. Water meters shall be free of obstructions for a minimum of a 3-foot radius from the center of the water meter box.
- C. Water meters shall be located on the Owner's side of the property line (edge of easement or R/W), unless directed by Washington Water Authority.
- D. Double meter sets shall be located on the common property line between the two properties being served.

1.11 WATER LINE DEPTH

- A. Minimum depth to the top of pipe for all water main lines less than 12-inch diameter shall be 3 feet as measured from the flow line of gutter or bottom of ditch, whichever is greater.
- B. Minimum depth to the top of pipe for water lines 12-inch diameter and greater shall be 4 feet as measured from the flow line of gutter or bottom of ditch, whichever is greater.
- C. Minimum depth of all water service lines from the main to the water meter shall be 30-inches.

1.12 WATER PRESSURE

- A. The water distribution system shall be designed to maintain a minimum working water pressure of 40 psi at the water meter.
- B. Design of new construction that results in less than 40 psi working pressure at the water meter shall be approved by Washington Water Authority on a case-by-case basis.
- C. Under no circumstances shall the working pressure of the water distribution system be below 20 psi.

1.13 VALVES

- A. Valves for 2-inch through 12-inch water distribution shall be resilient seat gate valves.

- B. Valves 14-inch and larger shall be butterfly valves.
- C. Valves at tees shall be provided to isolate water mains for maintenance or repairs and to limit outages. Valves may be required on multiple legs of tees as designed by the Engineer of Record and approved by Washington Water Authority.

1.14 AIR RELEASE VALVES

- A. Air release valves shall be required on uphill, dead-end lines or on other specific applications to protect the water distribution system at the discretion of Washington Water Authority.

1.15 STEEL ENCASEMENTS

- A. Water lines under culverts, creeks, concrete channels, retaining walls, or other difficult and/or dangerous to maintain areas shall be encased in a smooth steel encasement pipe. The steel encasement shall extend 10 feet either side of the area.
- B. Water lines through steel encasement shall be installed with three spacers per joint such that the spacers are equally spaced along the length of the pipe.
- C. Self-restraining gaskets (DIP only) or bell restraints shall be used for all joints inside the encasement pipe and for the first joint in each direction outside the encasement pipe.
- D. End seals shall be used on all encasement pipes.
- E. Ductile Iron Pipe shall be used in situations where fittings other than a tee are required on either side of the steel encasement to change direction or overcome varying field conditions. Additional joint restraints and the use of anchor collars shall be required as directed by Washington Water Authority.

1.16 PLANNED WATER OUTAGES

- A. Under no circumstances shall water be shut off to any active service in the course of new construction without written permission from Washington Water Authority. If water pressure needs to be reduced to facilitate construction, a preconstruction meeting shall be held.

1.17 PROTECTION OF WATER SUPPLIES

- A. There shall be no physical connections between a public or private water supply system and a sanitary sewer or appurtenances thereto which would permit the passage of any polluted water into the potable supply. Sanitary sewers shall be installed at least ten (10) feet horizontally from any existing or proposed water line. The distance shall be measured edge to edge, including from the outside of manholes. In cases where it is not practical to maintain a ten (10) foot separation, the appropriate reviewing agency may allow deviation on a case-by-case basis if supported by data from the design engineer. Such deviation may

allow installation of the sewer closer to a water main provided that the water main is in a separate trench or on an undisturbed earth shelf located to one side of the sewer, and at an elevation so the bottom of the water main is at least 18 inches above the top of the sewer.

- B. Sewer lines installed under a water line must have a clear distance between pipes of at least 18 inches. If 18 inches of clearance cannot be provided, either the sanitary sewer main or the water main shall be encased in at least twenty (20) feet of watertight encasement pipe, centered over the point of crossing. Crossings that are not perpendicular will require more than twenty (20) feet of encasement. The encasement shall extend a minimum of ten (10) feet perpendicular from the outside edges of the line that is not being encased. The ends of the encasement pipe shall be sealed watertight.
- C. The sewer line shall be installed such that a joint of pipe is centered along the water line and the joints are as far as possible from the water line.
- D. Any time the water main must pass under the sewer main, at least 18 inches of vertical separation must be provided, and either the sanitary sewer main or the water main shall be encased in at least twenty (20) feet of watertight encasement pipe, centered over the point of crossing. Crossings that are not perpendicular will require more than twenty (20) feet of encasement. The encasement shall extend a minimum of ten (10) feet perpendicular from the outside edges of the line that is not being encased. The ends of the encasement pipe shall be sealed watertight.

1.18 STREAM AND CREEK CROSSINGS

- A. Water mains installed under stream, and, or creek systems defined as “navigable waters” under the Clean Water Act and subsequently protected by the Navigable Waters Protection Rule shall be bored, either by horizontal directional boring or Jack and Bore, from stream bank to stream bank.
- B. Open trenching shall not be allowed within a “navigable water,” except under special circumstances as determined by WWA and subsequently permitted by U.S. Army Corps Engineers.

SECTION 2000

TRENCH SAFETY

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. The Contractor is responsible for ensuring that safe working conditions exist and safety procedures are being followed at the work site. The Contractor is responsible to notify OSHA of the commencement of all water construction.
- B. If the Contractor is working for any public body (state agency, county, municipality, school district, or other local tax unit or improvement district), they shall be responsible for notifying the Arkansas Department of Labor Safety Division, (501) 682-9091 when water jobs are to begin. A copy of a letter or reporting form shall be sent to Washington Water Authority.
- C. Regarding Trench Safety Systems, the Contractor shall design, install, and maintain a "Trench Safety System" in strict compliance with OSHA (Occupational Safety and Health Administration) Part 1926 of the Code of Federal Regulations and all other applicable federal, state, and local requirements.

SECTION 2100

EROSION AND SEDIMENT CONTROL

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. The Contractor shall accomplish temporary and permanent erosion protection related to grubbing, grading, excavation, paving, and other work as directed by the Engineer and as shown on the approved drawings. An erosion control plan shall be submitted to the Engineer prior to the commencement of construction.
- B. The Contractor is responsible for implementing Best Management Practices (BMPs) during construction activities, (including, but not limited to, sediment and erosion control structures) and achievement of final stabilization upon completion of construction activities.
- C. The Contractor shall be responsible for implementing all applicable requirements of the ADEQ General Stormwater Permit for Construction Activity, the Spill Prevention Control and Countermeasures Plan (SPCCP), as required by USEPA, local Municipal Separate Storm Sewer requirements, and all other environmental regulatory requirements that are associated with the construction activities that they are contracted to perform. The Contractor is responsible for managing all materials, equipment, and activities at the work site in a manner that is in compliance with local, State, and Federal environmental regulations.

PART 2 – PRODUCTS

- A. NOT USED

PART 3 – EXECUTION

3.01 TEMPORARY EROSION CONTROL

- A. The contractor shall construct temporary berms, dikes, dams, ditching or sediment basins, and maintain such control features until permanent erosion control features are placed all in accordance with Washington Water Authority or State “Erosion Control Standards”.
- B. Water removed from open pits and/or trenches shall have silt removed prior to leaving the immediate site of construction. Silt shall be removed by natural vegetation, a straw bale trench dewatering inlet device, settling pond, filter bag, a rock/geotextile fabric sediment trap/basin, or other appropriate sediment control measure. Water filtered through a basin shall not violate any water quality standard and shall have efficient sediment/silt removal prior to discharge to a waterbody.

- C. Contractor shall be responsible for providing adequate number of pumps for prompt and efficient dewatering. Ends of discharge hoses shall be provided with flow dispersion and filtration devices to prevent scouring of surface soils, discharge of turbid water, and/or washout of stream banks. Discharge from dewatering activities shall not be conveyed into or upon any roadside ditch, curb and gutter, street, or publicly used thoroughfare.
- D. The direct discharge of silty/muddy water to a stream, offsite, or across areas of equipment access points and/or construction haul roads is strictly prohibited.

3.02 OTHER CONTROLS

- A. A dedicated concrete truck wash out area shall be maintained to include adequate containment to prevent runoff of concrete truck wash water. Concrete truck drivers shall be notified to use wash out area.
- B. Contractor shall follow the appropriate waste storage and disposal practices, as per applicable environmental regulatory requirements. Solid waste dumpsters/roll-offs, or other appropriate waste receptacles will be maintained and used at the site. Good housekeeping practices will preclude trash, construction wastes, and debris to be dumped or scattered on the construction site. There shall be no open burning of any waste material. No solid materials, including building materials, shall be discharge to water of the State.
- C. No liquid waste chemicals, fuels, and/or oils are to be leaked or spilled on ground surfaces. Bulk storage of liquid chemical wastes will be provided with secondary containment with a capacity sufficient to contain the volume of the largest container within the secondary containment. All waste materials shall be stored in a manner to prevent releases and should be disposed of by a qualified waste disposal firm at an acceptable waste disposal facility. Records of the disposal of all solid, hazardous, non-hazardous, and liquid wastes are to be maintained by the Contractor. Contractor shall notify the Engineer of any spills or leaks that occur in spite of the preventive measures taken. Contractor shall notify the Engineer of any spills or leaks that occur in spite of the preventive measures taken. Contractor will prepare a report of any spills or leaks in accordance with the reporting and recordkeeping measures described in the BMPs. No contaminants from fuel storage areas, hazardous waste storage and truck wash areas shall be discharged to water of the State. These areas should not be located near a water body.
- D. Contractor shall maintain compliance with applicable State and/or local sanitary sewer, septic system, and waste disposal regulations.
- E. Off-site vehicle tracking of sediments and the generation of dust must be minimized. Measures such as stone at construction access points, parking areas, and unpaved roads, providing entrance wash racks or stations for trucks, and/or street sweeping shall be implemented where appropriate. Application of water to construction haul roads should be done, as appropriate, to control dust generation. Application of excessive levels of water that create mud should be avoided.

3.03 PERMANENT EROSION CONTROL

- A. The Contractor shall incorporate permanent erosion control features into the project at the earliest practicable time as the construction progresses all in accordance with the approved plans and project specifications.

SECTION 2200

SITE PREPARATION

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. Excavation, grading, cutting and removal of trees, shrubs and underbrush, and the removal of any debris existing above natural ground surface and within the cleared area necessary to permit the construction of the improvements.

1.02 PROTECTION

- A. In all cases the Contractor is responsible for protecting public and private property and protecting any person or persons who might be injured as a result of the Contractor's work.
- B. All utilities shown on the drawings may not represent the exact location however, the Contractor is responsible for verifying these locations and contacting the Arkansas One Call System before excavating.

PART 2 – MATERIALS

- A. NOT USED

PART 3 – EXECUTION

3.01 GENERAL

- A. The Contractor will be required to submit a plan to build access roads/trails for approval by the Engineer.
- B. It shall be the responsibility of each bidder to examine the site carefully and make his own calculations as to costs to be incurred by reason of the requirements of this section.
- C. Trees, shrubs, underbrush, and debris removed from the improvement right of way shall be disposed of by the Contractor in a manner approved by Washington Water Utilities.
- D. The Contractor shall not remove or disturb any vegetation except that required for the execution of the work.

3.02 SITE PREPARATION

- A. Clear areas necessary for performance of the work and confine operations to that area provided through easements, licenses, agreements, and rights-of-way. Entrance upon any

lands outside of that area provided by easements, licenses, agreements, or public rights-of-way, shall be at the Contractor's sole liability.

- B. Do not occupy any portion of the project site prior to the date established in the Notice to Proceed without prior approval of the Owner.
- C. Contractor shall be aware of certain easement considerations by individual property owners as stipulated in easement documents pertaining to the project.
- D. Remove, relocate, reconstruct, or work around natural obstructions, existing facilities and improvements encountered during site preparation as herein specified. Take care while performing site preparation work adjacent to facilities intended to remain in place. Promptly repair damage to existing facilities. Dispose of waste materials in a satisfactory manner off the work site.
- E. Protect, move, or brace public and private utilities as required by the affected utility.
- F. Maintain mailboxes in the manner that the Postal Service requires to prevent interruption of mail delivery.
- G. Site preparation includes the removal of trees, shrubs, brush, crops, and other vegetation within the limits of the easements (right-of-way), or as may be provided for in licenses, permits and agreements. All efforts shall be made to retain existing landscaping. In the event that trees, shrubbery, and hedges cannot be saved, then prior approval of the Owner and the Owner's Representative must be obtained before the existing landscaping is removed.
 - 1. Trees
 - a. All trees shall be saved unless removal is approved by Washington Water Authority.
 - 2. Shrubby
 - a. Shrubby shall be saved unless removal is approved by Washington Water Authority and the Owner's Representative. Make reasonable efforts to save all shrubby by trimming, in accordance with acceptable pruning practices, and treating wound surfaces with a commercial pruning compound.
 - 3. Small Plants and Flowers
 - a. At least two weeks prior to the start of construction, notify property owners of the proposed starting date so that the property owners can remove any small plants or flowers.

4. Protection of Existing Facilities

- a. The Contractor shall notify all property owners in the immediate vicinity of the construction area that may be affected by the construction activities a minimum of one week before starting work in that area. The notification shall include a description of the work, work hours, and a 24-hour contact name and number for the contractor.
- b. Fences interfering with construction, and located within public rights-of-way or as may be allowed for in permits or agreements, may be removed only if the opening is provided with a temporary gate which will be maintained in a closed position except to permit passage of equipment and vehicles, unless otherwise herein specified. Fences within temporary construction easements may be removed provided that temporary fencing is installed in such a manner as to serve the purpose of the fencing removed.
- c. Fencing removed shall be restored to the condition existing prior to construction unless otherwise specified. The Contractor is solely liable for the straying of any animals protected or corralled or other damage caused by any fence so removed.
- d. Driveways and driveway approaches removed or damaged during construction shall be restored to the original condition or better condition prior to construction.
- e. Make every reasonable effort to protect private sewer facilities. Private sewer facilities may not be shown on the Plans.
- f. Preserve property corners, pins, and markers. In the event any property corners, pins, or markers are removed by the Contractor, such property points shall be replaced at the Contractor's expense and shall be re-set by competent surveyors properly licensed to do such work. In the event such points are section corners or Federal land corners, they shall be referenced and filed with the appropriate authority.
- g. Where existing utilities and service lines are encountered, notify the owner thereof at least 48 hours (not including weekends and/or holidays) in advance of performing any work in the vicinity.
- h. Excavate, install pipeline, and backfill in the vicinity of such utilities in the manner required by the respective owner and, if requested, under his direct supervision. The Contractor shall be responsible for damages to a public or private utility that may occur as the result of the construction.

- i. Protect, move, or brace public and private utilities as required by the affected utility.
- j. Make a reasonable effort to ascertain the existence of obstructions and locate obstructions by digging in advance of machine excavation where definite information is not available as to their exact location. Where such facilities are unexpectedly encountered and damaged, notify responsible officials and other affected parties and arrange for the prompt repair and restoration of service.

SECTION 2300

EXCAVATION, BACKFILLING, AND COMPACTING

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. Excavation, backfilling, and compaction for water lines, appurtenances, and incidental construction.

1.02 QUALITY ASSURANCE

- A. If requested by Washington Water Authority, one moisture/density relationship test (AASHTO T-99 with Note 7, or AASHTO T-180 with Note 8) shall be taken at the beginning of the project, and one additional moisture/density relationship test shall be taken for every 5,000 cubic yards of imported material. ASTM testing methods for moisture/density Relationships may not be used for embankment and subgrade materials.
- B. Determine the field density of backfill in accordance with AASHTO Designation T-147.
- C. A minimum of one density test per 500 linear feet of pipe or portion thereof when the pipe is located in the street or under the curb and gutter.

1.03 PROTECTION

- A. The Work included in this Project may require excavation and related activities in close proximity to existing buried and aerial utility lines and facilities, such as water lines, sewer lines, storm drains, natural gas lines, electrical power lines, telephone cables, and TV cables. Where their presence is known, the approximate location of such utilities is shown on the Drawings, but all such utilities and individual service lines are not shown. The Contractor shall be aware of the potential for such utility lines to conflict with intended construction efforts, and the Contractor shall use appropriate precautionary measures to locate and protect such utility lines and services so as to avoid damage and interruptions to service.
- B. The Contractor shall contact the owners of the various existing utilities lines and services as may be affected by the construction and solicit their assistance in identifying, locating, marking, and protecting these facilities prior to the beginning of any excavation or other work which might endanger the existing utilities. If such utilities are damaged or impaired because of the Contractor's actions or omissions, the Contractor shall be responsible for the cost of repairs or replacements of the affected or damaged utility or service line.
- C. The Contractor shall comply with the Arkansas One-Call System and shall alert potentially conflicting utility systems accordingly.

- D. In all cases, the Contractor is responsible for protecting public and private property; and, protecting any person or persons who might be injured as a result of the Contractor's work.

1.04 DUST CONTROL

- A. The Contractor shall be responsible for maintaining the site and adjoining paved surfaces in a dust free condition. Fugitive dust control is the sole responsibility of the Contractor.

1.05 SEDIMENT CONTROL

- A. The Contractor shall be responsible for all sediment control in accordance with Section 2100 – Erosion and Sediment Control.

PART 2 – PRODUCTS

2.01 FOUNDATION MATERIAL

- A. Foundation materials for trench over excavation shall be Class 7 Aggregate Base Course, or “B” stone with Class 7 aggregate cap as designed by the Engineer of Record.

2.02 EMBEDMENT MATERIAL

- A. Embedment materials are restricted to materials as described below. The Engineer of Record shall provide as a submittal the gradation sieve analysis of the embedment materials proposed for each specific project.
- B. Without regard to the pipe material, all embedment materials include: bedding, pipe zone (including haunching), and initial backfill from six (6) inches below the bottom of the pipe to six (6) inches above the top of the pipe the full trench width with a minimum of six (6) inches of embedment materials all around the exterior of the pipe.
- C. Special design considerations, including supplemental trench drains, geotechnical fabric, and/or specific aggregate, and/or filter gradations as recommended in AWWA C605 and ASTM D2321 may be required to prevent migration of embedment particles. The Engineer of Record is responsible to design the embedment system as needed for the specific project.
- D. Embedment material shall be in accordance with ASTM D 2487, latest edition and shall conform to class 1A embedment materials in accordance with ASTM D 2321, latest edition. Material shall meet the grading requirements of a “MODIFIED” ASTM C 33, gradation 67, commonly referred to as ASTM #67 (3/4” concrete aggregate or 5/8” aggregate). Maximum aggregate size shall be 3/4 inch. This includes materials such as crushed stone or rock.

2.03 GRIT EMBEDMENT MATERIAL

- A. Grit shall be the by-product of rock crushing, generally consisting of 1/4" and smaller limestone material.

2.04 AGGREGATE BACKFILL MATERIALS

- A. Aggregate material for select backfill across streets, roads, driveways, and for placement of "gravel" or aggregates surfaced areas, shall be Class 7 Aggregate Base Course material conforming to the Standard Specifications of the Arkansas Department of Transportation, latest edition.

2.05 SELECT NATIVE BACKFILL MATERIAL

- A. Select native material shall be suitable on-site material or imported good earth, sand, or gravel that is free from large rocks (3" maximum diameter) or hard lumpy materials. Never use materials of perishable, frozen, spongy, or otherwise unsuitable nature as select material.

PART 3 – EXECUTION

3.01 EXCAVATION – GENERAL

- A. All excavation shall be carried accurately to the line and grade shown on the Drawings and as established by the Engineer of Record.
- B. When excavation is necessary to be carried below or beyond that which is required, fill the over-excavated space with compacted with Foundation Material as approved by the Engineer of Record
- C. The Contractor shall use a trench box or provide and install shoring where necessary to protect the labor, the work, or adjacent property. Shoring shall be maintained in place until the backfill has proceeded to a point where it can be safely removed.
- D. Dewater all excavations before any construction is undertaken in accordance with Section 2100 of these specifications.
- E. Install pipe only in dry trenches. Place concrete upon dry, firm foundation material only.

3.02 DISPOSAL OF EXCAVATED MATERIALS

- A. The Contractor shall be responsible for disposal of excess material, or disposal of excavated material unsuitable for backfilling.

- B. Disposal of excess material shall only be allowed on private property with written permission of the owner of the property. A copy of the written permission must be forwarded to the Engineer along with any permits as may be required by the governing authority, city, or county. Grading permits may be required.

3.03 EXPLOSIVES

- A. The use of explosives/blasting is not permitted.

3.04 TRENCH DEWATERING

- A. Dewater all trenches, in accordance with Section 2100, to the extent that water pipe can be placed on a dry and firm trench bottom. Never place pipe in a wet or unstable trench.
- B. Pump, pipe, and drain all water resulting from dewatering operations into a properly designed dewatering structure or device in accordance with Section 2100. Prevent flooding of streets or private property.
- C. Soil that cannot be properly dewatered: excavate and install 2” – 3” rock to provide a firm trench bottom.
- D. Divert surface runoff water away from the excavation. Where the excavation crosses natural drainage channels, care should be taken to prevent unnecessary damage or delays. Route diverted surface water into existing drainage structures, such as storm sewers, ditches, or streams. Prevent flooding of streets or private property.

3.05 EXCAVATION – TRENCHES

- A. During excavation, all pipe to be replaced shall be removed and disposed of offsite at a suitable landfill. Trench excavation for water lines shall be kept within the maximum width limits as shown on the Drawings. The specified maximum trench width from the bottom of the trench to 24-inches above the outside top of the pipe shall not be exceeded unless specifically authorized by the Engineer.
- B. Prior to excavation in paved areas, the Contractor shall saw-cut (or other acceptable method approved by the Engineer) the existing pavement to minimize the destruction of the existing pavement outside the limits of the trench. The maximum trench width for the installation of water lines, up to 12-inches in diameter, in paved areas shall not exceed 36-inches without written approval from Engineer. Contractor is responsible for damage to paved areas by construction equipment outside the limits of trench excavation.
- C. If necessary to prevent sliding and caving, cut the trench banks back on a slope above an elevation two (2) feet above the outside top of the pipe to reduce the earth load on the trench sides. Never exceed the specified maximum width until 2 ft. above the outside top of the pipe. See Section 2000 – Trench Safety.

D. Do not advance trench excavation more than three hundred (300) feet ahead of the completed pipe work and backfill.

E. Standard Trench Widths:

Minimum

Outside pipe diameter + 12 inches

Maximum

Outside pipe diameter + 24 inches

3.06 EMBEDMENT AND BACKFILLING – GENERAL

A. Install all water pipe using approved embedment materials only.

B. It is essential that the complete backfill be done in such a manner to minimize voids in the backfill.

C. Backfilling includes refilling and consolidating the fill in the excavation up to the surrounding ground surface or road grade.

D. Use select native materials for backfilling in unpaved areas.

E. Use mechanical compaction devices manufactured for that purpose to compact backfill materials in trenches.

F. Use mechanical compaction devices manufactured for that purpose to compact backfill materials in trenches.

3.07 BEDDING AND BACKFILLING PIPE

A. Bed pipe as described below and in accordance with the standard trench details shown in Standard Detail Drawings. The intent of the bedding is to create a uniform support which will protect the pipe from localized stress points and to provide for a well graded trench bottom.

B. Extend the trench excavation to a minimum depth of six (6) inches below the bottom of the pipe.

C. Install bedding materials in no greater than eight (8) inch compacted lifts. Install bedding from six (6) inches below the pipe to six (6) inches above the pipe. Shovel slice bedding beneath the pipe haunches.

D. Provide the following cover for water pipe:

1. Minimum depth to the top of pipe for all water mains lines less than 12-inches diameter shall be 3 feet.

2. Minimum depth to the top of pipe for water lines 12-inches diameter and greater shall be 4 feet.
 3. Minimum depth of all water service lines from the main to the water meter shall be 30-inches.
- E. The maximum depth of bury for PVC pipe is sixteen (16) feet. Any depths greater than sixteen (16) feet require ductile iron pipe, unless approved by Washington Water Authority.

SECTION 3000

STEEL ENCASUREMENT PIPE

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. Provide encasement pipe jacked through bored tunnel for crossing of water lines under roadways where shown on the Drawings.
- B. Provide encasement pipe by open cut construction where shown on the Drawings.
- C. Pulling or jacking carrier pipe through encasement pipe.
- D. Providing synthetic end seals at ends of encasement pipe.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Encasement pipe: Smooth wall steel pipe conforming to ASTM A-53 / ASTM A283 / ASTM A-135, Grade B, CW, physical tests only (no hydrostatic test required). The pipe shall have beveled ends prepared for welded joints. The pipe steel shall have a minimum yield strength of 35,000 psi.
- B. Welding materials: Type required for materials being welded and conforming to applicable AWS Specifications.
- C. Grout: Cementitious grout shall consist of a preblend of lightweight aggregate, cement, fly ash and admix to prevent segregation and promote expansion upon setting. Loose bulk density for the dry mix materials shall be 30 to 35 pounds per cubic foot. Grout shall equal or exceed Strong-Seal Grout 250 - Product Code 2133 and shall be packaged in 2 cubic foot bags.
- D. Flowable Fill: Flowable fill shall conform to Section 206 – Flowable Select Material of the Arkansas State Highway and Transportation Department's Standard Specifications for Highway Construction, latest edition.
- E. Casing Spacers: Shall be stainless steel, Cascade Model CCS as manufactured by Cascade Waterworks Mfg. Co. or approved equal.
- F. Casing End Seals: Casing end seals shall be one-piece and be of the pull-over type construction. Overlapping style end seals are not permitted. Casing end seals shall be of a synthetic material that is designed for the specific application. Casing end seals shall be

secured to the encasement pipe and the carrier pipe with stainless steel bands. Casing end seals shall be Cascade Model CCES or approved equal.

- G. Polyethylene Encasement: Polyethylene encasement shall be in conformance to ANSI/AWWA C105/A21.5, latest revision.

2.02 MINIMUM THICKNESS

- A. The encasement pipe shall be capable of supporting all traffic and earth loads. The Contractor shall submit design calculations supporting the selection of the encasement pipe thickness used.
- B. Minimum wall thickness for encasement shall be as follows:

<u>Diameter of Encasement Pipe</u>	<u>Minimum Wall Thickness</u>
20" or less	0.250" (1/4")
24"	0.3125" (5/16")
30"	0.3750" (3/8")
36"	0.500 (1/2")

Sizes not listed above shall be determined on an as-needed basis by Washington Water Authority.

- C. When boring under railroad right-of-way, minimum thickness shall be determined by railroad standards.

2.03 MINIMUM DIAMETER

- A. The minimum diameter for encasement pipe shall be such that the carrier pipe, along with casing spacers and joint restraints, will not bind against the inside of the encasement pipe during installation. The minimum diameter of encasement pipe shall be as follows:

<u>Diameter of Carrier Pipe</u>	<u>Diameter of Encasement</u>
3"	6"
4"	8"
8"	16"
10"	20"
12"-14"	24"
16"-18"	30"
20"-24"	36"

PART 3 – EXECUTION

3.01 EXCAVATION

- A. Highway Bore: Do not set up equipment or begin excavating pit on state highway without permission of Arkansas Highway and Transportation Department District Engineer or his authorized representative.
- B. Railroad Bore: Do not set up equipment or begin excavating pit on or near railroad property without permission of the respective railroad company.
- C. Highway and railroad permits will be obtained by the Engineer-of-Record. Contractor shall coordinate with Washington Water Authority on obtaining Right-of-way permit from railroad and shall conform to all requirements therein.

3.02 INSTALLATION, ENCASEMENT PIPE

- A. General: Install encasement pipe at grade and alignment shown on Drawings. Allow for height of casement spacers when establishing grade for gravity line encasement pipe. Refer to Standard Details.
- B. Bores:
 - 1. Excavate pits and trenches required at each side of crossing to minimum width and length necessary for boring and jacking operation and carrier pipe installation.
 - 2. Carefully set steel guide rails in pit to attain specified grade and alignment.
 - 3. Keep pit pumped free of standing water. Maintain pit bottom to provide stable base for rails and equipment and firm footing for workmen. Granular material used in bottom of pit will not be paid for as “Additional Trench Bedding”.
 - 4. Provide temporary sheeting and bracing as necessary to prevent earth slides.
 - 5. Bore tunnel and simultaneously jack encasement pipe forward one section at a time. Connect sections by full penetration butt welding performed in accordance with AWS D1.1.
 - 6. Remove excavated soil from boring operation as it enters pit and dispose of it offsite.
 - 7. End seal shall be installed after the carrier pipe has been installed.
- C. Open Cut:

1. Excavate trench as required.
2. Steel encasement pipe shall be installed, bedded, and backfilled the same as ductile iron pipe.
3. Steel encasement pipe shall be poly wrapped.
4. End seal shall be installed after the carrier pipe has been installed.

3.03 INSTALLATION, CARRIER PIPE

- A. Pull or jack carrier pipe through encasement pipe. Do not allow cables or jacks to be in direct contact with carrier pipe while pulling or jacking pipe. Use timber or padded steel member.
- B. A minimum of three casing spacers shall be installed on pipe up to 20-foot pipe joints.
- C. All carrier pipe installed through the encasement shall be fully restrained. Over-belling of the carrier pipe shall be prevented.

3.04 BACKFILL

- A. Prior to backfill, seal ends of encasement pipe with an end seal as shown in the Standard Details.
- B. Use material excavated from pit.
- C. Backfill against ends of encasement pipe.
- D. Backfill pit and carrier pipe in same manner as specified in Section 2300 – Excavation, Backfilling, and Compacting.

3.05 CLEANUP

- A. Clean up ground surface around work area in same manner as specified for line work in Section 2300 - Excavation, Backfilling and Compacting.

SECTION 3001

PVC ENCASEMENT PIPE

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. Provide encasement pipe directional bored tunnel for crossing of 2-inch water lines only under roadways where shown on the Drawings.
- B. Provide encasement pipe by open cut construction where shown on the Drawings.
- C. Pulling carrier pipe through encasement pipe.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Encasement pipe shall be Polyvinyl Chloride Pipe made from Type 1, Grade 1 or Grade 2, Polyvinyl Chloride Plastic conforming to ASTM D1784 and CS-256.
- B. The pipe shall conform to ASTM D2241 as it applies to Type 1, Grade 1 or Grade 2, Polyvinyl Chloride Plastic, SDR 17 Pressure Class 250.
- C. The joints shall be designed so that the pipe and fittings may be connected on the job without the use of glue or adhesive or any special equipment. The pipe and fittings shall have a push-on joint consisting of a single wire ring reinforced rubber gasket. The gasket and the annular recess shall be so designed and shaped that the gasket is locked in place against displacement as the joint is assembled. Gasket dimensions shall be in accordance with manufacturers' standard design dimensions and tolerances and shall be of such size and shape as to provide an adequate compressive force against the plain end and socket after assembly to effect a positive seal under all combinations of joint and gasket tolerances. Gaskets shall be vulcanized natural or vulcanized synthetic rubber. No reclaimed rubber shall be used. The joint shall be designed to withstand the same pressures as required for the pipe. The joint shall be designed so as to provide for the thermal expansion or contraction experienced with a temperature change of at least 75°F.
- D. The pipe may be furnished in manufacturers' standard lengths.
- E. The pipe shall conform to the specifications 14 and 61 of the National Sanitation Foundation Testing Laboratories, Ann Arbor, Michigan.

- F. As a minimum, the pipe and fittings shall have the following data applied to each piece: Nominal Size, Type of Material, SDR or Class, Manufacturer, NSF (National Sanitation Foundation seal of approval)
- G. Casing end seals shall be one-piece and be of the pull-over type construction. Overlapping style end seals are not permitted. Casing end seals shall be of a synthetic material that is designed for the specific application. Casing end seals shall be secured to the encasement pipe and the carrier pipe with stainless steel bands.

2.02 MINIMUM DIAMETER

- A. The minimum diameter for encasement pipe shall be such that the carrier pipe, along with casing spacers and joint restraints, will not bind against the inside of the encasement pipe during installation. The minimum diameter of encasement pipe shall be as follows:

<u>Diameter of Carrier Pipe</u>	<u>Diameter of Encasement</u>
2" ONLY	4"

PART 3 – EXECUTION

3.01 EXCAVATION

- A. Highway Bore: Do not set up equipment or begin excavating pit on state highway without permission of Arkansas Highway and Transportation Department District Engineer or his authorized representative.
- B. Railroad Bore: Do not set up equipment or begin excavating pit on or near railroad property without permission of the respective railroad company.
- C. Highway and railroad permits will be obtained by the Engineer-of-Record. Contractor shall coordinate with Washington Water Authority on obtaining Right-of-way permit from railroad and shall conform to all requirements therein.

3.02 INSTALLATION, ENCASEMENT PIPE

- A. General: Install encasement pipe at grade and alignment shown on Drawings.
- B. Bores:
 - 1. Excavate pits and trenches required as necessary at each side of crossing to minimum width and length necessary for boring operation and carrier pipe installation.

2. Keep pit pumped free of standing water. Maintain pit bottom to provide stable base for rails and equipment and firm footing for workmen. Granular material used in bottom of pit will not be paid for as “Additional Trench Bedding”.
4. Provide temporary sheeting and bracing as necessary to prevent earth slides.
5. Remove excavated soil from boring operation as it enters pit and dispose of it offsite.
6. End seal shall be installed after the carrier pipe has been installed.

C. Open Cut:

1. Excavate trench as required.
2. Encasement pipe shall be installed, bedded, and backfilled.
3. End seal shall be installed after the carrier pipe has been installed.

3.03 INSTALLATION, CARRIER PIPE

- A. Pull carrier pipe through encasement pipe

3.04 BACKFILL

- B. Use material excavated from pit if necessary.
- C. Backfill against ends of encasement pipe.
- D. Backfill pit and carrier pipe in same manner as specified in Section 2300 – Excavation, Backfilling, and Compacting.

3.05 CLEANUP

- A. Clean up ground surface around work area in same manner as specified for line work in Section 2300 - Excavation, Backfilling and Compacting.

SECTION 3100

CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. This section covers cast-in-place concrete materials, reinforcing steel, forms, and finishing in conjunction with water and sewer construction.
- B. Use Class B Concrete for all structures.
- C. Use Class A Concrete for bedding and blocking only.

1.02 SUBMITTALS

- A. Submit mix design, equipment details, and vendor name for field batched concrete.

PART 2 – PRODUCTS

2.01 CONCRETE

- A. Concrete: composed of Portland Cement; fine and coarse aggregate; water; and an air entraining agent. Provide either Class A concrete or Class B concrete as described below.
- B. For Class A and Class B concrete use ready-mixed concrete; conform to ASTM C 94, latest edition; deliver and place within one hour after all materials have been placed in the mixing drum.
- C. The concrete mix shall be designed so that the proportions will produce results that will meet the requirements of Class A or Class B concrete. Proportion components, except water, by weight. Water may be measured by volume. One sack of Portland Cement consists of one cubic foot or 94 pounds. Proportion components to meet these requirements:
 - 1. Class A Concrete:
 - a. Maximum net water/cement ratio = 0.49
 - b. Slump range: 1 - 4 inches
 - c. Minimum 28-day compressive strength: 3,000 PSI
 - 2. Class B Concrete:

- a. Maximum net water/cement ratio = 0.49
 - b. Slump range: 1 - 4 inches
 - c. Minimum 28-day compressive strength: 4,000 PSI
 - d. Air Content: 4 – 7
- D. Before beginning any concrete work, the Contractor shall have the concrete mix designed and the ingredients selected and proportioned by an approved independent testing laboratory meeting the requirements of ASTM E 329. Certified copies of all laboratory trial mix reports shall be sent to the Engineer from the testing laboratory for review. Do not place concrete prior to the Engineer's review and acceptance in writing of the concrete mix design.
- E. Cement: Portland Cement conforming to AASHTO M 85, Type I. Use Type III cement (high early strength) only if approved by the Engineer.
- F. Fly ash: Fly ash may be used as a partial cement replacement not exceeding 10% by weight of the cement when approved by Washington Water Authority. When fly ash is used, the total weight of both cement and fly ash will be used in design calculations.
- G. Water: potable water free from injurious amounts of acids, alkalis, oils, sewage, vegetable matter and dirt.
- H. Air entraining agent: use in all Class B concrete as required; conform to AASHTO M 154; add to the mixing water in solution; proportion to provide four (4) to seven (7) percent air in the concrete.
- I. Fine aggregate: clean, hard, durable particles of natural sand free from injurious amounts of organic impurities; conform to the gradation requirements of AASHTO T 27.
- J. Coarse aggregate: clean, hard, and durable crushed stone or washed gravel; reasonably well graded from course to fine; per AASHTO T 27.

2.02 REINFORCEING STEEL

- A. Steel bars: deformed, conforming to ASTM A 615 or A 617.
- B. Steel wire: conform to ASTM A 82, Cold-Drawn Steel Wire for Concrete Reinforcement.
- C. Wire mesh: conform to ASTM A 185; gauge and mesh per plans.
- D. Submit reinforcing steel bars shop drawings for approval.

- E. All steel reinforcement: free from rust, scale, mortar, dirt, or other objectionable coatings.

PART 3 – EXECUTION

- A. Perform excavation per Section 2300 - Excavation, Backfilling, and Compacting.
- B. Build forms neat, square, and flat so concrete will have smooth finish when forms are pulled. Construct forms to provide finished concrete to dimensions shown on plans.
- C. Place reinforcing steel accurately in accordance with details shown on the plans and properly secure in position.
- D. Concrete shall not be placed when the temperature is below 40° F and dropping or below 35° F if the temperature is rising, unless approved by the Engineer.
- E. Vibrate all structural concrete as it is placed using internal vibrators capable of transmitting vibration to the concrete at frequencies not less than 4,500 impulses per minute. Do not use form vibrators. Limit vibration to provide satisfactory consolidation without causing segregation. Do not insert vibrator more than six (6) inches into the lower courses previously vibrated. Use vibrators in a substantially vertical position; insert at uniformly spaced points no farther apart than the visible effectiveness of the vibrator.
- F. Allow concrete to cure for at least 48 hours before stripping forms. If concrete is in a structural member, do not remove forms until the concrete can withstand safely all superimposed loads.
- G. On all exposed surfaces, remove all fins and projections so the surface is smooth. Cut out and fill with grout any honeycombed areas. Extensive honeycombing is not allowable.
- H. All concrete shall be properly protected from too rapid curing or from freezing while green. If the weather is hot or dry, all freshly placed concrete shall be covered with a matting or other suitable material and kept moist for at least ten (10) days after pouring, or an approved curing compound may be used with the approval of the Engineer of Record.

SECTION 4000

WATER PIPE, FITTINGS, AND MATERIALS

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. This section covers the manufacture, transportation, and storage of pipe, pipe joints, fire hydrants, fittings, and other materials for water lines and service lines.
- B. Use only materials approved by Washington Water Authority.

1.02 SUBMITTALS

- A. Use of materials other than those specifically listed below is prohibited.
- B. Submit the manufacturer's certificate that the materials meet with these Specification requirements including material testing requirements.

1.03 LEAD-FREE BRASS

- A. All brass shall be manufactured in accordance with the Safe Drinking Water Act as amended to be LEAD-FREE brass (< 0.25% Pb).

PART 2 – PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) PIPE FOR WATER LINES

- A. PVC pipe less than 4 inches diameter shall not be used for main lines.
- B. PVC pipe 4 inches through 12 inches shall be manufactured in accordance with AWWA C900, latest revision, and shall be DR 14.
- C. PVC pipe, couplings, and fabricated fittings shall be made from virgin PVC resin that has been compounded to provide physical and chemical properties that equal or exceed cell class 12454 as defined in ASTM D1784, latest revision. Clean, reworked material generated from the manufacturer's own production shall be acceptable as long as the pipe produced meets all the requirements of the Specifications.
- D. Pipe shall have push-on rubber gasketed joints designed in accordance with ASTM D3139 and rubber gaskets complying with ASTM F-477.
- E. Nominal laying length shall be 20 feet. Minimum length of a cut section of pipe shall be 5 feet.

- F. Marking on pipe and shall include the following and shall be applied at intervals of not more than 5 feet.
 - 1. Nominal size in inches and OD base (for example, 8 PVC).
 - 2. PVC.
 - 3. Dimension ratio (for example, DR 14).
 - 4. AWWA designation number for this standard (ANSI/AWWA C900, or ASTM D-2241).
 - 5. Manufacturer's name or trademark and production run record or lot code.

G. PVC pipe for water lines shall be blue in color.

2.02 DUCTILE IRON PIPE FOR WATER LINES

- A. Ductile Iron Pipe shall conform to the requirements of "Ductile-Iron Pipe, Centrifugally Cast" AWWA Standard C151/A21.51, latest revision.
- B. Ductile iron pipe shall be designed in accordance with the requirements of "Thickness Design of Ductile-Iron Pipe", ANSI/AWWA C150/A21.50, latest revision. Minimum pressure class shall be 350 psi.
- C. Joint connections, pipe, and fittings (latest revision):
 - 1. Push on and mechanical rubber gasket joints: ANSI/AWWA C111/A21.11.
 - 2. Flanged: ANSI/AWWA C115/A21.15, ANSI B16.1.
- D. Nominal laying length shall be 20 feet. Minimum length of a cut section of pipe shall be 5 feet.
- E. Weights and Marking: Weights of pipe and fittings shall conform strictly to the requirements of ANSI Specifications. The weight, class or nominal thickness, and casting period shall be shown on each pipe. The manufacturer's mark, country where cast, year in which the pipe was produced, and the letters "DI" or "DUCTILE" shall be cast or metal stamped on the pipe, and letters and numerals on pipe sizes 14 in. (356 mm) and larger shall be not less than 1/2 in. (13 mm) in height.
- F. Corrosion Control

1. Outside coating shall be an asphaltic coating approximately 1 mil thick. The coating shall be applied to the outside of all pipe.
2. The interior lining for use under normal conditions shall be a cement– mortar lining and without seal coat in accordance with the latest revision of ANSI/AWWA C104/A21.4, latest revision, and NSF 61.
3. Polyethylene wrap in tube or sheet form conforming to the requirements of ANSI/AWWA C105/A21.5, latest revision.

2.03 HIGH DENSITY POLYETHYLENE (HDPE) PRESSURE PIPE AND TUBING

- A. HDPE tubing 3/4 inches through 3 inches in size may be used for service lines and shall be manufactured in accordance with AWWA C901, latest revision. Tubing shall be SDR 9 or SDR 7 depending on pressure conditions. Color shall be black or blue.
- B. HDPE pipe 4 inches through 24 inches in size may be used for water mains and shall be manufactured in accordance with AWWA C906, latest revision. Pipe shall be SDR 9 or SDR 7 depending on pressure conditions. Color shall be black or blue. Use of HDPE pipe for water distribution will be considered on a case-by-case basis.
- C. Marking on pipe and tubing shall include the following and shall be applied at intervals of not more than 5 ft.
 1. Nominal size and diameter base (e.g., ID, OD, IPS, or CTS).
 2. SIDR, SDR, or minimum wall thickness.
 3. The manufacturer’s name or trademark.
 4. The material designation code
 5. The AWWA pressure class
 6. The AWWA designation number for this standard (e.g., AWWA C901).
 7. The manufacturer’s production (lot) code that includes information such as resin source, manufacturing location, extrusion outlet (line), and manufacturing date.
 8. If not included in the manufacturer’s production code, the manufacturing date, including day, month, and year in a recognized standard format. The date format should be readily recognized as a date.
 9. The seal or mark of the testing agency that certifies the material.

2.04 POLYETHYLENE ENCASUREMENT (PIPE WRAP)

- A. Polyethylene encasement shall be in conformance to ANSI/AWWA C105/A21.5, latest revision. The virgin linear low-density polyethylene film shall have a minimum normal thickness of .008 inches (8 mils) and shall be provided in either flat tube or sheet form.
- B. The color shall be black with nominal 2% carbon black UV inhibitor and printed per the AWWA C105 standard.
- C. Tape for field taping of polywrapped pipe, fittings, etc. or field repair of missing polyethylene encasement material shall be Polyken #900, Scotchrap #50 or equal, at least 2-inches wide, and installed as per the Polyethylene Encasement Installation Guide published by DIPRA. Duct Tape is not permitted.
- D. All buried iron pipe, valves, and fittings shall be double wrapped.

2.05 DUCTILE IRON FITTINGS

- A. All ductile iron fittings shall conform to the requirements of ANSI/AWWA C153/A21.53, latest revision, for Ductile Iron Compact Fittings. All fittings shall be MJ x MJ and require Megalug joint restraints. All fittings shall be fusion-bonded epoxy coated inside and outside in accordance with ANSI/AWWA C116/A21.16.
- B. Solid sleeves shall be long bodied only.

2.06 SWIVEL ADAPTERS AND HYDRANT TEES

- A. Swivel adapters and hydrant tees shall be designed for a working pressure of at least 250-psi and to fit standard mechanical joint fittings (AWWA C111). One end of the swivel adapter and the branch of the hydrant tee shall be provided with a gland that may be rotated 360 degrees on the fitting. Lengths of swivel adapters shall be as specified.

2.07 MECHANICAL JOINT RETAINER GLANDS

- A. Restraint devices for mechanical joint fittings and appurtenances for nominal pipe sizes 3-inch through 48-inch shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10.
- B. Mechanical joint retainer glands shall be made from ductile iron and shall be designed for a working pressure of at least 350-psi for 3-inch through 12-inch ductile iron pipe, at least 305-psi for 3-inch through 12-inch PVC, and at least 250-psi for 18-inch through 48-inch ductile iron pipe. Buried pipe mechanical joints shall comply with AWWA C153 and AWWA C111.

- C. Retainer glands shall have an approved coating system for corrosion resistance equivalent to MEGA-BOND® and manufacturing traceability. Retainer glands shall be manufactured by EBAA Iron.

2.08 PIPE RESTRAINTS

- A. Bell restraints for AWWA C900 PVC sizes 4-inch through 12-inch shall be Series 1900 Restraint Harness, as manufactured by EBAA Iron, Inc. Devices shall have an approved coating system for corrosion resistance equivalent to MEGA-BOND® and manufacturing traceability.
- B. Bell restraints for Ductile Iron Pipe sizes 4-inch through 48-inch shall be Series 1700 Restraint Harness, as manufactured by EBAA Iron, Inc. Devices shall have an approved coating system for corrosion resistance equivalent to MEGA-BOND® and manufacturing traceability.
- C. When all-thread attachments are required, eye-bolt style attachments are not permitted. Romac “Ductile Lug” style attachments or approved equal shall be used. All-threads shall be made of 316 stainless steel.

2.09 RESTRAINED FLANGED COUPLING ADAPTERS

- A. Flanged coupling adapters used to transition from plain end pipe to a flanged fitting, above ground, shall be EBAA Iron Series 2100 Megaflange.
- B. Pressure rating shall be a minimum of 250 psi.

2.10 RESTRAINED COUPLINGS

- A. Restrained couplings to connect two pieces of pipe, size on size, shall be EBAA Iron Series 3800 Restrained Coupling.
- B. Pressure rating shall be a minimum of 250 psi.

2.11 BOLTS AND NUTS

- A. All bolts and nuts for valves, fittings, and restraints shall be 316 stainless steel unless otherwise indicated. Anti-seize lubricant shall be used when assembling all stainless steel hardware to reduce galling.

2.12 GATE VALVES

- A. Gate valves 2-inch through 12-inch nominal pipe size shall be resilient-seated type, non-rising stem gate valves, in conformance with the requirements of AWWA C509 or AWWA C515, latest revision.

- B. Gate valves shall be Made in USA and shall be Mueller Series 2360, or Washington Water Authority approved equal.
- C. All gate valves shall be designed for a minimum of 250 psi working pressure. All gate valves shall have 304 stainless steel bolts.
- D. All gate valves shall have O-ring stem seals. The O-ring stem seal shall be so designed that the seal above the stem collar can be replaced with the valve under pressure in the full-open position.
- E. Gate valves shall have standard mechanical joint ends unless otherwise indicated on the Drawings.
- F. Buried gate valves shall be designed for operation with a nominal 2-inch square operating nut. The standard direction of opening shall be open left as viewed from the top.
- G. Handwheels for gate valves shall be in conformance to AWWA C515, latest revision.
- H. The interior and exterior of the valve body and bonnet shall have factory applied fusion bonded epoxy coating meeting AWWA C550, latest revision.
- I. Valves shall be tested in accordance with AWWA C515, latest revision.
- J. Markings shall be cast on the bonnet or body, or stamped on a permanently affixed corrosion resistant tag of each valve.
 - 1. Manufacturer's name or mark.
 - 2. Year the valve casting was made.
 - 3. Size of the valve.
 - 4. Letters C509 or C515
 - 5. Working water pressure (e.g., 250W)

2.13 BUTTERFLY VALVES

- A. Butterfly valves 14-inch and larger shall conform with the requirements of AWWA C504, latest revision, for Rubber-Seated Butterfly Valves.
- B. Butterfly valves shall be Pratt Groundhog Butterfly Valves, or Washington Water Authority approved equal.

- C. Butterfly valves shall be designed for a minimum of 250 psi working pressure. Butterfly valves shall have 304 stainless steel bolts.
- D. Butterfly valves shall be of the tight closing, synthetic rubber-seat type, as follows:
 - 1. Valves 20 inches (nominal diameter) and smaller shall have bonded seats which are simultaneously molded in, vulcanized, and bonded to the body. Seat bond must withstand 75 pounds pull under test procedure ASTM D429, Method B.
- E. Valve discs shall utilize an on-center shaft and symmetrical design and be cast from Ductile Iron ASTM A 126 Class B. The disc edge shall be stainless steel type 316.
- F. Butterfly valves shall have standard mechanical joint ends unless otherwise indicated on the Drawings.
- G. Buried butterfly valves shall be designed for operation with a nominal 2-inch square operating nut. The standard direction of opening shall be open left as viewed from the top. The valve shaft shall be constructed of stainless steel and the bearings shall be corrosion resistant and self-lubricating. The valves shall be equipped with a totally enclosed type operator, fully gasketed and grease packed, suitable for direct burial.
- H. The interior and exterior of the valve body and bonnet shall have factory applied epoxy coating system meeting AWWA C550, latest revision.
- I. Valves shall be tested in accordance with AWWA C504, latest revision.
- J. Markings shall be cast on the bonnet or body or stamped on a permanently affixed corrosion resistant tag of each valve.
 - 1. Manufacturer's name or mark.
 - 2. Year the valve casting was made.
 - 3. Size of the valve.
 - 4. Class (e.g., 250B)

2.14 VALVE BOXES

- A. Valve boxes shall be Made in USA and shall be East Jordan Iron Works 8550 Series or Tyler Union 6850 Series, screw type, and shall be of correct length to match the bury of the main.

- B. The valve box and appurtenances shall include a base and a top section with a drop lid. The lid shall be marked with the word "WATER". All lids shall have a concrete pad with a minimum of 24 inches round dimension and shall be grouted in place.
- C. Lids on valves on fire lines shall be marked with the word "FIRE".
- D. Markings shall be cast on each part:
 - 1. Manufacturer's name or mark.
 - 2. Model number
 - 3. Year the casting was made.
 - 4. Material of construction
 - 5. USA
- E. A valve box alignment device shall be provided and installed for each valve box installation. The device shall be of HDPE or Glass Filled Polypropylene construction. It shall be furnished in two pieces that will lock together under the operating nut of the valve without requiring the removal of the operating nut. The device shall not affect the operation of the valve. The device shall be AFC Alignment Ring as manufactured by American Flow Control.

2.15 OPERATING NUT EXTENSIONS

- A. Operating nut extensions shall be used when the top of the operating nut is greater than 4 feet from the top of finished surface.
- B. The stem shall be 1" SCH40 steel pipe with a 2-inch square bar steel operating nut attached to the upper end. The stem extension shall be of adequate length to reach from the valve operating nut to a point within 24-inches to 12-inches of the finished surface. A box wrench, 2 1/8" I.D. square, made from steel 3/16-inches thick shall be welded to the lower end of the stem extension which will fit over the valve operating nut. Two-inch valves with a tee-head operating nut will require a rectangular shaped box wrench on the end of the valve stem extension. The extension shall be secured to the valve operating nut by two 3/8" set screws. A round center guide made from 1/8-inch or 3/16-inch steel plate shall be placed on the valve stem extension approximately 6-inches from the upper end. The diameter of the guide shall be slightly less than the inside diameter of the valve box. The guide shall be affixed to the stem extension in such a way that it can rotate freely on the stem. Welds on stem extensions (top and bottom nut) shall be 1/8" - 3/16" fillet weld around full circumference.

- C. Shop drawings shall be submitted to Washington Water Authority for approval prior to installing the stem extension pieces.

2.16 FIRE HYDRANTS

- A. Fire hydrants shall be dry barrel hydrants in conformance with AWWA C502, latest revision. Fire hydrants shall be designed for a working pressure of 250 pounds per square inch gauge. Fire hydrants shall be three-way.
- B. Paint for Washington Water Authority hydrants:
 - 1. Surface preparation standard shall be SSPC-SP6/NACE 3 Commercial Blast Cleaning.
 - 2. Fire hydrants shall be Reflective Red, coated with Sherwin Williams (SW) KEM400 with paint code F75RH1 with glass beads; commonly known as Mueller Red.
 - 3. All coating thicknesses shall be according to manufacturer's recommendations.
 - 4. The brass tag on the bonnet of the hydrant will not be painted.
- C. Fire hydrants shall be Mueller Super Centurion 250.
- D. Hydrants shall have a 6-inch mechanical joint inlet in conformance to the dimensions shown in ANSI/AWWA C110/A21.10, latest revision. Three-way hydrants shall have a 5-1/4-inch valve opening.
- E. Fire hydrants shall be equipped with a two-piece barrel with a safety stem coupling and a break-away flange at the ground line and shall be designed for a 48-inch bury.
- F. Hydrants shall be equipped with two 2-1/2-inch hose nozzles and one 4-1/2 inch pumper nozzle. The operating nut shall be a nominal 1-1/2-inch pentagon, National Standard operating nut designed to open left (counterclockwise).
- G. Hydrants shall be supplied with heavy duty, non-kinking nozzle cap chains.
- I. A fire hydrant extension shall be installed in all locations where the centerline of the pumper nozzle is less than 18-inches above the finished grade elevation. The extension shall bring the centerline of the pumper nozzle between 18-inches and 24-inches above the finished grade elevation. The centerline of the pumper nozzle shall be 24-inches above rough grade elevations where sidewalks and yards will be installed in the future, in new subdivisions only. Extensions shall be Mueller A-320, with no more than one extension allowed per hydrant.

- J. Identifications tags shall be installed indicating the depth of bury of all hydrants. Additional tags shall be installed indicating the length of any extension installed.

2.17 BLOW-OFFS

- A. Blow-off hydrants shall be 2-inch post type with 2-1/2-inch hose nozzle having National Standard threads.
- B. Hydrant shall have 2-inch shut-off valve and integral drain.
- C. Hydrant shall have threaded inlet.
- D. Hydrant shall be furnished for 3'-6" bury, with cap chain, and shall be painted red.
- E. Blow-Off Hydrants shall be Maingaurd #77 or approved equal.

2.18 AIR RELIEF VALVES

- A. All water mains shall have 1"-2" single bodied combination air and vacuum valves where indicated on the drawings. Valves shall have epoxy coated and lined cast iron bodies with stainless steel or non-metallic internal parts. Valves shall have a minimum 250 psi working pressure. Valves shall be listed under NSF-61 and shall have ISO 9001 certificate. Valves shall be supplied with a male thread outlet or flanged outlet. All nipples and isolation valves for 1"-2" valves shall be brass or stainless steel. Ball style isolation valve shall be full port.
- B. Air release valves shall be Val-Matic Model No. 201C for 1-inch or Val-Matic Model No. 202C for 2-inch or approved equal.

2.19 SERVICE SADDLES

- A. Service saddles for 1", and 2" NPT service taps shall be Romac 101NS or Mueller DR1S, and properly sized for use on the specific pipe being tapped.

2.20 TAPPING SLEEVES

- A. Tapping sleeves shall be designed for a minimum 250 psi working pressure and the material being tapped. All bolts and nuts shall be stainless steel. Tapping sleeves for 4-inch through 18-inch shall be stainless steel. Tapping sleeves shall have a MJ outlet. Tapping sleeves shall be Mueller H-304SS or Ford FTSS.

2.21 SERVICE CONNECTION MATERIALS

- A. Materials and standards for larger meters (2-inch and greater) are not listed in the standard

specifications. Larger meter installations require a site-specific design. Please contact Washington Water Authority if you require a meter size 3-inch or greater.

Single Meter Set

Main diameter x 1" saddle	Romac 101 NS Mueller DR1S
1" corporation stop	Ford FB1000-4-NL Mueller P-25008N
1" HDPE pipe with inserts	
5/8" x 3/4" x 7" meter yolk	Ford VBH-72-7W-4F-44-NL Mueller 234P24981R2-N
1/2" x 16" SCH 40 PVC brace	
12"x1" Brass Nipple with PVC cap Tailpiece	
Meter Box	Carson Industries 2200
18" cast iron flat meter lid	East Jordan 109

Double Meter Set

Main diameter x 1" saddle	Romac 101 NS Mueller DR1S
1" corporation stop	Ford FB1000-4-Q-NL Mueller P-25008N
1" HDPE pipe with inserts	
1" x 7.5" x 3/4" U branch	Ford U48-43-6.5-NL Mueller P-15363N
5/8" x 3/4" x 7" meter yolk	Ford VBH-72-7W-11-34-NL Mueller 234P24981R2-N
1/2" x 16" SCH 40 PVC brace	
12"x1" Brass Nipple with PVC cap Tailpiece	
Meter Box	Carson Industries 2200
18" cast iron flat meter lid	East Jordan 109

1-inch Meter Set

Main diameter x 1" saddle	Romac 101 NS Mueller DR1S
1" corporation stop	Ford FB1000-4-Q-NL Mueller P-25008N
1" HDPE pipe with inserts	
1" x 12" meter yolk	Ford VB74-12W-44-44-Q-NL
3/4" x 16" SCH 40 PVC brace	
12"x1" Brass Nipple with PVC cap Tailpiece	
24" diameter x 24" deep SDR51 PVC meter	
24" cast iron flat meter lid	East Jordan 111

2.22 TRACER WIRE

- A. Tracer wire shall be 12-gauge solid coated copper for underground burial.
- B. Jacket color shall be BLUE and made of High Density Polyethylene (HDPE) or High Molecular Weight Polyethylene (HMWPE) designed for direct burial.
- C. Connectors shall be used for all splices or repairs. Connectors shall be moisture displacement style as manufactured by 3M DBR, or equal.
 - 1. A locate or conductivity test shall be performed prior to signing off on the project.
 - 2. Wire shall be new and shall have the size, grade of insulation, voltage, and manufacturer's name permanently marked on outer covering at regular intervals. Insulation shall be type THHN, THWN, or XHHW and rated 600 volt, 75 degrees C or higher for wet locations.

2.23 MARKING TAPE

- A. At the request of Washington Water Authority, marking tape may be a requirement of design and will be considered on a case-by-case basis.
- A. Non-metallic water marking tape shall be warning tape as manufactured by Terra Tape "Extra Stretch", Rhino Marking and Protection Systems, Harris Industries, Inc., or approved equal.
- B. Tape shall have a minimum thickness of 4 mils and manufactured with heavy metal-free polyethylene tape that is impervious to all known alkalis, acids, chemical reagents, and solvents found in soil. The minimum overall width of the tape shall not be less than 3-inches.
- C. The tape shall be color coded Safety Blue and imprinted with the following message:
Caution – Buried Water Line Below

2.24 WATER LINE MARKERS

- A. Fiberglass post utility markers shall be fiberglass reinforced composite, 3.75 inches wide, and 72 inches long.
- B. Fiberglass post utility markers shall be blue in color.
- C. Fiberglass post utility markers shall have decals for visible identification of buried water line day or night.
- D. Signs shall be by Carsonite International, or equal.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Water Lines: Refer to Section 4100
- B. Water Service Lines: Refer to Section 4100

SECTION 4100

INSTALLATION OF WATER PIPE, FITTINGS, AND MATERIALS

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. Installation of Water Lines
- B. Installation of Water Services

1.02 SUBMITTALS

- A. Submit to the Engineer and Washington Water Authority for approval and procedures not described in these specifications

1.03 PROTECTION

- A. In all cases, the Contractor is responsible for protecting public and private property and protecting any person or persons who might be injured as a result of the Contractor's Work.
- B. All utilities shown on the drawings may not represent the exact location; however, the Contractor is responsible for verifying these locations and contacting "Arkansas One Call System" before excavating.

PART 2 – PRODUCTS

2.01 BEDDING AND BACKFILL

- A. Refer to Section 2300 – Excavation, Backfilling, and Compacting

2.02 PIPE, FITTINGS, AND MATERIALS

- A. Refer to Section 4000 – Water Pipe, Fittings, and Materials

2.03 CONCRETE

- A. Refer to Section 3600 – Cast-In-Place Concrete

PART 3 – EXECUTION

3.01 EXCAVATION – GENERAL

- A. Perform excavation and prepare in accordance with Section 2300 – Excavation, Backfilling, and Compacting.

- B. Never lay pipe in a water filled trench, or when trench conditions or weather are unsuitable for such Work.
- C. Divert surface water and de-water trenches during excavation.
- D. Excavate for bells so that the entire barrel of the pipe will be uniformly supported on the pipe bedding before placing pipe in the trench.

3.02 LAYOUT

- A. The Contractor shall install water lines, valves, fire hydrants, water meters, and other work as shown on the Drawings. Changes are not allowed without written notice from Washington Water Authority.

3.03 PIERS

- A. Install concrete piers as indicated on the plans per Section 3600 - Cast-In-Place Concrete.

3.04 COLD WEATHER INSTALLATION

- A. Washington Water Authority reserves the right to order pipe installation discontinued whenever, in its opinion, there is danger of the quality of work being impaired because of cold weather. The Contractor shall be responsible for heating the pipe and jointing material so as to prevent freezing of joints. Do not lay any pipe on frozen ground. No flexible or semi-rigid pipe shall be laid when the air temperature is less than 32°F unless proper precautions per the manufacturer's recommendations are taken by the Contractor and the method is approved by the Engineer and Washington Water Authority.
- B. When pipes with rubber gaskets or resilient-type joints are to be laid in cold weather, sufficiently warm the gasket or joint material so as to facilitate making a proper joint.

3.05 PIPE INSTALLATION – PUSH ON JOINTS

- A. Inspect each joint of pipe carefully internally and externally before it is placed in the trench. Plainly mark and separate from the remaining pipe any joint found to be cracked, warped, or otherwise damaged. Remove these damaged joints from the project site as soon as possible.
- B. Cut pipe in a neat and workmanlike manner without damage to pipe or pipe lining when trimming joint length. Cut ends shall be beveled according to the manufacturer's recommendation to prevent damage to the bell gasket.
- C. Use proper equipment for lowering sections of pipe into trenches. Lower pipe carefully into the trench so the spigot and bell will not become contaminated.

- D. Lay each pipe joint to line and grade as shown on the drawings. Keep a minimum of six inches between the pipe and the trench wall.
- E. Keep the pipe joints' interior clean from all dirt and other foreign matter as the Work progresses. Maintain the pipe's interior cleanliness until accepted or put in service.
- F. Close the open ends of the pipeline temporarily with an appropriate manufactured watertight plug at the end of each day's Work or when discontinuing pipe installation for an appreciable period.
- G. TRACER WIRE
 - 1. Tracer wire shall be installed on all buried water lines and service lines.
 - 2. Tracer wire shall be installed six inches above the pipe.
 - 3. Run wire continuous from valve box to valve box, meter box, or other access points. If no access point is available and a splice is required, provide a tracer wire splice pedestal consisting of a tracer wire splice pole and cap at nearest property line or at a location as approved by the Engineer.
 - 4. Pipe testing shall include trace wire. Contractor shall replace the trace wire along the pipe route for any areas in which the pipe cannot be located from the original trace wire installation.
 - 5. Wire breaks shall be repaired with repair kit at no additional expense to the Owner. Repair kits are to be used only to repair wire breaks that occur on tracer wire which has already been backfilled. The splice kit is used because there is not enough slack available in the tracer wire to splice the wire in a tracer wire splice pedestal. If the tracer wire is broken during installation, the Contractor should splice the wire in a tracer wire splice pedestal.

I. WATER LINE MARKERS

- 1. Fiberglass post markers shall be installed at highway crossings, creek crossings, railroad crossings, and valves

3.06 PIPE INSTALLATION – MECHANICAL JOINT CONNECTIONS

- A. All mechanical joint connections shall have Megalug joint restraints.
- B. The spigot end of the pipe, the bell of the connecting pipe, and the rubber gasket shall be thoroughly cleaned using soapy water and cloth, removing all foreign materials from the bells, especially the gasket seats as specified for push-on joints. Clean the gland in a

similar manner. An approved pipe lubricant shall be applied to the spigot end of the pipe and the gasket.

- C. After the gland and gasket are placed on the spigot end of the pipe, a sufficient distance from the end to avoid fouling the bell, insert the spigot end in the fitting bell to the point of firm contact with the bell shoulder. Then advance the rubber gasket into the bell and seat in the gasket seat. Hammering the gasket into the seat is not permitted. Exercise care to center the spigot end within the bell. Bring the gland into contact with the gasket, enter all bolts, and make all nuts hand tight. Exercise continued care to keep the spigot centered in the bell.
- D. Make the joints tight by turning the nuts with a torque wrench: First partially tighten a nut, then partially tighten the nut 180 degrees away from it. Work around the pipe with uniformly applied tension until the required torque is applied to all nuts.
- E. The Contractor shall provide a torque wrench suitable for measuring tension on bolts for at least such a time as the workmen making the joints have gotten the "feel" of the required tension. At no time should handles longer than those supplied by the wrench manufacturer be permitted. The torque range shall be as follows:

Diameter Inches	Range of Torque Foot Pounds
5/8	45 – 60
3/4	75 – 90
1	85 – 100
1-1/4	105 – 120

- F. Proper actuation of the gripping wedges for restraining glands shall be ensured with torque limiting twist off nuts. Tightening sequence shall be as follows. First partially tighten a nut, then partially tighten the nut 180 degrees away from it. Work around the pipe with uniformly applied tension until the required torque is applied to all nuts. Failure to follow proper the proper tightening sequence will result in the disassembly of the joint, removal of the current restraining gland, and installation of a new restraining gland. Any damaged PVC pipe shall be removed as well.
- G. All buried iron pipes, valves, and fittings shall be double poly wrapped.

3.07 SOLID SLEEVE INSTALLATION

- A. Solid sleeves shall be installed the same as mechanical joint connections for pipe installation.
- B. The maximum gap between the two pipes being connected by a solid sleeve shall be one-half (1/2) inch.

3.08 VALVE INSTALLATION

- A. All mechanical joint connections shall have Megalug joint restraints.
- B. Valves shall be jointed in accordance with the methods of jointing pipe as specified elsewhere herein. Valve stems shall be plumb and there shall not be any obstructions that will prohibit the installation of valve boxes directly over the stem. Megalug joint restraints shall be installed on all valves with mechanical joint ends.
- C. All valves shall be firmly supported from below with compacted crushed stone up to and including 12-inch valves, or concrete for all valves 14-inches and greater.
- D. All valves shall be polywrapped.
- E. Valve boxes shall be installed over the operating nut of each valve and be of adequate length to reach the finished ground or paved surface. Valve boxes shall be installed with a HDPE Valve Box Alignment Device of the proper size and manufacture to fit the valve and the valve box. Boxes shall be firmly supported, plumb, and centered over the valve operating nut. No part of the box shall rest on the valve. The box cover shall be flush with the finished surface.
- F. Operating nut extensions shall be used when the top of the operating nut is greater than 4 feet from the top of finished surface. The stem extension shall be of adequate length to reach from the valve operating nut to a point within 24-inches to 12-inches of the finished surface.
- G. Tracer wire shall be brought up on the OUTSIDE of the valve box. A “vertical” hole or notch shall be made through the valves box approximately 4-inches below the top. The tracer wire shall be pushed through the hole or notch. Approximately 12-inches of wire shall be coiled inside the valves box for traceability. The tracer wire shall not interfere with the insertion of the lid onto the valve box.
- H. All lids shall have a pre-cast concrete collar with a minimum dimension of 24 inches round as appropriate. All collars shall have 3 inches of Class 67 Base or grit base under the collar and shall be grouted in place.

3.09 FIRE HYDRANT INSTALLATION

- A. Pipe used to install fire hydrants from the main line to the base of the fire hydrant shall be 6- inch pipe, if less than 10' in length. All pipe from the valve on the water main to the fire hydrant shall be fully restrained.
- B. Pipe used to install fire hydrants from the main line to the base of the fire hydrant shall be 8- inch pipe, if equal to or greater than 10' in length. A separate maintenance valve, in

addition to the valve anchored to the main, shall be installed on all fire hydrant leads exceeding 10 feet.

- C. Hydrants shall be thoroughly cleaned before setting, removing all dirt and foreign matter from the barrel and bottom section up to the main valve. The main valve shall be in the "closed" position and the waste outlet shall be free of any obstructions.
- D. The Contractor shall take great care to protect the factory applied coating system. Means and methods for the protection of the fire hydrant are the responsibility of the Contractor. At no time shall chains or other abrasive materials come into contact with the factory applied coating system.
- E. Minor touchup for "incidental" scratches is permitted using factory provided touchup kits.
- F. When the factory applied coating system (from the bury line up), as identified by Washington Water Authority, has damage other than "minor scratches," a new upper barrel section shall be ordered and delivered from the factory, inclusive of all internal working parts up to the operating stem breakaway. The upper barrel shall be replaced, and the damaged upper barrel returned to the factory at no cost to Washington Water Authority. This includes, but is not limited to, excessive scratches, appearance of rust, or other aesthetic flaws. Field repainting of new fire hydrant installations is not permitted.
- G. Hydrants shall be located a safe distance from driveways, roadways, and narrow type sidewalks and in a manner to provide complete accessibility, and they shall stand plumb with nozzles at proper elevation. The hydrant's "bury line" shall be set at or no more than four (4) inches above the finished grade elevation; therefore, the bottom of hydrant nozzles shall be 18 to 24 inches above the finished grade elevation.
- H. Installation of fire hydrant extensions shall be made in the presence of the Engineer or the Engineer's representative and shall be per the manufacturer's instructions. The breakable flange and breakable stem coupling shall be removed and installed above ground level.
- I. The Contractor shall, if necessary, rotate the hydrant barrel or nozzle section at the flanged joint to obtain the desired nozzle position as specified by the Engineer. The pumper nozzle shall be at a right angle to and face the street unless otherwise directed by the Engineer.
- J. The bowl or bottom of the hydrant shall be supported firmly on the bottom and shall be braced against unexcavated earth at the end of the trench with concrete reaction backing. Solid concrete blocks may be used to support the bottom of the hydrant. If considered necessary by the Engineer, the hydrant shall be tied to the branch pipe with suitable Series 300 stainless steel rods or clamps. These rods or clamps shall be furnished by the Contractor without additional compensation.
- K. A drainage bed shall be provided under and around the base of the hydrant of at least six (6) cubic feet in volume and extending at least six inches (6") above the drain outlet and

shall consist of ASTM #67 gravel. Under no circumstances shall the drain outlet on the hydrant or the drainage bed be connected to a sewer.

- L. Backfilling and tamping around hydrant barrels shall be continuous in operation.
- M. If a fire hydrant is not located inside a concrete paved area, then a 15.0" x 15.0" x 4.0" (deep) Class "B" concrete pad shall be poured just below the break-away joint of the fire hydrant barrel.
- N. Fire hydrants, immediately after installation, shall be covered and wrapped with a heavy cloth, water-resistant sack, or black polyethylene sheeting, well taped in place around the hydrant, to identify the hydrant as being "not in service".

3.10 METER SETTINGS

- A. Meter settings shall be installed where shown on the Drawings and/or as directed by Washington Water Authority. Installation shall be as per the Standard Details. Meter setters shall be installed in a horizontal and plumb position within the meter box and at a depth to provide the required space between the top of the meter and the bottom of the meter box lid.
- B. A drainage bed consisting of ASTM #67 stone shall be placed a minimum of 6-inches thick and 6- inches outside the edge of the bottom of the meter box.
- C. Tracer wire shall be brought up on the INSIDE of the meter box with the water service line. Sufficient tracer wire shall be provided such that approximately 12-inches of wire will extend beyond the top of the box when pulled taut. The tracer wire shall be loosely coiled and place inside the meter box. Do not wrap the tracer wire around the meter setter.
- D. The bottom of the meter setter connections shall be visible at the bottom of the meter box at the time of testing and of final inspection. Any dirt or debris in the bottom of the meter box shall be removed before the project is released for final payment and/or acceptance.
- E. The final grade at the meter box location shall be determined by the Engineer of Record and the meter box shall be placed at that grade. Final grade should take into account probable future installation of topsoil and/or sod. Any boxes falling in driveways or sidewalks shall be relocated at the expense of the developer or lot owner. No meters shall be set by Washington Water Authority until the meter box is adjusted to the proper grade.

3.11 BLOW-OFF INSTALLATION

- A. Blow-off hydrants shall be thoroughly cleaned before setting, removing all dirt and foreign matter from the barrel and bottom section up to the main valve. The main valve shall be in the "closed" position and the waste outlet shall be free of any obstructions.

- B. Blow-off hydrants shall be installed in such a manner to provide complete accessibility, and they shall stand plumb with nozzles at proper elevation. The discharge nozzle shall be a minimum of 24-inches above finished grade elevation.
- C. The bowl or bottom of the blow-off hydrant shall be supported firmly on the bottom and shall be well braced against unexcavated earth on the backside of the blow-off hydrant. Solid concrete blocks, or other suitable material may be used to block the blow-off hydrant.
- D. A drainage bed shall be provided under and around the base of the blow-off hydrant of at least six (6) cubic feet in volume and extending at least six inches (6") above the drain outlet and shall consist of ASTM #67 gravel. Under no circumstances shall the drain outlet on the hydrant or the drainage bed be connected to a sewer.
- E. Backfilling and tamping around blow-off hydrant barrels shall be continuous in operation.
- G. Blow-off hydrants, immediately after installation, shall be covered and wrapped with a heavy cloth, water-resistant sack, or black polyethylene sheeting, well taped in place around the hydrant, to identify the hydrant as being "not in service".

3.12 TAPPING SADDLE INSTALLATION

- A. Tapping saddles shall be used 1-inch and 2-inch service taps.
- B. The pipe shall be free of dirt and other debris before attaching tapping saddle. That part of the pipe barrel, other than concrete pipe, which will be in contact with the gasket of tapping saddles, shall be smooth. All rough areas on the pipe barrel shall be smoothed. The Contractor shall field verify all pipe and fitting dimensions. Tapping saddles shall be installed at least twenty-four (24) inches from bell joints, fittings, end of pipe joint, or another tap.
- C. Tapping saddles shall be bolted securely to the pipe. The face of the outlet shall be zero to ten (0-10) degrees from horizontal. The bolts for tapping saddles shall be alternately tightened "snug" and then alternately tightened to a torque as recommended by the manufacturer.
- D. The tapping valve shall be attached securely to the tapping saddle to provide a watertight seal. Proper tools for installing brass hardware shall be used.
- E. The pilot drill and shell cutter shall be in good condition. The pilot, shell cutter, and any other component of the tapping machine that will or may come into contact with the interior of the tap valve or potable water pipe, shall be thoroughly sterilized with straight bleach or super-chlorinated solution. The shell cutter shall be the size required to cut the full opening specified.

F. After the tap is complete and the tapping machine has been removed, the bolts for the tapping saddle must be re-torqued per the manufacturer's specifications to ensure a proper seal.

G. The tapping saddle shall be enclosed in polyethylene material

3.13. TAPPING SLEEVE INSTALLATION

A. The pipe shall be free of dirt and other debris before attaching tapping sleeve. That part of the pipe barrel that will be in contact with the gasket of tapping sleeve, shall be smooth. All rough areas on the pipe barrel shall be smoothed. The Contractor shall field verify all pipe and fittings.

B. Tapping sleeves shall be bolted securely to the pipe. The face of the outlet shall be plumb. The bolts for tapping sleeves shall be alternately tightened "snug" and then alternately tightened to a torque as recommended by the manufacturer.

C. The tapping valve shall be bolted securely to the tapping sleeve. The tapping valve shall be adequately supported from beneath. The weight of the tapping valve shall not be supported by the tapping sleeve. A concrete "mud slab" at least six (6) inches thick shall be poured under the location of all tapping valves 14 inches and larger and the weight of the valve shall be supported by the mud slab. The tapping machine shall be bolted securely to the valve.

D. After installation of the tapping sleeve and the tapping valve and before drilling through the pipe, the assembly shall be hydrostatically by introducing water through the sleeve test tap.

E. The pilot drill and shell cutter shall be in good condition. The pilot, shell cutter, and any other component of the tapping machine that will or may come into contact with the interior of the tap valve or potable water pipe, shall be thoroughly sterilized with straight bleach or super-chlorinated solution. The shell cutter shall be the size required to cut the full opening specified.

F. Openings in the pipe barrel for tapping saddles installed on dry pipe shall be cut with a pilot drill and shell cutter. Torch cutting is not permitted.

G. Tapping operations must not commence before inspection by the Engineer or his authorized representative. Tapping operations must not commence before the tapping assembly has passed a pressure test. The tapping assembly shall be tested with both the valve open and closed.

H. Only qualified operators shall operate the tapping machine. The "coupon" shall be withdrawn and be given to the Engineer for inspection. Care shall be exercised to avoid

drilling or cutting the backside of the pipe by carefully assuring the engagement of the pilot drill and shell cutter shaft.

- I. After the tap is complete and the tapping machine has been removed, the bolts for the tapping sleeve must be re-torqued per the manufacturer's specifications to ensure a proper seal.
- J. All taps 14-inch and larger shall require the installation of a butterfly valve immediately after the tapping valve. The tapping valve shall be fully opened and abandoned in place.
- K. The tapping sleeve shall be enclosed in polyethylene material.
- L. Tapping sleeves shall be adequately thrust blocked with concrete.

3.14 INSTALL OF POLYETHYLENE PROTECTION MATERIAL

- A. Polyethylene material, either in tubing form or in the form of flat sheet or rolls, as specified herein, shall be placed around all buried mechanical joints of pipe and fittings, valves, fire hydrants, and all saddles, sleeves, and couplings, tapping saddles, and any other appurtenance with exposed bolts. Any and all iron or steel components installed below ground shall be wrapped with the polyethylene material.
- B. Ductile iron and steel pipe and appurtenances shall be completely encased in polyethylene tubing material. It is not the intent that the material form an enclosure that is absolutely air or watertight, but to prevent pipe to soil contact.
- C. Polyethylene tubing shall be applied to pipe by one of the following methods:
 - 1. Method "A": Cut polyethylene tubes to a length approximately two feet (4') longer than the length of the pipe section. Slip the tubes around the pipe, centering it to provide a one foot (2') overlap on each adjacent pipe section, and bunching it accordion fashion lengthwise until it clears the pipe ends. Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at joints to facilitate installation of the polyethylene tube. After assembling the pipe joint, take bunched polyethylene from the preceding length of pipe, slip it over the end of the new length of pipe, and secure in place. Then slip the end of the polyethylene from the new pipe section of the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Secure the overlap in place. Take up the slack width to make snug, but not tight, fit along the barrel of the pipe, securing the fold at quarter points with tape.
 - 2. Method "B": Cut polyethylene tubes to a length approximately one foot (1') shorter than the length of the pipe section. Slip the tubes around the pipe, centering it to provide six inches (6") of bare pipe at each end. Make polyethylene snug, but not tight, secure ends. Before making up a joint, slip two sections of six foot (6')

length of polyethylene tube over the end of the preceding pipe section, bunching it accordion fashion lengthwise. After completing the joint, pull the two sections of six foot (6') length of polyethylene over the joint, overlapping the polyethylene previously installed on each adjacent section of pipe by at least two feet (2'); make snug and secure each end.

- D. Pipe-Shaped Appurtenances. Bends, reducers, offsets, and other pipe-shaped appurtenances shall be covered with double layers of polyethylene in the same manner as the pipe.
- E. Odd-Shaped Appurtenances. Valves, tees, crosses, and other odd-shaped pieces which cannot practically be wrapped in a tube, shall be wrapped with two layers of flat sheets or split length of polyethylene tubes. The sheets shall be passed under the appurtenance and brought up around the body. Seams shall be made by bringing the edges together, folding over twice, and taping down. Slack width and overlaps at joints shall be handled as described in Paragraph 3.13.C.1 above. Tape polyethylene securely in place at valve stem and other penetrations.
- F. Openings in Tubing Material. Openings for branches, service taps, blow-offs, air valves, and similar appurtenances shall be made by making an "X" shaped cut in the polyethylene and temporarily folding the film back. After the appurtenance is installed, tape the slack securely to the appurtenance and repair the cut, as well as any other damaged areas in the polyethylene with tape.
- G. Junctions Between Wrapped and Unwrapped Pipe. Where polyethylene wrapped pipe joins a pipe that is not wrapped, extend the polyethylene tube to cover the unwrapped pipe a distance of at least two feet (2') and secure the end.
- H. The polyethylene material shall be secured around the pipe and appurtenances by at least three (3) circumferential wraps of tape.
- I. All tongs, cables, or chains that are used for lifting pipe and appurtenances that have been encased in polyethylene material shall be adequately padded to prevent damage to the material.
- J. Repair any rips, punctures, or other damage to the polyethylene with tape or with a short length of polyethylene tube cut open, wrapped around the pipe, and secured in place.
- K. Polyethylene material shall be stored on the job site in such a manner that it is not exposed to direct sunlight. Exposure during installation shall not exceed forty-eight (48) hours.
- L. Backfill material shall be the same as specified for pipe without polyethylene wrapping. Special care shall be taken to prevent damage to the polyethylene wrapping when placing backfill.

- M. Backfill material shall be free from cinders, refuse, boulders, rocks, stones, and/or other material that could damage polyethylene.

3.15 CONCRETE THRUST BLOCKS AND ANCHOR COLLARS

- A. Concrete thrust blocks and anchor collars shall be provided along the water line in accordance with the construction details, plan sheets, or as directed by the Engineer. The concrete mix shall be Class "B" for anchor collars and Class "A" for thrust blocks. All bends, tees, caps, plugs, and fire hydrants shall be thrust blocked unless specifically detailed in the construction drawings that no thrust blocking is required. Anchor collars shall be constructed on ductile iron pipe only; if the pipeline being restrained is primarily PVC or other non-ductile iron pipe, at least one full joint of ductile iron pipe shall be inserted in the pipeline run to receive the concrete anchor collar.
- B. Concrete for thrust blocks and anchor collars shall be placed against undisturbed soil. The excavation shall be hand shaped and free of loose material. Forms shall be used to confine the concrete in areas other than that part that is in contact with undisturbed soil in the direction of the thrust.
- C. No concrete shall be placed around any part of a joint or placed so that it interferes with the removal of any joint accessories such as bolts, followers, threads, collars, couplings, etc. Fire hydrant drains shall not be restricted.
- D. The top of the concrete thrust block or anchor collar shall be struck off with a wood straight edge or float.
- E. Concrete shall not be placed when the temperature is below 40° F and dropping or below 35° F if the temperature is rising, unless approved by the Engineer.
- F. Admixtures are not to be used without the approval of the Engineer.
- G. All reinforcement shall be inspected by the Engineer prior to placement of concrete. All placement of concrete must be in the presence of the Engineer or his representative. The Contractor is cautioned that he may be required to remove, without compensation, any concrete placed in the absence of the Engineer or his representative.
- H. Backfill over concrete thrust blocks or anchor collars shall not be placed before the concrete has attained initial set.
- I. No thrust blocks shall be less than six inches (6") thick between the pipeline or appurtenances and undisturbed soil in the direction of thrust on pipes 12-inch diameter and smaller. On larger pipes, the thickness of thrust blocks shall be as directed by the Engineer. A thrust block with any component of its length to width to depth ratio exceeding two (2) shall be reinforced with steel reinforcement bars as directed by the Engineer. The Engineer will consider the size of the thrust block, the size of the water

main, and the system pressure in the determination of the size and spacing of the steel reinforcement.

- J. The excavation shall be free of water before concrete is placed. Steel reinforcement shall be placed as specified on the drawings.
- K. The pipe or appurtenances to be in direct contact with concrete shall be cleaned before placing the concrete. The Engineer of Record is required to design the thrust blocks, anchors and other restraints and submit to Washington Water Authority for review and approval. If request by Washington Water Authority, the engineer of record shall provide a geotechnical report to include soil valves for thrust blocking design.
- L. Thrust blocks for vertical bends shall be adequate to resist the thrust by mass alone when the thrust is upward.
- M. Thrust blocks and anchor collars shall be adequate to restrain the pipeline and appurtenances at design pressure equal to 150% of the static pressure at the lowest point with a minimum pressure of 200 psi. The Engineer of Record shall provide calculations for review for all thrust blocks, anchor collars and other thrust restraints.
- N. Concrete thrust blocks and anchor collars on 12-inch and smaller pipelines shall have a minimum curing time of three days (72 hours) before any pressure is placed against the block or collar. Concrete thrust blocks and anchor collars on 14-inch and larger pipelines shall have a minimum curing time of seven days before any pressure is placed against the block or collar.
- Q. Concrete thrust blocks or anchor collars that fail to restrain the pipe or appurtenances shall be replaced by the Contractor at his expense.
- R. Reducers receiving an anchor collar shall be long bodied fittings.
- S. All water lines with dead ends shall be installed with an upstream valve, one full joint of ductile iron pipe with a MJ restraining gland, concrete anchor collar, a MJ cap with restraint, and a blow off assembly. The seat of the MJ restraining gland on the ductile iron pipe shall face the valve.
- T. Anchor collars subject to two-way thrust shall have two identical reinforcement steel mats. Anchor collars for 24" and smaller diameter pipe with two-way thrust shall have two (2) Mega-Lug retaining glands placed back-to-back, spaced just inside the two reinforcing steel mats. Anchor collars for 26" and larger diameter pipe shall have two weld-on thrust rings, spaced just inside the two reinforcing steel mats.

3.16 BACKFILLING AND INSPECTION

- A. Before backfilling, install concrete thrust blocks and anchor collars in accordance with the

details at the location and interval and shown on the Drawings. Use concrete as specified in Section 3600- Cast-In-Place Concrete.

- B. After the pipeline is installed and visually inspected by the Engineer, backfill the trench per Section 2300-Excavation, Backfilling, and Compacting.
- C. Test the pipeline per Section 5300-Inspection and Testing of Water Lines and Service Lines.
- D. Repair all incidental damage to buildings, structures, utilities, pavements, landscaping, etc.
- E. Repair all pavements per Section 6000-Pavement Repair.
- F. Repair sodded and grass areas to original condition per Section 6100-Lawn and Grass Restoration.

3.17 WATER LINE INSTALLATION - AERIAL CROSSINGS

- A. Construct piers as shown on Drawings.
- B. Install encasement pipe on piers as shown on the Drawings.
- C. Insulate encasement as required by Washington Water Authority.

3.18 SEWER LINE CROSSING

- A. Sewer lines installed under a water line must have a clear distance between pipes of at least eighteen (18) inches.
- B. The sewer line shall be installed such that a joint of pipe is centered along the water line and the joints are as far as possible from the water line.
- C. If 18-inches of clearance cannot be provided or when the water main must pass under the sewer main, either the sanitary sewer main or the water main shall be encased in watertight steel encasement pipe a minimum of 10 feet either side of the line, centered over the point of crossing. The ends of the encasement pipe shall be sealed watertight. Refer to Section 3400 – Steel Encasement Pipe for end seals.

3.19 STORM SEWER CROSSING

- A. All water lines crossing under all concrete storm drains, or any storm drain 30-inch diameter and larger, or all storm drains with multiple pipe runs, shall be steel encased a minimum of 5 feet either side of the storm drain.

3.20 CUT AND CAP

- A. Water lines that are to be abandoned shall be cut and capped. Water mains abandoned under roadways shall be filled with flowable fill in addition to being capped.
- B. Mechanical joint restraints and concrete shall be used to resist thrust loads.

3.21 ABANDON CORPORATION STOP

- A. All corporation stops used for testing and/or chlorination need to be properly abandoned by fully closing the corporation stop, removing all service line materials, installing a solid copper disk, and reinstalling the corporation nut resulting in a watertight seal in the event that the corporation valve fails.

SECTION 4200

WATERLINE PRESSURE REDUCTION PROCEDURES

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. This section covers the procedures associated with reducing water line pressure for construction.

1.02 PROCEDURES

- A. Water lines may need to have the pressure significantly reduced to facilitate construction in a project area, i.e., tie-ins or cut and caps.
- B. Water pressure reductions shall be approved and coordinated with Washington Water Authority.
- C. The maximum amount of time that the line is permitted to be shut down shall be determined by Washington Water Authority.
- D. The Contractor shall have sufficient materials, labor, and necessary backup provisions in place prior to initiating water line pressure reduction to ensure that construction activities can be completed within the time determined by Washington Water Authority.
- E. A minimum of 72-hour notice shall be provided to each affected customer using the attached water pressure reduction notice.
- F. The Contractor shall distribute the notices and generate a list of each address that the notices are delivered to. The list shall be given to Washington Water Authority for their files.

1.02 CONSTRUCTION REQUIREMENTS

- A. The excavation in the project area shall be dewatered prior to pressure in the water main being reduced.
- B. All water pipe, fittings, and materials shall be disinfected per AWWA C651, latest revision.
- C. Immediately after construction is complete, the existing water lines shall be flushed thoroughly and background chlorine levels re-established.

SECTION 4300

HORIZONTAL DIRECTIONAL BORING

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. Installation of water line with horizontal directional bore

1.02 SUBMITTALS

- A. Submit to the Engineer and Washington Water Authority for approval and procedures not described in these specifications

1.03 PROTECTION

- A. In all cases, the Contractor is responsible for protecting public and private property and protecting any person or persons who might be injured as a result of the Contractor's Work.
- B. All utilities shown on the drawings may not represent the exact location; however, the Contractor is responsible for verifying these locations and contacting "Arkansas One Call System" before excavating.

PART 2 – PRODUCTS

2.01 BEDDING AND BACKFILL

- A. Refer to Section 2300 – Excavation, Backfilling, and Compacting

2.02 PIPE, FITTINGS, AND MATERIALS

- A. Refer to Section 4000 – Water Pipe, Fittings, and Materials

2.03 CONCRETE

- A. Refer to Section 3600 – Cast-In-Place Concrete

PART 3 – EXECUTION

3.01 HEAT FUSION JOINTS

- A. Joints shall be of a heat fusion joining system. Pipe and fittings shall be thermal butt fusion, saddle fashion, or socket fusion in accordance with manufacturer recommended procedures as ASTM D-2161. At the point of fusion, the outside diameter and minimum wall thickness

of the fitting shall match the outside diameter and minimum wall thickness specifications of ASTM D-1248 for the same size pipe.

- B. Joining of the pipes and fittings shall be performed in accordance with ASTM D-2774. Depending upon the installation requirements and site location, joining shall be performed within or outside the excavation. Joints of pipe sections shall be smooth on the inside and internal projection bead shall not be greater than 3/16 inch.
- C. The tensile strength at yield of the butt-fusion joints shall not be less than the pipe. A specimen of the pipe cut across the butt-fusion joints shall be tested in accordance with ASTM D-638
- D. The manufacturer shall provide any necessary fusion training. The contractor and the onsite joint inspector shall be trained by the manufacturer or manufacturer's authorized representative. The fusion equipment and operator shall be required to demonstrate successful field experience.

3.02 ANCHOR FITTINGS

- A. Mechanical joint anchor fittings shall be used to transition from ductile iron to HDPE and from HDPE to PVC. The fitting shall be stronger than the pipe in that when it is subjected to tensile stress the pipe will pull apart before the fitting will pull out and the pipe will blow before the fitting will rupture under pressure.
- B. The mechanical joint adapter shall have a pre-installed stainless steel stiffener, in accordance with Plastic Pipe Institute (PPI) recommendations, to neutralize point-loading, ACQ, creep and loss of gasket seal due to diameter contraction. The stiffener shall be engineered sufficiently thick to avoid radial buckling due to gasket pressure.
- C. The mechanical joint adapter requires longer bolts and shall be sold with the modified longer bolt kit.

3.03 CONCRETE ANCHOR

- A. A concrete block shall be installed on each bore at the locations and to the dimensions shown on each plan sheet. The watermain shall be connected to each concrete block by a Mega Lug Retainer Strap. The Mega Lug Retainer Strap shall be anchored into the concrete using No. 3 rebar with a minimum embedment of 18".

3.04 PIPE INSTALLATION

- A. Proper connection to the piping at each end shall be done by standard excavation. The Contractor shall be responsible to provide a slurry containment pit and shall remove all excess material and dispose of appropriately off-site upon completion.

- B. Erosion control facilities shall be provided to contain any solids from migrating beyond the project site.
- C. Subsurface investigation, if deemed necessary, shall be provided prior to bids by the Contractor. No additional payments will be made if rock is encountered or if soil conditions require additional construction time and equipment. Proper equipment and methods shall be used in rock and soil bores to insure proper grades, elevations, and separations.
- D. The piping shall be installed at the minimum depths indicated in the plans and shall deviate no more than six inches along the vertical axis and two feet along the horizontal alignment.
- E. The Contractor shall provide accurate As-Built data on downhole survey data or a walkover location system that indicates X, Y and Z coordinates of the pipe at least every thirty (30) feet along the alignment or at a midpoint if the bore length is less than thirty (30) feet.
- F. Bending radius of the HDPE pipe shall strictly conform to all details shown on the plans and be no more than manufacturers recommendations.

SECTION 5000

INSPECTION AND TESTING OF WATER LINES AND SERVICE LINES

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. This section covers the inspection and testing of water lines and services lines. Testing is required before final acceptance of water lines and service lines by Washington Water Authority.

1.02 SCOPE OF WORK

- A. All pipelines shall be inspected and tested before final acceptance. The methods to be used are as follows:
1. New Water Pipelines
 - a. Visual inspection during installation and before backfill.
 - b. Hydrostatic pressure test.
 - c. Disinfection.
 - d. Bacteriological sampling.
 - e. Final Visual Inspection.
 - f. Tracer wire continuity test.
 2. Water Meter Setters
 - a. Visual inspection during installation and before backfill.
 - b. Final Visual Inspection.
 3. Service Lines
 - a. Visual inspection during installation and before backfill.
 - b. Hydrostatic pressure test.
 - c. Final Visual Inspection

d. Tracer wire continuity test.

e. Disinfection

1.03 DELIVERABLES

A. The Engineer shall provide a complete and comprehensive testing report summary complete with all inspection and testing dates and results.

PART 2 – PRODUCTS

A. NOT USED

PART 3 – EXECUTION

3.01 VISUAL INSPECTION DURING INSTALLATION AND BEFORE BACKFILL

A. The Engineer shall be responsible for inspecting water lines, water meter setters, and service lines during all phases of construction. The Engineer shall provide full time inspection services. All work not conforming to these specifications that is discovered during this inspection phase will be corrected by the Contractor.

3.02 PRESSURE TEST FOR TAPPING SLEEVES

A. The contractor shall provide all pumps or other equipment necessary to test the tapping sleeve before making a tap. The duration of the hydrostatic leakage test on tapping sleeves shall be thirty (30) minutes at 200 psi with zero leakage, or at static main line pressure, whichever is greater. The tapping sleeve assembly valve shall be tested in both the open and closed position.

3.03 PRESSURE TEST FOR WATER PIPELINES AND SERVICE LINES

A. After completion of construction of all water lines or sections thereof, the Contractor shall flush, test, and disinfect the new water lines and in accordance with the Engineer of Record's plan as described below.

B. Flushing

1. All water for flushing, testing, and disinfecting water lines shall be supplied by the Washington Water Authority.
2. The work shall be coordinated to ensure that it will not be carried on during periods of high water usage. Water valves or other appurtenances on the existing water system, new tapping valves, or valves or appurtenances that have been

accepted by Washington Water Authority, shall only be operated by, or under the direct supervision of, WWA.

3. The Contractor shall fill and flush the newly constructed lines and visually check all combination air release and vacuum valves, blow-off valve assemblies, line valves, fire hydrants, and meter setters to assure proper operation.
4. The Engineer of Record shall develop a flushing plan to ensure that all lines are properly flushed. The plan should specify the sequence in which valves and hydrants are to be opened and the duration thereof, ensuring complete flushing and protecting Washington Water Authority's water system from construction contaminated water. The volume to be flushed shall be no less than three (3) but no more than five (5) times the volume of the main to be flushed. The flow shall be such that a flushing velocity of not less than 2.5 feet per second and preferably 3.5 feet per second or greater is attained.

C. Hydrostatic Testing

1. All pipe shall be tested as set out in AWWA C600, latest revision, for ductile iron pipe and AWWA C605, latest revision, for PVC pipe. Tests will be conducted only after the line is completed, including all taps and meter settings as required and the backfill completed. These tests shall be performed by the Contractor in the presence of a Washington Water Authority Representative and the Engineer of Record. The Contractor shall furnish all necessary pressure gauges, meters, and pumps and make all taps and connections.
2. Each valved section of pipe shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. Before applying the test pressure, all air shall be expelled from the pipe by permanent taps or corporation cocks where necessary.
3. Test pressure shall be 200 psi or 150 percent of the normal static operating pressure, as determined by Washington Water Authority, whichever is greater. The contractor shall provide all pumps or other equipment necessary to maintain the test pressure within +/-0 psi at the test point for a period of two (2) hours. All interior valves including guardian valves on fire hydrants and other appurtenances shall be open during all tests.
4. The test pressure shall not vary by more than \pm zero (0) psi for the duration of the test. During the duration of the two-hour test, if the test pressure drops more than 0.0 psi from the start pressure, the test shall be terminated and considered failure due to assumed leaks in the tested pipe section. If the pressure rises beyond the allowed 0 psi variance, the test shall be terminated and remaining air shall be purged from the pipeline.

D. Leakage

1. The leakage test shall be conducted concurrently with the pressure test. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the above specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.
2. The maximum allowable leakage volume shall be per AWWA standards for PVC and Ductile Iron pipes. For PVC pipe see AWWA C605 Table 4a, for Ductile Iron pipe see AWWA C600 Table 5A.
3. Upon completion of a two-hour test where the test pressure did not vary by more than \pm five (5) psi, the contractor shall determine the leakage amount by measuring the amount of "make-up" water necessary to restore the original starting pressure.
4. Should any test of pipe laid disclose leakage greater than that specified, the leak(s) shall be located and repaired, and the line shall be re-tested at the Contractor's expense. All visible leaks shall be repaired regardless of the amount of leakage. It may be necessary to utilize leak detection equipment to locate not visible leaks at the Contractor's expense.

3.04 DISINFECTION

- A. After successful pressure testing, the line(s) shall be flushed at a velocity equal to or greater than 2.5 feet per second. The line shall then be disinfected in accordance with AWWA C651, latest revision, for Disinfecting Water Mains, continuous feed method, except that the placing of hypochlorite granules into the main during construction will not be permitted.
- B. The Contractor shall provide a test/chlorine tap no greater than 10' downstream from the beginning of the new water line. All excavation, installation, use of and proper abandonment of the test tap is the responsibility of the Contractor.
- C. The final concentration of chlorine inside the main shall be 25 parts per million (ppm) at all locations and shall be maintained for a minimum of 24 hours. The chlorine residual at the end of the 24-hour period shall not be less than 10 ppm. The contractor shall supply all test kits necessary to verify chlorine concentrations.
- D. The contractor shall operate all valves and hydrants in the treated section of water line during the initial 24 hours to ensure disinfection of the appurtenances.
- E. The contractor shall take great care when flushing the line to assure proper drainage is available to prevent harm at any adjacent downstream location.

- F. Disposal of the disinfecting water shall be in a manner that will protect the public and the receiving waters from harmful concentrations of chlorine. Dichlorination of the disinfecting water shall be in accordance with AWWA C655, Field Dichlorination, latest edition. A dichlorination plan shall be prepared by the Engineer of Record.
- G. After disinfection is complete, WWA shall then flush the disinfecting solution from the lines to a point that the chlorine concentration is back down to the same level as the treated water from the distribution system. The treated water lines will then be tested before being placed into service.

3.05 BACTERIOLOGICAL SAMPLES

- A. Bacteriological samples shall be taken by Washington Water Authority personnel only. Samples shall be taken on two consecutive days and shall be taken only on Monday, Tuesday, Wednesday, or Thursday. Before a line is placed in service, two consecutive series of samples which are not collected on the same day and are taken no more than 4 days apart must show that the water is bacteriologically safe for drinking purposes.

3.06 FINAL VISUAL INSPECTION

- A. Upon completion of the above tests, Washington Water Authority and the Engineer will perform a final visual inspection of water pipelines and meters.
- B. A punch list of defects (including obvious running leaks) will be prepared and sent to the Contractor for correction at the Contractors' expense.

3.07 TRACER WIRE CONTINUITY TESTING

- A. Contractor shall perform a continuity test on all tracer wire in the presence of the Engineer or the Engineers' representative. If the tracer wire is found to be not continuous during testing, Contractor shall repair or replace the failed segment of wire at their own expense.
- B. A final continuity test shall be performed by a Washington Water Authority representative before the project will be accepted by Washington Water Authority. If the tracer wire is found to be not continuous during testing, Contractor shall repair or replace the failed segment of wire at his own expense.

SECTION 6000

ASPHALT PAVEMENT REPAIR

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. This section covers the materials and procedures used in the repair of asphalt roads, streets, or other public rights-of-way where a water lines, sewer line, or structure is constructed.

1.02 REGULATIONS AND STANDARDS

- A. All permanent repairs of streets, roads, sidewalks, other public rights-of-way, private drives, private parking lots, etc. shall comply with the requirements shown on the Standard Detail Drawings and Tables. The Contractor is responsible for following the requirements of all local Ordinances, Regulations, or Codes governing the repairs to roads, streets, or other public rights of way. In particular:
1. Repair of State Highways: per requirements of the Arkansas State Highway Commission.
 2. Repair of county roads: per requirements of the County Roads Department.
 3. Repair of local municipal streets, sidewalks, and driveways: per the requirements of local municipal code.
 4. Permit for street cut and repairs shall be furnished by the Contractor.
 5. Contractor shall secure permits and inspections, post necessary bonds, and pay necessary fees.
- B. Temporary Repairs: Per requirements of the governmental agency having jurisdiction and these specifications. Must provide a minimum of a cold mix temporary patch.

1.03 TESTING, OBSERVATION, AND INSPECTION REQUIREMENTS

- A. Testing and inspection is required for pavement repairs in accordance with all local Ordinances, Regulations, or Codes governing the repairs. The inspection of street repairs shall be coordinated with Washington Water Authority to ensure compliance with all applicable standards.
- B. Gradation of stone materials shall be performed in accordance with ASTM C136.

- C. The Contractor shall provide at least 24 hours of advance notice for any concrete or asphalt placement.

PART 2 – PRODUCTS

2.01 BASE COURSE MATERIALS

- A. Base Course: Conform to ArDOT Standard Specifications for Highway Construction, Section 303.

2.02 ASPHALT MATERIALS

- A. Prime Coat: Medium curing cut-back asphalt; MC-30 or MC070; AASHTO M82; heated and applied within the temperature range 80 degrees F – 150 degrees F.
- B. Hot mix surfacing material shall meet the following requirements: Asphalt Cement Hot Mix Surface Course (1/2-inch) in accordance with Section 407 of the ArDOT Standard Specifications for Highway Construction.

PART 3 – EXECUTION

3.01 EXECUTION

- A. Asphalt surfaces for pavements, streets, roads, driveways, parking lots and walks shall be repaired with hot mix asphalt. Minimum thickness of asphalt surface replacement shall be 3-inches. The finished surface shall match and shall be level with surrounding pavement.
- B. Before replacing paved surfacing, the existing pavement shall be cut, sawed, or trimmed along straight and vertical lines along each side of the trench.
- C. Temporary repairs (if required) to paved surfaces shall be made with cold mix asphalt to allow access. Final repairs shall be made within 60 days weather permitting. Driveways shall be maintained to allow access during all weather conditions.

3.02 EXCAVATION AND BACKFILL

- A. Excavate and backfill in accordance with Section 2300 Excavation, Backfilling, and Compacting.

3.03 SUBGRADE PREPARATION

- A. Subgrade for asphalt paving improvements shall have all excess material including cold mix asphaltic concrete, soil, organic silty and clayey topsoils, and other unsuitable material removed and replaced with approved material.

- B. The base surface on which the replacement material is to be placed shall be finished smooth and any wet material or debris shall be removed.
- C. Fill and compact utility trenches
- D. Replace soft spots as required.

3.04 BASE COURSE FOR ASPHALTIC PAVING

- A. A concrete slab 6 inches in thickness and reinforced with #4 reinforcement bars placed at 12 inches on center each way shall be poured with the finished top of the slab extending to a point 2 inches below the finished surface. A bituminous tack coat shall then be applied to the concrete surface at a rate of 0.03 to 0.10 gallons per square yard. After proper curing of the tack coat, asphalt concrete hot mix surface course shall be placed with a compacted thickness of 2 inches and rolled with a steel wheeled roller to a minimum density of 92% of maximum density by Modified Proctor method.
- B. Place material on prepared subgrade in accordance with details shown on the Drawings.
 - 1. Spread base course the same day the material is hauled. It shall be thoroughly mixed, either by repeated handling with a blade grader or by harrowing sufficiently to secure a uniform mixture of coarse and fine particles.
 - 2. Compact base course by systematically rolling and watering as required to obtain a firm, uniform, smooth surface as specified in Division 300 of AHTD Standard Specifications for Highway Construction. Base course shall be compacted in 8-inch lifts. Prime coat shall not be put down until base course is compacted. Apply emulsified tack coat to all existing surfaces.
 - 3. After acceptance of completed base course, a prime coat shall be uniformly distributed over the prepared base, including vertical edges, at the rate of 0.4 gallons per square yard. Remove surplus asphalt material.
- C. Minimum density shall be 98 Percent Standard Proctor (ASTM D698).

3.05 ASPHALT PAVEMENT REPAIRS

- A. Asphalt pavement shall be replaced in accordance with details shown on the Drawings and all materials shall be furnished and installed in accordance with the Arkansas Highway and Transportation Department "Standard Specifications for Highway Construction." Before replacing paved surfacing, the existing pavement shall be cut, sawed, or trimmed along straight and vertical lines. The condition of the backfill and base course material, with special regard to the degree of compaction, may be checked and approved by Washington Water Authority before any surfacing is replaced.

- B. All street repairs shall require a “tee” patch, a minimum of 2’ wider than the trench width in accordance with the Standard Details.
- C. Trenches shall be backfilled with Class 7 base material compacted to 98% Modified Proctor Density.
- D. Before placement of new surface material, all excess material shall be removed to a minimum depth of nine (9) inches. A minimum of six (6) inches of 4,000 psi concrete shall be placed within three (3) inches of the street surface. Before placing asphalt, the concrete and sides of the cut shall be primed with MC-30 at the rate of 0.3 gallon per square yard.
- E. Minimum thickness of asphalt surface replacement shall be three (3) inches, unless shown otherwise. Hot mix asphalt material shall be delivered to the site in covered vehicles, at 275 deg-F (minimum), and immediately spread to a thickness to match adjacent surfaces after rolling. Compaction shall be by steel-wheel roller to a smooth, uniform surface matching adjacent surfaces.
- F. Paved parking lots disturbed or damaged in the process of construction shall be replaced in kind. Parking lots shall be replaced to same thickness as original but in no case less than 4-inches thick. Joint system in replacement shall be at same style and interval as that in the undisturbed parking lot.
- G. Paved concrete walkways disturbed or damaged in the process of construction shall be replaced in kind. Parking lots and walkway shall be replaced to same width and thickness as original but in no case less than 4-inches thick. Joint system in replacement shall be at same style and interval as that in the undisturbed walkway.
- H. Paved driveways disturbed or damaged in the process of construction shall be replaced in kind. Driveway shall be replaced to same width and thickness as original but in no case shall the asphalt be less than 3-inches thick.
- I. Concrete curbs disturbed or damaged in the process of construction shall be replaced in kind. Curbs shall be replaced to same width and thickness as original. Joint system in replacement shall be at same style and interval as that in the undisturbed curb.
- J. Any settlement or failure of surface replacement shall be repaired or replaced by the Contractor.
- K. All pavement repairs shall be in accordance with the Standard Details.
- L. All pavement markings shall be restored to new conditions per the requirements of the governmental agency having jurisdiction.

3.06 HOT-MIX SURFACING FOR ASPHALTIC PAVING

- A. Plant Mixing and Transporting: Mixing, transportation, and temperature limitations for hot-mix surface course materials shall be in accordance with the requirements of Division 400, Asphalt Pavements of the ArDOT Standard Specifications for Highway Construction.
- B. Placing, compacting, and acceptance shall be in accordance with Division 400, Asphalt Pavements of the ArDOT Standard Specifications for Highway Construction.
- C. Surface shall be uniform and shall match adjacent surfaces.

3.07 TEMPORARY SURFACING

- A. Comply with the requirements stated above or as otherwise approved to adequately maintain traffic and proper drainage.
- B. The surface shall match the surfaces on each side of the trench and shall be in accordance with applicable state, county, or local requirements.
- C. The Contractor shall maintain all temporary surfaces in good condition until permanent repairs are complete.

3.08 TRAFFIC CONTROL

- A. Whenever traffic flow restrictions of any kind are anticipated, the Contractor will be required to contact Washington Water Authority to be given permission to obstruct traffic flow.
- B. Street closing permits must be obtained from proper government agencies.
- C. Suitable construction signs, barricades, lights, etc. shall be erected and the work outlined by adequate lighting at night in order to protect persons from injury and avoid property damage. Provide qualified flagmen to direct traffic while working upon a highway, street, or road over which traffic must pass.
- D. If requested, Contractor will be required to submit a barricade plan to Washington Water Authority or traffic control agency having jurisdiction. Barricade plan shall be satisfactory to the traffic control agency having jurisdiction.
- E. Maintain traffic and protect the public from all damage to persons and property in accordance with applicable State, City, and County regulations. Maintain and protect access, for vehicle and pedestrian traffic, to and from all properties adjoining or adjacent to those streets affected by operations, and to subject the public to a minimum of delay and inconvenience.

- F. Traffic shall be detoured as required; however, no traffic shall be detoured without prior knowledge and approval of the traffic control agency having jurisdiction. Notify the traffic control agency having jurisdiction at least 24 hours in advance of the time proposed to detour traffic. No street shall be completely blocked, nor blocked more than one-half at any time without specific authorization.

- G. Closing streets with one access route shall not be acceptable or permitted. One traffic lane shall remain open at any given time. Excavated areas within the traffic lanes of highways, streets, roads, and pedestrian walkways shall be backfilled as soon as possible and the area opened to traffic.

SECTION 6001

CONCRETE PAVEMENT REPAIR

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. This section covers the materials and procedures used in the repair of concrete roads, streets, or other public rights-of-way where a water lines, sewer line, or structure is constructed.

1.02 REGULATIONS AND STANDARDS

- A. All permanent repairs of streets, roads, sidewalks, other public rights-of-way, private drives, private parking lots, etc. shall comply with the requirements shown on the Standard Detail Drawings and Tables. The Contractor is responsible for following the requirements of all local Ordinances, Regulations, or Codes governing the repairs to roads, streets, or other public rights of way. In particular:
 - 1. Repair of State Highways: per requirements of the Arkansas State Highway Commission.
 - 2. Repair of county roads: per requirements of the County Roads Department.
 - 3. Repair of local municipal streets, sidewalks, and driveways: per the requirements of local municipal code.
 - 4. Permit for street cut and repairs shall be furnished by the Contractor.
 - 5. Contractor shall secure permits and inspections, post necessary bonds, and pay necessary fees.
- B. Temporary Repairs: Per requirements of the governmental agency having jurisdiction and these specifications. Must provide a minimum of a cold mix temporary patch.

1.03 TESTING, OBSERVATION, AND INSPECTION REQUIREMENTS

- A. Testing and inspection is required for pavement repairs in accordance with all local Ordinances, Regulations, or Codes governing the repairs. The inspection of street repairs shall be coordinated with Washington Water Authority to ensure compliance with all applicable standards.
- B. Gradation of stone materials shall be performed in accordance with ASTM C136.

- C. The Contractor shall provide at least 24 hours of advance notice for any concrete or asphalt placement.
- D. Submit complete information regarding concrete mix to Engineer for review in accordance with the requirements of ASTM C94.

PART 2 – PRODUCTS

2.01 BASE COURSE MATERIALS

- A. Base Course: Conform to ArDOT Standard Specifications for Highway Construction, Section 303, Class 7.

2.02 FORMS

- A. Forms shall be constructed prior to placement of any concrete unless otherwise authorized by Engineer.
- B. Forms shall conform to shapes, lines, and dimensions as required to conform to the original shape and dimensions of the structure to be repaired.
- C. Forms shall be sufficiently tight to prevent leakage of mortar. Forms shall be properly braced or tied together so as to maintain position and shape.
- D. Forms shall be constructed of any material with sufficient strength which shall provide the finished work a satisfactory surface; however, metal forms shall not be permitted for concrete which will be exposed on any of the completed work, except upon the specific approval of the Engineer.
- E. Forms shall be constructed in such manner that a smooth concrete surface is produced which matches the existing surfaces on each side.
- F. Forms shall be removed in such a manner as to ensure the complete safety and integrity of the structure. When the structure is supported on shores, the removable floor forms, beams, and girder sides, and column and similar vertical forms may be removed after 96 hours, providing the concrete will not be damaged. Supporting forms or shoring shall not be removed until members have achieved sufficient strength to support their weight and imposed loads safely.
- G. Forms shall be coated with oil before placement of reinforcing steel or concrete. Excessive coating material shall not be permitted to form or stand in puddles in the forms nor allowed in contact with adjacent existing concrete against which fresh concrete will be placed.

2.03 CURB FORMS

- A. 2-inch dressed dimension lumber or metal of equal strength, free from defects that would impair appearance or structural quality of completed curb.
- B. Metal forms: Subject to approval of Engineer.
- C. Short-Radius Forms: 1-inch dressed lumber or plywood.
- D. Curb Face: No horizontal joints in form material closer than 7 inches from top of curb.
- E. Stakes and Bracing Materials: Provide as required to hold forms securely in place.

2.04 SIDEWALK FORMS

- A. 2-inch dressed lumber, straight and free from defects, or standard metal forms.
- B. Short-Radius Forms: 1-inch dressed lumber or plywood.
- C. Stakes and Bracing Materials: Provide as required to hold forms securely in place.

2.05 EXPANSION JOINTS AND JOINT FILLER

- A. Joint Filler - Joint filler shall be pre-molded joint filler of the non-extruding type, 3/4-inch to 1-inch thick conforming to ASTM M33, poured bituminous material conforming to ASTM M18, or rubber based compound conforming to Federal Specification SS-F-336. Joint filler shall be of sufficient dimension to extend through the full depth of the paved surface.
- B. Expansion and contraction joints for sidewalks, streets, driveways, curb and gutter, ditch paving, and protective slabs shall be spaced every 12 feet maximum and shall be placed to match the original joint system for the pavement.

2.06 CONCRETE

- A. Concrete shall be ready mixed concrete conforming to ASTM C94. Concrete shall not contain more than 6 gallons of water per sack of cement, including the water in aggregates, and not less than 6 sacks of cement per cubic yard of concrete.
- B. Cement: Portland Cement conforming to ASTM C150, Type 1
- C. Water used shall be clean and free from injurious amounts of oil, acids, alkalis, salt, organic matter, or other deleterious substances.
- D. Compressive Strength: 4,000 psi at 28 days.

E. Fine Aggregate: Fine aggregate shall consist of clean, sound, properly graded sand conforming to ASTM Standard C33 uniformly graded. Fine aggregate shall be graded within the following requirements:

1. Total passing the No. 4 Sieve - 95-100% by weight
2. Total passing the No. 16 Sieve - 35-75% by weight
3. Total passing the No. 50 Sieve - 10-25% by weight
4. Total passing the No.100 Sieve - 2-8% by weight

F. Coarse Aggregate: Coarse aggregate shall consist of crushed stone or gravel having clean, hard, strong, durable non-coated particles with not more than 5% by weight of soft fragments, 1/4% by weight of clay lumps, and 1% by weight of material removed by decantation, except that when the material removed by decantation consists essentially of crushed dirt the maximum amount permitted may be increased to one and one-half percent by weight. Rocks shall conform to ASTM Standard D289.

1. Coarse aggregate may be either of two sizes, 1-1/2 inch and smaller or 3/4 inch and smaller, and shall be graded within the following requirements:
 - a. Maximum size mesh screen (sq. mesh) 0-3% retained by weight
 - b. Half maximum size mesh screen (sq. mesh) 30-65% retained by weight
 - c. No. 4 sieve 94-100% retained by weight
2. Coarse aggregate for exposed aggregate surfaces shall be as follows:
 - a. Total retained on the 1-1/2 inch sieve 0%
 - b. Total retained on the 3/4 inch sieve 25 - 60%
 - c. Total retained on the 3/8 inch sieve 70 - 90%
 - d. Total retained on the No. 4 inch sieve 95 - 100%

G. Slump: 3 to 4 inches.

H. Air Content: Severe Condition. 5.5 percent for 1-1/2 inch aggregate.

I. The concrete shall be delivered and placed within 45 minutes after all materials including mixing water have been placed in the mixing drum.

2.07 CURING COMPOUND

- A. Liquid membrane-forming, clear or translucent, suitable for spray application.
- B. Conform to ASTM C309, Type 1.

2.08 REINFORCEMENT

- A. Reinforcement shall be free from rust scale or other coatings that will destroy or reduce the bond.
- B. Reinforcing steel shall be steel of 60,000 psi minimum yield strength, conforming to the following ASTM Standards:
 - 1. A 615, Standard Specification for Deformed Billet-Steel Bars for Concrete Reinforcement
 - 2. A 616, Standard Specification for Rail-Steel Deformed Bars for Concrete Reinforcement
 - 3. A 617, Standard Specification for Axle-Steel Deformed Bars for Concrete Reinforcement
 - 4. A 185, Specification for Welded Steel Wire Fabric for Concrete Reinforcement
- C. All reinforcing steel bars #3 (3/8" diameter) or larger shall be deformed bars conforming to these specifications. Plain (non-deformed) bars larger than 1/4" diameter shall not be used for reinforcing.
- D. The supplier of reinforcing steel shall furnish certification of compliance with these specifications.
- E. Reinforcement shall be shop bent, unless otherwise permitted by the Engineer. Reinforcement partially embedded in concrete shall not be bent.
- F. Reinforcement shall be accurately placed according to the Drawings or as specified herein and adequately secured in position by concrete, metal, or other approved chairs, spacers, or ties.
- G. Reinforcement shall not be welded unless specifically permitted by the Engineer.
- H. Reinforcement shall be protected by the thickness of concrete as shown on the Drawings. Where dimensions are not shown, the thickness of concrete over the reinforcement shall be as follows:

1. Where concrete is deposited against the ground without the use of forms, not less than 3 inches, except wire mesh reinforcement for concrete slabs which may be within 1-1/2 inches of the ground.
 2. Where concrete is to be exposed to the weather or to the ground but placed in forms, in slabs and wall not exposed to the ground or to the weather not less than 2 inches.
 3. In all other cases not less than 2 inches.
- I. Reinforcement for concrete streets, driveways, and parking lots shall be #6 bars placed at 6 inches on center perpendicular to the trench and #4 bars placed at 6 inches on center parallel to the trench.
 - J. Reinforcement for curb and gutter shall consist of #3 bars spaced at 6-inch centers longitudinally with #4 transverse tie bars spaced at 2-foot centers. The bars shall be firmly held in place by wiring bars together. Bar chairs or other suitable steel devices shall be used to support the reinforcement at a level 3 inches above the bottom of the concrete.
 - K. Reinforcement for sidewalks, ditch paving, and slope protection shall consist of 6-inch x 6-inch mesh, #6 for driveways and #9 for ditch paving, slope protection and sidewalks.

2.09 ACCEPTANCE OF MATERIALS

- A. Materials shall be subject to inspection for suitability by Washington Water Authority prior to or during incorporation into the Work

PART 3 – EXECUTION

3.01 GENERAL

- A. Concrete pavement shall be replaced in accordance with details shown on the Drawings and all materials shall be furnished and installed in accordance with the Arkansas Highway and Transportation Department “Standard Specifications for Highway Construction.” Before replacing paved surfacing, the existing pavement shall be cut, sawed, or trimmed along straight and vertical lines. The condition of the backfill and base course material, with special regard to the degree of compaction, may be checked and approved by Washington Water Authority before any surfacing is replaced.
- B. All street repairs shall require a “tee” patch, a minimum of 2’ wider than the trench width in accordance with the Standard Details.
- C. Trenches shall be backfilled with Class 7 base material compacted to 98% Modified Proctor Density.

- D. Before placement of concrete street material, all excess material shall be removed to a minimum depth of six (6) inches. A minimum of six (6) inches of 4,000 psi concrete shall be placed to match the line and grade of existing street surface.
- E. After removal of forms and finishing, backfill shall be placed around structures and thoroughly compacted.
- F. Paved walkways disturbed or damaged in the process of construction shall be replaced in kind. Walkway shall be replaced to same width and thickness as original but in no case less than 4- inches thick. Joint system in replacement shall be at same style and interval as that in the undisturbed walkway.
- G. Paved driveways disturbed or damaged in the process of construction shall be replaced in kind. Driveway shall be replaced to same width and thickness as original but in no case less than 6- inches thick. Joint system in replacement shall be at same style and interval as that in the undisturbed driveway.
- H. Paved parking lots disturbed or damaged in the process of construction shall be replaced in kind. Parking lots shall be replaced to same thickness as original but in no case less than 6-inches thick. Joint system in replacement shall be at same style and interval as that in the undisturbed parking lot.
- I. Concrete curbs disturbed or damaged in the process of construction shall be replaced in kind. Curbs shall be replaced to same width and thickness as original. Joint system in replacement shall be at same style and interval as that in the undisturbed curb.
- J. All pavement repairs shall be in accordance with the Standard Details.
- K. All pavement markings shall be restored to new conditions per the requirements of the governmental agency having jurisdiction.

3.02 EXCAVATION AND BACKFILL

- A. Excavate and backfill in accordance with Section 2300 Excavation, Backfilling, and Compacting.

3.03 PREPARATION OF SUBGRADE

- A. Bring the areas where pavement, curbs, and sidewalks are to be constructed to required grade on undisturbed ground and compact by sprinkling and rolling or mechanical tamping.
- B. As depressions occur, refill with crushed stone base course material and recompact until the surface is at the proper grade.

- C. Compact subgrade on fill to 95 percent of maximum density at optimum moisture content as determined by ASTM D698 Standard Proctor Density.

3.04 PLACING CRUSHED STONE BASE

- A. After subgrade for sidewalks and curbs is compacted and at proper grade, spread at least 4 inches of crushed stone base course material and compact to at least 95 percent of maximum density as determined by ASTM D698 Standard Proctor Density.
- B. Sprinkle with water and compact by rolling or other method.
- C. Top of compact granular fill shall be at proper level to receive concrete after taking slab thickness and desired finished grade into account.

3.05 SETTING FORMS

- A. Construct forms to the shape, lines, grades, and dimensions called for on the Drawings, or match shape, lines, grades, and dimensions of cut curbs.
- B. Stake wood or metal forms securely in place, true to line and grade.
- C. Brace forms to prevent change of shape or movement in any direction resulting from the weight of the concrete during placement.
- D. Construct short-radius curved forms to exact radius.
- E. Tops of forms shall not depart from grade line more than 1/8 inch when checked with a 10-foot straightedge.
- F. Alignment of straight sections shall not vary more than 1/8 inch in 10 feet.
- G. Forms shall be cleaned and oiled thoroughly after each use and before concrete is placed.

3.06 PLACING CONCRETE

- A. All placement of concrete shall be in the presence of the Engineer or his representative. The Contractor may be required to remove, without compensation, any concrete placed in the absence of the Engineer or his representative.
- B. Equipment for chuting, pumping and pneumatically conveying concrete shall be of such size and design as to ensure a practically continuous flow of concrete at the delivery end without separation of materials. All concrete in walls and columns shall be poured through tremies unless otherwise permitted by the Engineer. The free fall of concrete shall be held to a minimum.

- C. Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. The placing of concrete shall be carried on at such a rate that concrete is at all times plastic and flows readily into the spaces between the bars. No concrete that has been contaminated by foreign material shall be used.
- D. Once placement has started, it shall be carried on as a continuous operation until placement of the panel or section is complete. When construction joints are necessary, they shall be constructed in accordance with these specifications.
- E. Concrete shall be placed and vibrated in such a manner as to prevent coarse aggregate to separate from mortar, that no rock pockets are left, that the concrete flows readily around the steel reinforcement and into the extremities of the forms. Free water shall not be present on the surface of the concrete. All concrete paving shall be poured and vibrated with mechanical vibration equipment.
- F. Water shall be removed from the place of deposit before concrete is placed. Before depositing concrete on or against concrete which has taken its initial set, the surface of the hardened concrete shall be broken off down to coarse aggregate and wire brushed to remove foreign matter and laitance. A layer of grout of the same cement-sand ratio as the concrete without coarse aggregate shall be placed to a thickness of one to two inches on the brushed surface after which the new concrete shall be placed immediately.

3.07 SIDEWALK CONSTRUCTION

- A. Thickness of sidewalks shall a minimum of 4 inches or as shown on the Drawings. Concrete shall be placed true to grade to ensure that ponding of water will not occur.
- B. Place, process, finish, and cure concrete in conformance with this Section and the applicable requirements of ACI 614. Where the requirements differ, the more stringent shall govern.
- C. Placement of Preformed Asphalt Expansion Joints:
 - 1. Where sidewalk ends.
 - 2. Around posts, poles, or other objects protruding through the sidewalk.
 - 3. At maximum intervals of 15 feet.
- D. Contraction Joints:
 - 1. Provide transversely to walk.
 - 2. Saw cut weakened plane joints shall be straight and at right angles to the surface of the walk. Saw cuts shall be constructed midway between expansion joints to a

depth of 25 percent of slab thickness. Saw cuts shall be performed within 24 hours of placement.

E. Reinforcing: 6 by 6 inch, W1.4xW1.4 mesh shall be installed one third the slab thickness below the top surface.

F. Finish:

1. Broom surface with fine hair broom at right angles to length of walk and tool at edges, joints, and markings. Finish shall match that of adjacent surfaces.
2. Walks shall be scored at no less than 5-foot intervals and within 24 hours of concrete placement.

G. Curing:

1. Upon completion of finishing, apply an approved curing compound to exposed surfaces.
2. Protect sidewalks from damage for period of 10 days.

3.08 FLAT SURFACES

A. Concrete shall be deposited and leveled so that the surface conforms to the line, grade and finish required to match adjacent surfaces.

B. Exposed aggregate finish – Scrubbed finish shall be produced on green concrete. The surface shall be thoroughly wetted and scrubbed with stiff fiber or wire brushed, using water freely, until the surface film of mortar is removed and the aggregate is uniformly exposed. The surface shall then be rinsed with clean water. If portions of the surface have become too hard to scrub in equal relief, dilute hydrochloric acid (commercial muriatic acid diluted with 4 to 10 parts water) shall be used after the concrete is at least two weeks old to facilitate the scrubbing. The acid shall be removed within 15 minutes from the finished surface with clean water. This operation may be facilitated by casting the concrete against form faces which have been coated with a chemical retarder to keep the mortar adjacent to the form from setting. Every effort shall be exerted to assure that the new surface matches any existing adjacent surfaces.

C. Protect flat surfaces from damage for period of 10 days.

3.09 COLD WEATHER REQUIREMENTS

A. Concrete shall not be placed when the ambient temperature is below 40 degrees F, or when the concrete is likely to be subjected to freezing temperatures before final set has occurred. Concrete footings or slabs shall not be placed over frozen ground. The

temperature of the concrete when placed shall not be less than 45 degrees F. Suitable means shall be provided for maintaining the concrete at a temperature of 45 degrees F for not less than 96 hours after placing.

- B. Any concrete damaged by freezing shall be removed and replaced at the expense of the Contractor.

3.10 HOT WEATHER REQUIREMENTS

- A. Suitable precautions shall be taken in hot weather to avoid drying of the concrete prior to finishing operations.
- B. Concrete deposited in hot weather shall not have a placing temperature that will cause difficulty from loss of slump, flash set, or cold joints. Concrete temperatures shall be less than 90 degrees F.

3.11 TEMPORARY SURFACING

- A. Comply with the requirements stated above or as otherwise approved to adequately maintain traffic and proper drainage.
- B. Unless permanent repairs to paved surfaces will be repaired within two (2) days after backfilling the trench, the Contractor shall place suitable asphalt material in the trench. This shall apply to driveways, sidewalks, parking lots, or other paved surface whenever the backfill will not adequately support vehicular traffic, whenever dust from the trench creates a nuisance, or whenever the trench is a hazard.
- C. The surface shall match the surfaces on each side of the trench and shall be in accordance with applicable state, county, or local requirements.
- D. The Contractor shall maintain all temporary surfaces in good condition until permanent repairs are complete.
- E. Detours shall have a gravel, crushed stone, or asphalt surface. Dust shall be controlled by the application of asphalt or water.

3.12 TRAFFIC CONTROL

- A. Whenever traffic flow restrictions of any kind are anticipated, the Contractor will be required to contact Washington Water Authority to be given permission to obstruct traffic flow.
- B. Street closing permits must be obtained from proper government agencies.

- C. Suitable construction signs, barricades, lights, etc. shall be erected and the work outlined by adequate lighting at night in order to protect persons from injury and avoid property damage. Provide qualified flagmen to direct traffic while working upon a highway, street, or road over which traffic must pass.
- D. If requested, Contractor will be required to submit a barricade plan to Washington Water Authority or traffic control agency having jurisdiction. Barricade plan shall be satisfactory to the traffic control agency having jurisdiction.
- E. Maintain traffic and protect the public from all damage to persons and property in accordance with applicable State, City, and County regulations. Maintain and protect access, for vehicle and pedestrian traffic, to and from all properties adjoining or adjacent to those streets affected by operations, and to subject the public to a minimum of delay and inconvenience.
- F. Traffic shall be detoured as required; however, no traffic shall be detoured without prior knowledge and approval of the traffic control agency having jurisdiction. Notify the traffic control agency having jurisdiction at least 24 hours in advance of the time proposed to detour traffic. No street shall be completely blocked, nor blocked more than one-half at any time without specific authorization.
- G. Closing streets with one access route shall not be acceptable or permitted. One traffic lane shall remain open at any given time. Excavated areas within the traffic lanes of highways, streets, roads, and pedestrian walkways shall be backfilled as soon as possible and the area opened to traffic.

SECTION 6002

GRAVEL SURFACE REPAIR

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. This section covers the materials and procedures used in the repair of gravel roads, streets, or other public rights-of-way where a water lines, sewer line, or structure is constructed.

1.02 RELATED WORK

- A. Section 2300 - Excavation, Backfilling and Compacting.

1.03 REGULATIONS AND STANDARDS

- A. All permanent repairs of streets, roads, sidewalks, other public rights-of-way, private drives, private parking lots, etc. shall comply with the requirements shown on the Standard Detail Drawings and Tables. The Contractor is responsible for following the requirements of all local Ordinances, Regulations, or Codes governing the repairs to roads, streets, or other public rights of way. In particular:

1. Repair of State Highways: per requirements of the Arkansas State Highway Commission.
2. Repair of county roads: per requirements of the County Roads Department.
3. Repair of local municipal streets, sidewalks, and driveways: per the requirements of local municipal code.
4. Permit for street cut and repairs shall be furnished by the Contractor.
5. Contractor shall secure permits and inspections, post necessary bonds, and pay necessary fees.

1.04 TESTING, OBSERVATION, AND INSPECTION REQUIREMENTS

- A. Testing and inspection is required for pavement repairs in accordance with all local Ordinances, Regulations, or Codes governing the repairs. The inspection of street repairs shall be coordinated Washington Water Authority to ensure compliance with all applicable standards.
- B. Gradation of stone materials shall be performed in accordance with ASTM C136.

- C. The Contractor shall provide at least 24 hours of advance notice for any concrete or asphalt placement.

PART 2 – PRODUCTS

2.01 BASE COURSE MATERIALS

- A. Base Course: Conform to AHTD Standard Specifications for Highway Construction, Section 303, Class 7.
- B. Free from objectionable, deleterious, or other injurious matter.

PART 3 – EXECUTION

3.01 PLACING GRAVEL SURFACING

- A. Trenches shall be backfilled with Class 7 base material compacted to 95% of maximum density at optimum moisture content as determined by ASTM D698 Standard Proctor Density.
- B. Gravel surfacing shall be replaced to at least the compacted thickness of the original surface. All excavated material shall be removed from gravel surfaces affected by construction and sufficient new gravel material shall be placed to restore the original surfaced area. Minimum gravel thickness shall be six (6) inches.
- C. For compacted depths exceeding 8 inches, place material in multiple courses of equal depth which do not exceed 8 inches.
- D. Compact each course with mechanical compaction equipment. Compaction with wheel of backhoe or trackhoe is not acceptable. Compact to 98% Modified Proctor Density.
- E. Finish grade to provide smooth transition with surrounding gravel. Avoid leaving any humps or ruts.
- F. Repair settling as required.

3.02 TRAFFIC CONTROL

- A. Whenever traffic flow restrictions of any kind are anticipated, the Contractor will be required to contact Washington Water Authority to be given permission to obstruct traffic flow.
- B. Street closing permits must be obtained from proper government agencies.

- C. Suitable construction signs, barricades, lights, etc. shall be erected and the work outlined by adequate lighting at night in order to protect persons from injury and avoid property damage. Provide qualified flagmen to direct traffic while working upon a highway, street, or road over which traffic must pass.
- D. If requested, Contractor will be required to submit a barricade plan to Washington Water Authority or traffic control agency having jurisdiction. Barricade plan shall be satisfactory to the traffic control agency having jurisdiction.
- E. Maintain traffic and protect the public from all damage to persons and property in accordance with applicable State, City, and County regulations. Maintain and protect access, for vehicle and pedestrian traffic, to and from all properties adjoining or adjacent to those streets affected by operations, and to subject the public to a minimum of delay and inconvenience.
- F. Traffic shall be detoured as required; however, no traffic shall be detoured without prior knowledge and approval of the traffic control agency having jurisdiction. Notify the traffic control agency having jurisdiction at least 24 hours in advance of the time proposed to detour traffic. No street shall be completely blocked, nor blocked more than one-half at any time without specific authorization.
- G. Closing streets with one access route shall not be acceptable or permitted. One traffic lane shall remain open at any given time. Excavated areas within the traffic lanes of highways, streets, roads, and pedestrian walkways shall be backfilled as soon as possible and the area opened to traffic.

SECTION 6100

LAWN AND GRASS RESTORATION

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. This Section covers the replacement of sod in lawns disturbed by the construction.
- B. Consists of furnishing and applying fertilizer, seed, mulch cover, and water at all other locations disturbed by the construction.
- C. Maintenance service.

1.02 SCOPE OF WORK

- A. This Section covers the furnishing and placing of sod to form solid mats on areas shown on the Drawings (generally lawns or commercial green spaces) or seed and mulch all other areas disturbed by the Contractor.
- B. It covers the furnishing and applying of water.
- C. It covers the furnishing and placing of four (4) inches of topsoil on all areas disturbed during construction.
- D. It covers the furnishing and placing of fertilizer.
- E. All work shall be in accordance with details shown on the Drawings and within these Specifications.
- F. The Contractor is responsible for following the requirements of all local Ordinances, Regulations, or Codes governing re-vegetation and slope stabilization.

PART 2 – PRODUCTS

2.01 TOPSOIL

- A. Topsoil shall be reasonably free from subsoil, clay, lumps, brush, objectionable weeds and/or other litter and shall be free from roots and toxic substances or other material or substances that might be harmful to plant growth or be a hindrance to grading, planting and maintenance operations.

2.02 FERTILIZER

- A. Fertilizer shall be a standard commercial product complying with State and Federal laws and with the requirements issued by proper authorities.
- B. Fertilizer shall be delivered to the site in the manufacturer's original container, on which shall be plainly marked the manufacturer's name and the guaranteed chemical analysis.
- C. Except as noted in the following sentence, fertilizer shall contain not less than the percentages by weight of ingredients as follows:

Nitrogen - 13 percent
Phosphorus, P205 - 13 percent
Potash, K2 - 13 percent

Other 1:1:1 ratio fertilizers may be used, provided the available plant food remains the same as herein specified.

- D. All fertilizer shall be solid and shall be in a condition which will permit proper distribution.

2.03 SOD

- A. Solid sod shall be cut from well-established viable Bermuda, Zoysia or St. Augustine grass. Sod type shall match that established in the disturbed areas.
- B. Contractor shall apply a mixture of various annuals and perennials to provide overlapping times of seasonal peak vegetative cover. Seeding shall only be done just prior to the vegetation's peak season for best results. Seeding shall be used when there is sufficient time in the season to ensure adequate vegetation establishment and erosion control.
- C. To optimize soil stabilization, Contractor shall utilize a nurse crop of quick growing annuals within a mix of perennials appropriate for the season. The nurse crop germinates and grows rapidly, holding the soil until the slower-growing perennial seedlings become established. Permanent vegetation shall not be considered established until a ground cover of perennial vegetation is achieved that is uniform and mature enough to survive and be of sufficient density to preclude erosion.
- D. Contractor shall conduct seeding activities to achieve stabilization that are generally congruent with the following schedule:

Dormant Cold Season Temporary Stabilization (November 1 – February 28)

Seeding at this time of the year typically does not produce successful results, as cold temperatures inhibit seed germination. Contractor shall be responsible for achieving temporary stabilization via mulching, erosion control blankets, matting, compost, and/or other appropriate structural/nonstructural methods for temporary stabilization until seasonal weather conditions become more conducive to establishment of permanent

perennial vegetative cover. Fertilizers shall be added at this time in preparation for seeding. Contractor shall be responsible for achieving temporary stabilization at all areas that are unstable and subject to erosion. Contractor shall apply temporary seeding, as follows:

Dormant Cool Season Temporary Cover Crop Seed Mix (Nov. 1 – Feb. 28)

Plant Species	Growth Season	Seeding Rate
Winter Rye (<i>Secale Cereale</i>)	Cool season annual	75 lb/ac
Perennial Ryegrass (<i>Lolium perenne</i>)	Cool season perennial	75 lb/ac

Pre Warm Season (Spring) Seeding (March 1 – May 31)

As the growing season approaches, Contractor shall apply a mix of quick germinating cool season species combined with warm season species listed below. The cool season species will serve to hold the soil until warmer weather arrives stimulating the warm season species to germinate.

Pre Warm Season (Spring) Seed Mix (Mar. 1 – May 31)

Plant Species	Growth Season	Seeding Rate
Oats (<i>Avena sativa</i>)	Cool season annual	20 lb/ac
Perennial Ryegrass (<i>Lolium perenne</i>)	Cool season perennial	20 lb/ac
White clover (<i>Trifolium repens</i>)*	Cool season perennial	20 lb/ac
Korean (Kobe) lespedeza (<i>Kummerowia stipulacea</i>)*	Cool season perennial	20 lb/ac
Bermuda (<i>Cynodon dactylon</i>)	Warm season annual	20 lb/ac
Bahiagrass (<i>Paspalum notatum</i>)	Warm season perennial	30 lb/ac
Weeping love grass (<i>Eragrostis curvula</i>)	Warm season perennial	30 lb/ac

*All legume seed must be properly inoculated with appropriate inoculant

Warm Season Seeding (June 1 – August 31)

In the midst of the growing season, Contractor shall apply a mix of warm season annuals and perennials, as follows:

Warm Season Seed Mix (June 1 – Aug. 31)

Plant Species	Growth Season	Seeding Rate
Sudan grass (<i>Sorghum bicolor</i>)	Warm season annual	20 lb/ac
Alyce clover (<i>Alysicarpus ovalifolius</i>)	Warm season annual	20 lb/ac
Brown-top millet (<i>Panicum ramosum</i>)	Warm season annual	20 lb/ac
Bermuda (<i>Cynodon dactylon</i>)	Warm season perennial	25 lb/ac
Bahiagrass (<i>Paspalum notatum</i>)	Warm season perennial	25 lb/ac
Buffalo grass (<i>Bouteloua dactyloides</i>)	Warm season perennial	25 lb/ac
Weeping love grass (<i>Eragrostis curvula</i>)	Warm season perennial	25 lb/ac

Late Season Seeding (September 1 – October 31)

During late summer to early fall, Contractor shall apply the following mix:

Late Season Seed Mix (Sept. 1 – Oct. 31)

Plant Species	Growth Season	Seeding Rate
Oats (<i>Avena sativa</i>)	Cool season annual	30 lb/ac
Winter Rye (<i>Secale Cereale</i>)	Cool season annual	30 lb/ac
White clover (<i>Trifolium repens</i>)*	Cool season perennial	25 lb/ac
Perennial Ryegrass (<i>Lolium perenne</i>)	Cool season perennial	50 lb/ac
Virginia wildrye (<i>Elymus virginicus</i>)	Cool season perennial	25 lb/ac

- E. Contractor has option of adding warm season perennials to Late Season Seed Mix (September 1 – October 31) and/or Dormant Cool Season Temporary Cover Crop Seed Mix (November 1 –February 28) or seeding with warm season perennials during other seeding periods. This is to be determined on a site-specific basis. Contractor shall confer with Washington Water Authority prior to seeding activities to determine specific seed mix.
- F. Contractor shall submit all labels/tags from bags and seed purchase invoices to Washington Water Authority.

2.04 MULCH

- A. Mulching shall be used in conjunction with both temporary and permanent seeding practices to enhance their success by providing erosion protection prior to the onset of vegetative growth. Straw mulching shall be of oat, wheat, or rice straw mulch. Hay mulch shall be prairie grass, Bermuda grass, or other hay as approved. Mulch shall be dry and reasonably free from Johnson grass or other noxious weeds and shall not be excessively brittle or in an advanced state of decomposition. All material will be inspected and approved prior to use.

2.05 LIME

- A. Lime shall be agricultural grade ground limestone or equivalent as approved by the Engineer.

2.06 WATER

- A. Water shall be free from any substances, in solution or in suspension, which would inhibit the rapid growth of grass.
- B. Contractor shall be responsible for any fees and water use charges as may be charged to the Contractor by Washington Water Authority.

PART 3 – EXECUTION

3.01 SEQUENCE

A. Unless otherwise requested in writing and acceptable to the Engineer, the sequence of work for seeding shall be:

1. Finish grading
2. Application of lime and fertilizer
3. Seeding
4. Firming and cultipacking
5. Mulching seeded areas
6. Vibratory rolling
7. Cleanup
8. Protection
9. Maintenance
10. Final acceptance

B. If trenching operations do not commence within 30 days after clearing and grubbing, the disturbed area shall be seeded.

3.02 FINISH GRADING

A. After trench backfilling and compacting activities have been completed, all areas which have been disturbed or damaged by construction operations shall be brought to original grade, or if directed by the Engineer, graded to secure effective drainage. Unless otherwise indicated, a slope of at least 1 percent shall be provided. All ruts, deep tracks, dead furrows, and ridges shall be eliminated.

B. In areas of maintained lawn grass, 6 inches of topsoil shall be placed. Imported topsoil may be substituted for stockpiled surface material. Topsoil shall be of a quality at least equal to the existing surface material in adjacent areas, free from trash, debris, and well suited to support plant growth.

C. Maintain finish grade until final acceptance. Repair damage caused by work operations or erosion. Add imported topsoil, if required.

3.03 CLEARING

- A. Prior to seeding, vegetation that may interfere with operations shall be mowed, grubbed, and raked. The collected material shall be removed from the site. The surface shall be cleared of stumps, loose surface rocks, roots, cable, wire, and other materials that might hinder the work or subsequent maintenance.

3.04 FERTILIZER AND LIME APPLICATION

- A. Fertilizers shall be applied at appropriate agronomic rate. If necessary to achieve final stabilization, fertilizer shall be applied at a minimum rate of 250 pounds per acre (0.0057 pounds per square foot) in advance of tilling/seedbed preparation operations. When soil samples are not practical, fertilizer shall consist of 13-13-13 (nitrogen, phosphorus, and potassium content). Lime shall be applied at a rate of one tone per acre or as recommended by soil test. The fertilizer distributor box shall be equipped with baffle plates to prevent downward movement of fertilizer when operating on a slope. The fertilizer shall be raked in and thoroughly mixed with the soil to a depth of approximately 2 inches prior to the application of seed or mulch.
- B. Fertilizer shall be uniformly incorporated into the soil or combined with seed in the hydro-seeding operation.

3.05 APPLICATION OF SEED

- A. Areas to be seeded shall be dressed to natural shape.
- B. The Contractor shall obtain an approved topsoil from any available source and place uniformly on the designated areas and spread evenly to a minimum thickness of four (4) inches. Irregularities in the surface shall be corrected so as to prevent formation of depressions where water will stand. **TOPSOIL SHALL NOT BE PLACED WHEN THE SUBGRADE IS FROZEN, EXCESSIVELY WET, OR IN A CONDITION DETRIMENTAL TO THE PROPOSED PLANTING AND PROPER GRADING.**
- C. Broadcast sowing of seed 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 seeded shall be lightly firmed with a cultipacker immediately after broadcast.
- D. The contractor shall water and maintain seeded areas from time of completion until final acceptance of the project.
- E. The contractor shall be responsible for establishing ground cover on all disturbed areas. Repeated seeding shall be required if necessary throughout the warranty period.

3.06 HYDROSEEDING

- A. Hydroseeding shall be carried out by means of a proper hydroseeder where approved slurry of seeds, mulch, fertilizers, binders, and organic matter are sprayed on the prepared soil surface.

3.08 APPLICATION OF MULCH

- A. Mulching shall be spread in a uniform continuous blanket, at a rate of 1 to 3 tons per acre (air dried weight) or to a uniform 2-inch depth. Mulch shall be spread by hand or by an approved blower type mulch spreader whereby the application of mulch cover and tackifier may be combined into one operation. If this method is used, no change in application rates will be allowed. Care shall be taken to remove all wire and/or twine from baled hay/straw when the control structures are removed from the site. Mulch shall be anchored in the soil to a depth of two to three inches to form a soil-binding mulch to prevent loss or bunching or held in place with a tackifier.

3.09 PROTECTION

- A. Seeded areas shall be protected against traffic. If necessary, barricades or warning signs shall be erected. Such protective devices shall be maintained until acceptance of the work as specified herein.

3.10 SOD PLACEMENT

- A. Solid sod or topsoil shall not be placed until all other items of work are complete.
- B. Prior to placing the sod and topsoil in the areas designated, the ground surface shall be cleared of materials greater than $\frac{3}{4}$ " that might hinder proper grading, tillage, or subsequent maintenance operations such as stumps, stones, roots, cable, wire, grade stakes, etc., and brought to four (4) inches below the finished grade. The areas shall then be thoroughly tilled to a depth of at least three (3) inches by plowing, disking, harrowing or other acceptable means. Lightly rake to provide a smooth, uniform, and fine surface texture. Remove ridges and fill depressions as required to drain.
- C. The Contractor shall then obtain an approved topsoil from any available source and place uniformly on the designated areas and spread evenly to a minimum thickness of four (4) inches. Irregularities in the surface shall be corrected so as to prevent formation of depressions where water will stand. **TOPSOIL SHALL NOT BE PLACED WHEN THE SUBGRADE IS FROZEN, EXCESSIVELY WET, OR IN A CONDITION DETRIMENTAL TO THE PROPOSED PLANTING AND PROPER GRADING.**
- D. After the topsoil has been spread and graded, the surface shall be cleared of stones, stumps or other objects that might hinder planting or maintenance preparations. Paved areas over which hauling operations are conducted shall be kept clean.

- F. Where any portion of the surface becomes gullied or otherwise damaged, the affected areas shall be repaired to the aforementioned condition.
- G. Areas to be sodded shall be shaped in such manner that they will, after placement of sod, conform to the typical sections. Lay sod uniformly, evenly, and parallel to the finished contour.
- H. Minimize traffic on newly laid sod during installation. Provide plank or wood sheets as may be required to protect sod already laid during sodding operations.
- I. Lay each strip with tightly-fitted joints against each other without voids. Do not overlap edges. Joints at the ends of sod strips shall be staggered with adjacent strips of sod.
- J. Finish sod edges at walks, curbs, planting, mulch edges, and other vertical surface by cutting neatly and fitting tightly to edge and line.
- K. Sod mat to be approximately one inch below finished height of walks, pavement, curbs, etc. Any sod not conforming to this requirement will be removed, the subgrade adjusted, and the sod re-laid.
- L. Where new sod joins existing lawns, cut straight and neatly into existing lawn and level subgrade to allow height to match.
- M. Soil shall be firmed or healed in along the edges of the sodded areas.
- N. Stake sod on the slope ratio of 1 on 2 or steeper with minimum of two 8-inch stakes per square yard.
- O. After all sod is laid and thoroughly watered, roll all sodded areas (except staked sod), either with a small mechanical or hand roller, sufficiently to set or press sod into soil.

3.11 WATERING

- A. Prior to placement of seed or sod, areas shall be sprinkled with water sufficiently to make them moist, but not muddy. The initial application of water may be omitted if the area is sufficient moist from rainfall.
- B. Immediately following the placing and tamping of sod, the covered area shall be wetted thoroughly. Subsequent applications of water shall be as required.
- C. Immediately following the application of the mulch cover for seeding, water shall be applied in sufficient quantity to thoroughly moisten the soil to the depth of pulverization and then as necessary to germinate the seed and maintain growth.

3.12 MAINTENANCE

- A. For the first two (2) weeks following the placing of the sod, all sodded areas shall be thoroughly watered daily, through the use on an on-site watering system.
- B. Continue maintenance until sodded areas are established with sod knitted in place. Maintenance period shall be a minimum of 28 days, or to final acceptance.
- C. Maintenance of sodded areas shall include watering, weeding, mowing to a two to two and one half (2-2 1/2") inches height after growth has exceeded three (3") inches and prior to a four (4") growth, and replacement and installation of sod as originally specified for sodded areas failing to survive. Clippings from mowing which mat on the grass are to be removed.
- D. Water all sodded areas during maintenance period as necessary to maintain sod and soil moisture, supplement rainfall, to promote growth, proper rooting to ensure sod survival and to prevent dormancy.
- E. All seeded areas shall be maintained and watered by the Contractor until acceptance of the work as specified herein. Maintenance shall include reseeding, watering, repair, or erosion damage, and maintenance of mulch.
- F. Replanting: Prior to acceptance, seeded areas that show signs of substantial desiccation, as evidence by loss of color and distinct yellowing or by lack of germination, shall be considered failed and shall be reseeded and continue to be reseeded until acceptable cover is obtained. Replanting operations shall be as originally specified.
- G. Maintenance of Grades: Original grades of seeded areas shall be maintained after commencement of planting operations and until acceptance. Any damage to the finished surface from construction operations shall be repaired within a reasonable time. In the event erosion occurs from rainfall, such damage shall be repaired within a reasonable time. Ruts, ridges, tracks, and other surface irregularities shall be corrected, and re-seeded where required.
- H. Maintenance of Mulch: Mulch shall be maintained until covered with growing grass seedlings. Material that has been removed from the site by wind or other causes shall be replaced and secured.

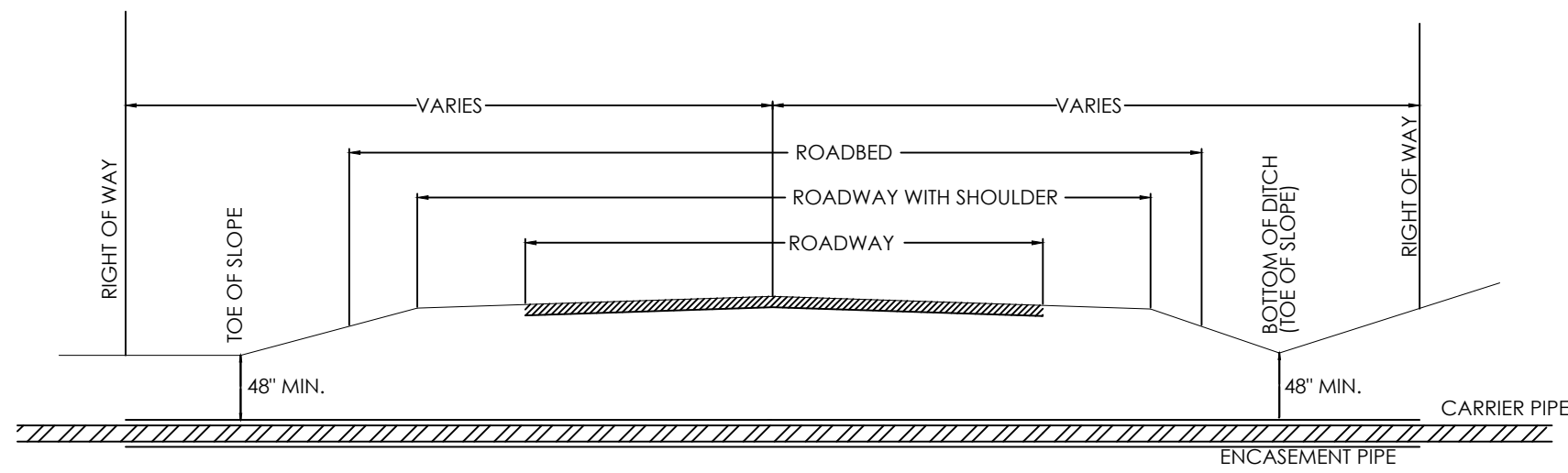
3.13 COMPLETENESS

- A. The lawn and grass operations shall not be considered complete until a uniform (e.g., evenly distributed, without large bare areas) perennial vegetative cover with a density of 80% of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures.

- B. If a satisfactory stand of grass has not been produced, the Contractor shall renovate and reseed the grass or unsatisfactory portions thereof.
- C. A satisfactory stand is defined as grass or section of grass that has:
 - 1. No bare spots larger than 1 square foot.
 - 2. Not more than 10 percent of total area with bare spots larger than 1 square foot.
 - 3. Not more than 15 percent of total area with bare spots larger than 6 inches square.

3.14 INTERMITTENT CLEANUP

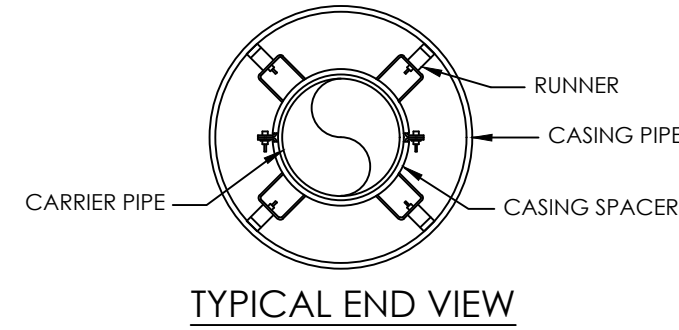
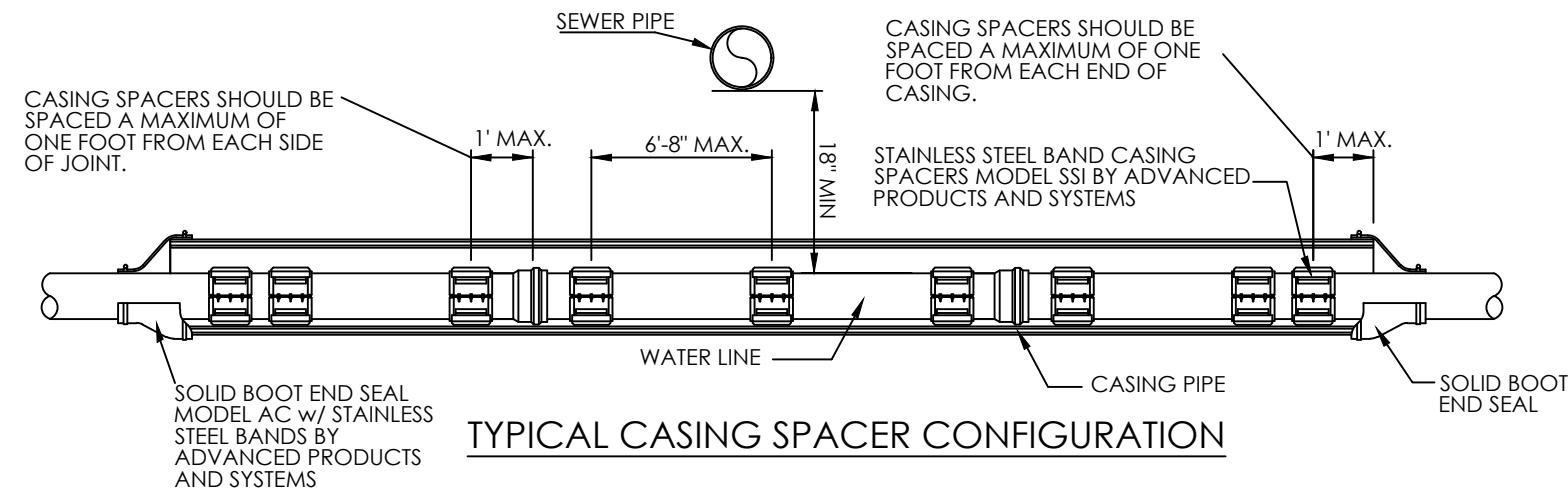
- A. Immediately following the lawn and grass restoration operations, all gutters, sidewalks, driveways, street pavement, yard or other areas shall be cleaned of all debris, excess sod, topsoil, or other objectionable matter. All such cleanup operations shall be completed before sodded areas are measured for payment.



- NOTES:**
- CASING SHALL EXTENDED A MINIMUM OF SIX (6) FEET BEYOND THE FLOW LINE OF PARALLEL DITCHES. TOE OF SLOPE, OR FACE OF CURB AS APPLICABLE FOR THE HIGHWAY SECTION.
 - ENCASEMENT MAY BE OF METALLIC OR NONMETALLIC MATERIAL.
 - THE STRENGTH OF THE ENCASEMENT MATERIAL SHALL EQUAL OR EXCEED STRUCTURAL REQUIREMENTS FOR HIGHWAY DRAINAGE CULVERTS.
 - A MARKER BEARING THE UTILITY OWNERS NAME SHALL BE PLACED AT EACH RIGHT OF WAY LINE WHERE CROSSED. (NOT REQUIRED FOR SERVICE LINES)
 - OWNERSHIP OF THE LINES SHALL BE SHOWN ON VENTS.
 - CASING PIPE SHALL BE SEALED AT THE ENDS WITH A FLEXIBLE MATERIAL.
 - CASING SHALL EXTEND RIGHT OF WAY TO RIGHT OF WAY.

ROAD CROSSING

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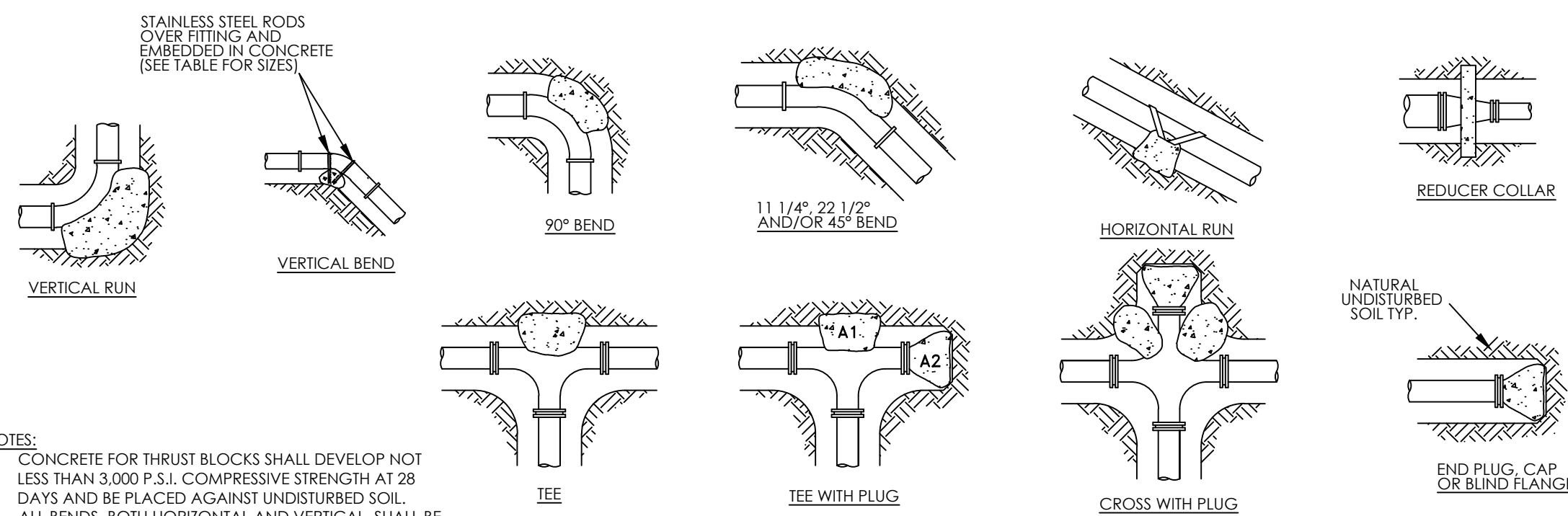
- NOTES:**
- SPACERS SHALL BE PREFABRICATED STEEL SPACERS, SMITH-BLAIR MODEL 883.
 - QUANTITY OF RUNNERS SHALL BE IN ACCORDANCE WITH CARRIER PIPE SIZE AS FOLLOWS:
TO 14" DIAMETER - 4 RUNNERS
16" TO 36" DIAMETER - 6 RUNNERS
38" TO 48" DIAMETER - 8 RUNNERS
 - DIMENSIONS BETWEEN SPACERS SHALL BE AS FOLLOWS:
STAINLESS STEEL - 8 TO 12 FEET.
CARBON STEEL - 8 TO 12 FEET.
 - WIDTH OF SPACERS SHALL BE IN ACCORDANCE WITH CARRIER PIPE SIZE AS FOLLOWS:
TO 14" DIAMETER - 8" WIDTH
16" AND LARGER DIAMETER - 12" WIDTH
 - A MINIMUM OF THREE SPACERS PER FULL JOINT OF PIPE. MAXIMUM SPACING BETWEEN SPACERS SHALL BE 6'-8".
 - ALL D.I. CARRIER PIPE MUST HAVE FIELD LOCK GASKETS INSTALLED WITHIN THE CASING PIPE. ALL PVC CARRIER PIPE MUST HAVE BELL RESTRAINTS ON EVERY PIPE BELL WITHIN THE CASING PIPE.
 - WATER LINES SHALL BE "CENTERED" IN CASING.
 - MAINTAIN 18" MINIMUM BETWEEN WATER AND SEWER MAINS. SEE "WATER CROSSING AT SEWER LINE" DETAIL.
 - ALL ENCASEMENT PIPE SHALL BE NEW STEEL & HAVE A MINIMUM WALL THICKNESS AS SHOWN IN THE ENCASEMENT/CARRIER PIPE SIZING CHART.

NOMINAL WATER LINE SIZE	NOMINAL ENCASEMENT SIZE (MIN.)	MIN. WALL THICKNESS (IN.)
3"	6"	0.250" (1/4")
4"	8"	0.250" (1/4")
6"	12"	0.250" (1/4")
8"	16"	0.250" (1/4")
10"	20"	0.250" (1/4")
12" to 14"	24"	0.3125" (5/16")
16" to 18"	30"	0.375" (3/8")
20" to 24"	36"	0.500" (1/2")

ENCASEMENT / CARRIER PIPE SIZING CHART

WATER MAIN ENCASEMENT

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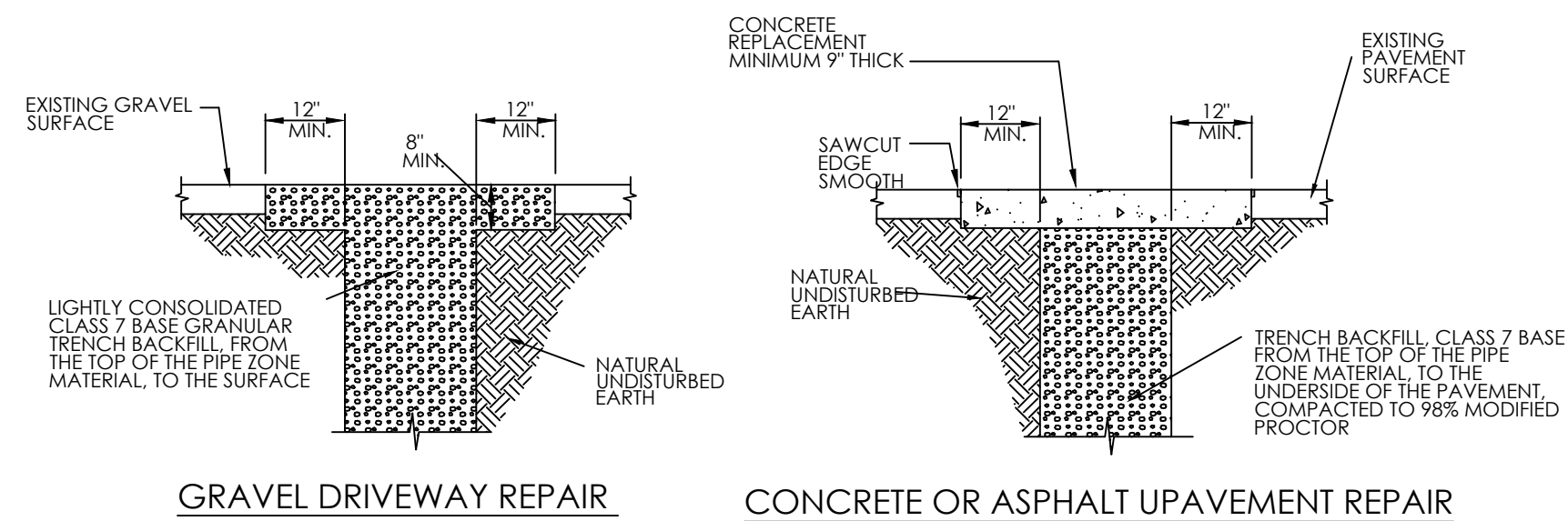


- NOTES:**
- CONCRETE FOR THRUST BLOCKS SHALL DEVELOP NOT LESS THAN 3,000 P.S.I. COMPRESSIVE STRENGTH AT 28 DAYS AND BE PLACED AGAINST UNDISTURBED SOIL.
 - ALL BENDS, BOTH HORIZONTAL AND VERTICAL, SHALL BE BACKED WITH CONCRETE. VERTICAL BENDS SHALL BE PLACED ON CONCRETE PADS WHERE BENDS TURN UP, OR LOADED WHERE BENDS TURN DOWN.
 - WRAP PIPE JOINTS IN 8 MIL POLYETHYLENE BEFORE PLACING CONCRETE. USE LONG-RADIUS FITTINGS WHEREVER POSSIBLE.
 - BEARING AREA SHOWN IN TABLE, IS BASED UPON A 2,000 LB/SF. SOIL BEARING, AND UPON A PIPE LINE PRESSURE OF 250 PSI PLUS WATER HAMMER. AREAS SHOWN SHALL BE ADJUSTED, SHOULD FIELD CONDITIONS VARY. UTILIZE MEGALUG THRUST RESTRAINTS ON MECHANICAL JOINT FITTINGS AND VALVES, IN ADDITION TO THESE THRUST BLOCKS.

THRUST BLOCK SCHEDULE									
BEARING AREA OF THRUST BLOCKS IN SQ. FT. (HORIZONTAL BENDS)					VOLUME OF THRUST BLOCK IN CU. YDS. (VERTICAL BENDS)				
FITTING SIZE	TEE W/YE PLOG OR CAP	90° BEND, PLUGGED CROSS	TEE PLUGGED ON RUN (A1)	TEE PLUGGED ON RUN (A2)	BEND ANGLE	45°	22 1/2°	11 1/4°	538°
2, 3 & 4	1.3	1.8	1.3	1.8	1.0	1.0	-	-	2.3 & 4
6	2.8	4.0	2.8	4.0	2.2	1.1	1.0	-	6
8	3.0	7.1	3.0	7.1	3.2	2.0	1.0	-	8
10	7.2	11.1	7.2	11.1	4.0	3.1	1.6	-	10
12	11.3	16.0	11.3	16.0	8.7	4.4	2.3	-	12
									ROD SIZE
									EMBEDMENT
									CUBIC YARDS

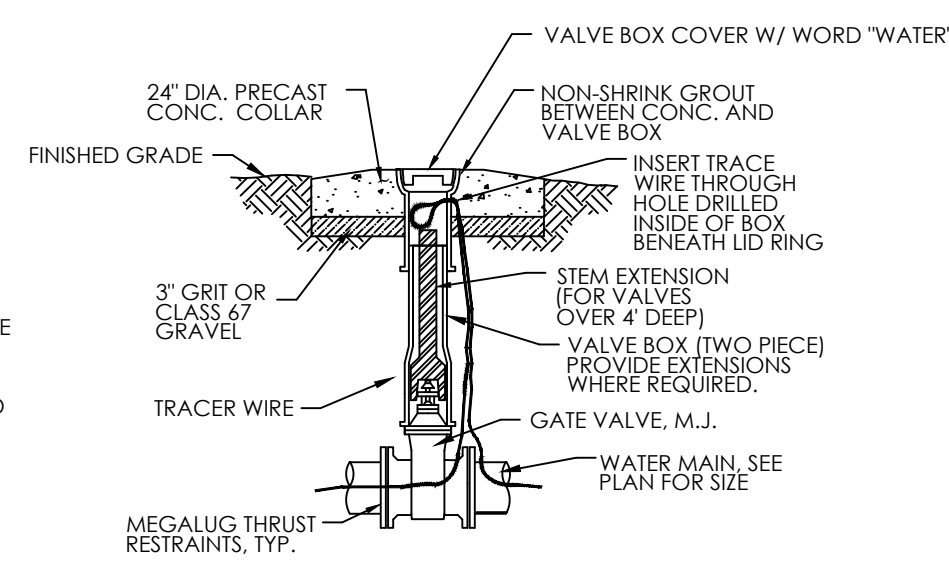
THRUST BLOCKING

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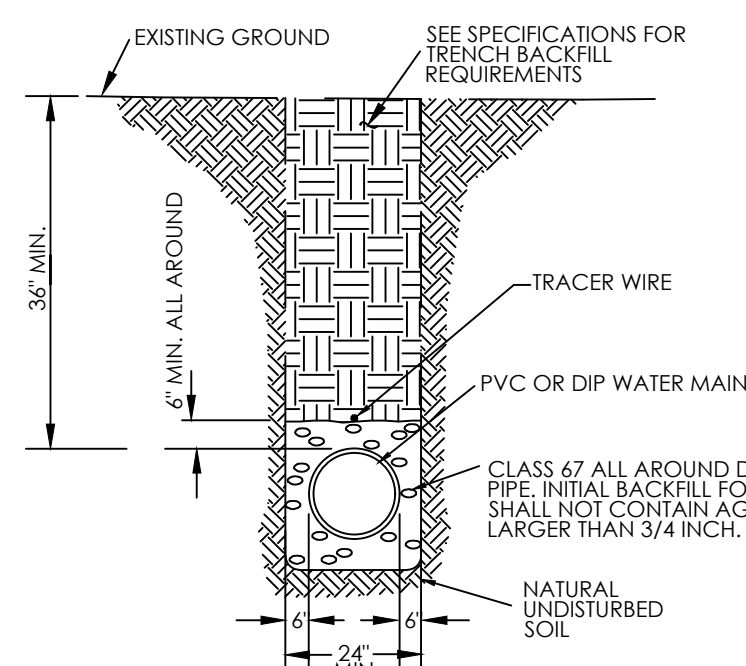
REPAIR DETAILS

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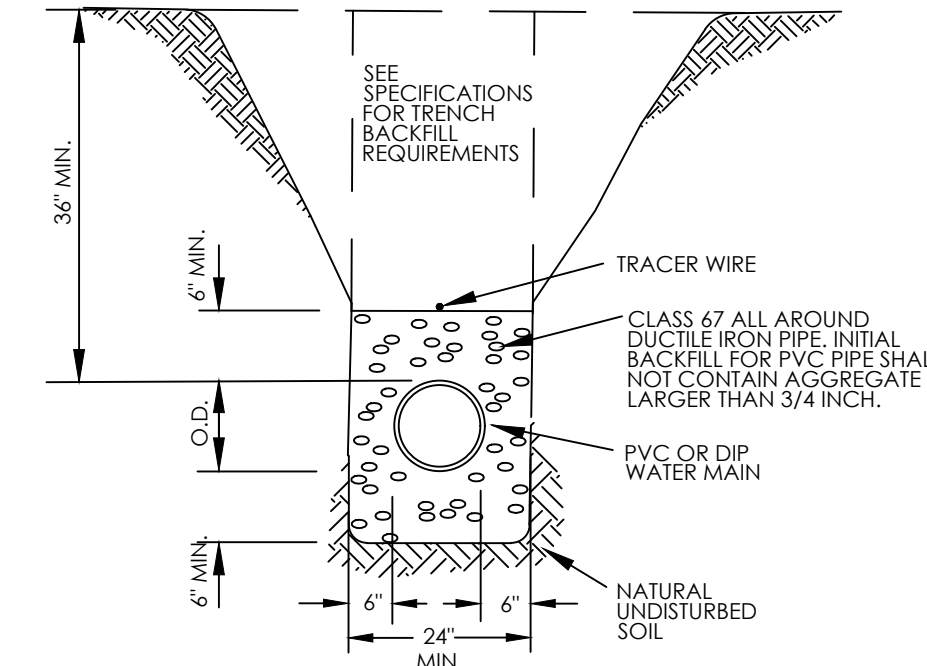
GATE VALVE

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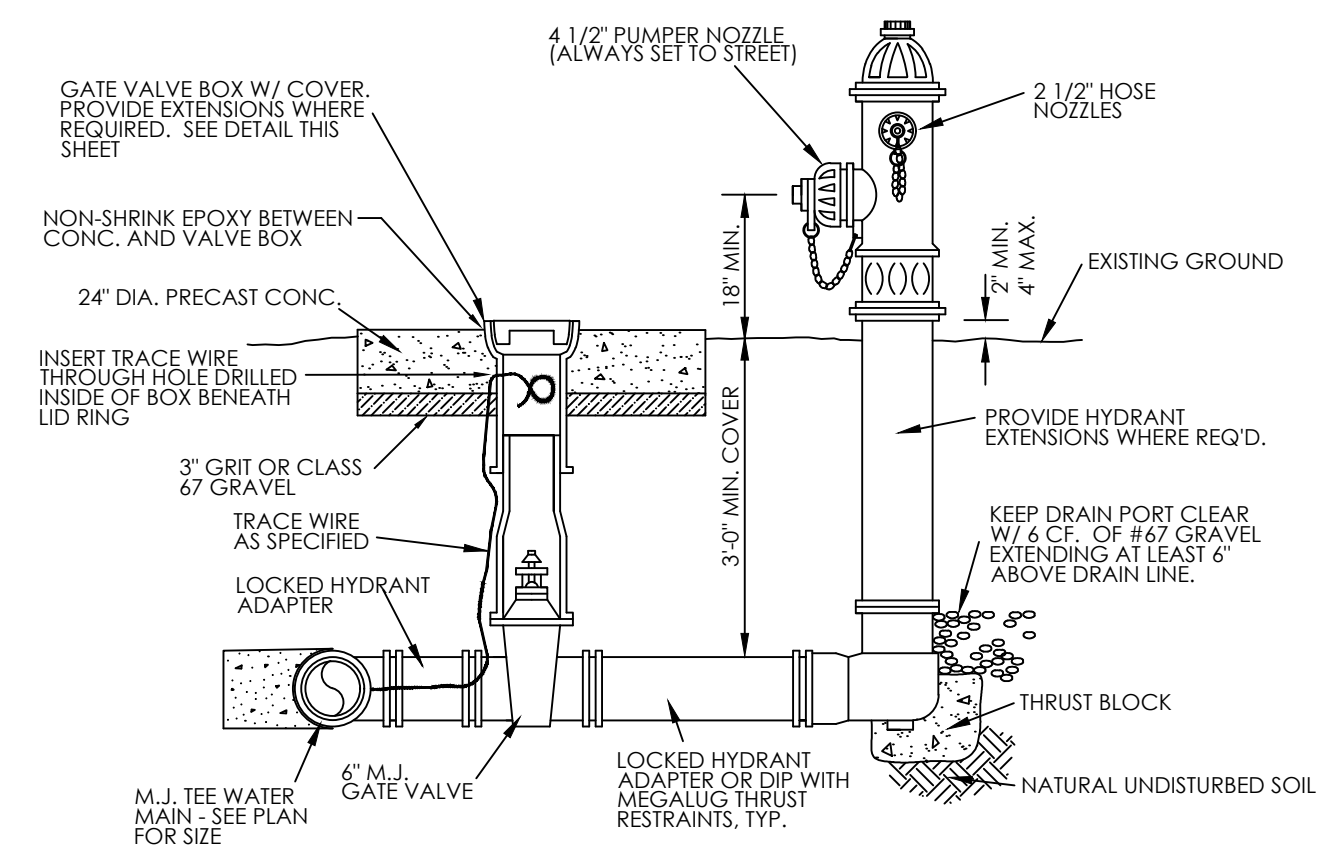
TYPICAL SOIL TRENCH

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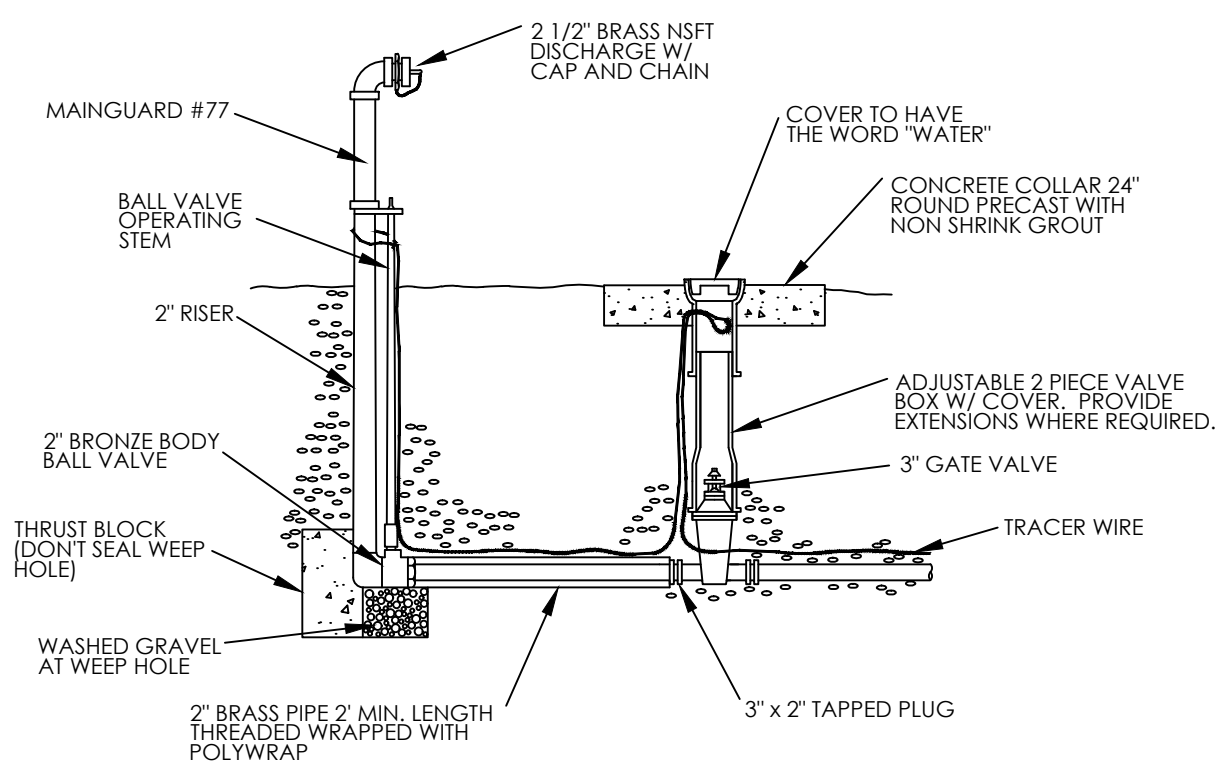
ROCK EXCAVATION TRENCH

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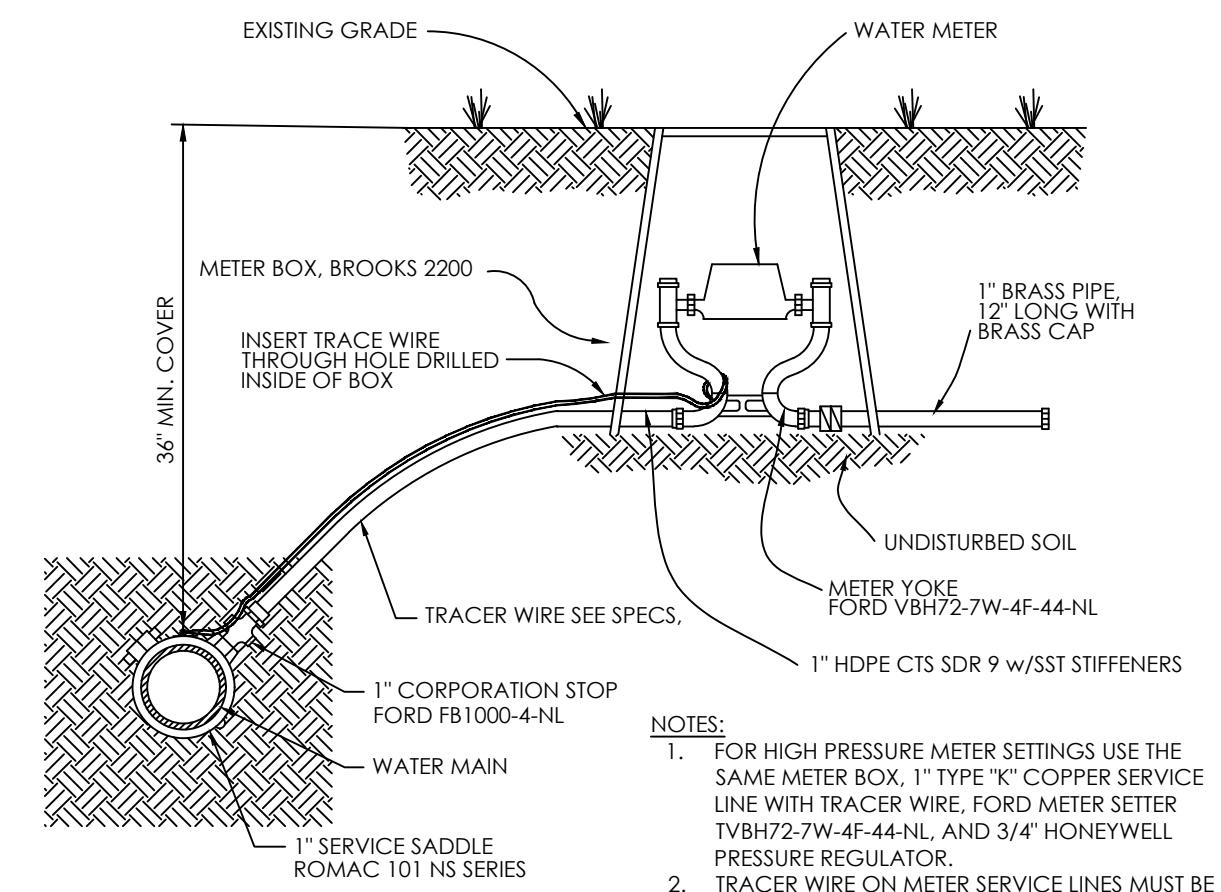
FIRE HYDRANT ASSEMBLY

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BLOWOFF ASSEMBLY

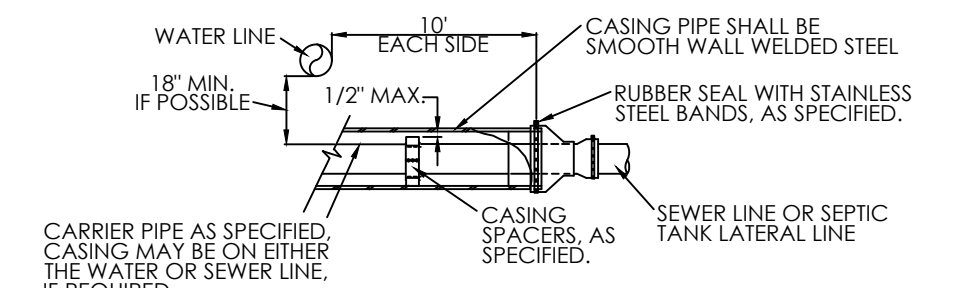
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SINGLE METER SETTING

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- NOTES:**
- INSTALL STEEL CASING ON THE WATER PIPE OR SEWER PIPE WHERE 18-INCHES OF VERTICAL SEPARATION CANNOT BE MAINTAINED OR WHENEVER SEWER PIPE IS ABOVE WATER LINE.
 - SEE "WATER MAIN ENCASEMENT" DETAIL.
 - SEWER LINES SHALL BE HELD TO SPECIFIED SLOPE.
- * SEE "WATER MAIN ENCASEMENT" DETAIL FOR REQUIRED CASING SIZES AND THICKNESSES.



WATER CROSSING AT SEWER LINE

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