



# Aristocrat Ranchette Water Project, Inc.

ENGINEERING & CONSTRUCTION STANDARDS

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## PART I – ENGINEERING AND PLAN REQUIREMENTS

### 1. INTRODUCTION

The Aristocrat Ranchette Water Project (ARWP) is a not for profit organization which receives treated water from Central Weld County Water District. The ARWP owns and operates a water pump station, storage tank, and distribution system. The ARWP's bylaws allow the board of directors to adopt, maintain, and modify engineering and development standards for any proposed extension, connection to, or modification of the ARWP system. These standards set forth both engineering and construction related requirements. No exceptions, modifications, or exemptions to these standards are allowed unless provided in writing by the ARWP and its engineer. All roadway ROW is within Weld County. Developer must notify Weld County for any ROW requirements.

### 2. DEFINITIONS

ARWP: The Aristocrat Ranchette Water Project. The owner of the water system.

ARWP Engineer: The ARWP's designated on-call engineering.

Developer: The entity, person, or persons proposing to extend, tie-in to, or otherwise modify the ARWP water system.

### 3. HYDRUALIC MODELING

#### 3.1. Hydraulic Model and Report

A hydraulic analysis for the water distribution system for a given project shall be completed by the ARWP Engineer. The developer shall submit to the ARWP engineer, all project survey information, along with corresponding elevations, and the elevation at the ARWP tank site. Recommendations from the ARWP engineer for pipe sizing and layout will be determined from the modeling process and the results submitted to the developer's engineer prior to starting the final design.

#### 3.2. Topographical Survey Requirements

A topographical survey of the project area must be submitted along with the hydraulic model to determine provided pressures. The survey shall cover the areas where proposed water mains are to be laid and shall be provided at 1-foot contour intervals.

#### 3.3. Modeling Results and Requirements

Modeling recommendations and requirements provided by the ARWP Engineer are final and must be followed.

### 4. CONSTRUCTION PLAN REQUIREMENTS

The following information shall be included, where applicable, on all plans submitted to the ARWP Engineer.

#### 4.1. Title Block Requirements

- Project name
- Project owner information
- Sheet number
- Revision history

#### 4.2. Cover Sheet Requirements

- Name of project
- Vicinity and location maps
- P.E. stamp and signature block
- ARWP approval signature block
- Fort Lupton Fire Department approval signature block
- Sheet index
- Contact information for ARWP administration staff, LWMC operator, and ARWP engineer
- Contact information for other utility providers in project area

#### 4.3. Existing Conditions (Topographical Survey) Requirements

- Existing contours (1-foot contour interval)
- Existing utilities including rim and inverts on manholes and valve boxes etc.
- Property ownership information
- Right-of-way (ROW) and easements
- Street names
- North arrow and scale bar
- Location of any structures in the project area

#### 4.4. Water Utility Notes and Plan Requirements

- ARWP construction notes (included in these standards)
- Street names
- Proposed water main and appurtenances
- Section views of utility crossings
- Water piping lengths
- Stationing
- List of quantities for water mains
- Number of taps (address and tap size), tap number to be provided by ARWP
- Property ownership information
- Right-of-way (ROW) and easements (existing and proposed)
- Lot and block numbers
- Lot dimensions
- North arrow and scale bar
- Location of proposed structures, fences, trails, or other improvements

#### 4.5. Detail Sheet Requirements

- Provide all applicable ARWP standard details.

## 5. ENGINEERING REQUIREMENTS

### 5.1. Engineering Design and Construction Management

All construction plans shall be prepared in accordance with the latest revision of these Engineering Standards and plan submittal procedures of the ARWP.

The ARWP engineer shall review all plans, provide construction oversight, construction closeout services, and review and approve all material submittals prior to installation. The cost of all engineering related costs shall be the responsibility of the developer.

### 5.2. ARWP Approval Block

The below title block shall be placed on the cover sheet of engineering plans submitted to the ARWP.

<u>ENGINEERING REVIEW</u> <u>ARISTOCRAT RANCHETTE WATER PROJECT</u> <u>(ARWP)</u>	REVIEW IS FOR GENERAL COMPLIANCE WITH ARWP ENGINEERING STANDARDS AND REQUIREMENTS. THE ARWP IS NOT RESPONSIBLE FOR THE CORRECTNESS OF DESIGN, DIMENSIONS, DETAILS, QUANTITIES OR DESIGN SAFETY.
<input type="checkbox"/> NO EXCEPTIONS TAKEN	_____
<input type="checkbox"/> MAKE CORRECTIONS NOTED	_____
<input type="checkbox"/> REJECTED-SEE CHECKLIST	_____
	ARWP ENGINEER
	DATE
THESE PLANS ARE VALID FOR TWO (2) YEARS AFTER THE DATE OF APPROVAL. RESUBMITTAL TO THE ARWP IS REQUIRED AFTER THAT TIME PERIOD.	

### 5.3. Engineering Fee Deposit

Engineering fees for development project coordination, review, construction oversight, or other costs incurred by the ARWP engineer shall be paid for directly by the developer. The ARWP will dictate an initial deposit which will be drawn on. Once the initial deposit is drawn down 80% the deposit will be replenished by the developer. If the deposit is not replenished work by the ARWP will cease and the development will not move forward. See ARWP annual fee schedule for deposit requirements.

### 5.4. Tap Request and Fee

Tap fees shall be paid as required by the ARWP. The ARWP sets tap fees at its sole discretion. The developer must agree to and sign the *ARWP Policy and Procedure for New and Replacement Tap Connections and Service Line Installations*. See ARWP annual fee schedule for tap fees.

#### 5.5. Water Tap Construction Observation

Water tap connections to or any excavations of the ARWP will be overseen by an ARWP designated representative paid for by the developer or entity completing the tap.

#### 5.6. Plan, Profile and Sections

Engineering plans shall show the horizontal layout of the proposed water main. Water main profiles are required where the proposed finished grade (roadway or otherwise) does not match the existing grade. The profiles shall show the water main, existing grade, proposed finished grade, and any utility crossings. Sections of utility crossings are required where the water main is two feet or less vertically from another utility.

#### 5.7. Horizontal Layout

The water main shall be stationed either off the centerline of the roadway with offsets or the centerline of the proposed water main. All bends, valves, or other appurtenances shall be stationed and labeled clearly. Lengths, size and material of proposed water main shall be clearly called out. Lengths shall be from fitting to fitting, or fitting to appurtenance.

The location of the waterline as measured off ROW, property lines, or easements shall be shown along with the width of the ROW and/or easement.

When tying into an existing main the plans shall show the distance to and location of the nearest valve on both sides of the proposed tie-in.

### **6. EASEMENTS AND PLATS**

All construction drawings must be accompanied by recorded plats and/or easements where water lines are located. All easements must be shown and dimensioned on the construction drawings. Easement information shall include book and page number of recordings.

### **7. STANDARD NOTES**

The following General Construction, Construction Procedures/Project Closeout, and Compaction Testing Requirement notes must be placed in the notes sheet of the construction plans.

#### **GENERAL CONSTRUCTION NOTES**

1. All materials and workmanship shall be in conformance with the ARWP Engineering Standards. All work shall be inspected and approved by the ARWP Engineer.
2. The contractor shall notify the ARWP Engineer and the ARWP at least one-week (1) week prior to any construction.
3. All required permits shall be obtained by the contractor from the ARWP and other required agencies for work performed in the public right of way.



4. The contractor shall notify Utility Locates and determine the location of all existing underground utilities prior to proceeding with the excavation. All work performed in the area of the public utilities shall be performed according to the requirements of these agencies.
5. The contractor shall contact all appropriate utility companies and the ARWP prior to the beginning of any construction. The contractor shall be responsible for locating any existing utility (including depths) which may conflict with the proposed construction. All existing utilities shall be protected from damage by the contractor. Damaged utilities shall be repaired by the contractor at his own expense.
6. At least ten (10) days prior to the start of construction, a pre-construction meeting will be held and attended by the contractor and representatives of other approving agencies. It will be the responsibility of the contractor to contact the ARWP staff and Engineer.
7. The contractor is responsible for notifying all customers possibly affected by outage of water during construction.
8. Prior to installation of water mains, road construction must have progressed to at least the "sub-grade" stage. Sub-grade is defined as an elevation of no more than seven inches below the finished street grade.
9. All valve boxes and fire hydrants will be adjusted to the final finished grade by the contractor.
10. When necessary to lower or raise water lines at storm drains and other utility crossings, a minimum clearance of one and one-half feet (1½') shall be maintained between outside of pipes.
11. The contractor shall always have in his possession one (1) signed copy of the plans which have been approved by the ARWP.
12. All water mains shall be C900 DR 18. Provide 8 Mil. polyethylene wrapping per AWWA Standard C105 at storm and conduit crossings, and fire hydrants and valves. All fittings shall be made from gray-iron or ductile iron and furnished with mechanical joint ends. All fittings shall have a pressure rating of two hundred fifty (250) psi and shall be wrapped with an 8 Mil. minimum thickness polyethylene material per AWWA Standard C105. All ductile iron pipe or fittings to be polyethylene wrapped.
1. There shall be a minimum cover of five feet (5') over all water mains and service lines.
2. All bends, tees, fire hydrants shall be mega lugged and protected from thrust by using concrete thrust blocks per Details.

3. All backfill material shall be compacted to ninety-five (95%) standard proctor density. All testing and compaction tests must be submitted in a typed format to the ARWP Engineer prior to Initial Acceptance. Material testing reports with a letter stamped by a Licensed Professional Engineer attesting that the work is in conformance with the project specifications will be furnished to the ARWP Engineer. Compaction of all trenches must be attained in accordance with the soils report.
4. Trenches shall be excavated, and the pipe exposed for the inspection at any location of the project if so ordered by the inspector. All trenches must be backfilled at the end of each day and the end of pipe at tie-in location for the next day be fenced for safety.
5. No work shall be backfilled until the water line construction has been inspected and approved for backfilling by the ARWP Engineer or representative of the ARWP Engineer.
6. Chlorination and Flushing: The lines shall be chlorinated in accordance with AWWA C-601 or latest, "Disinfecting Water Mains." The preferred method is to use enough chlorine tablets to produce a 100 mg to 1 solution. These tablets should be adhered to the top of the pipe section with Permatex. The chlorination and flushing of any finished pipeline shall be done prior to the hydrostatic testing. Sterilization and flushing of all mains shall be inspected by the ARWP Inspector. Clearwater test shall be completed by a certified lab and the results submitted to and approved by the ARWP Engineer prior to service lines being installed.
7. Hydrostatic Testing: All pipe shall be field pressure tested to a minimum of one hundred fifty (150) psi for 2 hours. All testing shall be done in the presence of an ARWP Inspector.
8. The contractor/developer will be held responsible for the proper functioning of the water lines for up to two (2) years from the date of Initial Acceptance of the lines by the ARWP. Any malfunction during this period of guarantee shall be remedied by the contractor to the satisfaction of the ARWP Engineer at no expense to the ARWP.

#### **CONSTRUCTION PROCEDURES/PROJECT CLOSEOUT**

1. A pre-construction meeting shall be held with the ARWP Engineer. The Design Engineer, contractor shall also be in attendance. The meeting shall be scheduled at least ten (10) days prior to the start of construction.
2. Project shall be inspected by an ARWP inspector during construction of all proposed water system improvements. The cost of inspection shall be the responsibility of the developer.
3. Upon completion of construction, compaction test results shall be received by the

ARWP Engineer.

4. Water mains tested in accordance with ARWP specifications, in the presence of ARWP representative, and results submitted to ARWP Engineer.
5. Punch list work completed by contractor and project re-inspected for Initial Acceptance of construction.
6. Notice of Initial Acceptance and starting date sent to developer, Design Engineer and contractor.
7. The project will be inspected for Final Acceptance approximately one (1) year and ten (10) months after Initial Acceptance.
8. Upon completion of the inspection, any problems which need to be corrected will be itemized and sent to the developer for correction prior to Final Acceptance.
9. The contractor shall keep a neat set of as constructed drawings during construction. The developer is responsible for submitting as built documentation prior to initial acceptance. As-builts and electronics, CADD files etc., including plats showing addresses for each lot to be served shall be submitted to ARWP Engineer for review.
10. The date of Final Acceptance will be indicated in the conditions of the Initial Acceptance Letter. The developer shall be responsible for contacting the ARWP for a final inspection and Final Acceptance.

## COMPACTION TESTING REQUIREMENTS

Compaction tests will be taken by an approved testing laboratory at locations designated by the ARWP Engineer. All expenses involved in these tests will be borne by the developer/contractor. Results of the tests will be made available to the ARWP Engineer immediately and copies of test results will be supplied to the ARWP Engineer once per week. A final typed bound copy of final test results must be submitted to the ARWP Engineer at the end of the project. In all cases where the tests indicate compaction less than that required in these Standards, additional compaction and tests will be required until these specifications are met. Probationary Acceptance of the lines by the ARWP will be contingent upon satisfactory compaction results. No hydrostatic testing of the water main will be allowed until satisfactory compaction is obtained. Frequency of testing will be as follows:

- a. One (1) test at every above ground appurtenance (i.e. valve box, manhole) at two-foot (2') increments.
- b. One (1) test every two hundred (200) LF of mainline trench at two-foot (2') increments beginning two feet (2') above pipe to final grade and one test at final grade.
- c. Two (2) tests at every service. One (1) test three feet (3') from main line and one (1) test two (2) beyond proposed edge of road all at two-foot (2') increments.
- d. These requirements are for all water lines/equipment installed within public ROW and in dedicated easements.

## PART II – WATER SYSTEM SPECIFICATIONS

### 1. PURPOSE AND GENERAL REQUIREMENTS

#### 1.1. General

All water distribution systems shall comply with the requirements of the Engineering Standards for water main and service line construction and may include special criteria established by the ARWP for the overall hydraulics of the water utility system. Special criteria shall be outlined at pre-design meetings scheduled, as determined necessary, by the ARWP Engineer.

### 2. DESIGN CRITERIA

#### 2.1. Distribution System Layout

- 2.1.1. Distribution mains and lateral lines shall be located as indicated on the accepted plans.
- 2.1.2. Dead ends shall be minimized by looping whenever possible. All permanent dead ends shall require a fire hydrant.
- 2.1.3. Special attention should be given to other utilities (storm and sanitary sewer if any) during the design phase to minimize water lowering's.
- 2.1.4. Mains and laterals shall be extended to the boundaries of filings and completely across the frontage of individual lots. Valves shall be placed at the boundary and a minimum of one (1) length of pipe installed past the valve for future tie-ins.

#### 2.2. Location of Water Line Appurtenances

##### 2.2.1. Water Mains in Roadways

When the water mains are placed in roadways they shall be placed as follows:

- a. On streets running north and south, the water main shall be placed ten feet (10') east of the centerline of the street.
- b. On streets running east and west, the water main shall be placed ten feet (10') north of the centerline of the street.
- c. On streets shaped as a "U" or on streets having unusually sharp turns, the water main will conform to the above specifications as near as practical, but the final location shall be as determined by the ARWP Engineer or his representatives.

##### 2.2.2. Water Mains in Easements

In areas where water mains are placed in easements, all water mains shall be located within the easements shown on the approved drawings. All water main easements must be a minimum of twenty feet (20') in width for exclusive easements and ten feet (10') additionally per each other utility for non-exclusive easements. No water line shall be located less than five feet (5') from the edge of an easement.

### 2.3. Service Line Layout and Locations

- 2.3.1. Water service shall be located a minimum of ten feet (10') horizontally from the sewer service. Service lines shall be installed in a continuous straight line and shall enter the property a minimum distance of five feet (5') from the nearest lot corner.
- 2.3.2. The main to be tapped must extend a minimum distance of twenty feet (20') beyond the lot line of the property to be served and the service line connection and service must be a minimum distance of five feet (5') into the lot.
- 2.3.3. In the case of corner lots, the property may be served from the side lot line under the same regulations as above along as the water and sewer services are on the same side of the lot.
- 2.3.4. If service is requested for lots at the end of a cul-de-sac street, the main to be tapped must be not more than fifty feet (50') from any property line in the cul-de-sac. The service pipe shall be in a continuous straight line and shall enter the property a minimum distance of five feet (5') from the nearest lot corner.

### 2.4. Valve Spacing and Marking

- 2.4.1. Valves shall be placed with a maximum spacing of six hundred feet (600') in all distribution mains and lateral lines.
- 2.4.2. Tees shall require three (3) valves. Crosses shall require four (4) valves. All valves located at intersections shall be placed within three feet (3') of the tee or cross.
- 2.4.3. Valves shall also be placed at each end of a line running through an easement on private property, on each side of a creek or channel crossing.
- 2.4.4. All valves will require permanent marker post per the Details.

### 2.5. Pipe

All pipe used for distribution mains and lateral lines shall be C900 PVC DR18 pipe unless otherwise approved in writing by the ARWP Engineer.

### 2.6. Pipe Minimum Depth and Locate Wire

All pipe shall be installed with a minimum five feet (5') of cover from finished grade of street to the top of pipe. Twelve (12) gauge insulated tracer wire is required on all water lines and locate station at each fire hydrant, and wire stubbed into each valve box.

### 2.7. Pipe Deflection

Changes in direction of waterline pipe shall require bends in all instances. Deflection of PVC pipe may be achieved by deflection according to manufacturer's recommendations only. All deflections proposed on construction plans shall have distances and degrees of deflection.

## 2.8. Fire Hydrant Spacing and Locations

- 2.8.1 In single-family residential areas, fire hydrants shall be spaced a maximum of five hundred feet (500') apart as measured along street curb line. A hydrant shall be placed at the end of each cul-de-sac, and at all permanent dead end lines.
- 2.8.2 In business, industrial and high-density residential areas, hydrants shall be spaced not greater than three hundred feet (300') apart or as approved by Fire District.
- 2.8.3 Fire hydrants shall be located, where possible, on the northeast corner of an intersection a minimum of eighteen inches (18") behind the curb or sidewalk, or a minimum of twenty-four inches (24") inside the street ROW, and set on the curb return. Where this is not possible, fire hydrants shall be located as directed by the ARWP Engineer. All fire hydrant street valves shall be six inches (6") and shall be located at, or within three feet (3') of, tee from the main line. See Valve and Fire Hydrant Location Detail.

## 2.9. Air Relief Valves

- 2.9.1. Air relief valves shall be installed at each high point in all distribution mains and at high points of lateral lines or other areas as directed by the ARWP Engineer.
- 2.9.2. Air relief valves shall be installed in precast manholes or vaults fitted with air vents open to the atmosphere and in accordance with the Details.

## 2.10. Blow-offs

Provisions shall be included in the design to allow for the flushing of distribution mains and lateral lines at any low point in the system, or at any point noted on the approved plans. Fire hydrants shall be used for all permanent blow-offs.

## 2.11. Pressure Reducing and Regulating Valves

Pressure reducing and regulating valves shall be of a type capable of maintaining pre-adjusted downstream pressures, varying rates of flow and upstream pressure without causing water hammer. Valves shall be piston type, not spring operated, with flanged end connections, and shall be installed in concrete valve vaults of sufficient size to provide adequate maintenance and operation. Valves shall have gate valves and pressure gauges on both upstream and downstream sides and shall have bypasses with smaller pressure reducing and regulating valves to handle minimum flows as determined by the ARWP Engineer. All gate valves in the vaults shall be capable of being operated from above ground by use of two-inch (2") square valve keys. All PRV's shall be as manufactured by Cla-Val.

## 2.12. SCADA

SCADA will be required for all equipment which is necessary to monitor. SCADA shall be compatible with the ARWP 's system, and the system must be approved by the ARWP Engineer.

### 3. WATER MAIN CONSTRUCTION

#### 3.1. General Provisions

All water main construction within the ARWP and all water service line construction connecting to the Companies water system shall be done in accordance with these Engineering Standards, and the accepted plans shall apply to new water system construction as well as repairs to existing facilities. When special conditions are encountered or deviations from these Engineering Standards are required by the ARWP Engineer and such changes are in the best interest of the ARWP, the decision of the ARWP Engineer shall be final.

#### 3.2. Permits Required

No permits will be issued until the ARWP Engineer has approved and signed final construction drawings, and the required fees paid. A pre-construction meeting with the ARWP Inspector and ARWP Engineer, the developer and contractor shall be scheduled and completed prior to the commencement of any construction. A full set of submittals is required to be submitted 2 weeks prior to the pre-construction meeting. The ARWP Engineer shall be notified seven (7) working days before construction is to begin.

#### 3.3. Maintenance of Traffic

A traffic control plan must be submitted to ARWP for approval. The county may require a traffic control plan as well. The county approved traffic control plan must be provided to the ARWP engineer.

#### 3.4. Excavation

Excavation for pipelines, fittings, and appurtenances shall be open trench to the depth and in the direction necessary for the proper installation of the same as shown on the approved drawings or as otherwise approved by the ARWP Engineer. Any water which may be encountered or may accumulate in the excavation shall be pumped out or otherwise removed as necessary to keep the bottom of the excavation free and clear of water during the progress of the work.

3.4.1. Limit of Excavation – Except by expressed written permission of the ARWP Engineer, the maximum length of open trench shall be 200 hundred feet (200'), or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is smaller. The distance is the collective length at any location, including open excavation, pipe laying and appurtenances, construction and backfill which has not been temporarily resurfaced. No trench shall be left open at any time that the contractor is not on the job site engaged in construction operations. In existing developments excavation will not be permitted to advance more than one hundred fifty feet (150') ahead of pipe laying and two hundred feet (200') in advance of the backfill operations. No trench will be left open overnight without written permission of the ARWP engineer.

3.4.2. Inspection by the ARWP Engineer – The purpose of the inspection shall be to reject any pipe that, independent of the physical tests herein specified, fails to conform to the requirements of the referenced specifications, or that may have been damaged during transportation and/or in subsequent handling.



The ARWP Engineer reserves the right to reject any and all pipe sections that may contain visual imperfections or imperfections of any type that may be considered by the ARWP Engineer to be detrimental to the operation and life of the pipe.

- 3.4.3. Trench Width – The overall trench width shall not be more than twenty-four inches (24”) nor less than twelve inches (12”) wider than the largest outside diameter of the pipe to be laid therein, measured at the top of the pipe, exclusive of branches. Excavating and trenching shall be true to line so that a clear space of not more than twelve inches (12”) or less than six inches (6”) in width is provided on each side of the largest outside diameter of the pipe for proper placement and densification of the bedding or backfill. For the purpose of this section, the largest outside diameter shall be the outside diameter of the bell, on bell and spigot pipe. All trenching sizes shall be in accordance with the Standard Bedding Details. Where the width of the lower portion of the trench exceeds the maximum width herein stated, the contractor, at his own expense, shall furnish and install special pipe embedment or concrete encasement to protect the pipe from the additional loading. The pipe supplier shall determine the type and quantities of special pipe embedment, using trench-loading criteria based upon saturated backfill weighing 120 pounds per cubic foot and allowance for truck and other superimposed live loads.
- 3.4.4. Excavation Below Grade – The trench shall be excavated to a minimum depth of six inches (6”) below the bottom of the pipe. Before the pipe is laid, the subgrade shall be made by backfilling with an approved material in three-inch (3”) uncompacted layers. The bedding material shall be hand leveled as to provide a continuous bearing and support for the pipe at every point.
- 3.4.5. Trenching by Hand or Machine – Hand methods for excavation shall be employed in locations directed by the ARWP Engineer. In other locations, the contractor may use trench digging machinery or employ hand methods.
- 3.4.6. Bracing Excavations:
  - a. All excavations shall be properly supported in the manner as required by Occupational Safety and Health Administration or as required by State laws and Municipal ordinances and as may be necessary to protect life, property, the work, or as ordered by the ARWP Engineer. Excavations shall be braced, sheeted and supported such that they will be safe, and the ground alongside the excavation will not slide or settle. Excavation shall be so braced or sheeted so as to provide conditions under which workmen may work safely and efficiently at all times. The sheeting, shoring and bracing shall be so arranged as not to place any stress on portions of the completed work until the general construction thereof has proceeded far enough to provide ample strength.
  - b. Care shall be exercised in the drawing or removing of sheeting, shoring, bracing and timbering to prevent the caving or collapsing of the excavation faces which are being supported.
- 3.4.7. Grading and Stockpiling – The contractor shall control grading in a manner to prevent water from running into excavations. Obstruction of surface drainage shall be avoided, and means shall be provided whereby storm and wastewater can be uninterrupted in existing surface drains or temporary drains.

### 3.5. Dewatering

- 3.5.1. The contractor shall provide and maintain at all times during construction, ample means and devices with which to promptly remove and properly dispose of all water from any source entering the excavations or other parts of the work. Dewatering shall be accomplished by methods which will insure a dry excavation and preservation of the bottoms of excavations. Said methods may include well points, sump pumps, suitable rock or gravel placed below the required bedding for drainage and pumping purposes, temporary pipelines and other means, all subject to the approval of the ARWP Engineer.
- 3.5.2. Dewatering for the water lines shall commence when groundwater is first encountered and shall be continuous until such time as water can be allowed to rise in accordance with the provisions of this section.
- 3.5.3. The contractor shall dispose of the water from the work in a suitable manner without damage to adjacent property or to new construction.
- 3.5.4. If ground water is discovered, the contractor shall have on sight at all times a Construction Dewatering permit issued by the Colorado Department of Public Health and Environment (CDPHE).

### 3.6. Foundations and Bedding

- 3.6.1. Foundations in Poor Soil – If excessively wet, soft, spongy, unstable or similarly unsuitable material is encountered at the surface upon which the bedding material is to be placed, the unsuitable material shall be removed to a depth as determined in the field by the ARWP Engineer and in accordance with the Standard Bedding Details.
- 3.6.2. Foundations in Rock – Where rock is encountered, it shall be removed below grade and the trench backfilled with rock uniformly graded between three-quarter inches ( $\frac{3}{4}$ " ) and one and one-half inches ( $1\frac{1}{2}$ " ) to provide a compacted foundation cushion with minimum allowable thicknesses of three inches (3" ) under the outside diameter of the pipe bell and six inches (6" ) under the pipe barrel. Material, other than what has been stated, can be used if accepted by the ARWP Engineer and necessary agencies. Whether or not the foundation material will be considered as rock and require bedding as described above will be determined by the ARWP Engineer.
- 3.6.3. Pipe Clearance in Rocks – Ledge rock, boulders and large stones shall be removed to provide a clearance of at least six inches (6" ) below and on the side of the pipe and fittings.

### 3.7. Bedding Procedure

- 3.7.1. The pipe shall be carefully bedded as shown in the Standard Bedding Details. The contractor shall be responsible for accurately shaping the pipe subgrade to fit the bottom of the pipe for the width shown on the Bedding Details. Use of the drag template shaped to conform to the outer surface of the pipe will be required if other methods do not give satisfactory results.
- 3.7.2. Each joint shall be recessed in bedding material as required by the Bedding Detail in such a manner as to relieve the bell or coupling of the pipe of all load and to insure continuous

bearing along the pipe barrel upon the pipe sub-grade.

- 3.7.3. The pipe bedding, using either squeegee or clean imported sand shall conform to the limits set by the ARWP Standards. The bedding material, either squeegee or imported sand, shall be placed by hand in layers not exceeding three inches (3") in thickness to the centerline (springline) of the pipe and each layer shall be solidly tamped with the proper tools so as not to injure, damage or disturb the pipe. Backfilling shall be carried on simultaneously on each side of the pipe to assure proper protection of the pipe. From the springline of the pipe to a distance twelve inches (12") above the top of pipe, the bedding material must be placed in layers not to exceed twelve inches (12").
- 3.7.4. The area shown on the Details from trench bottom to twelve inches (12") above this pipe shall be called the "pipe zone."

### 3.8. Installation of the Water Pipe

#### 3.8.1. General:

- a. All pipe shall be laid without break from fitting to fitting. Pipe shall be laid to the line and, where required, grade, as shown on the approved plans and in such a manner as to form a close concentric joint with the adjoining pipe and prevent sudden offsets of the line. Where possible, vertical deflections shall be made at pipe joints and vertical bends shall be eliminated. The interior of the water pipe shall be cleaned of all dirt and superfluous material of all description as the work progresses.
- b. At all times when pipe laying is not in progress, the open end of the pipe shall be closed with a tight-fitting cap or plug to prevent the entrance of foreign matter into the pipe. These provisions shall apply during the noon hour as well as overnight.

3.8.2. Alignment at Grade: The water line shall be laid and maintained to the required lines and grades as shown on the plans.

3.8.3. Whenever obstructions not shown on the plans are encountered during the progress of the work and interfere to such an extent that an alteration in the approved plans is required, the ARWP Engineer shall have the authority to change the plans and order a deviation from the line and grade.

#### 3.8.4. Laying of Pipe

- a. Lowering of Water Main Material into Trench – Proper implements, tools and equipment satisfactory to the ARWP Engineer shall be provided and used by the contractor for the safe and convenient performance of the work. All pipe, fittings, valves and hydrants shall be carefully lowered into the trench piece by piece in such a manner as to prevent damage to the water main materials and protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench.

If damage occurs to any pipe, fittings, valves, hydrants or water main accessories in handling, the damage shall be immediately brought to the ARWP Engineer's attention.

- b. Inspection Before Installation – All pipe and fittings shall be carefully examined for cracks and other defects while suspended and before installation. Spigot ends shall be examined with particular care as this area is the most vulnerable to damage from handling. Defective pipe or fittings shall be laid aside for inspection by the ARWP Engineer, who will prescribe corrective repairs or rejection.
- c. Cleaning of Pipe and Fittings – All lumps, blisters and excessive coating shall be removed from the bell or coupling, and spigot ends of each pipe, and the outside of the spigot and the inside of the bell or coupling shall be wire brushed and wiped clean and dry and free of oil and grease before the pipe is laid.
- d. Laying of Pipe – Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. If the pipelaying crew cannot put the pipe into the trench and place it without getting earth into it, the ARWP Engineer may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size, or plastic caps, shall be placed over each end and left there until the connection is made to the adjacent pipe. During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe.

As each length of pipe is placed in the trench, the spigot end shall be centered in the bell or coupling, and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the bells or couplings. Precautions shall be taken to prevent dirt from entering the joint space.

- e. Cutting of Pipe – The cutting of pipe for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or cement lining and so as to leave a smooth end at right angles to the axis of the pipe.
- f. Bell or Coupling Ends to Face Direction of Laying – Pipe shall be laid with the bell or coupling ends facing in the direction of laying, unless otherwise specified by the ARWP Engineer. Where the pipe is laid on a grade of ten percent (10%) or greater, the laying shall proceed upward with the bell or coupling ends of the pipe upgrade, if the progression of work allows.
- g. Permissible Deflection at Joints – Wherever it is necessary to deflect the pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions or plumb stems or where long radius curves are permitted, the amount of deflection allowed shall not be more than the manufacturers recommendations.
- h. Insulation Between Different Metallic Pipe Materials – Whenever it is necessary to join pipe or fittings with dissimilar metal, a method of insulating against the passage of electric current shall be provided and shall be approved by the ARWP Engineer.
- i. Installation of Polyethylene Wrapping (When Specified).
- j. Fittings – All fittings for polyvinyl chloride pipe shall be wrapped with polyethylene tubing as described above. Installation procedure shall be as follows:

Wrap tees, crosses and other fittings with a flat sheet obtained by splitting open a

length of polyethylene tube. Pass the sheet under the valve or fitting and bring it up around the body. Joint the seams by bringing the edges together, folding over twice and securing in place with tape.

Handle slack tube and overlapping at joints in the same manner described above for pipe.

Prepare openings for air reliefs, etc., by making an X-shaped cut in the polyethylene and temporarily folding back the edges. After installation is completed, replace the polyethylene and repair the cut with polyethylene adhesive tape.

#### 3.8.5. Jointing of Push-on Joint Pipe:

- a. Cleaning and Assembly of Joint – The inside of the bell remove oil, grit, excess coating and other foreign matter. The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the bell socket, or the coupling end of polyvinyl chloride pipe.
- b. A thin film of gasket lubricant shall be applied to either the inside surface of the gasket or the outside of the spigot end of the pipe or both. Gasket lubricant shall be supplied by the pipe manufacturer and approved by the ARWP Engineer.
- c. The spigot end of the pipe shall be placed into the bell or coupling end, without touching the ground with the spigot end after cleaning. The joint shall then be completed by forcing the plain end to the bottom of the socket. Pipe shall be marked with a depth mark to ensure that the spigot end is inserted to the full depth of the joint. Field-cut pipe lengths shall be marked by painting or file mark. The spigot end shall be ground or filed to resemble manufacture pipe end. Complete assembly instructions shall be provided by the pipe manufacturer.

3.8.6. Setting of Fittings – Fittings and plugs shall be joined to pipe in the manner specified herein for cleaning, laying and joining pipe.

#### 3.8.7. Installation of Water Line Appurtenances

- a. Valve Boxes and Valve Vaults:
  1. A valve box or valve vault shall be provided for every valve.
  2. All gate valves twelve inches (12”) and less and all butterfly valves twenty inches (20”) and less shall have valve boxes. Pressure reducing valves, check valves, and air relief valves shall be installed in concrete vaults. Valve stem extensions are required on all valve nuts greater than five feet (5’) in depth.
  3. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the wrench nut of the valve, with the box cover 6” below surface of the finished road.
- b. Valve Markers – All valves installed on the main transmission line with the exception of those on extended property lines, shall be identified with three inches (4”) flat

fiberglass post marker offset as directed by the ARWP Engineer and marked, with the distance to the valve and the appropriate identifying initials. Where the valve is to be installed in a vault equipped with a vent pipe, the vent pipe will also serve as a valve marker.

### 3.9. Backfilling

#### 3.9.1. General:

- a. All trenches shall be backfilled after pipe, fittings and appurtenances have been installed, inspected and approved by the ARWP Engineer. Bedding and “pipe zone” backfill shall be installed in accordance with this Section.
- b. Whenever a compaction requirement value is specified herein, the optimum moisture content and Standard Proctor Density shall be determined in accordance with AASHTO T-99 for ninety-five percent (95%).

3.9.2. Density Requirements in Trench – The contractor shall obtain a Standard Proctor Density of ninety-five (95%) for the total depth of all trenches in open fields and in dedicated ROWs. Backfilling shall be done with good sound earth, sand or gravel, and no oil cake, bituminous pavement, concrete, rock or other lumpy material shall be used in the backfill unless these materials are scattered and do not exceed six inches (6”) in any dimension and are not placed within one foot of the 2-1/2’ limit. Material of perishable, spongy or otherwise improper nature shall not be used in backfilling and no material greater than four inches (4”) in any dimension shall be placed within one foot (1’) of any pipe, manhole or structure. Backfilling shall be accomplished in the zone in layers not to exceed three feet (3’). All backfill material shall be subject to the approval of the ARWP Engineer.

3.9.3. Compacted Fill – Compaction shall be done by use of vibratory equipment, tamping rollers, pneumatic tire rollers or other mechanical tampers of the type and size approved by the ARWP Engineer. Hand tampers shall be used around all manholes, valve boxes, and any surface structure. The backfill shall be placed in horizontal layers of such depths as are considered proper for the type of compacting equipment being used in relation to the backfill material being placed. Each layer shall be evenly spread, properly moistened and compacted to the specified density. Any damage to the pipe as a result of contractor’s operation shall be repaired and/or replaced.

3.9.4. Procedure at Street Zone – The top two and one-half-foot (2 ½’) from finish street grade or ground surface, as the case may be, shall be compacted in horizontal layers not exceeding eight inches (8”) in thickness, using approved hand pneumatic or mechanical type tampers to obtain a Standard Proctor Density of ninety-five percent (95%). Flooding and jetting are not permitted. From existing street grade to two and one-half-foot (2 ½’) below street grade, the material for backfill may contain stones up to two inches (2”) in diameter, in quantity not exceeding twenty percent (20%) of the volume where said coarse materials are well distributed throughout the finer material and the specified compaction can be obtained.

### 3.10. Compaction Tests

Compaction tests will be taken by an approved testing laboratory at locations designated by the ARWP Engineer. All expenses involved in these tests will be borne by the developer/owner. Results of the tests will be made available to the ARWP Engineer immediately and copies of test results will be supplied to the ARWP Engineer once per week. A final typed bound copy of final test results must be submitted to the ARWP Engineer at the end of the project. In all cases where the tests indicate compaction less than that required in these Standards, additional compaction and tests will be required until these specifications are met. Probationary Acceptance of the lines by the ARWP will be contingent upon satisfactory compaction results. No hydrostatic testing of the water main will be allowed until satisfactory compaction is obtained. Frequency of testing will be as follows:

- a. One (1) test at every above ground appurtenance (i.e. valve box, manhole) at two-foot (2') increments.
- b. One (1) test every two hundred (200) LF of mainline trench at two-foot (2') increments beginning two feet (2') above pipe to final grade and one test at final grade.
- c. Two (2) tests at every service. One (1) test three feet (3') from proposed gutter and one (1) test behind proposed walk all at two-foot (2') increments.
- d. These requirements are for all utilities installed within public ROW and in dedicated easements.

### 3.11. Final Clean Up

After backfilling and compaction has been completed, the ROW shall be dressed smooth and left in a neat and presentable condition as close to final grade as possible and to the satisfaction of the ARWP Engineer.

### 3.12. Safety Precautions

All excavations shall be performed, protected and supported as required for safety and in the manner set forth in the operation rules, orders and regulations prescribed by the Occupational Safety and Health Administration Federal Register. Barriers shall be placed at each end of all excavations and at such places as may be necessary along excavations to warn all pedestrian and vehicular traffic of such excavations. Lights shall also be placed along excavations from sunset each day to sunrise of the next day until such excavation is entirely refilled.

### 3.13. Water and Sewer Crossings

3.13.1. Water mains shall be located a minimum of ten feet (10') horizontally from existing or proposed sanitary sewer lines (centerline distance). Where water mains cross house sewers or sanitary sewers, they shall be above sewers and laid to provide a vertical clear distance of at least eighteen inches (18") between the bottom of the water main and the top of the sewer. When a new water main crosses an existing sewer at a point less than eighteen inches (18") above the sewer, the ARWP Engineer shall be notified, and adjustments shall be made. Stability of the water and sewer lines at a point of crossing is critical and care must be taken to ensure proper welding and compaction of both water

and sewer lines.

- 3.13.2. Where it is not feasible to install a water main above an existing or proposed sewer, e.g., to maintain minimum cover, the water main shall be laid to provide a vertical clear distance of at least eighteen inches (18") between the bottom of the sewer and the top of the water main.
- 3.13.3. No water pipe or main shall pass through or, come within ten feet (10') horizontally of, any part of a sewer line or manhole.

### 3.14. Pipeline Testing After Installation

- 3.14.1. Chlorination – All mains, extensions and private pipe shall be chlorinated accordance with AWWA C-651 or latest, "Disinfecting Water Mains" and the local health authority having jurisdiction prior to the lines being accepted.

The chlorination of the finished pipelines shall be done in the presence of the ARWP Engineer. Prior to the hydrostatic testing the ARWP must receive documentation which indicates all Bacteriological test have passed.

- 3.14.2. Material – Chlorine tablets may be used for disinfection in twelve-inch (12") and smaller. For pipes having a larger diameter, a chlorine slurry is fed into the water filling the pipe. If chlorine tablets are used, they shall be attached to the inside top of the pipe with Permatex just prior to the pipe installation. Hypochlorite may be used and shall conform to Federal specification O-C-114, Type II, Grade B.

The contractor shall take all necessary precautions to prevent the flow of strong chlorine solution into existing water facilities and shall assume all responsibility for damages done by heavily chlorinated water.

- 3.14.3. Method – Flushing and sterilization of lines shall be accomplished in accordance with the requirements of the Colorado State Board of Health. Chlorine dosage shall be at least one hundred (100) parts per million and shall be retained in the line at least twenty-four (24) hours, after which time the residual at the end of the line and at other representative points in the line shall be at least ten (10) parts per million. If the residual at the end of twenty-four (24) hours is less than ten (10) parts per million, the entire operation shall be repeated.

All valves in the lines being sterilized shall be opened and closed several times during the contact period. After completion of sterilization, the system shall be flushed with clean water until the residual chlorine content is not greater than 1 part per million, or the existing systems normal residual. A ARWP representative will take all chlorine test. De-chlorination will be required on all flushing of lines with chlorine levels greater than system norm.

The contractor will be required to supply test bottles and pull clear water samples in the presence of a ARWP representative. A sample will be taken at every flushing hydrant and blow off. Or as directed by the ARWP engineer. The contractor will submit the samples to a state-certified laboratory.



3.15. Hydrostatic Pressure Test

- 3.15.1. The hydrostatic test pressure for any type of pipe shall be one hundred fifty (150) pounds per square inch based on the elevation of the lowest point in the line of section under test and carried to the elevation of the test gauge. All sections of newly laid pipe, subsequent to backfilling, shall be subjected to the hydrostatic pressure test.
- 3.15.2. The duration of the hydrostatic pressure test shall be at least two (2) hours.
- 3.15.3. Air Removal Before Test – Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the contractor shall install corporation cocks at such points as the air can be expelled as the line is filling with water. After all the air has been expelled, the corporation cocks shall be closed, and test pressure applied. Any cracked or defective pipe, fittings, valves or hydrants discovered in sequence of this pressure test shall be removed and replaced by the contractor with sound materials, and the test shall be repeated until results satisfactory to the ARWP Engineer are obtained.
- 3.15.4. Procedure – 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 manner satisfactory to the ARWP Engineer. The pump, pipe connection, gauges and all other necessary equipment and personnel to complete the test, shall be furnished by the contractor and shall be approved by the ARWP Engineer. All corporation cocks and taps to the main line and all connection piping and valves that may be required to make the test, whether or not specified or shown on the construction drawings, shall be installed by the contractor.

While the test pressure is maintained, the new pipe will be inspected, and any leaks will be repaired. After all leakage has stopped, the pressure of one hundred fifty (150) psi shall be maintained for two (2) hours.

The contractor shall ensure that a satisfactory test is completed and shall employ all methods necessary to pass the test, including disconnection from existing watermains and use of a temporary plug, if necessary.

- 3.15.5. Test Results – The contractor will be responsible for presenting certified test results to the ARWP Engineer prior to acceptance of the lines.

3.16. Responsibilities of the Contractor

- 3.16.1. The contractor shall be responsible for notifying the ARWP Engineer at least ten (10) days prior to start of any construction. If work is suspended for any period of time after initial start-up, the contractor must notify the ARWP Engineer forty-eight (48) hours prior to re-start.
- 3.16.2. At all points of connection of new water mains to existing water mains, the contractor will be responsible for excavating and verifying location of the existing lines, prior to installation of any new construction. If it is necessary to shut down any portions of the existing water system to make such connection, the contractor will be responsible for notifying all ARWP customers to be affected by water outage at least 48 hours prior to

such outage. All existing water main valves shall be operated only by ARWP Staff. The duration of water outage to the existing ARWP customers shall be minimized and if directed by the ARWP Engineer, the contractor shall provide temporary water supply to the customers by means of tank trucks, temporary connections to charged facilities, etc.

#### 4. WATER MAIN EQUIPMENT

##### 4.1. Polyvinyl Chloride (PVC) Pressure Pipe

All polyvinyl pipe furnished under this specification shall be manufactured in strict accordance with AWWA Standard C-900 and shall conform to the following additional requirements:

- e. Size of Pipe – This specification shall cover polyvinyl chloride pipe in four-inch, six-inch, eight-inch (4", 6", 8").
- f. Joint Type – Pipe joints shall be made using an integral bell with an elastomeric gasket push-on type joint or using machined couplings of a sleeve type with rubber ring gaskets and machined pipe ends to form a push-on type joint.
- g. Class and Type – All sizes of pipe shall be Class 235, dimension ratio 18 (DR 18).
- h. Pipe Lengths – Each length of pipe will be a standard laying length of twenty feet (20'). Random lengths shall not be acceptable.

##### 4.2. Polyethylene Wrapping

Polyethylene wrapping shall be installed around all ductile iron pipe, fittings, valves, fire hydrant barrels, and rods and clamps and where specified by the ARWP Engineer. Polyethylene wrapping shall be in accordance with AWWA Specification C-105/A21.5-82 or latest revision. Minimum thickness of polyethylene wrapping shall be eight (8) mils.

##### 4.3. Fittings

4.3.1. All fittings shall be ductile iron, cement mortar lined, and shall conform to AWWA C-110/A21.10-82 for mechanical joints and AWWA C-111-71 or ANSI A21.11 for push on joint gasket or latest revisions thereof.

4.3.2. Fittings shall be wrapped in polyethylene when used with wrapped pipe line.

##### 4.4. Valves

4.4.1. Gate Valves – shall conform to AWWA C-500-80 (or latest revision) flexible wedge, with a minimum working water pressure of two hundred fifty (250) PSIG for valves twelve inches (8") and smaller. Valve seats, the discs and the stem shall be constructed of bronze. Stem seals shall be with two (2) "O" rings, each of which shall be designed as to allow replacement under full line pressure when the valve is in the full open position. Valves shall have two-inch (2") square operating nuts and shall open counter clockwise (left) unless otherwise directed by the ARWP Engineer.

4.4.2. Butterfly Valves – shall conform to AWWA C-504-80 (or latest revision) with a minimum

working water pressure of one hundred fifty (150) PSIG and shall be supplied with flanged connections and shall be suitable for buried service installation. The pivot axis of the disc shall be mounted in the horizontal position and provided with geared operators and position indicators. Operator manholes shall be provided as shown in the Details. Valve operators shall have two-inch (2") square operating nuts and shall open counter clockwise (left).

- 4.4.3. Fire Hydrants – All fire hydrants shall be Muller Centurion Model 423.. Color shall be red. Open Left.
- 4.4.4. Check Valves – shall be of the swing check type and shall be used wherever the flow of water must be in one direction only and reverse flow must be prevented. Check valves shall be of the outside spring and lever type and shall be installed in vaults or manholes. Check valves shall be furnished with flanged end connections and shall be installed in a manner which allows easy access for inspection, adjustment and maintenance.
- 4.4.5. Valve Boxes and Valve Markers – shall be installed in accordance with the Details. Markers shall be installed to locate all valves.
- 4.4.6. Air Relief Valves– shall be installed at each high point on all water mains and at all other locations as directed by the ARWP Engineer. Air Relief Valves shall be located in pre-cast concrete manholes in accordance with the Details and shall automatically release air from the lines when the lines are being filled with water, and shall admit air into the lines when water is being withdrawn in excess of the inflow. The valve and body shall be designed to operate under a maximum working pressure of one hundred fifty (150) psi. Valves shall be iron body, with bronze trim. Floats shall be stainless steel. One (1) two-inch (2") valve shall be installed on the stem between the pipe and relief valve or as shown in the Details.
- 4.4.7. Pipe and fittings used in the relief valve system shall be galvanized steel, standard weight, and connections shall be threaded. Gate valves shall be bronze, with female iron pipe thread ends and shall have handwheels.
- 4.4.8. Restraints – Mechanical restraints shall be used at all valves, bends, fittings with mechanical or push-on type connections and dead ends. Mechanical restraints shall be "Mega Lugs," "Star Products," "All Grip" Series 3600, uni-flange Series 1400 and 1500, or approved equal.
- 4.4.9. Thrust Blocks – Concrete thrust blocks shall be installed at all tees, plugs, bends, and fire hydrants in accordance with the Details. Where thrust blocks are used to block plugs or valves or as indicated by the ARWP Engineer, the valve or plug shall be protected from concrete by an eight (8) mil thickness of polyethylene. Size of thrust block and dimensions shall be in accordance with the Details. The concrete used for the thrust blocks shall be three thousand (4,000) psi, twenty-eight (28) day strength. Thrust blocks shall be installed in addition to mega Lugs for all valves, bends, fire hydrants, and plugs.
- 4.4.10. Pre-Cast Concrete Vaults and Manholes – All butterfly valve manholes, air relief and vacuum valve vaults, pressure reducing valve vaults, meter vaults, and other vaults shall be pre-cast or poured in place concrete. Design of manholes shall be for traffic loading and shall include, sump pit, cast iron rings and covers of a pattern approved by the ARWP

Engineer, with the word “water” cast thereon. All vaults and manholes shall be water tight and all joints, pipe openings, and other places where infiltration could exist shall be sealed from the outside with a mastic waterproof sealant. All inside joints shall be grouted.

#### 4.5. Service Lines and Appurtenances

- 4.5.1. Water is conveyed from mains to the plumbing of licensed premises by service lines and their appurtenances. In the context of these Standards, service lines include all pipe and fittings up to the point of entry into a residence as shown in the Details. All water pipe beyond service pipe and meter shall be controlled by the local plumbing codes.
- 4.5.2. All new or replacement service lines and appurtenant fittings installed in areas being supplied from the ARWP shall conform to the following minimum standards which shall be binding regardless of the regulations of any other agency covering like installations.
- 4.5.3. The corporation stop and that portion of the service pipe between the meter and the corporation stop shall all be of the same size.
- 4.5.4. Service lines shall be of the size which is adequate to supply the requirements of the property being served. The minimum size line shall be three-fourths inches ( $\frac{3}{4}$ ”). The only acceptable materials for a service line are seamless copper (Type K). Service lines shall be of the same type material from beginning to end.
  - a. Compaction – Prior to any backfilling, the service line and all of its appurtenances from the tap to the dwelling shall be inspected and approved by a representative of the ARWP. Once approved for backfilling and compaction, the backfill material shall be carefully compacted as specified in these specifications.
  - b. Separate Trenches – Service pipes may not be installed in trenches containing conduits which carry any substance other than potable water, and a service line shall be separated laterally from foreign conduits by a minimum of ten feet (10’).
  - c. Pipe Size:
    1. Service lines shall be of a size which is adequate to supply the requirements of the property being served. The minimum size allowable for a service line shall be three-quarter inch ( $\frac{3}{4}$ ”).
    2. Adequate size for a service line shall be defined in terms of head loss as follows: The combined pressure drop in the service line and meter between the main and the building shall not exceed ten (10) psi at peak demand.
    3. The requirements of the property being served shall be defined as peak demand, as calculated in the AWWA Manual of Water Supply Practices, entitled “Sizing Water Service Lines and Meters.”
    4. All service lines shall have a bury depth of five (5) feet.
  - d. Type of Pipe

1. All service pipes supplying water from the ARWP's system shall conform to one of the following specifications.
  2. Seamless Copper Tube 250 PSI of the type designated as "Type K" (soft) with insulator in the industry shall be used for service lines three-quarter ( $\frac{3}{4}$ " ) through two inches (2"), or 250 PSI rated poly. Only compression fittings are allowed.
- e. Installation – Service line from corp stop to curb stop is to be one continuous pipe.

#### 4.6. Ownership and Maintenance

These water system specifications are intended to be supplemental and subordinate to the operating rules of the ARWP and will be so construed in any conflicting situations.

- a. Ownership – The service pipe and fittings from the meter to the house through which an owner receives water service from the facilities of the ARWP shall be installed and maintained at the expense of the owner.
- b. Maintenance – The owner shall maintain all privately-owned piping except as set forth under the referenced operating rules. This shall include the service pipe and all fittings and fixtures from the meter to the house, except the water meter.
- c. The curb stop service box and meter pit shall be kept conveniently accessible. Any box or pit not easily accessible shall be cleared by the owner of the premises within a reasonable time after notification by the ARWP. Failure by the owner to comply may cause the ARWP to do the necessary maintenance work and charge the cost thereof to the premises served.
- d. Frozen Service Pipes and Stub-In Connections – The ARWP will not be responsible for the thawing of frozen service pipe or appurtenances.

#### 4.7. Water Meters

- 4.7.1. Water meters must be installed inside a meter pit.
- 4.7.2. All water meters shall be under the control of the ARWP.
- 4.7.3. All water meters are included with the purchase price of the tap and are available through the ARWP.
- 4.7.4. All water meters will be installed by ARWP personal.
- 4.7.5. Size of Meter:
  - a. Meters shall be of the same size as the corporation stop and that portion of the service pipe between the meter and the corporation stop. In no case shall a meter smaller than five-eighths by three-quarter-inch ( $\frac{5}{8}$ "x $\frac{3}{4}$ " ) be installed.
  - b. The Meter pit shall be purchased and installed by the developer. See meter pit detail for requirements.

4.7.6. Valves for Use With Meters:

- a. Gate valves three-inch (3") and smaller to be used with copper service pipe shall be all bronze, with non-rising stems and solid wedge disc, manufactured in accordance with ASTM Specification B 62-76 and Federal Specification W.W.-V-54 Class A 125 psi W.S.P., two hundred (200) psi, W.O.G.
- b. Valves for one and one-half inches (1 ½") and two-inch (2") meters shall be curb stops as shown on the Details.

4.7.7. Meter Bypass Lines – A bypass line shall be required for all meters four inches (4") and larger unless otherwise specified by the ARWP, whether installed in an outside or inside setting. Bypass lines shall contain an independent control valve and shall contain no tees, plugs, or other outlets through which water could be withdrawn. Bypass lines permit the consumer to have water while his meter is being repaired or replaced. No bypass lines will be allowed for meters three inches (3") and smaller.

4.7.8. Meter Check Valves – Double check valves may be required for all meters one and one-half inches (1 ½") and larger unless otherwise specified by the ARWP, whether installed in an inside or outside setting.

4.8. Backflow and Backflow Prevention Devices

4.8.1. Backflow, which is the flow of water, or other liquid, or foreign materials into the distribution mains of the ARWP 's system from another source is strictly prohibited and shall be prevented by the installation of an appropriate, approved backflow prevention device, purchased and installed by the consumer at his own expense.

4.8.2. The type and complexity of the backflow prevention device shall be determined by the ARWP in accordance with the Manual of Cross-Connection Control for the Colorado Department of Health and Environment and shall be based upon the degree of hazard caused to the public from contamination by toxic, or non-toxic substances.

4.8.3. Backflow devices shall be tested annually at owner's expense. Test results shall be submitted to the ARWP Engineer.

4.8.4. A toxic substance is any solid, liquid, or gas which, when introduced into the water supply system, creates a danger to the health and wellbeing of the consumer.

4.8.5. A non-toxic substance is any solid, liquid, or gas of a non-poisonous nature that is potable or edible, and that creates a moderate or minor hazard to the domestic water system. Examples are connections of food processing lines such as syrups, lard, beer, etc., or connections to steam and steam boilers where the steam does not come into contact with poisonous materials.

4.8.6. Devices vary as to function, and may be air gap type, reduced pressure backflow preventive type, pressure vacuum breaker, atmospheric vacuum break, or double check valve type. Backflow prevention devices are characterized by great care in construction Details, the use of materials that will give the least possible wear or corrosion, and ready accessibility for inspection and cleaning.

4.9. Service Line Materials

- 4.9.1. All tapping saddles must be full support wide bearing (bronze) or bronze double strap
- 4.9.2. Corporation stops must be Mueller compression x tapered thread.
- 4.9.3. Curb stops must be Mueller compression.
- 4.9.4. Couplers must be Muller compression.
- 4.9.5. Service stop boxes must be Mc Donald 5601 Erie Pattern with stationary rod.
- 4.9.6. Meter Pits shall be 24" DFW
- 4.9.7. Meter Pit Lids shall be:
  - a. 24" Casting Meter Pit Cover with Cast Iron Lid
  - b. 27/32" Pentagon Bolt (five star)
  - c. 1 7/8" Drilled Hole
  - d. Frost Lid
- 4.9.8. Yoke shall be Mc Donald 702 compression with vertical check valve.
- 4.9.9. Service line material must be type K copper or 250 PSI Poly.

4.10. Pipe Casings

Pipe Casings may be required to be used where water lines cross under utilities. The type of casing material and its properties shall have prior approval from the ARWP Engineer before using.