



**Clackamas River Water**

*Revised October 2015*

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## SECTION 01000

### GENERAL REQUIREMENTS FOR PRIVATE DEVELOPERS

#### PART 1 – GENERAL

##### 1.01 SUMMARY

A. The Developer and his Contractor(s) shall:

1. Maintain, supervise, and otherwise be responsible for all construction activities, of which the Clackamas River Water District waterline and appurtenance work may be the whole or part, as denoted on the Drawings.
2. Furnish all labor, materials and equipment required to complete the Work.
3. Furnish and install miscellaneous items incidental to or necessary for completion of the Work.

##### 1.02 REFERENCES

- A. CRW Technical Specifications, latest revision, as referenced.
- B. CRW Rules and Regulations, latest revision.
- C. All CRW documents referenced in this Section may be accessed in electronic pdf format via the District's website at [www.crwater.com](http://www.crwater.com). A single copy of referenced documents may be requested at no charge.

##### 1.03 DEFINITIONS

- A. *Contractor*: The entity hired by the Owner to perform approved construction and installation of the water system.
- B. *Developer*: The Owner of the property for which water service is requested.
- C. *District*: Clackamas River Water (or "CRW"), a domestic water supply district organized under ORS 264 and to whom operation of all respective facilities the Developer shall transfer ownership. The District may be represented by one or more individuals in the administration and inspection of the Developer's work.
- D. *Engineer*: A registered professional engineer, hired by the Developer to design the District-approved water facilities.
- E. *Or Approved Equal* – Indicates that the material or product to be supplied or installed must be equal to that specified and as approved by the District.
- F. *Owner*: See "Developer" above. **For purposes of these specifications, the Owner/Developer shall be considered the same entity, and the terms may be used interchangeably throughout.**

## 1.04 APPLICATION FOR AND INSTALLATION OF WATER SERVICES

### A. Conditions of Assessment and Review of Water Service Requests:

1. The District will provide preliminary review of feasibility of requested services. Special requirements and/or conditions of water service (hydraulic requirements, cross-connection/backflow control, fire flows, etc.) will be determined during initial review(s). The Developer/Owner is required to read the Developer's Agreement and provide signature indicating his acknowledgment of the terms and conditions therein.
2. The Developer/Owner shall conform with District requirements for sizing and placement of waterlines. For those cases where CRW determines that oversizing or replacement of a specific Developer-requested improvement is beneficial to meet future system needs, the District will coordinate design and cost distribution requirements for service.

### B. Prior to installation, the Developer shall:

1. Complete the CRW Application for New Service.
2. Sign the Clackamas River Water Developer's Agreement (provided by CRW).
3. Pay appropriate fees to the District for plan check, inspection and administration fees. Any unused portion will be reimbursed, and any additional required charges must be paid.

i. Payments shall be made to:

Clackamas River Water  
ATTN: Accounts Receivable  
P.O. Box 2439  
16770 SE 82<sup>nd</sup> Drive  
Clackamas, OR 97015

ii. The District's fees for coordination of Developer's design, design review, submittal review, and construction inspection are apportioned as follows:

a. Fee for plan review, plan approval and construction inspection is **4.6%** of the total cost of the project, as estimated by the District. This fee may increase or decrease depending on the scope of the project.

b. Service connection fees, as calculated by the most

current version of CRW "Fees and Charges" worksheet.

- c. Other fees may be assessed on a case-by-case basis for complex projects, as determined by the District.
4. Submit 3 sets of full size (22"x34" or 24"x36") waterline plans, stamped by a registered professional engineer, to CRW for review and approval. Proposed plans must comply with CRW specifications – CRW approval is required prior to the Developer or his Contractor(s) beginning construction.
5. Submit documentation of the qualified Oregon-licensed and bonded utility contractor who will be performing the work.
6. Schedule and administer a preconstruction meeting which includes CRW, Developer and Contractor representatives.
7. Provide all required submittals, and obtain CRW approvals on all submittals prior to starting construction.
8. A certificate of insurance (typically provided by Developer's Contractor) naming Clackamas River Water as additional insured certificate holder.
9. Obtain an approved dedicated or platted easement for the waterline extension for the benefit of Clackamas River Water's use. An easement may not be required for waterlines in public right-of-way – the Developer shall discuss easement requirements with the District for the specific installation.
10. Provide written approval by County, State, or other jurisdiction showing road opening permit, utility placement permit, county/local plumbing and/or building permit, as required; as well as Fire District approval of proposed hydrant locations.

**C. Immediately following installation, the Developer shall:**

1. Provide acceptable disinfection and pressure testing results as required by CRW specifications. All work must meet CRW, County and State requirements, as applicable, including chlorination/de-chlorination, bacterial testing and pressure testing.
2. Submit one set of full-size (22"x34" or 24"x36") mylar as-built drawings and a CD with electronic as-builts in AutoCAD format, which should include related dependent files such as xrefs, plot styles, font files, etc. If the Developer (or his Engineer) cannot meet this requirement, CRW will charge the Developer additional fees for the cost of labor and materials to complete the as-built drawings.
3. Convey ownership of the installed waterline and appurtenances to CRW so that the District can assume operation and maintenance responsibility after the 2-year maintenance bond has expired. Use the CRW-supplied Transfer of Asset form.
4. Provide a temporary connection easement to the District for lots that do not have direct waterline frontage. In the event of future extensions, these lots

will be required to pay the share of future waterline frontage costs. (Should properties without current service connect to the newly installed waterline, CRW will negotiate reimbursement with the original Developer via a “late-comers agreement” or similar instrument.)

5. Provide a two-year maintenance bond for the partial or full value of the installation, as required by the District.

D. **Final Approval/Acceptance:** The District will send the Developer a letter of approval/acceptance when all items have been completed. No services will be sold and/or activated until all above items are completed and accepted by the CRW Board of Commissioners.

#### 1.05 REGULATORY REQUIREMENTS

- A. Comply with all Federal, State, and local laws, regulations, codes, and ordinances applicable to the work.
- B. References in the Specifications to local codes and/or requirements shall mean those of Clackamas River Water, Clackamas County, ODOT/State of Oregon, and any other local, state or federal requirements as specified.
- C. Refer to Clackamas County Roadway Standards, Oregon Department of Transportation (ODOT) Specifications, or other applicable local jurisdictional requirements for resurfacing of roadways.
  1. Follow all requirements for sub-base, road re-surfacing and testing as stipulated by the jurisdictional road agency’s specifications.
- D. Other standards and codes that apply to the work are designated in the Specifications.

#### 1.06 ACCESS BY CLACKAMAS RIVER WATER (CRW) OFFICIALS

- A. Authorized representatives of CRW shall at all applicable times have access to the work area. The Developer and his Contractor(s) shall provide proper facilities for access and inspection.

**END OF SECTION**

## SECTION 01012

### SITE CONDITIONS

#### PART 1 – GENERAL

##### 1.01 RELATIONSHIP WITH EXISTING FACILITIES

- A. District's personnel will be responsible for operating and maintaining the existing facilities.
  - 1. Operation of the existing system by the Developer/Contractor is prohibited.
  - 2. Developer/Contractor shall at no time undertake to close off any lines or open valves or take any other action which would affect the operation of the existing system.
    - a. For service interruptions, Developer/Contractor shall notify the District at least four working days prior to interruption of the existing system. The request shall include purpose, location, and estimated duration of proposed interruption.
  - 3. All materials and equipment (including emergency equipment) necessary to expedite a tie-in must be on hand prior to the shutdown of existing services or utilities.
- B. Pipeline installations shall be on the South and East Side of roadways for standardization of utilities, unless otherwise directed by the District or as otherwise indicated on the approved Drawings. All materials shall meet or exceed the test pressure of the system where they are to be installed. Variations require District approval.
- C. The Contractor shall maintain continuous water service and connection to the existing system during construction. No existing equipment shall be taken out of service without the written permission of the District. As applicable, Contractor shall provide all temporary equipment (pumps, piping, generators, etc) required to keep affected facilities and services in operation throughout the construction period.
  - 1. Contractor shall plan the work and carry it out with minimum interference to the operation of the existing facilities. Prior to starting

the work, confer with the District to develop an approved work schedule which will permit the facilities to function normally as practical.

2. It may be necessary to perform certain construction tasks outside normal working hours in order to avoid undesirable conditions or scheduling conflicts. The Contractor shall perform this work at such times as requested from or by the District, and at no cost to the District. Such scheduling needs will be discussed at the preconstruction meeting.
  - a. If the Contractor desires to carry on work at night or outside regular hours, he shall give seven (7) days notice to the District to allow inspection personnel arrangements to be made by the District.
3. Contractor shall not make connections between existing work and new work until necessary inspection and tests have been completed on the new work and it is found to conform in all respects to the requirements of the District.
4. After all new lines and services are activated (including testing and disinfection), disconnect and cap the waterlines which are to be abandoned. Notify the District four days prior to capping operations. Field verify type and size of cap required by fully exposing each existing waterline prior to requesting main shutdown.

#### 1.02 DEVELOPER/CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTIES AND SERVICE

- A. Oregon law requires the Contractor to follow rules adopted by the Oregon Utility Notification Center. Contractor shall comply with such requirements as set forth in the Oregon Administrative Rules, Chapter 952, Division 1, Utility Notification Center. Copies of these rules may be obtained by calling the Center at (503) 232-1987.

#### 1.03 FIELD RELOCATION

- A. During the progress of construction, minor relocations of the work may be necessary. If field conditions are encountered that will prevent construction as shown, notify the District before continuing with the work. The Developer's Engineer may make minor field revisions as necessary to resolve the field condition, and shall submit these revisions to the District for approval. If the Contractor fails to notify the District when such field conditions are encountered, and proceeds with the work despite the conflict, it shall be at his own risk. The

District reserves the right to reject unapproved work and require reinstallation of approved work, at the Developer/Contractor's sole expense.

**END OF SECTION**



## SECTION 01200

### PROJECT MEETINGS

#### PART 1 – GENERAL

##### 1.01 PRECONSTRUCTION MEETING

- A. Prior to the start of construction, the Developer will schedule a meeting of the Contractor, Developer's Engineer, and Clackamas River Water representatives. The general purpose of the meeting will be to establish working relationships, begin coordination of construction matters, discuss the scope of Work, and review schedules and material submittals.
- B. The agenda for the meeting will cover at least the following items- the Developer shall provide a work-specific agenda at the meeting:
  - 1. Review of the scope of work and any procedural or scheduling issues needing special attention.
  - 2. Organization of the Developer's forces and personnel, including contractors and material suppliers.
  - 3. Lines of authority and channels and procedures for communication.
  - 4. Duties and responsibilities of the parties.
  - 5. District's construction management (CM) organization and personnel, if applicable.
  - 6. Developer/Contractor's proposed construction schedule, including sequence of critical work.
  - 7. Processing of shop drawings and other data that will be submitted to District for review.
- C. The Developer/Contractor should be prepared to discuss the following topics:
  - 1. County Road opening permit / utility placement permit.
  - 2. Preliminary construction schedule and critical path.
  - 3. Schedule of submittals and submittals needing short turn-around times.
  - 4. Sequencing of critical work.
- D. Minutes of Meeting
  - 1. The Developer/Contractor will compile minutes of the meeting and distribute copies to all participants.

##### 1.02 PROGRESS MEETINGS

- A. Project meetings, if necessary, shall be scheduled at a time and location that is

mutually agreed upon between the Developer/Contractor and District.

1. Meetings are to enable orderly project review during the progress of work.
  2. Attendees may include the District, Developer/Contractor, Developer's Engineer, subcontractors and suppliers' representatives as applicable, and other interested or affected parties.
  3. Depending on the need for the meeting, the Developer or District will preside over the meeting and will compile and distribute minutes of the meeting, as applicable.
- B. The purpose of the progress meetings is to coordinate the efforts of all concerned to result in smooth and coordinated progress towards completion of the overall project.
- C. Contractor shall bring to each meeting an updated 3-week "look ahead" schedule.
- D. The Contractor will be required to address the following items at the meeting:
1. Work completed last week.
  2. Work anticipated next week.
  3. Corrective measures and procedures proposed to regain planned schedule, cost or quality assurance, if necessary.
- E. Other Agenda items to be discussed:
1. Status of Requests for Information, submittals and shop drawings.
  2. Identify problems that impede planned progress.
  3. Other current business pertaining to the Work.

**END OF SECTION**

## SECTION 01300

### SUBMITTALS

#### PART 1 – GENERAL

##### 1.01 SUMMARY

- A. Submittals covered by these requirements include manufacturers' information, shop drawings, test procedures, test results, samples, requests for substitutions, and miscellaneous work-related submittals, as applicable, for all materials, plans, and/or procedures as required.
- B. The Contractor shall furnish drawings, specifications, descriptive data, certificates, samples, tests, methods, schedules, manufacturer's installation instructions and other information to fully demonstrate that the materials and equipment to be furnished and the methods of work comply with the provisions and intent of the Clackamas River Water Rules and Regulations and these Specifications.

##### 1.02 DEVELOPER/CONTRACTOR RESPONSIBILITIES

- A. The Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall assure that the materials and equipment incorporated into the Work, or the methods of performing the Work, shall be as described in the accepted submittals.
- B. The Contractor shall verify that all features of all products conform to the specified requirements. Submittal documents shall be clearly edited to indicate only those items, models, or series of equipment that are being submitted for review. All extraneous materials shall be crossed out or otherwise obliterated.
- C. The Contractor shall ensure that there is no conflict with other submittals and notify the District in each case where his submittal may affect the work of another contractor or the District. The Contractor shall coordinate submittals among its subcontractors and suppliers including those submittals complying with requirements specified in applicable specifications.
- D. The Contractor shall coordinate submittals with the work. The Contractor shall not proceed with work related to a submittal until the submittal process is complete. This requires that District-reviewed submittals are returned to the Contractor stamped "No Exceptions Taken" or "Make Corrections Noted." Any work done by the Contractor with materials or procedures not approved by the District may be rejected.
- E. The Developer/Contractor shall certify on each submittal document that he has reviewed the submittal.
- F. The Contractor shall keep copies of all approved submittals on the jobsite at all

times. The District reserves the right to review these documents at any time.

### 1.03 CATEGORIES OF SUBMITTALS

#### A. General

1. Submittals fall into two general categories;
  - a. Submittals for review and comment: These submittals require action by the District.
  - b. Submittals that are primarily for information only: These submittals do not require District's approval.

#### B. Submittals for Review and Comment

1. Submittals shall be transmitted by the Developer/Contractor directly to the District. The District will review the submittal for compliance and will provide written comments regarding acceptability.

#### C. Submittals for Information Only

1. Where specified, the Developer/Contractor shall furnish submittals to the District for information only. The District may, at its option, review and comment on any product data. Incomplete or inadequate product data will be returned to the Contractor for resubmittal.

### 1.04 TRANSMITTAL PROCEDURE

#### A. General

1. Unless otherwise specified, all submittals shall be accompanied by an approved Shop Drawing/Submittal Transmittal Form provided by the Developer/Contractor.
2. A separate form shall be used for each specific item, class of material, equipment, and items specified in separate, discrete sections, for which the submittal is required.
3. Submittal documents common to more than one piece of equipment shall be identified with all the appropriate equipment numbers.
4. Submittals for various items shall be made with a single form when the items taken together constitute a manufacturer's package or are so functionally related that expediency indicates checking or review of the group or package as a whole.
5. A unique number, sequentially assigned, shall be noted on the transmittal form accompanying each item submitted ("1, 2, 3..."). A sequential letter designation shall follow the submittal number for resubmittals ("1a, 1b...").

B. Submittal Completeness

1. Submittals that do not have all the information required to be submitted, including deviations, are not acceptable and will be returned without review.

1.05 SUBMITTAL CONTENT

A. Prepare submittals with information required by individual Specification Sections.

B. Shop Drawings:

1. Develop project-specific, scaled drawings to fully establish materials and products that will be provided and their relationship to other products that will be furnished and installed.
2. Identify products, assemblies, equipment and systems.
3. Provide equipment identification numbers or tag numbers.
4. Illustrate critical dimensions.
5. Provide Product Data to demonstrate conformance with the specified requirements. Product data may consist of manufacturer's standard catalog information and data sheets, marked to indicate the specific products that will be provided. Provide supplemental information as necessary to fully demonstrate how products will be modified from the manufacturer's standard products to meet the specification requirements.

C. Manufacturer's Instructions: Written or published information that establishes the manufacturer's recommendations, guidelines and procedures for installation of products, equipment and assemblies.

D. Samples: Mount, display or package samples in a manner that will facilitate review and establish workmanship and quality of materials.

E. Operations and Maintenance Data, as required.

1.06 REVIEW PROCEDURE

A. General

1. Submittals are specified for those features and characteristics of materials, equipment, and methods of operation that can be selected based on the Developer/Contractor's judgment of their conformance to the specified requirements. Other features and characteristics are specified in a manner that enables the Developer/Contractor to determine acceptable options without submittals. The review procedure is based on the Developer/Contractor's guarantee that all features and characteristics not requiring submittals conform as specified.
2. Review shall not extend to means, methods, techniques, sequences or

procedures of construction, or to verifying quantities, dimensions, weights, gages, or fabrication processes.

3. Review of a separate item, as such, will not indicate approval of the assembly in which the item functions.
4. The Developer/Contractor shall submit the specified information as follows:
  - a. Submittals for Review and Comment:
    - i. Submit 2 original hard copies of all submittal documentation.
    - ii. If authorized by the District, Developer/Contractor may prepare submittals and Shop Drawings in electronic “.pdf” format including half-sized and full-sized drawings, catalog information and other required submittal information. Transmit electronic submittals by email to the District. Break down submittals that are larger than 4 megabytes into smaller sections, using logical division points to create sections.
    - iii. Developer/Contractor shall provide a written request to the District for consideration of electronic submittals.
  - b. Submittals for Material Selection: When the specifications require a physical selection of color or material type by the District, two copies of physical samples shall be submitted.
  - c. Submittals for Information Only: Unless otherwise specified, submittals for information shall follow the specified procedures of transmittal outlined in section 1.07.A.4.a above.

B. Submittals for Review and Comment

1. The District will review the submittal and return one physical copy (and an electronic copy if applicable) with comments and additional mark-ups as needed. The returned submittal shall indicate one of the following actions:
  - a. If the review indicates that the material, equipment or work method complies with the project, submittal copies will be marked "NO EXCEPTIONS TAKEN." In this event, the Developer/Contractor may begin to implement the work method or incorporate the material or equipment covered by the submittal.
  - b. If the review indicates limited corrections are required, copies will be marked "MAKE CORRECTIONS NOTED." The Developer/Contractor may begin implementing the work method or incorporating the material and equipment covered by the submittal in accordance with the noted corrections. Where submittal information will be incorporated in O&M data, a

corrected copy shall be provided.

- c. If the review reveals that the submittal is insufficient or contains incorrect data, copies will be marked "AMEND AND RESUBMIT." Except at its own risk, the Developer/Contractor shall not undertake work covered by this submittal until it has been revised, resubmitted and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."
- d. If the review indicates that the material, equipment, or work method does not comply with the standard specifications, copies of the submittal will be marked "REJECTED - SEE REMARKS." Submittals with deviations that have not been identified clearly may be rejected. Except at its own risk, the Developer/Contractor shall not undertake the work covered by such submittals until a new submittal is made and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."
- e. If the submittal information does not require a review by the District, copies of the submittal will be marked "District's Review not Required" and will be returned without review.

C. Submittals for Information Only

- 1. Such information is not subject to submittal review procedures and shall be provided as part of the work, and its acceptability determined under normal inspection procedures.

1.07 PROCESSING TIME

- A. Developer/Contractor shall prepare submittals and transmit to District for review in sufficient time to allow District's review in accordance with the Contractor's schedule.
- B. District's time for review will begin upon receipt of a complete and comprehensive submittal containing all required information.
- C. District will review submitted information and transmit a response to Developer/Contractor.
  - 1. In some instances, review times for specific submittals may be modified by the individual specification Section.
  - 2. Resubmittals will be subject to the same review time.

1.08 EFFECT OF REVIEW OF CONTRACTOR'S SUBMITTALS

- A. Review of drawings or information regarding materials or equipment that the Developer/Contractor proposes to provide shall not relieve the Developer/Contractor of its responsibility for proper installation and/or operation

of the materials or equipment, or other errors therein, and shall not be regarded as an assumption of risks or liability by the District.

- B. A mark of "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED" shall mean that the District has no objection to the Developer/Contractor, upon its own responsibility, using the plan or method of work proposed, or providing the materials or equipment proposed.

**END OF SECTION**



## SECTION 01500

### CONSTRUCTION FACILITIES AND UTILITIES

#### PART 1 – GENERAL

##### 1.01 SUMMARY

- A. This section includes requirements for Developer/Contractor to obtain temporary construction water service at the job site.

#### PART 2 – NOT USED

#### PART 3 - EXECUTION

##### 3.01 TEMPORARY WATER SUPPLY

- A. Obtaining access to and payment for potable water for soil moisture conditioning, pipeline pressure testing and other construction uses will be the responsibility of the Developer/Contractor.
- B. Unless specified elsewhere, water for the project will be provided to the Developer/Contractor from the location designated by the District.
  - 1. As stated in other sections, Developer/Contractor shall not operate District's or other public/private water system.
  - 2. Developer/Contractor shall follow District procedure for requesting the necessary connections to the public water supply for temporary water connection. Developer/Contractor shall install all conveyance piping and truck filling facilities that are required to transport water for the work.
  - 3. The Developer/Contractor shall pay a refundable deposit to the District for the provision of a meter to monitor use of water for construction purposes.
  - 4. As required, Developer/Contractor shall temporarily install valves, flow meters, air gaps, backflow preventers and other appurtenances required by the District of the water distribution system to maintain the integrity of the existing water systems.
  - 5. Upon completion, Developer/Contractor shall coordinate removal of temporary water facilities with District and/or other entity.

**END OF SECTION**

## SECTION 01720

### RECORD DRAWINGS

#### PART 1 – GENERAL

##### 1.01 SUMMARY

- A. This section provides definitions and procedures for preparation and submittal of as-built Record Drawings.

##### 1.02 DEFINITIONS

- A. Record Drawings: Documents maintained and annotated by the Developer/Contractor during construction to illustrate the final location of piping, equipment, structures and all other installed facilities and utilities.

##### 1.03 DEVELOPER/CONTRACTOR RESPONSIBILITY

- A. Record changes or deviations that vary from the details indicated on the original approved plans.
- B. Identify buried or concealed construction and utility features that are revealed during the course of construction.
- C. Record the horizontal and vertical location of buried utilities that differ from the locations indicated, or which were not indicated on the approved plans.
- D. When the configuration and arrangement of the Work is changed from that indicated on the Drawings or Specifications, the authorizing document for the change, such as a Request for Clarification, Shop Drawing, or Field Order, shall be clearly referenced on the Record Drawings as a comment.
- E. Supplement the Record Drawings with detailed layout sketches, schedules, installation drawings and fabrication drawings.

#### PART 2 – PRODUCTS (NOT USED)

#### PART 3 – EXECUTION

##### 3.01 RECORD DRAWINGS

- A. Record Drawings shall be full size (22"x34" or 24"x36") and maintained in a clean and legible condition. The Developer's Engineer will provide one set of full size Drawings for use as a Record Drawing set.
- B. Marking of the drawings shall be kept current and shall be done at the time the materials and equipment are installed. Do not use the Record Drawing set for construction purposes.

- C. Annotations to the Record Drawings shall be legible and shall be made with an erasable colored pencil conforming to the following color code:
  - 1. Additions and Final Dimensions - Red
  - 2. Deletions - Green
  - 3. Comments - Blue
- D. The Developer's Engineer shall review the Contractor's updated Record Drawing mark-ups. The District reserves the right to inspect the record drawings at any time.
- E. At the completion of the work, but prior to final acceptance, the Developer shall submit the completed as-built Record Drawings to the District.
  - 1. Provide one full size mylar set and one electronic set in AutoCAD format.

**END OF SECTION**

## SECTION 01770

### FINAL ACCEPTANCE PROCEDURES

#### PART 1 – GENERAL

##### 1.01 SUMMARY

- A. This section describes administrative and procedural requirements for final acceptance of Developer's work.

##### 1.02 INSPECTION FOR COMPLETION

- A. District and Developer/Contractor shall jointly walk through and inspect the project site to determine whether the Work is satisfactory and complete.
- B. The Developer/Contractor's punch list will be reviewed and additional items identified during the inspection that require corrective action will be added as necessary.

##### 1.03 FINAL COMPLETION

- A. The Developer shall submit the following items to the District:
  - 1. Completed punchlist.
  - 2. Approved easements.
  - 3. Approved as-built record drawings (full size mylar and electronic AutoCAD format).
  - 4. Donation of assets form.
  - 5. Two year maintenance bond.
- B. The District will provide the Developer with a letter of acceptance once all final completion requirements are met.

**END OF SECTION**

## SECTION 02225

### TRENCH EXCAVATION AND BACKFILL

#### PART 1 – GENERAL

##### 1.01 SUMMARY

- A. This section describes trench excavation and backfilling for pipe and pipeline accessories.
- B. For additional information, refer to CRW Standard Details with the Contract Drawings (referenced herein as “Drawings”).

##### 1.02 REFERENCE SPECIFICATIONS

- A. AASHTO T89, T91 – Determining Liquid and Plastic Limits of Soils
- B. AASHTO T99, T180 – Moisture Density Relationships of Soils
- C. ASTM C136 – Sieve Analysis of Fine and Coarse Aggregates
- D. ASTM D1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort
- E. ASTM D2216 - Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- F. ASTM D2434 - Permeability of Granular Soils
- G. ASTM D2922 - Density of Soil and Soil-Aggregate in Place by Nuclear Methods
- H. ASTM D3017 - Water Content of Soil and Rock in Place by Nuclear Methods
- I. ASTM D4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- J. Clackamas County Roadway Standards (latest revision)
- K. Oregon Department of Transportation (ODOT) Standard Specifications (latest revision)
- L. Oregon OSHA (OAR 437 Division 3) ; Federal OSHA (29 CFR 1926)

### 1.03 DEFINITIONS

- A. *Clay Material*: Clay that is obtained from on-site or off-site sources and used for construction of clay capping placed around the pipeline in specific locations identified on the Drawings.
- B. *Clear Width of Trench*: Width of trench as measured at the top of the pipe or conduit.
- C. *Fine Grading Material*: Material placed at the bottom of the excavated trench prior to installation of pipe, conduit or pipeline accessories.
- D. *Imported Material*: Fill material that is processed at an off-site facility, purchased by the Contractor and hauled to the site for use as backfill material.
- E. *In-Place Density of Compacted Backfill*: Density determined in the field when tested in accordance with AASHTO T99, ASTM D2922 and ASTM D3017.
- F. *Maximum Density* : Density determined in the laboratory when tested in accordance with ASTM D1557.
- G. *Native Material*: Natural soils that exist below surface fill material, generally consisting of fine-grained silts and clays with medium to high plasticity.
- H. *Pipe Bedding Depth*: The thickness of Bedding Material placed between the underside of the pipe and the trench bottom to uniformly support the barrel of the pipe.
- I. *Pipe Zone*: The area from the top of the Pipe Bedding Material and extending above the pipe crown to the dimension indicated on the Drawings.
- J. *Relative Compaction*: The ratio, in percent, of the in-place field dry density to the laboratory maximum dry density.
- K. *Roadway Shoulders*: Paved areas and unpaved areas beyond the fog line of the roadway pavement and extending to the opposite edge of any roadside drainage features.
- L. *Trench Backfill*: Material placed between the top of the pipe bedding material and the bottom of the pavement base rock, ground surface or other surface material to fill the trench excavation.

#### 1.04 SUBMITTALS

- A. Prepare and submit in accordance with Section 01300.
- B. Material Data: For all proposed fine grading and pipe bedding material, clay material, Native Material, imported backfill material, and other soil materials, submit:
  - 1. Material source.
  - 2. Gradation.
  - 3. Moisture-density curves.
  - 4. Permeability tests (for Clay Material).
- C. Testing laboratory name, lab qualifications and certifications.

#### 1.05 QUALITY ASSURANCE

- A. Initial Compaction Demonstration For All Backfill
  - 1. Demonstrate adequacy of compaction equipment and procedures.
  - 2. Compaction Sequence Requirements: When specified degree of compaction is achieved, proceed with trenching and backfilling activities using the established equipment and procedures.
- B. Testing of Native Backfill
  - 1. Frequency of sampling of native backfill material generated from trench excavations shall be as directed by the District.
  - 2. Contractor shall obtain representative soil samples of material excavated from pipe trenches and scheduled to be used as backfill material after installation of the pipe.
  - 3. Sampling and testing of native backfill shall be in accordance with jurisdictional agency's requirements.
- C. Frequency of Sampling of Imported Material:
  - 1. Obtain representative samples of products from supplier.

2. After initial testing demonstrates that the proposed borrow material meets the specified requirements, obtain and test one additional sample for every 500 cubic yards of imported material.

## **PART 2 –PRODUCTS**

### **2.01 GENERAL**

- A. Classes of backfill used for waterline trench backfill (within and apart from the pipe zone) are indicated in these specifications and on the Drawings. The District reserves the right to modify the use, location, and quantities of the various types of backfill during construction. General backfill classes correspond to those specified and designated by Clackamas County and ODOT (refer to reference documents in Part 1 above). Unless otherwise indicated, the following class definitions apply:
  1. Class A – Native or common material that is approved to meet the characteristics required for the specific surface loading or other criteria of the backfill zone.
  2. Class B – Imported granular material consisting of gravel or crushed rock meeting the requirements of this Section; typical designated size shall be 1"-0 or ¾"-0.
  3. Class C – Clean sand with no particle size larger than ¼ inch. (USE ONLY AS REQUIRED).
  4. Class D – Pit run or bar run material, well graded from coarse to fine; maximum dimension shall be 3 inches. (USE ONLY AS REQUIRED).
  5. Class E – Controlled Density Fill (CDF) or Controlled Low-Strength Material (CLSM) conforming to the requirements of this Section. (USE ONLY AS REQUIRED).
- B. Water for Moisture Conditioning of Fill Material: Use water from an approved source.

### **2.02. CLASS A BACKFILL – NATIVE**

- A. In general, Class A backfill will be used in unsurfaced areas where subsequent trench settlement must be held to a minimum.



1. When approved, Class A backfill may be used as trench backfill above the pipe zone or as otherwise specified.
- B. Excavated (native) trench material shall be used. Remove all rocks and cobbles larger than 2 inches.
- C. Soil excavated for the pipe trench shall be free of leaves, grass, roots, stumps, and other vegetable (organic) matter.

#### 2.03. CLASS B BACKFILL – GRANULAR

- A. The aggregate shall consist of uniform quality, clean, tough, durable fragments of rock or gravel, free from flat, elongated, soft or disintegrated pieces, and other objectionable matter occurring either free or as a coating on the stone.
  1. Class B backfill will generally be limited to traveled roadways and crossings where final surfacing will be made shortly after backfilling and subsequent trench settlement must be held to a minimum.
  2. Class B backfill shall be used as trench backfill above the pipe zone or as otherwise specified.
- B. All rock shall be crushed gravel or rock meeting the following quality standards:
  1. Abrasion (AASHTO): Maximum wear = 35 percent.
  2. Fractured face: Minimum particles = 5 percent.
  3. Liquid limit (AASHTO T89): Not greater than 30 percent.
  4. Plastic index (AASHTO T91): Not greater than 6 percent.
- C. Granular backfill for foundation stabilization, when required, shall be 1-½ inch-minus crushed rock, with reasonably uniform gradation from coarse to fine, and free from excessive dirt or other organic material.

- D. Based on U.S. standard sieves, the gradation of the aggregates to be furnished shall be as indicated below:

**Table 1: Class B (Granular) Backfill Gradations**

<b>Sieve Designation (Square Opening)</b>	<b>Percent Passing by Weight</b>	
	<u>1 ½ inch minus</u>	<u>¾ inch minus</u>
2 inch		100
1-1/2 inch	95 - 100	
1 inch	-	100
¾ inch	60 - 80	90 - 100
¾ inch	-	60 - 80
1/4 inch	35 - 50	40 - 60
No. 200	0 - 5	0 - 5

2.04. CLASS E BACKFILL – CONTROLLED DENSITY FILL (CDF)

- A. Class E backfill will be used at road crossings and locations where paved roadway is removed, or as otherwise directed by the local jurisdiction.
- B. Fluid mix of cement, aggregate, fly ash, and water, with a maximum unconfined compressive strength of 200 psi (1,100 psi compressive strength).
- C. The water shall be free of oil, salts, and other impurities.
- D. Controlled density backfill shall be thoroughly machine-mixed in a pug-mill or rotary drum and shall be placed in the designated location within 1-½ hours after mixing.
- E. “Alternative Trench with Controlled Density Backfill” as specified by Clackamas County standard detail U270 will be considered by the District when applicable, and if standard CDF is not otherwise specified.

2.05. CLAY

- A. For use when approved by the District.

- B. Locate suitable on-site or off-site source of clay and import clay material to the site for construction of clay capping/check dam around the pipeline. Final approval of source by the District is required.
- C. Permeability: Not greater than  $1 \times 10^{-6}$  cm/sec when tested in accordance with ASTM D2434.

### **PART 3 –EXECUTION**

#### **3.01 REMOVAL AND REPLACEMENT OF ASPHALT PAVEMENT**

- A. Refer to Section 01010 – General Requirements and to the applicable road jurisdiction specifications for excavation, trenching and surface restoration work within existing roadways.

#### **3.02 TRENCH EXCAVATION**

##### **A. General**

1. Excavate trenches and maintain excavation such that pipe and pipeline accessories are installed in an open trench.
2. Excavate to subgrade elevation and to trench width dimensions indicated on the Drawings.
3. De-watering Required:
  - a. At all times provide and maintain ample means and devices to promptly remove and dispose of all water entering the trench excavation during trench preparation for pipe laying, during the laying of the pipe, and until the the pipe zone has been completely backfilled. These provisions shall apply during the noon hour as well as overnight.
  - b. Trench water in the pipeline during construction is prohibited. Place a clean, properly-sized air bladder type expansion plug in the pipe between installations or for overnight protection.

##### **B. Trench Bottom**

1. Excavate and shape trench bottoms to provide uniform subgrade for placement of Bedding Material.

2. Unsuitable Hard Trench Bottom: If bottom of excavation is found to consist of rock or any material that cannot be excavated to provide a uniform bearing surface:
  - a. Notify Developer's Engineer and the District of the conditions encountered and obtain concurrence that an unsuitable trench bottom condition is present.
  - b. Remove such rock or other material to a depth of not less than six (6) inches below the original design elevation of the bottom of the trench.
  - c. Place approved Class B granular backfill (3/4"-0 typical), as specified herein, to restore the trench bottom to the original design elevation. Place material in a single lift and compact to 95 percent of maximum density.
  
3. Unsuitable Soft Trench Bottom: If bottom of excavation is found to consist of soft or unstable material which is incapable of properly supporting pipe:
  - a. Notify Developer's Engineer and the District of the condition encountered and obtain concurrence that an unsuitable trench bottom condition is present.
  - b. Remove such material to the depth and length determined by the Engineer and District.
  - c. Place approved Class B granular backfill (1-1/2" foundation rock) as specified herein to restore the trench bottom to the original design elevation. Place in lifts not exceeding eight inches in uncompacted thickness and compact to 95 percent of maximum density.

E. Trench Widths

1. Excavate trench with vertical walls and with uniform width.
2. Minimum and maximum trench widths: As indicated in the Specifications.
3. Minimum width of unsheeted trenches in which pipe is to be laid shall be 18 inches greater than the inside diameter of the pipe, or as approved. Sheeting requirements shall be independent of trench widths.

### 3.03 ROCK EXCAVATION

- A. Where the bottom of the excavation encounters ledge rock and/or boulders and large stones, these shall be removed to provide 12 inches of clearance on each side and below all structures, pipe and appurtenances.
- B. Excavations below subgrade in rock shall be backfilled to subgrade with approved bedding material and thoroughly compacted.
- C. The Contractor: 1) shall verify if local, county, and/or state rules and regulations allow for the use of explosives for excavation of rock on the project, and 2) is required to obtain all necessary permits as may be applicable.

### 3.04 BACKFILL IN PIPE ZONE

- A. Pipe base and pipe zone backfill are to be ¾-inch minus, Class B granular backfill.
- B. Place material within the Pipe Zone as follows:
  - 1. First Lift
    - a. Carefully place and compact Bedding Material around and under the pipe to a level even with the spring line of pipe.
    - b. Place Bedding material in a single lift and compact to 95 percent of maximum density.
  - 2. Second and Subsequent Lifts
    - a. Place Pipe Zone material from the spring line of the pipe in lifts of approximately 8 inches in uncompacted depth and compact to 95 percent of maximum density.
    - b. Provide compacted Pipe Zone material over the top of the pipe to a total depth as indicated on the Drawings.
    - c. Total depth of pipe zone shall be no less than 12 inches above crown of pipe.
- C. Pipe Displacement
  - 1. Take necessary precautions in placement and compaction of backfill material to prevent displacement of piping.
  - 2. In the event there is movement of the pipe, re-excavate, re-lay, and backfill the pipe.

- D. Requests to use water-settling methods to consolidate fill material shall be submitted to and approved by the District.

### 3.05 TRENCH BACKFILL ABOVE PIPE ZONE

#### A. Class A Backfill

1. Backfill the trench above the pipe zone with excavated trench materials.
  - a. Determine the type of compaction equipment, method to use, and amount of compaction required to prevent subsequent settlement.
    - i. Compact the backfill with mechanical vibratory or impact tampers to a minimum of 90 percent relative compaction.
    - ii. Contractor shall comply with the following:
      - 1) For lifts less than or equal to 8-inches, use of a mechanical (vibratory or impact), walk-behind compaction device is allowed.
      - 2) For lifts greater than 8-inches, a hydraulic backhoe-compaction device ("hoe-pack") is allowed.
      - 3) A 24-inch initial lift shall be followed by 12-inch subsequent lifts, as applicable.
      - 4) A 3-foot initial lift prior to hoe-packing may be provided if authorized by the District.
2. Remove all cobbles and stones two (2) inches in diameter and larger from material used for backfill in the upper 12 inches of Class A backfilled trenches.
3. Where Class A backfill is specified in areas where topsoil conditions exist, replace topsoil in the top six (6) inches of the trench. Compact and rake to match the ground surface adjacent to the trench.

#### B. Class B Backfill:

1. Backfill the trench above the pipe zone with approved granular backfill in lifts not exceeding eight inches loose depth.
2. Compact each lift to a minimum of 95 percent of relative compaction with mechanical vibrating or impact tampers.

3. Contractor shall comply with the following:
  - a. For lifts less than or equal to 8-inches, use of a mechanical (vibratory or impact), walk-behind compaction device is allowed.
  - b. For lifts greater than 8-inches, a hydraulic backhoe-compaction device is allowed. A 24-inch initial lift shall be followed by 12-inch subsequent lifts, as applicable.
- C. Class E Backfill (as required by road/utility permit):
  1. Backfill within the pipe zone with approved Class B gravel backfill.
  2. With District's approval, fill the pipe with water or provide adequate weight to prevent flotation of pipe.
  3. Backfill above the pipe zone with controlled density material to the bottom of the existing asphalt.
  4. Prior to placing Class E backfill around valves and other appurtenances, utilize plastic skirting and crushed rock to provide adequate protection of valves, bonnets, operating nuts, valve cans, and other devices. Contractor shall refer to Drawings for further information.
- D. Maintain roads, shoulders, drainage ditches, and trenches to Clackamas County Specifications (or to the specifications of other governing jurisdiction, as applicable).
- E. When backfill is placed mechanically, push the backfill material onto the slope of the backfill previously placed and allow to slide down into the trench. Do not push backfill into the trench in such a way as to permit free fall of the material until at least two feet of cover is provided over the top of the pipe.
- F. Under no circumstances shall the Contractor allow sharp, heavy pieces of material to drop directly onto the pipe or the compacted material around the pipe.
- G. Backfill voids that may form when removing shoring and bracing.

### 3.06 FIELD QUALITY CONTROL

- A. Contractor's Compaction Testing Responsibilities

1. Accomplish specified compaction of trench backfill, utilizing standards as found in AASHTO T99 or as otherwise directed by the governing jurisdiction's standards.
    - a. Typical compaction shall be 95% of maximum relative density, or as otherwise specified.
  2. Control operations by compaction tests to verify that compaction work complies, and is complying at all times, with requirements specified in this Section concerning compaction, control, and testing.
  3. Test Results:
    - a. Contractor shall immediately notify District of any failing compaction tests, to ensure that these areas are identified and addressed for re-compaction and re-testing.
    - b. Copies of written test results shall be submitted to the District within one week of testing.
- B. Location and Frequency of Compaction Testing
1. At a minimum, compaction tests shall be made every 150 linear feet, or as otherwise directed by the District.
    - a. Initial test shall be 3 feet above top of pipe.
    - b. Subsequent tests, as required for deeper trenches, shall be completed for every additional 3 feet above initial test depth.
  2. Follow compaction requirements as specified by jurisdictional road agency, when applicable.
- C. Compaction Re-testing
1. If compaction fails to meet specified requirements, the Contractor shall perform remedial work by one of the following methods:
    - a. Remove and replace backfill at proper density.
    - b. Bring density up to specified level by other means acceptable to the District.
  2. Re-testing
    - a. For re-testing, the District shall select areas to be tested once Contractor has completed compaction and necessary preparation work.



D. District Confirmation Testing

1. At any time, the District may perform in-place density and moisture content testing by any one of the following methods: ASTM D2922, D2216, and/or D3017; including combinations of the above or other methods, as determined necessary.
2. These tests may be made by the District at the desired frequency and location to verify that compaction is meeting requirements previously specified.
3. The Contractor shall remove overburden above level at which the District wishes to test, and shall backfill and re-compact material after testing is completed.

**END OF SECTION**

## SECTION 15100

### WATERLINES AND APPURTENANCES

#### PART 1 – GENERAL

##### 1.01 SUMMARY

- A. This section covers work necessary to furnish, install, and test all buried piping systems, as shown on the drawings and as specified herein.

##### 1.02 REFERENCE SPECIFICATIONS

- A. AWWA C104 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
- B. AWWA C105 – Polyethylene Encasement for Ductile-Iron Pipe Systems (as directed by the District).
- C. AWWA C110 – Ductile Iron & Gray-Iron Fittings for Water.
- D. AWWA C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe & Fittings.
- E. AWWA C115 – Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
- F. AWWA C151 – Ductile-Iron Pipe, Centrifugally Cast, for Water.
- G. AWWA C153 – Ductile Iron Compact Fittings for Water Service.
- H. AWWA C207 – Steel Pipe Flanges for Waterworks Service.
- I. AWWA C600 – Installation of Ductile-Iron Water Mains & Their Appurtenances.
- J. AWWA C606 – Grooved and Shouldered Pipe Joints.
- J. AWWA C651 – Disinfecting Water Mains.

##### 1.03 SUBMITTALS

- A. Prepare and submit in accordance with Section 01300.
- B. **Demonstrate full compliance with all aspects of this Specification Section, including, but not limited to complete manufacturers' data on all pipe material, fittings, and coatings.**

## PART 2 – PRODUCTS

### 2.01 GENERAL

- A. Pipe sizes are nominal inside diameter unless otherwise noted. All sizes of pipe shall be as called out on the drawings and specified herein. **All pipe and fittings delivered to the job site shall be clearly marked to identify the material, class, thickness, and manufacturer. All material shall be new and free of blemishes.**
- B. Where only one type of pipe is called out, no substitutions shall be allowed.
- C. Piping materials of like kind shall be the product of one manufacturer.
  - 1. **All materials submitted shall be NSF approved and UL listed, and shall comply with the specifications of the respective standard as provided by the American Water Works Association (AWWA), latest revision, as referenced in this Section.**
  - 2. **All products furnished shall be subject to on-site inspection by the District, and any materials not complying with any of the specifications herein shall be rejected at the discretion of the District representative.**
  - 3. When requested by the District, the Developer/Contractor shall promptly provide written certification that the manufacturer's inspection and testing results comply with the applicable AWWA standard(s).
- D. The Developer/Contractor is responsible for furnishing and installing all items necessary to construct a complete and workable piping system. This includes, but is not limited to, insulating couplings and gaskets, piping specialties, and all other items required within the nature and scope of the installation. All items, including those not specified herein but required by the installation, shall be of first quality, equal in grade to similar materials specified herein, and shall comply with all applicable reference standards listed herein.

### 2.02 CEMENT LINED DUCTILE IRON PIPE AND FITTINGS

- A. PIPE
  - 1. Ductile iron pipe shall be centrifugally cast from Grade 60-42-10 ductile iron and shall comply in all respects with AWWA C151 (ANSI A21.51).
  - 2. Pipe delivered to the jobsite shall be clearly and legibly marked, complying with the pipe marking requirements as specified in AWWA C151, Section 4.6, Marking Pipe, as follows:

- a. Weight, class or nominal thickness, AWWA standard and casting period shall be shown on each pipe.
  - b. Manufacturer's mark, country where cast, year pipe was produced, and the letters "DI" or "DUCTILE" shall be cast or metal stamped on the pipe.
  - c. Letters and numerals on pipe sizes 14-inch and larger shall be not less than ½ -inches in height.
3. Buried pipe shall be Class 52, cement-mortar lined, asphaltic-coated ductile iron.

#### B. FITTINGS

1. Fittings shall be of the same material and class as the pipe to which they are joined and shall be manufactured in accordance with AWWA C110 or AWWA C153. Where taps are shown on fittings, tapping bosses shall be used.
2. Fusion bonded epoxy-coated fittings shall be U.S. Pipe Permafuse or equal. Any fitting with marred interior or exterior coating will be rejected and repaired by a factory representative or replaced. Mortar lining for fittings shall be the same thickness as specified for pipe.
3. All fittings shall comply with marking requirements of AWWA C110/C153.

#### C. JOINTS

1. All connections shall be a minimum rating of 1-½ times the line pressure, as approved by the District.
2. All joints on ductile iron pipe shall be push-on joint, mechanical joint, or flanged joint, as specified.
3. Restrained joints shall be one of the following types, and as indicated on the Drawings and approved by the District:
  - a. Welded-On Retainer Ring Type: Single gasket push-on type joint meeting applicable requirements of ANSI/AWWA C111/A21.11, with restraint provided by a welded-on retainer ring.
    - i. Joints shall be U.S. Pipe TR Flex, American Lok-Ring, Clow Super-Lock, or equal.

- b. Mechanical Joints with Joint Restraint: Joint restraint shall be utilized in place of thrust blocking as shown on the Drawings or as approved by the District. Install restraints in accordance with manufacturer's recommendations. The following are District-approved restrained joint systems:
  - i. Romac Grip Ring or RomaGrip, Romac Industries, Inc.,
  - ii. Megalug, EBAA Iron Inc.;
  - iii. LocTyte, Pacific States Cast Iron Pipe Co.;
  - iv. TR Flex or Field-Lok, U.S. Pipe and Foundry Co.;
- c. Restraining Gaskets shall be US Pipe Field-Lok or equal.
- d. Bell Restraint System shall be used only when approved by the District, and equal to Romac 611 or EBAA Series 1500TD.
- e. Lubricant for push-on joint piping shall be the pipe manufacturer's standard and NSF 61 approved.
- f. Flanged joints for ductile iron pipe shall be as indicated in AWWA C115, in sections 2.03 and 2.07 of these specifications, or as otherwise indicated on the drawings.
- g. **Deflection of restrained joint pipe shall follow Manufacturer's recommendations.**

#### D. LINING AND COATING

- 1. All ductile iron pipe and fittings shall have a standard cement mortar lining seal-coated with asphaltic material in accordance with AWWA C104 (ANSI A21.4).
- 2. Surface repair coatings for tar-coated pipe shall be 3M Spray-on Rubberized Undercoating, or equal.
  - a. Provide appropriate cloth wrapping between multiple repair coatings as directed by the District and manufacturer's specifications.

#### E. POLYETHYLENE ENCASEMENT

- 1. When required, the surfaces of all buried ductile iron pipe and fittings, including those that are fusion epoxy coated, shall be encased with one sheet of 8-mil minimum thickness polyethylene to form a continuous and

all-encompassing layer of polyethylene between the piping and surrounding earth or backfill material. All polyethylene shall be secured in place with 10-mil polyethylene tape. Installation shall conform to requirements of ANSI/AWWA C105/A21.5 and manufacturer's specifications. Excess slack width in the polyethylene tube shall be taken up to make a snug (but not tight) fit around the pipe barrel and secured with adhesive tape in a fold on the top of each pipe length at the quarter points. Any rips, punctures or other damage to the polyethylene sleeve shall be repaired with adhesive tape or a short length of polyethylene tube cut open, wrapped around the pipe and secured in place.

## 2.03 STEEL PIPE

### A. PIPE

1. Steel pipe and fittings shall be manufactured and furnished in accordance with ASTM A53, and shall be seamless or electric resistance welded.
2. Minimum wall thickness of steel shall be 3/8 inch for pipe 12 to 24 inches in diameter. Pipe less than 10 inches in diameter shall be Schedule 40 minimum. Pipe shall be rated for a minimum of 1-½ times the system line pressure as approved by the District..

### B. FITTINGS

1. All fittings shall have a minimal pressure and loading rating equal to the pipe to which they are connected.
2. Fittings for steel pipe shall be steel with butt weld, flanged, or mechanical grooved ends and couplings conforming to AWWA C606.

### C. JOINTS

1. All joints on steel pipe shall have butt weld, flanged, or mechanical grooved ends.
2. All flanged joints shall be full or raised face, as specified on the drawings. Flanges shall be in accordance with AWWA C115 (ANSI A21.15) and AWWA C207, and faced and drilled to ASME B16.1, class 125 flange standards.
3. Grooved ends shall be the flexible radius type. Grooved end couplings shall conform to AWWA C606 and shall be Victaulic Style 31 or equal.

## 2.04 COPPER PIPE

- A. Follow the specifications as set forth in Section 15150 – Service Connections, for furnishing and installation of copper pipe and tubing.

## 2.05 BOLTS, NUTS, WASHERS, AND GASKETS – GENERAL REQUIREMENTS

- A. Unless otherwise specified, bolts and nuts for exposed flanges and fittings shall be as follows:
  - 1. For buried pipe, bolts shall be carbon steel, ASTM A307 grade B, with ASTM A563 grade A heavy hex head nuts for class B and D flanges.
  - 2. For restrained joint or mechanical joint use NSS Cor-Ten bolts for buried service.
  - 3. Bolts and nuts may be furnished from equivalent strength stainless steel if precautions are taken to prevent galling of threads during tightening. Use an approved anti-sieze compound for all stainless steel bolts to prevent galling of bolt threads.
  - 4. Washers shall be of the same material as the bolts.
- B. Unless otherwise specified, gaskets shall be as follows:
  - 1. Gasket material shall be oil resistant synthetic rubber or neoprene free from corrosive alkali or acid ingredients and suitable for use in potable water service. Gaskets shall be one piece, full face or cut ring, with holes to pass bolts.
  - 2. Gaskets for mechanical joint (MJ) connections shall meet the requirements of AWWA C111, including characteristics, dimensions and marking requirements.
  - 3. Gaskets for full faced flanged joints shall be 1/8 in. thick, sheet rubber conforming to AWWA C111, C115 and C207.
  - 4. Use cut ring gaskets for raised face (RF) flanges.
  - 5. Gaskets for push-on joints shall be oil resistant synthetic rubber, nitrile or neoprene, suitable for use in potable water service, conforming to AWWA C111.
  - 6. Bell gaskets shall be made by the same manufacturer of the pipe.
  - 7. Full face gaskets shall be used when insulation kits are required, unless specified otherwise on the drawings.

8. Nitrile gaskets, for use in special circumstances (i.e. contaminated soils, etc.) shall be used only as specified by the District.

## 2.06 PIPING CONNECTIONS

### A. PIPE COUPLINGS

1. Flexible couplings shall be Romac 501, Smith-Blair 411, or equal, with the stop removed from the middle ring. Flexible reducing couplings shall be Romac RC501 or equal.
2. Flange Adapters
  - a. When required, flange adapters shall be Romac FCG or RFCA, Smith-Blair Series 900, or equal.
  - b. When approved by the District, Insulating Flange Coupling Adapters shall be as specified in "2-a." above, or as indicated on the drawings, with rubber insulating boot, low alloy steel bolts and nuts conforming to AWWA C111.
3. Transition Couplings
  - a. Transition couplings shall be epoxy-coated steel or ductile iron couplings with rubber rings and high strength low alloy steel bolts and nuts conforming to AWWA C111, with an insulating boot at the smaller diameter end of the coupling. If the pipes are the same diameter put the insulating boot on the OD Steel pipe. Coupling shall be Romac 501 or equal.
  - b. For connections involving OD steel pipe, install the coupling with a District-approved restraint system as shown on the Drawings.
4. Termination ("end-cap") couplings shall be as follows:
  - a. End cap couplings for steel pipe shall be ROMAC EC501, or equal.
  - b. Termination couplings for ductile and cast iron shall be a Mechanical Joint cap or plug.
  - c. Termination couplings for bell joints shall be a Tyton plug.
5. Mechanical couplings, not a part of the pipe itself, shall be ductile iron couplings with rubber rings and high strength low alloy bolts and nuts conforming to AWWA C111. Couplings shall be Smith-Blair No. 441 or equal.



B. DIELECTRIC ISOLATION

1. General

- a. All piping shall be dielectrically isolated from piping or other materials that are constructed from dissimilar metals.

2. Flange Insulation Kits

- a. Flange insulation kits shall consist of a manufacturer approved gasket, two insulating washers and two steel washers for each bolt, and one full-length mylar insulating sleeve.
- b. Flange insulation kits shall have an ANSI rating equal to that of the flange.
- c. The flange shall be tape-wrapped with 10-mil butyl rubber polyethylene-backed adhesive tape to provide a seal between the two flanges.
- d. Bolts for flange insulation kits shall be 1/8-inch undersized, ASTM A193, Grade B7 alloy stud bolts and ASTM A194, Grade 2H carbon steel heavy hex nuts.
- e. Insulating flange gaskets shall be full face, 1/8-inch rubber. For raised face flanges, use cut ring gaskets as specified.
- f. Flange insulation kits shall be as manufactured by Calpico Inc., San Francisco, CA; Pacific Seal, Inc., Burbank, CA; or Central Plastics Co., Shawnee, OK, or approved equal.

2.07 PRESSURE TAPS (“HOT” OR “WET” TAPS)

A. GENERAL

- 1. The tapping Developer/Contractor and waterline Developer/Contractor must be licensed and bonded to do business in Oregon.
- 2. Hot-tap welders shall be qualified as prescribed in AWS D1.1, Sec 5, Parts C, D, and E or under ASME Boiler and Pressure Vessel Code, Sec. IX, QW-201, QW-301 all positions. All welding shall comply with the requirements of AWWA C207 section 4.3, unless otherwise specified.
- 3. The welder must provide three previous pressurized thin wall pipe welding references (Ameron 14 gauge type).
- 4. The tapped hole in the main shall be undersized a maximum of ½ inch as measured across the diameter of the pipe.

5. All sleeves will have a test plug for a compressed air test between 25-35 psi. Prior to testing, a mixture of soap and water is to be sprayed onto the sleeve at all welds, seams, valves and contact points with the pipe to inspect for air leakage. No leakage will be accepted.
6. All taps will be thrust blocked and have a concrete block supporting the tapping valve.
7. **Contractor is required to test the approved tapping valve and sleeve integrity prior to installation/tap.**

B. STEEL PIPE TAP – SPECIAL CONSIDERATIONS

1. Tapping sleeve for OD steel pipe size-on-size shall be weld-on, JCM 416 Type 4, or equal, with Insulation Kit. Sleeve shall be fabricated from minimum 3/16-inch steel.
2. Unless otherwise specified, flanges used on the tapping neck shall be steel, flat or raised face, class 125 drilling, and Class D (150 psi rated) according to AWWA C207.
3. Both the sleeve and the exposed metal around the tap shall be tar coated. Taps smaller than the main require a JCM 422 stainless steel sleeve, or equal.

C. DUCTILE IRON PIPE TAP – SPECIAL CONSIDERATIONS

1. Tapping sleeves shall be full circle, stainless steel JCM 432 or 452, Mueller H-304-SS, or approved equal.

D. CAST IRON PIPE TAP – SPECIAL CONSIDERATIONS

1. Tapping sleeves shall be full circle, stainless steel JCM 432 or 452, Mueller H-304-SS, or approved equal.

E. CONCRETE CYLINDER PIPE TAP – SPECIAL CONSIDERATIONS

1. Tapping sleeves will be weld-on JCM 416 Type 4 concrete pipe type sleeves, or approved equal.
2. Weld-o-lets may be used upon approval of the District.
3. Refer to the drawings and section 3.02-E.4 below for further requirements when working with concrete cylinder pipe.

## 2.08 WATERLINE CASING

### A. STEEL CASING

1. Steel casing pipe, spacers and accessories for casing waterlines shall be as specified on the drawings.
2. Casing pipe shall be Schedule 40 steel, manufactured of steel plate to the requirements of ASTM A1011 or A1018.
3. Casing spacers, end caps and other accessories shall be as manufactured by Calpico, Inc., San Francisco, CA, or equal.

## 2.09 TRACER WIRE

- A. Tracer wire for locating purposes shall be No. 12 THHN or TWU standard solid copper wire with blue colored Type UF insulated jacket.

## **PART 3 – EXECUTION**

### 3.01 PREPARATION AND HANDLING OF PIPE

- A. The District will inspect each pipe and fitting before the buried pipe or fitting is lowered into the trench, or the exposed pipe or fitting is installed (as applicable). The interior and exterior protective coatings shall be inspected, and all damaged materials shall be removed from the project site and replaced with new, undamaged material.
1. The Developer/Contractor shall clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.
  2. The District reserves the right to reject any damaged materials it determines unfit for installation.
- B. Use proper tools and equipment for the safe and adequate protection of the pipe. Carefully handle pipe in such a manner as to avoid any physical damage, in accordance with AWWA C600. Do not drop or roll pipe into trenches.
- C. Before tapping, all materials and devices which will make contact with the potable water system must be clean and bacteria-free. All installations will comply with CRW Technical Specifications, Oregon Health Authority

requirements, manufacturer's requirements, and American Water Works Association (AWWA) Standards, as referenced herein.

- D. As applicable, all exposed **steel piping**, fittings and related hardware shall be prepared as follows:
1. Prepare surfaces with SSPC-SP5 "White Metal Blast Cleaning". Only when directed by the District will -SP1, -SP2 or -SP3 be allowed.
  2. Interior and exterior coatings shall be a potable grade polyamide epoxy approved for potable water contact which conforms to NSF Standards 60 and 61, unless cement lining conforming to AWWA Standards is specified. Apply the coating in 3 coats at 3 mils each, dry test at 9 mils minimum, to the manufacturer's recommendations. (Refer to Section 09900, "Paints and Coatings", if applicable.)

### 3.02 INSTALLATION OF PIPING

#### A. GENERAL

1. All pipe shall be carefully placed and supported at the proper lines and grades and, sloped where possible to permit complete drainage. Piping runs shown on the drawings shall be followed as closely as possible, except for minor adjustments to accommodate field conditions. Major field relocations/realignments require prior District approval.
  - a. Pipe depth may vary depending on location of other utilities and status of line(s) (abandoned or live). The Developer/Contractor may be required to remove abandoned waterlines for the purpose of installation of new lines in same trench, or to support communication or other utility lines for new alignments.
2. Piping shall be installed without springing or forcing the pipe in a manner which would set up stresses in the pipe, valves, or connected equipment. (See table 1 below).
  - a. Contractor shall complete the assembly of each length of piping before laying the next length in the trench, including pushing pipe in place and completing joint connections.
3. Straight runs of piping upstream and downstream of flow measuring devices shall be smooth for the required lengths per manufacturer's recommendations, as applicable.
4. Unless otherwise directed, lay pipe with bell end facing in the direction of the laying. For lines on an appreciable slope, face bells upgrade at the discretion of the District.

5. Wherever it is necessary to deflect pipe from a straight line to avoid obstructions, either in the vertical or horizontal plane, or where long-radius curves are permitted, the amount of deflection allowed shall not exceed the values in the following table:

*Table 1 – Maximum Allowed Deflection of Ductile Iron Pipe.*

Maximum Deflection*† Permitted in 18-Ft <b>Mechanical Joint</b> Ductile Iron Pipe (AWWA C600)			Maximum Deflection*† Permitted in 18-Ft <b>Push-on Joint</b> Ductile Iron Pipe (AWWA C600)		
<u>Pipe Diameter in Inches</u>	<u>Max. Deflection in Degrees</u>	<u>Max. Deflection in Inches</u>	<u>Pipe Diameter in Inches</u>	<u>Max. Deflection in Degrees</u>	<u>Max. Deflection in Inches</u>
4 - 12	2.5	10	4 - 12	2.5	9.5
14 - 24	1.5	5.5	14 - 36	1.5	5.5

*\* Maximum deflection shall be whichever is less between the above value and the manufacturer's recommendation.*

**† Deflection for Restrained Joint Pipe shall follow Manufacturer's Recommendations.**

6. All pipe flanges shall be set level, plumb, and aligned. All flanged fittings shall be true and perpendicular to the axis of the pipe. All bolt holes in flanges shall match mating flange alignment, bolt pattern, thickness and pressure requirements.
7. For pipes passing from concrete foundations or footings to soil, a flexible pipe coupling, as approved by the District, shall be installed within 1 foot of the foundation, or as otherwise indicated on the drawings. Particular care shall be taken to ensure full support of the pipe in the soil between and beyond the joints.
  - a. Flexible couplings shall be flexible expansion joint type, as manufactured by EBAA Iron, Inc., or approved equal. (Refer to the drawings, as applicable.)
8. Alignment: Pipelines intended to be straight shall not deviate from the straight line at any joint in excess of 1 inch.
9. Do not lay pipe in water or when, in the opinion of the District, trench conditions are unsuitable.

**B. UTILITY SEPARATION REQUIREMENTS**

1. Horizontal separation between waterlines and sanitary sewer shall be 10 feet. **For water crossings over or under sanitary sewer, follow the stipulations of OAR 333-061-0050.**

2. Waterlines near utilities (other than sewer) require minimum separation as follows:
  - a. Horizontal separation: 3 feet.
  - b. Vertical separation (at crossing): 18 inches.
  - c. Separation distances may be modified on a case-by-case basis after review and approval by the District and applicable local jurisdiction/other utility owner.

C. CLEANING PIPE AND FITTINGS

1. Remove all lumps, blisters, and excess coal-tar coating from the bell-and-spigot ends of each pipe. Wire brush the outside of the spigot and the inside of the bell and wipe clean, dry, and free from oil and grease before the pipe is laid.
2. Wipe the ends of mechanical joint pipe and fittings and of rubber gasket joint pipe and fittings clean of all dirt, grease, and foreign matter.
3. Do not allow foreign material to enter the pipe when placing in the trench.
4. Push-on Joint Pipe: After the first length of push-on joint pipe is installed in the trench, secure pipe in place with approved backfill material tamped under and along sides to prevent movement. During placement, keep ends clear of backfill. After each section is jointed, immediately place backfill as specified.

D. CUTTING PIPE

1. Cut pipe for inserting valves, fittings, or closure pieces in a neat and workmanlike manner without damaging the pipe or lining. Leave a smooth end at right angles to the axis of the pipe.
2. Cut ductile iron pipe with milling type cutter or saw. Do not flame cut.
3. Dress cut end of pipe to remove sharp edges or projections that may damage the rubber gasket. Dress cut ends of push-on joint pipe by beveling, as recommended by the manufacturer.

E. WELDING PIPE

1. Where applicable and otherwise required, all pipe welding shall be done by a certified welder meeting all qualification requirements of section 2.07.A of these specifications.

F. SPECIAL INSTALLATION CONSIDERATIONS FOR BURIED PIPE

1. General

- a. All buried pipe shall be prepared as specified and shall be laid on the prepared granular base and bedded to ensure uniform bearing. Take all precautions necessary to prevent uplift and floating of the pipe prior to backfilling. Place a same size clean expansion sewer plug or air bladder type plug in the pipe between installations or for overnight protection.
- b. Since pipe, joints, and fittings vary slightly between manufacturers, lay and join all materials in strict accordance with the manufacturer's recommendations.
- c. Adhere to Section 02225 – Trench Excavation and Backfill – for trench grading, preparation, and backfilling for pipe placement.
- d. At the location of each joint, dig bell joint holes of ample dimensions in the bottom of the trench and at the sides where necessary to permit the joint to be made properly and to permit easy visual inspection of the entire joint.

2. Special Connections

- a. Provide special piping connections for dissimilar pipe types in accordance with the project drawings.
- b. Thrust restraint, insulated connections, and protection of existing pipe's integrity shall be accomplished in accordance with the drawings and specifications.

3. Piping Anchorage

- a. Mechanical joint restraints shall be installed as shown on the drawings. For all other situations, District approval is required to install mechanical joint restraints. Properly engineered lengths of restraint for fitting type and pressures are required, and shall follow manufacturer's recommendations. Mechanical joint

restraints will not be used on plain end fittings due to tapered ends.

- b. Thrust blocks, in lieu of piping joint restraint systems, shall be used only as directed by the District.**
- c. Provide reaction or thrust blocking as indicated on the drawings, or as directed by the District.
  - i. Concrete for thrust/collar blocks shall have a 28-day compressive strength of 3,000 psi minimum.
  - ii. Place the blocking so that the pipe, fittings and joints will be accessible for disassembly and repairs, unless otherwise indicated.
  - iii. Wrap all pipe and fittings that will contact concrete with 4-mil plastic sheeting. Refer to CRW standard details with the Drawings.
  - iv. Allow concrete to cure a minimum of 5 days prior to filling or testing the waterline.
  - v. A high-early concrete mix may be used if approved by District. Developer/Contractor must submit mix design per Section 01300, and provide documentation that the proposed high-early mix will yield an average 3-day strength of 1,200 psi at 50 °F cure temperature.
- d. Securely anchor piping by approved restraint systems or suitable thrust blocking at all tees, plugs, caps, and other locations where unbalanced forces exist, as shown on the Drawings and as directed by the District.
- e. For restraint of existing piping, a metal harness of adequate restraint design may be used in conjunction with concrete gravity blocking only when approved by the District. Use a stainless steel metal harness or furnish with comparable corrosion protection, as approved by the District.
- f. For collar blocks, Developer/Contractor shall adhere to the following procedure:
  - i. A District approved retainer gland (Romac 612 or equal) shall be secured to the pipe at the collar block location.



- ii. Cut the undisturbed soil on the sides and bottom of the trench, and perpendicular to the pipe. The dimensions of the collar block will be determined by the design engineer and approved by the District.
  - iii. Place a No.5 rebar mat, 12-inch on center, around the pipe at the retainer gland and into the cut. Restrain all pipe from the gland to the valve or fitting with the approved restraint system. Place concrete in 12-inch lifts consolidating each lift to fill all possible voids. The concrete shall be a minimum of 12-inches above and below the pipe.
  - iv. Unless directed otherwise by the District, a minimum of 7 feet of undisturbed soil shall separate the collar block from any fitting or valve placed downstream of the block. No additional joints shall exist between the collar block and restrained fitting or valve unless a District-approved restraint has been installed on the intermediate joint.
4. Working with Concrete Cylinder Pipe (CCP)
- a. Any steel rod wrap that is cut will be tack welded back to the pipe and permanently welded back to the flange.
  - b. Using an approved mortar, grout all exposed exterior piping surfaces to manufacturer's recommendations.
  - c. For applications when quick-set interior repairs are required on CCP, instead of mortar use a thin layer of quick-cure coating such as Tnemec Epoxoline Series FC22, touch-up kit, or equal; apply heat for rapid curing.
5. Tracer Wire
- a. Tracer wire shall be attached to the top and along the centerline of the pipe.
  - b. Tracer wire shall be routed through all valve boxes as shown on the drawings. Run tracer wire from the pipe up the outside of the valve box riser and inside the valve box top to prevent binding of the operating nut.
  - c. All locations of tracer wire intersections shall be soldered to provide electrical continuity, and protected from adverse soil

conditions with the use of shrink tubes or other approved waterproof connector devices.

- d. Leave 1 foot of slack tracer wire in mainline at each valve and at each service tap to facilitate splicing, soldering and waterproofing.

6. Casing

- a. Welding of casing shall conform to the welding requirements as stated in section 2.07A of these specifications.
  - i. Contractor shall provide continuous seam welding for all casing joint connections.
  - ii. Handling, storage and transport of steel casing pipe shall conform with manufacturer's recommendations.
- b. Install carrier pipe in casing pipe using approved casing spacers, end caps and other accessories, as shown on the drawings and in accordance with casing spacer manufacturer recommendations.

3.03 PIPELINE CLEANING, TESTING AND DISINFECTION

A. GENERAL

- 1. Pipelines shall be subject to acceptance tests as specified herein. The Developer/Contractor shall provide all necessary labor and equipment for testing, and shall dispose of all waste, including water, in an acceptable and authorized manner. All tests shall be conducted in the presence of the District.
- 2. Testing and disinfection for ductile iron pipe shall be in accordance with latest AWWA standards, Oregon Health Authority-Drinking Water Program, and as otherwise specified in this section.
- 3. Pressure testing of all other pipe material shall follow applicable AWWA standards, but shall generally conform to the requirements of this section.
- 4. The Developer/Contractor shall furnish all required equipment and materials for cleaning, testing and disinfection, including temporary blow-offs, valves, hydrants, air releases and sampling points as necessary.

B. CLEANING

1. The interior of all pipelines shall be thoroughly cleaned of all debris prior to testing and prior to making connections.
  - a. Cleaning shall be accomplished by flushing with water at a velocity of 2.5 ft/s and, if necessary, by pulling a tightly-fitting cleaning ball or swab through the pipe.
  - b. No test shall commence until the pipeline is completely cleaned to the satisfaction of the District. As applicable, pump suction lines shall be cleaned prior to operation of pumps.

C. TESTING – GENERAL

1. The Developer/Contractor shall notify the District at least 48 hours in advance of scheduled pipeline testing.
  - a. All piping, fittings, valves, services, thrust blocks, and other appurtenances (as applicable) shall be in place and properly set prior to issuance of the testing notice to the District.
    - i. Typically, 5 days minimum is required for proper curing of concrete. If an approved high-early concrete is used for thrust blocks, Developer/Contractor may provide a shorter cure time (i.e. 3 days minimum) upon District's approval. Refer to Execution- Piping Anchorage above for further information on using high-early concrete.
  - b. Sections of pipeline to be tested shall be completely backfilled or partially backfilled as approved by the District.
  - c. Developer/Contractor shall not start a test unless the District's representative is present, or District's pre-approval has been otherwise obtained.
2. If leakage in excess of allowable values occurs in any section of pipe, the Developer/Contractor shall promptly locate and repair all leaks and retest the line until the leakage has been eliminated. All costs of repairs and retests shall be borne by the Developer/Contractor.
3. The Developer/Contractor shall take all necessary precautions to prevent any joint infiltration or inflow while the lines and their appurtenances are being tested; and shall, at his own expense, repair any damage to the lines and their appurtenances, or to any other structures, resulting from or caused by these tests.

4. Newly constructed pipe shall be isolated from existing pipe and shall satisfactorily pass the test specified herein prior to connection of that pipe to any existing piping or valves, unless otherwise indicated on the Drawings.
  - a. As applicable, backflow prevention devices shall be utilized as required to isolate new waterlines, including temporary protection during testing activities.
5. Potable water shall be used for all hydrostatic tests. The Developer/Contractor may obtain test water from the District's water distribution system from a point or points approved by the District.
  - a. The Developer/Contractor shall follow the District's policies and procedures for obtaining testing water. Refer to Section 01500, Construction Facilities and Utilities, for further information.
6. Care shall be exercised to isolate equipment which is not rated for the specified test pressure to avoid damage to the equipment.
7. The District will provide written acceptance of pressure testing to the Developer/Contractor.

D. HYDROSTATIC LEAK TEST

1. Slowly fill the pipe with water and allow to stand for 24 hours prior to pressure testing. Expel all air from the pipe. Apply and maintain the specified test pressure for the entire test period.
  - a. The test pressure shall be calculated at the point of highest elevation for the section of line being tested, or as specified by the District. The test pressure shall be as shown on the Drawings or 1-½ times the working pressure, but not less than 150 psi.
  - b. The pump suction shall be in a barrel or similar device, or metered so that the amount of water required to maintain the pressure may be measured accurately.
2. The duration of each pressure test shall be 2 hours with the water loss formula test or, at the inspector's discretion, a 30 minute no-loss test may be given. The length of each test may vary to ensure that the system is acceptable to the District.
3. Leakage shall be defined as the quantity of water necessary to hold the specified test pressure for the duration of the test period. No pipe

installation will be accepted if the leakage is greater than the allowable rate, as determined by the following formula:

$$L = \frac{1}{2} \times \frac{ND(P)^{\frac{1}{2}}}{7,400}$$

In the above formula:

L = Allowable leakage, in gallons per hour

N = Number of joints in the length of pipe tested

D = Nominal diameter of pipe, in inches

P = Average test pressure during the test, in pounds per square inch

4. Regardless of the allowable leakage calculations, no visible leaks will be allowed on bridge sections or exposed piping systems.

#### E. DISINFECTION

1. A District representative shall operate any system valves associated with waterline testing.
2. All potable water pipelines shall be disinfected in accordance with Method 2 or 3 of AWWA C651 prior to being placed in service, as referenced and amended herein.
3. Disinfection Solution:
  - a. Sodium hypochlorite solution shall be within a concentration range of 5% to 15% and shall have a free chlorine residual of 40 to 50 parts per million (ppm) in the pipe after injection.
  - b. When approved by the District, a solution strength of 300 ppm shall be used for swabbing pipe and fittings on short pipe sections, waterline repairs, tie-ins and hydrant installations. The solution will be thoroughly swabbed on each pipe component and fitting. Per AWWA C651-4.7.4, this solution shall sit for a minimum of 15 minutes prior to flushing to allow for adequate contact time.
  - c. Allowable forms of chlorine for disinfection are:
    - i. Method 2 – Sodium hypochlorite solution (5-15%)
    - ii. Method 3 – Calcium hypochlorite – dry granules only (**no tablets shall be used**).

### 3. Disinfection Procedure

- a. Use an approved solution-feed chlorinating device which provides adequate backflow prevention.
- b. Method 2: Dilute the sodium hypochlorite solution with water to obtain a 1 percent solution. Approximate ratio is 1 gallon of 5.25% sodium hypochlorite to 4.25 gallons of water. 5.25% hypochlorite is comparable to commercial bleach such as Clorox or equal.
- c. Method 3: Mix calcium hypochlorite granules with water to make a thick paste, then thin to approximately 1 percent solution (10,000 ppm chlorine).
- d. Inject the chlorine solution into the pipeline to be chlorinated at the beginning of the line through an approved corporation stop (Ford or equal), C.C. thread or approved tap in the top of the pipeline.
  - i. Water from the existing system or other District-approved source shall be controlled so as to flow slowly into the newly laid pipeline during the application of chlorine. The rate of chlorine mixture flow shall be in such proportion to the rate of water entering the pipe that the combined mixture shall contain 40 to 50 ppm of free available chlorine.
  - ii. Valves shall be manipulated so that the strong chlorine solution in the line being chlorinated will not flow back into the line supplying the water. Use check valves if necessary.
- e. Retention Period
  - i. Chlorinated water shall be retained in the pipeline long enough to destroy all non spore-forming bacteria. With proper flushing and the specified solution strength, 24 hours is required. At the end of the 24-hour period, the disinfection mixture shall have a strength of at least 10 ppm of chlorine. If the mixture is less than 10 ppm, flush the line and repeat the disinfection procedure.
  - ii. During disinfection and under District direction, operate all valves, hydrants, and other appurtenances to assure

that the disinfection solution is dispersed into all parts of the line, including dead ends, new services, and similar areas that otherwise may not receive the chlorinated water.

- iii. Do not place concentrated quantities of the disinfectant in the line before it is filled with water. **Use of chlorine tablets is prohibited.**
- iv. After chlorination, flush until the water through the line is equal in chemical and bacterial quality to the permanent source of supply.
- f. After chlorination and flushing, the water shall remain in the pipe for an additional 24 hours before bacterial sampling. After bacterial tests have been performed and accepted by the District, the Developer/Contractor shall replace the test corp with a solid bronze plug that has C.C. type threads. Galvanized plugs will not be accepted.
- g. Dispose of chlorinated water in an approved manner. Do not allow chlorinated water to flow into a waterway without using a satisfactory method of reducing chlorine concentrations to a safe level as determined by the U.S. Environmental Protection Agency and Oregon State Department of Environmental Quality.

F. SUMMARY OF TESTING AND DISINFECTION PROCEDURE

1. The District's procedures for waterline testing and disinfection as described above follows the typical timeline as follows:
  - a. Waterline filling, release excess air, and allow filled waterlines to sit for 24 hours.
  - b. Conduct pressure testing as specified.
  - c. Disinfect waterlines and allow to sit for 24 hours.
  - d. Flush waterlines, fill and allow to sit for 24 hours.
  - e. Sampling (typically by District), results available in 24 hours.
  - f. Connect and activate waterlines as specified.

**END OF SECTION**



## SECTION 15150

### WATER SERVICE CONNECTIONS

#### PART 1 – GENERAL

##### 1.01 SUMMARY

- A. This section covers work necessary to furnish, install, and test all water service connections as shown on the drawings and as specified herein.

##### 1.02 REFERENCE SPECIFICATIONS

- A. AWWA C800 – Water Service Line Valves and Fittings
- B. ASTM B88 – Standard Specification for Seamless Copper Water Tube
- C. Refer to Section 15100 – Waterlines and Appurtenances

##### 1.03 SUBMITTALS

- A. Prepare and submit in accordance with Section 01300.
- B. Demonstrate full compliance with all aspects of this Specification Section, and shall include, but not be limited to, complete manufacturers' data on all pipe material, fittings, and coatings.

#### PART 2 – PRODUCTS

##### 2.01 GENERAL

- A. Pipe sizes are nominal inside diameter unless otherwise noted. All sizes of pipe shall be as called out on the drawings and specified herein. **All pipe and fittings delivered to the job site shall be clearly marked to identify the material, class, thickness, and manufacturer. All material shall be new and free of blemishes.**
- B. Where only one type of pipe is called out, no substitutions shall be allowed.
- C. Piping materials of like kind shall be the product of one manufacturer.
  - 1. **All materials submitted shall be NSF approved and UL listed, and shall comply with the specifications of the respective standard as provided by the American Water Works Association (AWWA), latest revision, as referenced in this Section.**

2. **All products furnished shall be subject to on-site inspection by the District, and any materials not complying with any of the specifications herein shall be rejected at the discretion of the District representative.**
  3. When requested by the District, the Developer/Contractor shall promptly provide certification that the manufacturer's inspection and testing results comply with the applicable AWWA standard(s).
- D. The location and size of service connections will be as shown on the drawings.
- E. All pipe dope, cutting paste and other incidental service materials will be NSF-approved for potable water, as specified in Section 15100.
- F. **As required by U.S. Senate Bill S.3874, all service connection materials, including brass or bronze valves and fittings, shall be certified "lead-free" or "no-lead (NL)" to meet the following requirements:**
1. **Not containing more than 0.2 percent lead when used with respect to solder and flux.**
  2. **Not more than a weighted average of 0.25 percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.**
  3. **For the purposes of these specifications, allowed exemptions to the "lead-free" requirement include:**
    - a. **Pipes, plumbing fixtures, or fittings (including backflow preventers) used exclusively for non-potable services.**
    - b. **Service saddles or water distribution main gate valves that are two inches diameter or larger.**

## 2.02 SERVICE CONNECTION COMPONENTS

- A. All components of a service connection shall be the same size as the nominal designation of the service connection pipe.

## 2.03. SERVICE PRESSURES

- A. Compression or grip fittings may be used where working pressures are less than 100 psi.
- B. High pressure ball-type corporation and angle meter stops shall be used where working pressures are equal to or greater than 100 psi. An A-24 Ford meter reducer or equal is to be installed to connect ¾-inch meters.

- C. No quick joint (Ford “Q”) style connections shall be used- use onlygrip joint (Ford “G”) style connections.(“G” style connections include a standard rubber gasket and threaded connection.; “Q” style connections include a stainless steel ring and compression spring assembly- **“Q” style shall not be accepted.**)

#### 2.04. TAPPING MATERIALS

- A. Developer/Contractor shall provide all necessary equipment and materials for making service taps and connections, including incidental items such as cutting paste and similar materials.
- B. Before tapping, all materials and devices making contact with the potable water system will be clean and bacteria free. Disinfecting of all installations will comply with Section 15100 of these specifications, the Oregon Health Authority, manufacturer’s recommendations and AWWA Standards (as referenced).

#### 2.05 SERVICE MATERIALS: STANDARD DOMESTIC ¾ - 1 INCH SERVICE

##### A. CORPORATION STOPS

- 1. In general, typical service connections to ductile iron or cast iron watermains shall be ¾-inch or 1-inch, “lead-free” corporation stops that are direct-tapped\* at a 45° angle upward.  
\*(No saddle required)
- 2. Corp stops shall be Ford F1000-4-G-NL (grip joint) style or equal. **No Q (quick joint) style corp stops shall be used.**
  - a. For high pressure applications (100-300 psi) use Ford FB1000-4-G-NL corp stop or equal.
- 3. Corporation stops for ¾-inch and 1-inch services shall have a CC-threaded inlet and a compressive or grip connection for a copper pipe outlet.

##### B. SERVICE SADDLES

- 1. Service saddles shall be as follows:
  - a. For ¾” or 1” service connections to OD steel, PVC or transite watermain, use double-strap “lead-free” brass or stainless steel service saddles, with CC-threaded outlet.
  - b. Saddles shall be Ford F202B-NL, Romac 202S, or equal.

C. SERVICE COUPLINGS

1. Copper-to-copper couplings shall be Ford C44-XX-G-NL or equal.

D. MISCELLANEOUS FITTINGS

1. Reducers and adapters shall be Ford, Mueller or equal.

E. ANGLE METER STOPS

1. Angle meter stops shall have a copper inlet and inside IP outlet with swivel nut and padlock wing.
2. Angle stops shall be Ford KV43-444W-G-NL (grip joint) style or equal. **No Q (quick joint) style corp stops shall be used.**
  - a. For high pressure applications (100-300 psi) use Ford BA43-444W-G-NL angle stops.

F. COPPER TUBING

1. Copper tube used for ¾- and 1-inch service connections shall be Type K, soft seamless conforming to ASTM B88.
2. Flared fittings, when required, shall conform to ANSI B16.26.

G. METERS

1. The District will furnish and install an approved meter.
  - a. Meters shall be Badger Recordall Disc series, lead-free alloy, model 55, or equal.

H. METER BOXES

1. Meter boxes for standard ¾" or 1" services shall be as follows:
  - a. Armorcast, Model A6001946PCX12, 13" x 24" x 12", heavy wall polyethylene with cast iron reader lid; or equal.

## 2.06 SERVICE MATERIALS: 1-½ - 2 INCH SERVICE

### A. GATE VALVE

1. 1-½ and 2-inch service connections to ductile iron or cast iron water mains shall be a 2-inch CC-threaded, double-strap service saddle that is tapped perpendicular and horizontal to the main.
  - a. For locations where conditions merit and as directed by the District (existing utility conflicts, etc.), the service connection may be tapped at a 45° angle and the gate valve installed at a specified distance from the main line connection.
2. Gate valves for 1-1/2 and 2-inch service connections shall be resilient seat, 2-inch size, with approved connections to both the service saddle (or tee) and the copper service line. Refer to specification section 15200 for valve requirements.

### B. SERVICE CONNECTION TO MAIN

1. Service saddles shall be utilized on all connections to existing water mains as follows:
  - a. For 1-½-in or 2-in service connections to existing ductile iron or cast iron watermain, use double-strap “lead-free” brass or stainless steel service saddles with 2-inch CC-threaded outlet.
  - b. Saddles shall be Ford F202B-NL, Romac 202S, or equal.
2. For connections to new water mains, an approved tee will be required unless otherwise directed by the District.

### C. SERVICE COUPLINGS

1. Copper-to-copper couplings shall be Ford C44-XX-G-NL or equal.

### D. MISCELLANEOUS FITTINGS

1. Reducers and adapters shall be Ford, Mueller or equal.

E. COPPER TUBING

1. Copper tube used for 2-inch services shall be Type K, hard drawn copper conforming to ASTM B88. (Soft copper shall be used only by District approval.)

F. METERS AND SETTERS

1. The District will furnish and install an approved 1-½ or 2-inch meter.
  - a. 2-inch meters shall be as specified and provided by the District.
  - b. 2-inch meter shall be radio-read capable, equipped with antenna and register, as specified by the District.
2. Meter setter assemblies shall be Ford 70 Series Coppersetter, model VBH77-95035-003-NL, or equal, and shall include:
  - i. Flanged angle ball valve and flanged angle single check valve with ¾" test port, for flanged meter connection;
  - ii. 1-inch dedicated bypass line with inline bypass ball valve and single check valve;
  - iii. CC-threaded (FIP) inlet and outlet brass elbows;
  - iv. Other components as required by District specifications, and included in the meter setter assembly, or equal.
  - v. **As applicable and if available, the District may supply the meter setter for installation, at cost.**

G. METER BOXES

1. Meter boxes for 1-½ or 2-inch services shall be as follows:
  - a. The District will specify each meter box to be provided by the Developer/Contractor. Typical meter box shall be concrete with metal lid, equal to Oldcastle H-Series 2436-30 meter box with Uni-Half or steel cover as approved, concrete polymer meter box with cast iron or steel lid, or equal.
  - b. Additional criteria, including dimensions and traffic loading rating, will be specified as required for each application.

## **PART 3 – EXECUTION**

### **3.01 PREPARATION AND HANDLING**

- A. Excavation and backfill shall conform to the requirements of Section 02225.
- B. Follow preparation and handling procedures as specified in Section 15100 for all service connection piping and materials.

### **3.02 INSTALLATION**

#### **A. PLACEMENT OF SERVICE**

- 1. Prior to making the service connection, clean dirt and foreign matter from exterior of water main to ensure integrity of the completed connection.
  - a. Do not place the service connection within 18 inches of pipe joint or other tap, or as otherwise directed by the District.

#### **B. SERVICE TAPS**

- 1. Taps shall be made by experienced workmen using approved equipment with the proper adapters for the size of main being tapped.

#### **C. PREPARATION OF TRENCH**

- 1. Follow procedures for trench preparation as specified in Section 02225.

#### **D. COPPER TUBING**

- 1. Using a tubing cutter, cut copper tubing with square ends, ream and clean all burrs.
- 2. Care shall be taken to prevent the tube from kinking or buckling on short radius bends. The Developer/Contractor shall remove and replace kinked or buckled sections of copper tube at his expense.

#### **E. SERVICE CROSSINGS OF ASPHALT-SURFACED ROADS**

- 1. Service connection piping under asphalt-surfaced roads shall be bored or jacked.

2. Open cutting of asphalt roads requires prior written approval by the governing roadway jurisdiction.
3. The service connection pipe shall be installed so that it has a minimum cover of 2½ feet (30 inches) with a slight positive grade sloping away from the water main. (Ref. Clackamas County ordinance 7.03, 170-B)
4. Paved road crossings shall comply with any additional stipulations as shown on the Drawings and as may be required by local road jurisdiction (city, county, state, etc), including jurisdictional requirements referenced in these specifications.

F. PRESSURE TESTING AND DISINFECTION OF SERVICES

1. Service connections shall be pressure tested and disinfected in accordance with Section 15100 and as specified below.
2. Test service connections and service connection pipe at the normal working pressure after successful installation of the water main. Services may be tested and disinfected in conjunction with water main testing. In no case shall service connection piping be tested before water main testing is completed.
  - a. Connect the service to the water main.
  - b. Visually inspect for leaks and repair any leaks before backfilling.
  - c. Duration of the pressure test shall be at least 15 minutes.
3. Prior to connecting new copper tubing to existing copper tubing or meter stop, douse with 500 ppm chlorine solution.
  - a. Flush new copper tubing by fully opening corp stop/gate valve and allowing water to run for 2 minutes.
  - b. Close corp stop/gate valve and meter stop and allow to stand for a minimum of 30 minutes prior to opening meter stop.

G. BACKFLOW PREVENTION

1. When required, backflow prevention devices will be indicated on the Drawings.
2. The Developer/Contractor shall coordinate selection and installation of an approved backflow prevention device with the District's cross connection specialist.



- a. The Developer/Contractor shall follow Section 01300 when submitting for approval.
  - b. The Developer/Contractor shall follow Oregon Health Authority requirements for backflow prevention.
  - c. The Developer/Contractor shall ensure that the selected backflow preventer is compatible with metering/radio read requirements as required by the specific metering application.
3. The Developer/Contractor's water trucks, hoses, and related appurtenances used for obtaining and applying temporary water for construction purposes shall be inspected by the District. When applicable, the District will require backflow prevention devices for the Developer/Contractor's temporary water service during construction, as stated in Section 01500.
4. Residential water services:
- a. Service lines supplying an irrigation system will include a Double Check Valve Assembly installed immediately downstream of the point where the irrigation line ties into the domestic water supply line.
  - b. Service lines supplying a non-potable fire protection system will include an approved Double Check Detector Assembly installed immediately downstream of the point where the fire line ties into the domestic service line.
  - c. Service lines exclusively supplying a non-potable fire protection system will include a secondary control valve at or near the property line, as approved, with an approved Double Check Detector Assembly installed immediately downstream.
  - d. For properties with an auxiliary water supply (i.e. domestic well or other supply), District and Oregon Health Authority backflow and cross-connection requirements must be followed, including recommendations from the District cross connection specialist.
5. Commercial water services:
- a. Service lines that provide water for commercial use will include the installation of a Double Check Valve Assembly immediately

downstream of the water meter and prior to any other service connection.

- b. Service lines supplying a non-potable fire protection system will include a secondary control valve at or near the property line, as approved, with an approved Double Check Detector Assembly installed immediately downstream.
6. For all installations involving high hazard water use as defined by the Oregon Health Authority, a Reduced Pressure Backflow Assembly will be installed immediately downstream of the water meter and prior to any other connection.

**END OF SECTION**

## SECTION 15200

### VALVES, HYDRANTS AND APPURTENANCES

#### PART 1 – GENERAL

##### 1.01 DESCRIPTION OF WORK

- A. This section covers all work necessary to furnish, install and test piping appurtenances, valves and special items as shown on the drawings, specified herein and as referenced in Section 15100 - Piping and Appurtenances.

##### 1.02 REFERENCE SPECIFICATIONS

- A. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe & Fittings
- B. AWWA C502 - Dry-Barrel Fire Hydrants
- C. AWWA C504 - Rubber-Seated Butterfly Valves
- D. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service
- E. AWWA C512 – Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service
- F. AWWA C515 – Reduced Wall Resilient Seated Gate Valves for Water Supply Service
- G. AWWA C550 - Protective Interior Coatings for Valves & Hydrants
- H. AWWA C600 - Installation of Ductile-Iron Water Mains & Their Appurtenances
- I. AWWA C605 - Underground Installation of PVC Pressure Pipe & Fittings for Water
- J. Clackamas County Roadway Standards, latest revision
- K. Clackamas County Fire District #1 Standards, latest revision

##### 1.03 SUBMITTALS

- A. Prepare and submit in accordance with Section 01300.
- B. **Demonstrate full compliance with all aspects of this Specification Section, including, but not limited to complete manufacturers' data on all valves, hydrants, and related appurtenances.**

## PART 2 – PRODUCTS

### 2.01 GENERAL

- A. **All materials delivered to the job site shall be clearly marked to identify the material, class, thickness, and manufacturer. All material shall be new and free of blemishes.**
- B. Valves, hydrants and related materials of like kind shall be the product of one manufacturer. Where only one type of product is called out, no substitutions shall be allowed.
1. **All materials submitted shall be NSF approved and UL listed, and shall comply with the specifications of the respective standard as provided by the American Water Works Association (AWWA), latest revision, as referenced in this Section.**
  2. **All products furnished shall be subject to on-site inspection by the District, and any materials not complying with any of the specifications herein shall be rejected at the discretion of the District representative.**
  3. When requested by the District, the Developer/Contractor shall promptly provide certification that the manufacturer's inspection and testing results comply with the applicable AWWA standard(s).
- C. **As required by U.S. Senate Bill S.3874, all service connection materials, including brass or bronze valves and fittings, shall be certified "lead-free" or "no-lead (NL)" to meet the following requirements:**
1. **Not containing more than 0.2 percent lead when used with respect to solder and flux.**
  2. **Not more than a weighted average of 0.25 percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.**
  3. **For the purposes of these specifications, allowed exemptions to the "lead-free" requirement include:**
    - a. **Pipes, plumbing fixtures, or fittings (including backflow preventers) used exclusively for non-potable services.**
    - b. **Service saddles or water distribution main gate valves that are two inches diameter or larger.**

D. Valves (General Requirements for all Valves in this Specification)

1. All valves shall be complete with all necessary operating components required for the proper completion of the work included under this section.
2. Operating torque to operate any valve shall not exceed 40 ft-lb. Unless otherwise indicated, the direction of rotation of the wheel, operating nut or lever to open the valve shall be counterclockwise. Each valve body or operator shall have cast thereon the word "OPEN" and an arrow indicating the direction to open.
3. Actual length of valves shall be within 1/16 inch (plus or minus) of the specified or catalog length except where installed adjacent to flexible or mechanical pipe couplings, where different lengths of a replacement can be accommodated.
4. Flanges shall meet the requirements of ANSI B16.1.
5. Valve boxes and extended stems shall be provided for all buried valves, as specified below.
6. Valve-to-pipe joint materials, including gaskets, bolts and nuts, shall be ductile iron pipe mechanical joints and shall meet the requirements of AWWA C111.
7. Gate Valves shall be furnished in accordance with section 2.02 below, at full line size unless specifically called out to be of reduced size.
8. Butterfly Valves shall be furnished in accordance with section 2.03 below.
9. Unless otherwise specified, valves shall be rated for **250 psi working pressure** minimum.

2.02 GATE VALVES

- A. Gate valves shall be 250 psi-rated, class 125 drilling, cast ductile iron body, bronze-mounted, resilient seated, NRS valves with O-ring seals, and meeting the requirements of AWWA C515.
- B. Unless otherwise shown, valves shall have 2-inch square operating nut.
- C. The valves shall be full-port and fusion epoxy-coated (internal and external surfaces).
  1. Coating shall meet the requirements of AWWA C550.

- D. Gate valves shall be M&H/Kennedy 7000 series, Clow 2638, American Flow Control (AFC) 2500, or equal.
- E. Tapping Valves
  - 1. Tapping gate valves shall be flange by mechanical joint, shall conform to the above specifications unless stated otherwise, and as recommended by the manufacturer for use with the tapping sleeve supplied.
  - 2. Valves shall be cast ductile iron body, resilient seated NRS tapping valves with 2-inch square operating nut, fusion epoxy coated inside and outside, meeting the requirements of AWWA C509.
  - 3. Valves for O.D. Steel weld-on taps will be installed with insulation kits for flanged (or other) connections between dissimilar metals. Install tracer wire to either side of transition, and bring up both ends of tracer wire in a valve box for continuity purposes. (Follow basic valve box installation.)

#### 2.03 BUTTERFLY VALVES

- A. Butterfly valves shall be generally used on 14-inch diameter pipe and greater, unless otherwise specified on the drawings.
- B. Butterfly valves shall be Class 150B short body type and meeting AWWA C504.
  - 1. The valve must have factory-installed operators, with 2-inch square operating nut.
  - 2. The valve components shall withstand environmental conditions in contact, including epoxy coatings and casting that comply with the referenced standards, to provide continuous trouble-free service.
  - 3. High-pressure butterfly valves must be able to withstand 1½ times the main pressure or as approved by the District.
  - 4. Butterfly valves shall be Clow, Mueller, M&H 4500, or equal.
  - 5. Class 250B butterfly valves shall be used when specified or required by the District.

#### 2.04 AIR RELEASE AND COMBINATION AIR RELEASE VALVES

- A. Air release valves (ARV) automatically vent air from pipelines. Combination air release valves (CARV) vent air from and relieve vacuum pressure in pipelines. **For the purposes of these specifications, "ARV" shall be used collectively for both ARV and CARV assemblies, unless otherwise indicated. Specific devices required will be indicated on the drawings.**
  - 1. Valve body and cover shall be ASTM A126 GR.B cast iron. Internal linkage, stem, and float shall be Type 304 stainless steel.

2. Air release valves shall be NSF 61 certified and meet the requirements of AWWA C512.
- B. The ARV shall be designed to operate under working pressures of 150 psi and shall have been tested at a pressure not less than 300 psi.
1. For operating pressures over 150 psi, install a District-approved CARV with a 300 psi operating pressure.
- C. Air release valves shall be as follows:
1. CARV shall be APCO Series 143C (1") or 145C (2");
  2. ARV shall be APCO Series 142;
  3. As manufactured by APCO Valve and Primer Corporation, Schaumburg, IL, or equal.
- D. ARV Mainline Connection
1. ¾-inch to 1-inch connections shall be direct-tapped with C.C. thread corporation stop.
  2. 2-inch connections shall be via a double-strap service saddle with C.C. thread corporation stop, tap, and neoprene gaskets.
  3. Service saddles shall be adequate for use with the size, type, and class of the water pipe.
    - a. Saddles shall be Ford F202, Romac 202S or equal.
- E. Angle Valve
1. The angle valve for 2-inch shall be bronze body, plug disc.
  2. Valves shall have threaded connection and shall be Hammond 1B454T or equal.
    - a. For 1-inch use an angle meter stop with reducer as specified in Section 15150, when approved by the District, and sized to fit the ARV.
- F. ARV Miscellaneous Fittings
1. Miscellaneous fittings, including reducers and adapters shall be brass and of domestic origin; Ford, Mueller, or equal.

2. Brass nipples shall conform to Federal Specification WW-P-460 for brass or bronze threaded pipe fittings.

G. Copper Tubing

1. Copper tubing for 1-inch shall be Type K, soft, seamless, conforming to ASTM B88.
2. Tubing for 2-inch shall be hard Type K, conforming to ASTM B88.

H. Corporation Stop

1. The corporation stop shall be as specified in Section 15150.

I. ARV Vault

1. The vault enclosure for the air release valve assembly shall be one length of 24-inch diameter bell-and-spigot, reinforced concrete sewer pipe conforming to ASTM C76, Class II.
2. As approved by the District, an alternate ARV vault may be allowed as follows:
  - a. The 1-in ARV vault may be formed by stacking two plastic meter boxes (sized for 1 ½ inch service).
  - b. The 2-in ARV vault may be formed by stacking two plastic meter boxes (sized for 2 inch service- Oldcastle H Series 2436 x 30" with Uni-half lid, or equal).
  - c. Meter boxes shall be manufactured by Armorcast, Model A6001946PCX12 or approved equal, installed by District approval only.
3. The vault ring and cover shall be cast iron with machined bearing surfaces. 24-inch rings and covers shall conform to ODOT requirements for HS-20 loading.
  - a. Covers and lids shall be cast iron and marked with "W" or "WATER", with holes symmetrically placed.

J. Mortar

1. To set the ARV vault, ring and cover, use premixed mortar conforming to ASTM C387.
2. Alternate mortar/grout mixes require prior District approval.



K. Gravel and Backfill

1. Furnish and install as specified in Section 02225.

2.05 VALVE APPURTENANCES

A. Valve Boxes

1. Valve box (VB) tops shall be cast iron, "Vancouver Style 910", minimum 6-inch diameter and 3/16 inch wall thickness, a standard 18 inches long, and bituminous varnish coated.
  - a. Valve box top shall be VBT91018D as manufactured by East Jordan Iron Works, or approved equal.
2. Valve box lids shall be cast iron, Vancouver Style 910 with "W" or "WATER" designation cast thereon. All parts shall be bituminous varnish coated.
  - b. Valve box lids shall be VBL910WD as manufactured by East Jordan Iron Works, or approved equal.
3. Valve can or bottom material and valve box extensions shall be 6-inch diameter, white plastic pipe.
  - a. VB bottom material shall be white Schedule 40 PVC or equal.
  - b. PVC extensions shall be 6-inch diameter by 24 inches long, SDR-35 SWR Valve Can Riser, and cut to fit within 4 inches of the top.
  - c. PVC extensions shall be used when there is less than 6 inches of adjustment available between the PVC top and the Vancouver bottom. Extensions shall be glued in place according to manufacturer's installation procedures.
  - d. The District's pre-approval of extension is required before installation.
4. A minimum of 4 inches of vertical separation shall be maintained between finished grade of the valve box top and the top edge of the valve box bottom, to prevent damage from the valve box lid bearing on the PVC valve box bottom.

5. A bell reducer shall be installed at the valve operation bonnet on all gate valves 8 inches and larger.
  - a. Reducers shall be 8-inch x 6-inch, rubber gasketed SDR-35 bell-by-bell Concentric Reducer.
  - b. The gasket shall be left in place on the 6-inch side for securing and sealing the valve can.

B. Extension Stems for Buried Valve Operators

1. When the centerline depth of the valve is more than 6 feet below grade, operating extension stems shall be provided to raise the operating nut within 3-4 feet below grade and/or box cover. Extension stems shall be constructed of steel and shall be complete with 2 inch square operating nut.

## 2.06 FIRE HYDRANTS AND FIRE SERVICE PIPING

A. Hydrants

1. Hydrants shall be of the break-flange or safety-top type, rated for 250 psi working pressure, cast ductile iron and conform to AWWA C502.
2. Nominal 5-1/4-inch main valve opening with 6-inch bottom connections.
3. Equip with two 2-1/2-inch hose nozzles and one 4-1/2-inch pumper nozzle.
4. Operating nut shall be 1-1/2-inch National Standard Pentagon nut.
5. The main valve shall be equipped with O-ring seals and shall open counterclockwise.
6. Nozzle threads shall be American National Standard. Inlet connection shall be mechanical joint.
7. The District will only accept submittals for and usage of the following hydrant brands:
  - a. Mueller Super Centurion A-423
  - b. Clow Medallion
  - c. M&H 129

- d. U. S. Pipe Style 94 Metropolitan 250
  - e. Waterous Pacer, WB-67-250.
- B. Hydrant Base Block
  - 1. Solid pre-cast concrete pier blocks having nominal dimensions of 8-inch thickness by 16-inch square base.
- C. Hydrant Drainage Rock
  - 1. Gravel for drainage shall be washed 1-1/2-inch drainage gravel and shall be free of organic matter, sand, loam, clay, and other small particles.
  - 2. Drainage rock shall be covered with geotextile fabric prior to installation of hydrant plumbing.
- D. Thrust Lugs (For New Construction)
  - 1. Mega-lug as manufactured by EBAA Iron Sales, Inc., Eastland, Texas, or equal.
  - 2. Romac Grip Ring or RomaGrip, Romac Industries Inc.
- E. Thrust Rods or Split "Mega-Lug" (For Existing Hydrants, as Required by District)
  - 1. Thrust rods, nuts and washers shall be nickel or stainless steel coated and used only when approved by the District.
- F. Restrained Joint Systems (As Required)
  - 1. Required for hydrants and fire service piping, as directed by the District.
  - 2. Restrained joint shall be Flanged spools, Field Lock Gaskets (bell joints only), Romac Grip Rings, Mega Lugs or approved equal.
- G. Fire Service Vault
  - 1. Vaults for fire services shall be as constructed by Oldcastle Precast Inc., Wilsonville, OR, or equal.
  - 2. Vault size and dimensions shall comply with the following table:

Table 1 – Fire Service Vault Sizing

Backflow Device Nominal Size	FDC Tee Inside Vault	FDC Tee Outside Vault
	<i>Oldcastle Vault No.</i>	
4-inch	676-LA or 776-LA-7	577-LA
6-inch	687-2-LA or 5106-1-LA	676-LA or 776-LA-7
8-inch	5106-1-LA	687-2-WA or 5106-1-LA
10-inch	5106-1-LA or 612-3-LA	5106-1-LA
>10-inch	Consult District	

3. Provide a standard galvanized ladder with aluminum extension, sized to fit specific vault, mounted for access clear of vault hatch. Ladder shall be as manufactured by Oldcastle Precast, or equal.
4. Vault hatch/doors shall be supplied precast into the vault lid, and shall be non-skid, aluminum diamond-plate spring-assisted doors, as manufactured by East Jordan, Syracuse, Bilco, or equal.

### PART 3 – EXECUTION

#### 3.01 GENERAL

- A. Trench excavation and backfill shall conform to Section 02225.
- B. Before installation, all valves shall be thoroughly cleaned of all foreign material, and shall be exercised and inspected for proper operation, and verified that the valves seat properly.
- C. All valves shall be installed so that the stems are vertical.
- D. Jointing shall conform to AWWA C600 or AWWA C605, whichever is applicable.
  1. Joints shall be tested with the adjacent pipeline.
  2. If joints leak under test, valves shall be disconnected and reconnected, and the valve and/or the pipeline re-tested.
- E. Piping on either side of inline valves will follow “dead-end” valve restraint requirements.
- F. Faces of flanges shall be cleaned thoroughly before flanged joint is assembled.
  1. After cleaning, the gasket shall be inserted and the nuts tightened in a uniform star pattern around the flange.

2. If flanges leak under test, the nuts shall be loosened, the gasket reset or replaced, the nuts retightened, and the valve and/or pipeline retested.

G. Valve Support

1. All valves 8-inches or larger installed via hot taps or tie-ins to existing systems will be supported with a concrete pier block on compacted gravel base in accordance with AWWA C600 section 4.3.6.2.

H. Testing of Valves, Hydrants and Appurtenances

1. Valves shall be tested at the same time that the adjacent pipeline is tested. Joints shall show no visible leakage under test. Joints that show signs of leakage shall be repaired prior to final acceptance. If there are any special parts of control systems or operators that might be damaged by the pipeline test, they shall be properly protected. The Developer/Contractor shall be held responsible for any damage caused by the testing.
2. Pressure testing and disinfection, including water services and mains, shall be as stipulated in Section 15100 and 15150.

3.02 BUTTERFLY VALVES

- A. The butterfly valve operating nuts shall be installed on the opposite side of the pipe as the lateral valve, if possible.
- B. All butterfly valves will be pressure tested above ground and witnessed by a District Inspector prior to installation.

3.03 AIR RELEASE AND COMBINATION AIR RELEASE VALVES

A. Tapping Pipe

1. Pipe taps 1-inch and smaller shall be direct tapped, CC Thread corporation stops and installed by experienced workmen using tools in good repair with proper adapters for size of main being tapped.
2. Install service saddles on 2-inch taps and larger, and install all material as recommended by the manufacturer.
3. Developer/Contractor shall proceed as indicated on the drawings and consult with the District for connections involving non-standard existing mains or laterals (AC, PVC, OD steel, GI, CCP) to ensure that proper

saddles and other materials are used to complete the tapped connection.

B. Piping

1. Cut pipe with sharp tools and ream ends of all cut sections.
2. Apply NSF 61-approved joint compound to all pipe threads, fittings, and valves prior to joining.
3. Maintain slight positive slope from tap to ARV, and from ARV to above-ground vent, per drawings.

C. ARV Vault

1. Compact the pipe zone and bedding for the vault in accordance with Section 02225, and set the concrete vault in place.
2. Provide Class B gravel bedding and backfill in accordance with Section 02225.
3. The vault shall be placed off center and the air valve oriented for easy access to the valve operator.
4. Grout the vault ring in place as shown on the drawings.
  - a. The ring shall have continuous and uniform bearing on the concrete pipe.
  - b. The vault cover shall not contact the vent piping in any position.
5. Extend the ARV vent outlet with properly sized galvanized piping and fittings from the vault to the above-ground air relief vent as shown on the drawings.
6. Install "mushroom cap" tee vent with bug screen on vent outlet.
7. Secure vent outlet piping to 4"x4" treated wood post using galvanized metal strap, as shown on the drawings.

3.04 VALVE APPURTENANCES

A. Center the valve box level and plumb over the valve operating nut.

1. Set valve boxes so that they do not transmit shock or stress to the valves.

2. Set the valve box covers flush with the surface of the finished pavement as shown on the drawings.
  3. Cut PVC box extensions to the proper length so that the valve box lid does not ride on the PVC extension when set at grade.
- B. Backfill shall be the same as specified for the adjacent pipe, per Section 02225.
1. Place backfill around the valve boxes and thoroughly compact to a density equal to that specified for the adjacent trench and in such a manner that will not damage or displace the valve box from proper alignment or grade.
  2. Misaligned valve boxes shall be excavated, plumbed, and backfilled at the Developer/Contractor's expense.
  3. In landscaped or off-road areas install an asphalt or concrete pad, 1.5-foot square by 4-inches thick, around the valve box lid, as shown on the drawings or as directed by the District.

### 3.05 FIRE HYDRANTS, FIRE SERVICE PIPING, AND BACKFLOW PREVENTION

A. General Location and Placement

1. Installation shall conform to provisions of AWWA C502, except where otherwise specified, and to Clackamas County Fire District #1 Standards.
2. Depth of bury shall be as indicated on the plans and as approved by the District.
3. Locate as shown to provide accessibility and minimize possibility of damage from vehicles or injury to pedestrians. Improperly located hydrants shall be disconnected and relocated at the Developer/Contractor's expense.

B. Hydrant Barrel Placement

1. In general, place hydrant so that clearance on all sides of the hydrant barrel is a minimum of 3 feet from any obstacle or feature (i.e. tree, fence, pole, post, etc.).
  - a. Provide a minimum horizontal clearance of 5 feet from any power pole.

2. When placed behind the curb, set hydrant barrel so that no portion of the pumper nozzle or hose nozzle cap is less than 3 feet from the gutter face of the curb.
  3. When set in lawn space between curb and sidewalk, or between sidewalk and property line, no portion of the hydrant or nozzle cap shall be within 12 inches of the sidewalk.
  4. To provide adequate clearance for bolts and nuts, set hydrants so that the bottom of the safety flange is spaced as follows above finished grade or sidewalk level:
    - a. 3 to 9 inches above finished grade for installations in concrete or asphalt pavement areas.
    - b. 3 to 9 inches above finished grade for landscaped areas, or as otherwise directed by the District.
  5. Any deviations to the above placement requirements must be approved by the District prior to installation.
  6. Hydrants and related appurtenances must be installed to accommodate handicap clearance requirements as stipulated by ADA and/or County standards, and in cases of conflict the Contractor shall consult with the District prior to installation.
- C. Excavation
1. Excavate in accordance with specification Section 02225.
  2. For hydrant piping and base block, refill over-excavated areas with gravel and hand tamp to provide firm foundation.
- D. Hydrant Base Block
1. Place concrete pier block on firm, level subgrade to assure uniform support.
- E. Hydrant and Fire Service Piping Placement
1. All hydrant service valves shall be flanged to the tee and MJ outlet.



- a. If the hydrant is more than 40 feet from the service valve, a second MJ X MJ service valve may be placed at the hydrant, as directed by the District.
  2. Carefully set hydrant to prevent the base block from breaking.
  3. Ductile iron pipe jointing procedures shall conform to specification Section 15100 and Section 3.4 of AWWA C600.
    - a. All hydrant and fire service piping shall be restrained joint.
    - b. After the hydrant is in place and connected to the pipeline, place temporary blocks to maintain the hydrant in a plumb position during subsequent work.
    - c. All fire service piping will have a service valve at the main and at the property line.
  4. Hydrants not in service will be covered or bagged.
- F. Hydrant Drainage Rock
1. Place drainage rock around the base block and hydrant bottom as specified in AWWA C600.
  2. Maintain the hydrant in a plumb position during backfilling.
- G. Thrust Lugs
1. Unless otherwise specified, provide restrained mechanical joints for all joints between the fire hydrant and the tee.
  2. All hydrant tees will be restrained 18 feet each side with no bell joints closer than 10 feet on main piping run.
  3. Fittings shall be restrained with Mega-lug, Grip Ring or approved equal.
- H. Fire Service Vault
1. Fire service vaults shall be installed in accordance with CRW standard details and OAR 333-061-0071.
  2. No outlets or connections (including hydrants) will be permitted on fire service lines prior to the backflow assembly without District approval.

3. All piping preceding the backflow assembly will be constructed of potable water-approved materials. Installation will conform to section 15100.
4. For fire department connections (FDC), install ball drip valves at the check valve and route drain piping to floor drain, as indicated on the drawings.

I. Backflow Prevention

1. For backflow prevention, the District will evaluate the degree of hazard and determine which type of device, if any, is appropriate.
  - a. Developer/Contractor shall coordinate selection and installation of backflow prevention device with the District's cross connection specialist.
  - b. Devices will be Double Check Detector Assembly or Reduced Pressure Detector Assembly as approved by the District.
  - c. Selection of an appropriate backflow prevention device shall be in accordance with the current listing of the Foundation for Cross-connection Control and Hydraulic Research – University of Southern California, and as approved by the State of Oregon. (Go to <http://www.usc.edu/dept/fccchr/list.html> for further information)
  - d. Devices shall have manufacturer-installed valves and bypass meter with backflow device.
    - i. The bypass meter shall be an appropriate make and model that is approved by the District prior to installation.
    - ii. The Developer/Contractor (or property owner) shall provide a radio meter read interface, Neptune R900i pit version or equal, which will be installed by CRW. The assembly shall come with 20 feet of coaxial cable for optional through-the-lid antenna installation.
  - e. The Developer/Contractor will provide and coordinate testing of the backflow device with the District's cross connection specialist.
    - i. For new installations, the Developer/Contractor shall request activation of the line when ready for testing.

- ii. For existing/retrofit installations, the Developer/Contractor shall provide notice to the District and coordinate testing within 3 business days after activation of the service.
  - iii. Test reports are to be submitted to the District.
  - iv. Failure to submit backflow test results will be cause for termination of service.
- f. Install backflow prevention assemblies and piping in accordance with Clackamas River Water details and specifications.

**END OF SECTION**