Appendix D
MINIMUM DESIGN AND CONSTRUCTION STANDARDS
WATER DISTRIBUTION AND COLLECTIONS SEWER SYSTEMS

SNOWMASS
WATER & SANITATION
DISTRICT

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SECTION 1 PURPOSE AND INTRODUCTION

These specifications have been adopted by the Snowmass Water and Sanitation District (SWSD) Board of Directors. This design code is intended as an engineering reference manual containing the *minimum standards* for the design and construction of water distribution and sewage collection systems. It is intended to supplement conditions contained in Line Extension Agreements and the SWSD Rules and Regulations as adopted by SWSD Board of Directors and defines the engineering standards that new water and sewer systems must meet prior to acceptance. Developers, contractors and engineers designing or constructing water or wastewater distribution and collection systems that will, if accepted, be a part of or connect to the SWSD distribution and collection system must comply with these specifications and the Rules and Regulations of the SWSD. Any variation from these specifications or the Rules and Regulations of the SWSD shall require prior written approval from the SWSD's Board of Directors or their designated representative. These specifications and design criteria are guidelines. The SWSD does not assume responsibility for the design made by other design professionals and does not relieve them from responsibility for their design. The SWSD will observe and inspect construction for compliance with District requirements.

SECTION 2 ENGINEER AND CONTRACTOR QUALIFICATIONS

All water and sewer lines or structures to be connected to the SWSD system or which are intended to be dedicated to the District upon completion shall be designed by a professional engineer registered in Colorado. The design engineer shall contact the District before commencing the design work to obtain the District standards, regulations, specifications and current as-builts. The general contractor shall furnish evidence of a minimum of $1,000,000 liability insurance coverage. All contractors and subcontractors doing work on projects to be connected to the SWSD system must be licensed to do business in the Town of Snowmass Village.

SECTION 3 DESIGN

SECTION 3.1 DESIGN INFORMATION

All available information regarding other utilities, property lines and physical improvements both existing and proposed within the area of the proposed construction shall be verified by the applicant and shown on the plans. The location and size of all distribution, collector, interceptor, and outfall SWSD mains and service lines shall conform to the current master plan adopted by the District.

3.1.1 PROJECT DESIGN REPORT

A Project Design Report shall be required to be submitted by the applicant to the District, which shall include the following:

- **A.** Name, address, location of project, adjacent street names, legal description of project site, and geographic location of site indicated on a vicinity map.
- **B.** Existing and proposed zoning and land use application.
- **C.** Type and size of development.
- **D.** The average and peak water and wastewater flow expected to be generated by the development including the peak flow impact on the upstream and downstream water system and wastewater collection system.
- **E.** An estimate of future development that is anticipated to impact the proposed development as well as the existing water and wastewater collection system.
- **F.** An engineer's estimate of the cost of design and construction of the proposed water and wastewater collection system.
- **G.** The number of bathrooms, bedrooms, kitchens, the total and type of square footage of all buildings, and the total and type of all plumbing fixtures that will connect to the SWSD system.
- **H.** An estimate of the total number of EQR's for the project, broken down by individual living space and commercial classification; based on the District's EQR schedule.

3.1.2 OFFSITE IMPACTS

The SWSD and the District Engineer shall determine what, if any, impacts or downstream constraints the proposed development may have on the existing District distribution and collection system, and to what extent the applicant must participate in the system improvements or upgrades.

SECTION 3.2 PRE-DESIGN MEETING

Prior to the preparation of preliminary construction drawings, all applicants shall consult with the District to obtain locations of existing District main sewer lines affected by the proposed construction. The size and approximate location of the proposed improvements will be discussed at this time to determine the compatibility with the District's master plan. Approval of the proposed line extensions, subject to design and inspection review by the District engineer and the District's Board of Directors, are required for any of the District's line extensions.

SECTION 3.3 DRAWINGS, STANDARDS AND DESIGN CRITERIA - WATER AND SANITARY SEWER

The water and sanitary sewer lines shall be placed in public roads and streets wherever possible. Where easements over private property are necessary it shall be the responsibility of the applicant to provide the

necessary easements for dedication to SWSD. Water or sewer alone in a trench shall require a minimum of a 20-foot easement. Water and sewer lines parallel to each other shall require a minimum of a 30-foot wide easement. In no case shall the sewer line be located closer than, 10-foot from a water main, 5 feet from a cross pan or gutter, 10 feet from the edge of a right of way or easement boundary or main water line. Wider easements may be required by the District for lines that are deeper than 10 feet. Sewer line alignment shall provide easy access by a tandem axle, 60,000 pound sewer cleaning machine, 35 feet in length. Water and sewer facilities shall be shown as the most prominent features on the water and sewer utility drawings to distinguish them from all other utilities, buildings, roads, and other work.

3.3.1 GENERAL DESIGN CRITERIA See sections 5, 6, 7, 8, 9 and the Standard Details for references.

A. WATER MAINS

1. SIZING -The minimum size water main shall be 8inches diameter. Water main sizes shall be increased, at the cost of the developer, to meet the minimum pressure requirements for fire and peak hour flows. Water mains shall be installed centered within a minimum 20-foot easement. Mains shall extend to the farthest point in the development or area to be served so that future extension of the water system may be accommodated.

All water mains shall be sized for a maximum working pressure of 200 psi, and minimum working pressure of 40 psi, as normal psi range including fire flows. The absolute minimum working pressure at peak hour flows shall be 40 psi.

2. LOOPING - All exterior main feed water supplies to developments shall be looped and the internal water system shall be looped for dependability and to meet the pressure requirements of peak day water usage plus fire flows. Looping and valve locations shall be such that an interruption of service due to a water main break will put no more than 750 feet of main or more than two fire hydrants out of service while maintaining adequate flows and pressure in the remaining portion of the system. All new water line extensions will be looped unless approved the District's engineer.

3. VALVING Main line valves shall be installed on each line at all street intersections, with a maximum in line distance between valves of five hundred feet (500') in commercial and multi-family areas, and six hundred feet (600') in single-family residential areas and 750' in open space areas. Valves shall also be installed on all fire hydrant branches and all distribution main branches off transmission mains. Where connecting to previously installed extensions of the water system with valves already installed, the SWSD may require replacement of older valve installations to provide for "new" conditions. Additional valves may also be required to provide for isolation of the new system from older sections to provide for testing of newly completed lines separate from the existing system.

4. SERVICE LINE TAPS A DIP MJ tee and DIP service line valve shall be installed with a concrete kick block and megalugs provided on each end of the fitting for each service line larger then 2 inches. Only 1 main tap per building is allowed for both domestic and fire protection. Main line tap and service line should be sized accordingly to provide all required water use. All water or sewer lines inside building foundations, underground garages, or other inaccessible places shall be considered service lines not a main line, regardless of size

5. FIRE PROTECTION Fire flows shall be determined in accordance with the ISO (Insurance Services Office) "Guide for Determination of Required Fire Flow", utilizing the standard method of calculation. All flows for commercial, multi-family, and single family residential areas will be met according to the UFC

(Uniform Fire Code), Appendix 3A or as directed by the Snowmass Wildcat Fire Marshal's office. Developer is required to obtain fire protection requirements and approved fire hydrant locations from the Snowmass Wildcat Fire District. A fire hydrant location drawing must be signed and approved by the SWFD prior to acceptance of Final Design drawings by the SWSD.

6. FIRE HYDRANTS shall be installed at each street intersection and at intermediate points for maximum spacing of 350 feet in commercial and multi-family areas and 500 feet in single-family residential areas.

Water mains not designed to carry fire flows shall not have fire hydrants connected to them. Flow testing of the fire hydrants and new lines is to be performed by the contractors with the fire department or other certified fire protection agency present to certify flows prior to final acceptance.

Prior to acceptance, flow testing of the fire hydrants in new developments and systems shall be performed by the contractors with the Snowmass Wildcat Fire Protection District, or other certified fire protection agency, and witnessed by the Snowmass Wildcat Fire Protection District.

SWSD Department personnel and the Snowmass Wildcat Fire Department personnel are the only people authorized to operate fire hydrants on the system.

B. SEWER MAINS

1. DESIGN FLOWS: COLLECTOR SEWERS - New sewer lines shall be designed on the basis of the projected peak flow at ultimate build out. The projected peak flow is calculated by multiplying the estimated average flow in gallons per minute by a peaking factor. A peaking factor of 4.0 shall be used for the peak occupancy season and all design flows. The District recognizes one EQR [equivalent residential unit] as a flow of 350 gallons per day. The minimum acceptable interceptor/collector pipe diameter shall be 8 inches.

2. DESIGN SLOPES - The following are minimum slopes which shall be provided. However, slopes greater than these are desirable and shall be required by the District where deemed practical by the SWSD Engineer.

MINIMUM PIPE SLOPES

SEWER SIZE	%
4"	1.0
6"	0.8
8"	0.4
10"-24"	0.3

3. MANHOLES - Manholes shall be designed to promote smooth, continuous flow between adjacent reaches of sanitary sewer flow. The minimum drop through a manhole shall be 0.1 feet. The intermediate angle of a line entering a manhole shall not be less than 90 degrees of the line exiting the manhole. Cleanouts are not permitted on SWSD main sewer lines 8 inches or larger in diameter.

3.3.2 PRELIMINARY DRAWINGS

TITLE SHEET

The first sheet of the drawings shall be the title sheet and shall include the following information:

A. Location/vicinity map with north and scale indicated.

B. Title sheet should include the project name, legal name of the project area, recording data, (Book No. and Page No. of all plats or easements used), and a description of the information shown thereon.

C. A sheet index with any special instructions.

D. The name, address, and phone number of the design firm and project District along with the date of the design.

E. The title sheet shall provide a space for the District's approval

Electronic drawings shall be submitted to the District in accordance with the review procedures as set forth in section 3. Drawings shall be prepared according to the following general requirements.

A. The drawings shall be drawn on standard 24 inches X 36 inches ("D" size).

B. Each sheet shall bear the Professional Engineer's Seal, signature, and number.

C. All sewer design drawings shall reflect the profiles and shall be oriented and read left to right, with north or west to the left. Profiles shall read from left to right from the downstream to upstream manholes.

D. Soil boring and test investigation information shall be shown on the drawings to achieve effective design, if necessary.

E. Design drawings shall show existing lines, sizes, materials, services, valves, FH's, MH's, proposed line sizes, materials, alignments, connections to existing system, and other existing utilities.

F. Upon completion of the District's review the design engineer shall schedule a meeting with the District to review the preliminary drawing and associated comments.

G. After review of the District comments on the preliminary drawings, the design engineer shall proceed with preparation of Final Design drawings following these standards.

H. If the preliminary design drawings are not acceptable to the District, the SWSD may require the preliminary drawings to be corrected or modified per the review comments and resubmitted for approval prior to preparation of Final Design drawings.

3.3.3 FINAL DESIGN DRAWINGS

TITLE SHEET

The first sheet of the drawings shall be the title sheet and shall include the following information:

A. Location/vicinity map with north and scale indicated, on the SWSD Maps with SWSD Base Map grid.

B. Title sheet should include the project name, legal name of the project area, recording data, (Book No. and Page No. of all plats or easements used), and a description of the information shown thereon.

C. A sheet index with any special instructions.

D. The name, address, and phone number of the design firm and project District along with the date of the design.

E. The title sheet shall provide a space for the District's approval.

3.3.3.1 SITE MAP

A geographic location of the site with location to major arterial streets, a north arrow, and any other landmarks that may be helpful; including but not limited to the following:

a. Lot lines, property lines and dimensions.

b. Existing and proposed contours.

c. Existing water and sewer lines, services, valves, FH's, MH's, proposed

water and sanitary sewer lines including service lines, valves, FH, and manholes with proposed invert and rim elevations.

d. Street names; easement and right of way descriptions and dimensions; location of curbs, sidewalks, and gutters.

e. All existing and proposed utilities verified by each utility.

f. Location of existing or proposed retaining walls, water supply lines or wells, paved areas, building envelopes that include decks, porches and patios, dry wells, storm sewers, and roof and footer drains.

g. 1 inch = 50 scale

3.3.3.2 PLAN for WATER - PLAN AND PROFILE FOR SEWER (SWSD may require a waterline profile)

The plan and profile sheets shall include the following information as is applicable:

Plan View

a. Scale: Horizontal 1 inch = 50 feet. Show scale numerically and graphically.

b. North arrow-north top of page or left.

c. Show outline of water and sewer mains and service lines. Show center-line of water and sewer main with appropriate ties, distance between manholes, bends, valves, fittings, services, FH"s, sewer grades, pipe type and size.

d. Show street and alley center-line, name and number, property lines, lots, blocks, structures, utility lines, fire plugs, curbs, gutters, cross gutters, sidewalks, driveways, paving, property lines, existing and proposed utilities, sewer systems, storm drainage systems, and other improvements existing and proposed within 100 feet of proposed construction.

e. Provide details of recorded easements, right of ways, access roadways, existing as well as those to be granted/dedicated. Include date, book number and page number of recording.

f. Special features such as river crossings shall be detailed.

g. Natural or manmade features which may have an effect on the sanitary wastewater system will be depicted on the drawings, i.e. trees, shrubs, ponds, mailboxes, lights, poles, fences, walls, etc.

h. Manhole rim and invert elevations shall be tied and shown using the SWSD's datum of U.S.G.S. located at the WWTP.

i. Use manhole numbers that conform to the District's master plan numbering system.

j. On each sheet of the plan, show a sufficient number of typical sections to give the relative location of surface and underground improvements with respect to the proposed water and sewer mains. Indicate size, type and other pertinent data for all improvements.

k. Indicate the type, size and Districtship of all existing utilities in easements, streets or rights-of-way in which the sewer lines are to be constructed. Tie all horizontal crossings of utilities and other underground objects to the nearest downstream manhole indicating manhole number. Tie all horizontally parallel utilities and other underground objects to the centerline of the right-of-way or easement.

l. Indicate portions of existing utilities that are "To be abandoned" because of sewer line construction, if any.

m. Plot crowded intersections in enlarged scale and provide details for other than standard structures.

n. If any service stub-outs using in taps or line "wye's" are to be installed for future service connections, they are to be indicated on the plan as well as shown in a table stating the pipe stations and direction of the connection. All taps and "wye's" installed for future service are to be extended and capped five feet inside the property to be served. Two swing ties shall be indicated on Drawings of Record taking ties from the upstream and downstream

manholes. Typically all services shall be stubbed into the property five feet upstream of the most downstream property line of the lot to be serviced.

o. Layout and design based upon SWSD elevation datum and SWSD Horizontal datum and grid system. Grid System is 1,000' N/S and 1,500' E/W on the drawing. Consult the District Engineer for the grid area for the proposed project. The grid and datum's used must match SWSD Base Maps and Asbuilts.

p. Label in detail, all water fittings, tees, bends valves, FH's, services with line size, type, restraint, Thrust Block and Mega-lugs to be installed.

q. Label in Detail manholes with MH number, station, rim, center line or invert in and out.

Sewer (or when required, Water) Profile

a. Scale: horizontal 1 inch=50 feet, vertical 1 inch = 10 feet. Show scale numerically and graphically.

b. Indicate design flow and pipe capacity in cubic feet per second (cfs), flow velocity in feet per second (fps), hydraulic flow lines for pipes 12 inches and greater.

c. Show pipe size, type & schedule, length, and percent of grade including locations and dimensions of casings, borings, tunneling, etc.

d. Manhole rim and in/out invert elevations shall be tied and shown using the District's datum of located at the WWTP.

e. Show any specialized coatings, linings, or treatment of pipe interiors.

f. Show location of manholes, special structures, soil boring, etc.

g. Show crossings or close parallel utilities such as gas, water, electrical, etc.

h. Show existing and proposed surface elevations.

i. Label in Detail manholes with MH number, station, rim, center line or invert in and out. Stationing of new sewer lines to be installed shall start at 0+00 at the lowest MH installed.

3.3.3.3 SPECIFICATIONS AND DETAILS

Design engineer is to use the SWSD water and sewer line material and installation standards and details, attached herein for design and the contractor is to use the SWSD Design Standards for construction. These specifications and details shall be attached as is to the design drawings and used for construction unchanged or altered. If additional specifications or details are required to complete design or construction of special facilities, those specifications and details need to be submitted and approved by the SWSD prior to use or inclusion into the design drawings

Should conflicts between or within the written specifications, details, and the design drawings arise, the conflicts shall be resolved by the District Engineer and District Manager. Design Engineer is responsible to bring such conflicts to the District if a conflict exists.

3.3.3.4 SUPPORTING DATA

When required, a complete set of calculations supporting the design criteria used shall be furnished with the preliminary drawings. The title page of the calculations shall be dated and have the name and number of the professional engineer making the calculations. The calculations shall include projected flows, domestic service demands, EQR assessment, fire demands, design velocity, slope, estimated project cost, maximum population to be served, depth of flow at maximum design flow or other water flow data as requested by the SWSD.

SECTION 3.4 DRAWINGS OF RECORD

After the construction on a project is complete, and once the sewer lines and water lines have been inspected

and approved by the District, and the District's Board of Directors has accepted the facilities to commence the two-year warranty period, the applicant shall revise the approved design drawings to reflect changes and revisions incorporated during the construction. Once the revised drawings have been reviewed by the District for completeness, including documentation that easements and rights-of-way have been acquired and executed, the revised drawings shall be provided to the District within 60 days of final inspection and approval. The drawing set shall be marked Drawings of Record and sets shall be stamped and signed by a Professional Engineer registered in Colorado.

As-Constructed drawings are an accurate scaled representation of appurtenances and infrastructure, as it exists in the field at the time of project completion. Water line infrastructure submitted to the SWSD for final acceptance will have the following:

A. 3 hard copies on standard 24 inches x 36 inches sheet with engineers stamp and signature. (Labeled "As-Constructed")
B. AutoCad file in the most current version.
C. PDF copy of the stamped as-constructed drawings
D. GIS shapefile in District's coordinate system.

The drawing(s) will, along with generally accepted drawing practices and standards, detail as follows:

A. Pipe size, type, joints, valves, and valve type(s), fittings and fitting type(s), curb boxes and location measurements of each. (2 swing tie measurements for each measured in feet. The ties should be from a permanent surface object)
B. Existing water lines and/or abandonment(s) with associated measurements.
C. Fill material and type: Special notation for water if less than 8 feet or greater than 12 feet and for sewer if less than 5 feet or greater than 12 feet.
D. Street names and other significant location data.
E. Special notes or comments. (Pipe encased in concrete, etc.)
F. Drawings must be submitted on SWSD grid and Datum's to be accepted, no exceptions

The following are **not** considered As-Constructed drawings and will not be accepted:

A. Construction plans.
B. Free hand drawings or sketches.
C. Drawing measurements that are based upon water line locates ***after*** installation work is buried.

Designation of all abandonment will be included on as constructed drawings as a watermark and labeled as abandoned with the date of abandonment and pipe material.

The Design Engineer shall certify in writing that the as-builts have been completed in accordance with the plans and specifications approved by the SWSD.

SECTION 3.5 EASEMENTS DESCRIPTIONS AND DRAWINGS

Easement legal descriptions and drawings must be prepared by a Professional Land surveyor, registered in the State of Colorado.

Easement drawings shall be presented in a scale sufficient to show all boundaries, shall bear a professional land surveyor seal and signature, and shall describe the beginning, each line bearing and distance and the total area contained in acres.

SECTION 3.6 APPROVED DRAWINGS

Construction shall not begin until the Contractor has received the approved and signed drawings from the SWSD District Manager. Approved drawings are only authorized for construction for a period of 12 months. If Construction does not start within the 12 month period, the developer must resubmit drawings for review and approval. The Contractor shall have in his possession at all times, one copy of the plans and specifications and one copy of the approved drawings. The developer shall give the SWSD 1 month notice prior to construction. Shorter time frames may result in construction delays due to scheduling inspection.

SECTION 4 PRE-CONSTRUCTION REQUIREMENTS

SECTION 4.1 CONTRACTOR INSURANCE AND BONDING

4.1.1 INSURANCE

Prior to the start of construction, all contractors working on water and sewer lines designed to be dedicated to the SWSD shall provide insurance documents showing the Contractor, District, District, District Engineer, and any other entities as determined by the District as additional insured for the following minimum sums:

$1,000,000 bodily injury for any one person.
$2,000,000 bodily injury for two or more persons.
$1,000,000 property damage for one accident.
$2,000,000 property damage for the term of the project.

4.1.2 BONDING

The contractor shall provide a Performance and Payment Bond for the total contract amount for the period of construction and a 2-year Maintenance Bond for the period immediately following and commencing at the final inspection and approval of the project as defined by the District.

SECTION 4.2 APPROVED DRAWINGS

Construction shall not begin until the District, the District's Engineer, and the Contractor have received the approved drawings. The contractor shall have in his possession at all times on the job site one copy of the plans, specifications, and approved drawings.

SECTION 4.3 CONSTRUCTION PROGRAM

The contractor shall submit to the District Manager and District Engineer a detailed plan for the construction project including but not limited to date, location, method and interval for staking including offsets and length between staking. This program shall show the proper sequence of operations and a time period for each phase of work. Any revisions shall be submitted to the District Manager and District Engineer in a timely manner.

The contractor shall submit this plan to the District at least 1 month prior to the start of construction. The report shall name the superintendent or foreman, who shall be the contact person designated by the contractor to act in all situations on his behalf to mitigate any problems arising on the job.

SECTION 4.4 SANITATION

The contractor shall adhere to the current TOSV/Pitkin County and State of Colorado Health Department sanitation rules and regulations. Unless arrangements are made otherwise, a portable toilet shall be provided by the contractor at each job location.

SECTION 4.5 LINE LOCATIONS

The contractor shall be responsible for obtaining any and all line locations, both main lines and services, from all utilities. Contact the Utility Notification Center of Colorado (UNCC) at 811 or (800) 922-1987 for water and sewer line locates.

SECTION 4.6 POTHOLING UTILITIES

The contractor shall pothole any utility that may be in conflict with the alignment of the water or sewer line prior to commencing construction or at least 2 days or manholes ahead of construction, or as determined by the SWSD Engineer.

SECTION 4.7 PRE-CONSTRUCTION MEETING

A pre-construction meeting shall be organized and coordinated by the applicant at least 1 week prior to commencing construction to acquaint all involved parties, including but not limited to the contractor, the contractor's foreman or superintendent, representatives of other utilities, County or TOSV representatives, District representatives, Project Engineers and District representatives, to familiarize all parties with the scope of the project and their possible participation. No construction shall commence until the pre-construction meeting is held and all parties are notified.

SECTION 4.8 STAKING

The Applicant's Engineer, at the Applicant's expense, shall stake sewer line and grade, and manholes using 25 foot stations for the first 100 feet in and out of manholes and every 50 feet thereafter. Offsets for each station shall be set for checking grade during installation.

Water line bends, valves, FH, connections to the existing system, services, and all other water facilities shall be staked for construction.

SECTION 4.9 WRITTEN NOTICE

The contractor shall provide written notice to the SWSD District Manager and District Engineer (including the starting date, time and location of construction) at least 1 week prior to commencing construction. After construction has started, 48 hours notice must be given to the District Engineer for individual inspections.

SECTION 4.10 PERMITS

Before any work is approved to begin by the District, the contractor must show that he has obtained all licenses and permits for the construction required.

Contractor shall follow all requirements of the TOSV road cut permits or requirements for traffic control and street closures.

SECTION 4.11 PHOTOGRAPHS OR VIDEO RECORDINGS

At least 5 working days prior to construction the Contractor shall provide the District at the Applicant's expense photographs and videos both in electronic format of original conditions prior to the start of construction for all sewer projects.

SECTION 4.12 VALVE OPERATION AND SERVICE INTERRUPTIONS AND SHUTDOWNS

Only District personnel are authorized to operate valves, fire hydrants, and access manholes within the

District. The contractor shall contact the District 970-923-2056 prior to all work on or near the SWSD lines.

Any interruption in service shall be scheduled at least 48 hours in advance with the District. The contractor shall aid the District in notification of all customers affected by the water shutdown.

SECTION 4.13 CONSTRUCTION SCHEDULES

SWSD ordinances prohibit construction from November 1st to April 1st of any calendar year. The time window for all line extension contracts or replacement contracts shall be approved by the SWSD.

All projects that have not started within six months from date of application and survey shall be void and new applications and surveys will be required.

The contractor shall not work during a national holiday and the generally recognized days before and after constituting a holiday weekend. The contractor shall shutdown, have all trenches backfilled, and streets and alleys completely open to vehicular traffic by 3:00 PM the Thursday prior to any holiday weekend.

SECTION 4.14 STAGING AREAS

The contractor shall make arrangements in writing at his expense for securing a staging area, comply with all SWSD, TOSV, and Pitkin County regulations regarding stored materials, equipment, etc., and inform the District in writing of the arrangements for a staging area.

SECTION 4.15 MATERIAL LISTS

The contractor shall submit a list of materials to be used on any project to the District Engineer 28 days prior to the start of construction for his approval.

SECTION 4.16 NOTIFICATION

The construction program and revisions shall be distributed to all property and business Districts that may be affected by the construction at least five days prior to the start of construction. This notification shall state dates, times and location of the construction along with a map showing alternate parking and delivery locations. The map shall also show temporary pedestrian access and walkways, temporary locations for dumpsters, and areas that will be reserved for material storage. The SWSD will notify all it's customers of water service interruptions. The contractor is to inform SWSD 48 hours in advance of any service interruption. Contact the Main SWSD office at 970-923-2056.

SECTION 4.17 CONFINED SPACE PERMITS

If at any time during the construction, the contractor needs to access a previously dedicated District manhole or other confined space, the contractor shall make all entries adhering to all OSHA required confined space regulations. The contractor must notify the SWSD prior to entering any District confined space facilities.

The contractor shall furnish the District with an approved confined space program developed by the contractor's company 30 days prior to commencement of construction.

SECTION 5 EXCAVATION AND BACKFILL FOR BURIED PIPELINES

SECTION 5.1 GENERAL

5.1.1 SCOPE: The work to be performed under this Specification shall include all labor, materials, equipment, plant and services as are necessary for the excavating and backfilling of all pipeline trenches.

The work shall include the excavation of whatever substances are encountered to the depths shown on the Drawings or modified in the field by the Engineer and installation of compacted bedding, backfill and surface restoration as described herein.

Wherever in this Specification a Standard is quoted or used, such as, but not limited to, ASTM, AWWA and ACI, this shall be interpreted to be the latest revision of that Standard.

5.1.2 REFERENCES:

A. American Society for Testing and Materials (ASTM)

1. ASTM C117 – Standard Test for Materials Finer than 75-um (No. 200 Sieve) in Mineral Aggregates by Washing.

2. ASTM C136 – Standard Method for Sieve Analysis of Fine and Coarse Aggregates

3. ASTM D75 – Standard Practice for Sampling Aggregates

4. ASTM D422 – Method for Particle-Size Analysis of Soils

5. ASTM D698 – Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using the 5.5-lb (2.49 kg) Rammer abd 12-in (304.8 mm) Drop

6. ASTM D1556 – Test Method for Density of Soil in Place by the Sand-Cone Method

7. ASTM D2487 – Classification of Soils for Districting Purposes

8. ASTM D2922 – Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

9. ASTM D4253 – Test Methods for Maximum Index Density of Soils Using a Vibratory Table

10. ASTM D4254 – Test Method for Maximum Index Density of Soils and Calculation of Relative Density

11. ASTM D4318 – Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils

B. Occupational Safety and Health Administration

1. The Contractor must conform to the amended Rules and Regulations of Construction Standards for Excavations, CFR 29, Part 1926, Subpart P of Title 29 including appendices of the Occupational Safety and Health Administration, Labor, including revisions thereto.

5.1.3 CONTRACTOR SUBMITTALS: The Contractor shall submit certified gradation test data verifying that the material and gradation of imported materials meet the requirements of this Section.

Particle size analysis of soils and aggregates shall be determined in accordance with ASTM D422.

5.1.4 QUALITY ASSURANCE:

A. All soils testing will be done by a testing laboratory of the District's choice at the Contractor's expense.

B. Where soil material is required to be compacted to a percentage of maximum density, the maximum density at optimum moisture content will be determined in accordance with ASTM D698. Where granular, cohesionless material is required to be compacted to a percentage of relative density, the calculation of relative density will be determined in accordance with ASTM D4253 and D4254. Field density tests will be performed in accordance with ASTM D1556, ASTM D2922, or by other means acceptable to the Engineer.

5.1.5 GENERAL REQUIREMENTS: All excavation shall be made by open cut. Permission may be granted to tunnel under driveways, crosswalks, curbing, walkways and utility installations, but such tunnels shall not exceed 10 feet in length.

The length of trench permitted to be open at any one time may be limited when, in the opinion of the Engineer, such limitation is necessary for protection of the work or the convenience of the public.

When excavations are through lawns, cultivated fields, pastureland, or areas having grass cover, the Contractor must stockpile separately all topsoil, which shall be replaced on top of the backfilling in the trench. All surfaces that have grass shall be reseeded by the Contractor. All lawns and other grass-covered areas, not excavated, on which excavated material is placed, shall be protected.

It is the general intent that the Contractor leave the work area in a similar and equal condition as it was preceding the Contract work.

5.1.6 PROTECTION OF EXISTING FACILITIES:

A. General: Existing power lines, telephone lines, 6-inch and greater diameter trees, six feet or more from the pipe centerline, shrubbery, fences, water mains, gas mains, sewers, cables, conduits, ditches, embankments and other structures in the vicinity of the work not authorized to be removed, shall be supported and protected from injury by the Contractor during the construction and until completion of the work affecting them. The Contractor shall be liable for all damages done to such existing facilities and structures, as herein provided and he shall save the District from any liability or expense for injuries, damages, or repairs to such facilities.

The Contractor shall notify the District or Owners of the existing utilities, whether aboveground or underground, 48 hours prior to proceeding with trench excavation whenever such trenching operations are within ten feet of the possible location of any existing utility. The notification shall also include a request for field staking any such underground facility that may be in the area of influence by the construction.

Should any such utility be damaged in the trenching operations, the Contractor shall immediately notify the Owner of such utility and, unless authorized in writing by the Owner of utility, the Contractor shall not attempt to make repairs except to prevent further damage to property. Duplicate copies of any written authorization given to the Contractor to make repairs shall be filed with the Engineer and shall be so worded as to save the District from any responsibility whatsoever relative to the sufficiency of the repairs.

If during construction any underground utility conduit, including sewers, water mains, gas mains and drainage structures, or any aboveground utility facilities are required to be relocated, the Contractor shall notify the utility owner well in advance of his approach to such utility so that arrangements with the District or Owners of the affected utility can be completed without delay to the work.

SECTION 5.2 PRODUCTS

5.2.1 GENERAL: All backfill material shall be approved before use. The backfill material shall be free from rubbish, large stones, clods, roots, brush, debris, frozen lumps of earth, or other objectionable material, and shall be moistened as required.

The Contractor is responsible for the stability of slopes during construction. Excavation and fill operations shall be coordinated with water control and stabilization measures to prevent unstable conditions.

A. Water shall be clean and free from harmful substances. The amount of water used in compaction shall be sufficient to obtain the percent of compaction required.

B. Topsoil is defined as the existing material nominally within a 6-inch depth beneath the existing ground surface. The Engineer shall verify the suitability of this material as topsoil prior to stockpiling.

5.2.2 PIPELINE BEDDING AND BACKFILL:

A. Trench Zones: For the purposes of this Specification, the terms “Bedding Zone,” “Pipe Zone” and “Backfill Zone” shall refer to the trench zones as identified following:

1. Bedding zone. The Bedding Zone shall consist of all material placed below the pipe invert or, when permitted, the native materials graded and prepared for direct placement of the pipe.

2. Pipe zone. The Pipe Zone shall consist of all material placed above the pipe invert to an elevation 12-inches above the top of the pipe.

3. Backfill zone. The Backfill Zone shall consist of all material above the Pipe Zone.

B. Material: All bedding and backfill material shall have the approval of the Engineer. All bedding and backfill material shall be free of frozen material, organic material and debris. The materials to be used in the Bedding and Pipe zones shall be “road base” as described below. The materials to be used in the Backfill zone shall be “backfill material” as described below. All materials may be subject to gradation tests and compaction tests prior to approval of the use of that material. The test results shall be submitted to the Engineer for approval and verified as to their accuracy. The cost of these tests shall be borne by the Contractor.

1. Roadbase bedding material or roadbase backfill. This material shall be Class 6 aggregate base course as specified by the State of Colorado Department of Highways; and shall meet the following gradation:

Sieve Size	Total Percent Passing by Weight
¾-inch	100
No. 4	30 - 65
No. 8	20 - 55
No. 200	3 - 12

2. Select material. Select material shall not be permitted unless authorized by the Engineer. This material shall consist of suitable material screened from the excavated earth having no rocks or stones greater in size than 2 inches for DIP or RCP and ¾-inch for all other pipe.

5. Trench stabilization material. The backfill material shall be 12-inch uniformly-graded,

crushed rock concrete aggregate. If larger material is needed, it must be approved by the Engineer prior to placement.

6. Backfill material. Backfill material shall consist of material shall free from rubbish, large stones, clods, roots, brush, debris, frozen lumps of earth, or other objectionable material, and shall be moistened as required.

Backfill material within the Town of Snowmass Village shall consist of “road base” to final grade.

No boulders over 6 inches in any dimension shall be allowed in the top 12 inches of the trench. All boulders shall be carefully placed so that no damage will be done to the pipeline. No backfill material shall have boulders larger than 24 inches in any dimension. Boulders larger than 8 inches in any dimension shall be carefully lowered into the trench until the backfill is 4 feet over the top of the pipe.

SECTION 5.3 EXECUTION

5.3.1 PREPARATION:

A. Ground Surface Preparation: Prior to excavating, complete all clearing and grubbing and demolition operations.

B. Topsoil: In natural areas where excavation will occur, strip all topsoil, or in the absence of topsoil, strip the top surface material and store separately from other excavated materials.

C. Concrete Walks, Roadways, Parking Areas, and Road Crossings: Cut existing pavement full depth to a true line before excavation.

D. The Contractor is to field-verify by excavation the location of all utility crossings, service connections, and connections to existing lines before proceeding with trenching operations.

5.3.2 TRENCH EXCAVATION:

A. TRENCH WIDTH: The minimum clear trench width measured at the top of the pipe barrel shall be not less than the outside pipe diameter, plus 16-inches.

For all pipe, the maximum clear trench width measured at a point 12-inches above the top of the pipe barrel shall be not greater than the trench width shown on the following table.

MAXIMUM TRENCH WIDTH TABLE

Pipe Diameter (inches)	Maximum Trench (inches)
4	24
6	26
8	28
10	30
12	33
14	35
15	36
16	37

If the above-stated maximum trench widths are exceeded, either through accident or otherwise, and if the Engineer determines that the combined dead and live loads will exceed the design loadings on the

pipe, the Contractor shall either cradle the pipe in concrete, or use a pipe of a stronger class, as required by the Engineer.

B. TRENCH WALLS: The Contractor may slope or bench the trench sidewalks. Such sloping or benching shall terminate at a depth not lower than one foot above the top of the pipe barrel, and from that point down, the trench wall shall be vertical. The trenching operation, including the spoil bank and sloping of the trench sidewalls shall be confined to the width of the permanent and temporary rights-of-way, if any.

C. TRENCH DEPTH: The trenches shall be excavated to such depths that the pipeline can be laid at the elevation of the grade lines shown on the Drawings, or at depths or covers specified on the Drawings.

1. Ductile-Iron Pipe. The trench shall be excavated to the depth required to install the pipe on firm, undisturbed, soil, with the approval of the Engineer, the Contractor may over excavate the trench and the trench bottom brought to the pipe invert with road base.

   For areas where large stones or rock excavation are required, so that hand-shaping of the trench is impractical, the trench shall be over excavated and the trench bottom brought to the pipe invert with road base.

2. All Other Pipe Materials. The pipe trench shall be excavated below the bottom of the pipe and backfilled with the road base.

D. TRENCH PREPARATION: The trench shall be excavated only so far in advance of pipe laying as permitted by the Engineer. All trenches shall be drained so that pipe laying may take place in de-watered conditions.

Bell holes in the trench bottom shall be provided at each joint to permit the jointing to be made properly and to prevent the pipe from bearing on the bells.

After excavation, the trench bottom shall be uniformly graded and hand-shaped so that the pipe barrel (exclusive of the joint) will have uniform and continuous bearing on firm, undisturbed trench bottom (when permitted), or thoroughly compacted road base, throughout the length of the pipe. The trench grade shall permit the pipe spigot to be accurately centered in the preceding laid pipe joint, without lifting the pipe above the grade and without exceeding the permissible joint deflection.

If unstable foundation is encountered, the Contractor shall excavate the unstable material and backfill the over excavation with 12-inch uniformly-graded, crushed rock concrete aggregate. If larger material is needed, it must be approved by the Engineer prior to placement.

5.3.3 SHORING:

A. As needed, all trench sidewalls shall be properly protected to meet Federal, State and local laws in regard to safe working conditions.

5.3.4 WATER CONTROL AND DEWATERING: For all excavation, the Contractor shall provide suitable equipment to de-water, and he shall keep the excavation de-watered so that pipeline construction and backfill operations can be carried on under de-watered conditions.

5.3.5 STORAGE OF EXCAVATED MATERIALS:

A. Generally excavated material will be stockpiled near the immediate construction area so as not to interfere with other work.

B. In natural areas, place excavated materials close to the excavation and in as confined a configuration as possible. Where adjacent slopes are too steep to stockpile, transport materials to

special stockpile locations in nearby areas.

5.3.6 TRENCH BACKFILL:
A. General: Unless accurate results cannot be obtained, the compaction requirements shall conform to maximum dry density according to ASTM D698, Moisture-Density Relations of Soils (Standard Proctor). When the ASTM D698 test is not applicable, the percentage compaction requirements shall conform to ASTM D2049 Test for Relative Density of Cohesionless Soils.

When required by the Engineer the Contractor shall excavate backfilled trenches for purposes to perform compaction tests at locations and depths required by the Engineer. The Contractor shall be responsible to reinstall and compact the test excavations at no additional cost to the District.

B. Bedding Zone Installation: Bedding material shall consist of the material on which the pipe is placed. Bedding material shall be placed to the required elevation of the pipe invert six inches thick. Compaction equipment shall be used to thoroughly compact the bedding material to a minimum of 95 percent maximum dry density, or to 70 percent relative density. The moisture content of the material shall be within 2 percent of optimum. See Standard Detail W08.

C. Pipe Zone Installation: After the specified bedding material has been placed and approved, the same backfill material shall be installed to an elevation of 12-inches above the top of the pipe. This backfill shall be placed and compacted in distinct, separate lifts not to exceed 6-inches of loose depth; except that the first loose lift shall not be higher than the pipe centerline Compaction shall meet the requirements of “Bedding Zone Installation,”.

D. Backfill Zone Installation: All backfill above the pipe zone shall be carefully placed and compacted. Compaction shall be by mechanical tamping in 8-inch maximum loose lifts using mechanical or hand tampers, weighing not less than 20 pounds, or vibratory rollers. All other means must be approved in writing by the Engineer. All backfill shall be compacted to 95% of maximum laboratory dry density or 70 percent relative density. The material shall be within 2.0 percent of optimum moisture content.

5.3.7 OVEREXCAVATION OF UNSUITABLE MATERIAL: In areas where unsuitable or unstable material is encountered, the Contractor shall over-excavate the unsuitable material and backfill and compact with material approved by the Engineer. Over-excavation and replacement of unsuitable material will be done only upon authorization by the District.

5.3.8 RESTORATION:
A. Streets and Roadways: Any pavements disturbed during construction shall be repaired in accordance with the requirements of the municipality.

B. Concrete Structure, Walks and Curbs: Restore all existing concrete structures to conditions equal to or exceeding existing structures and according to the requirements of the governing municipality.

C. Landscape Restoration: Finish all slopes in accordance with the lines, cross-sections, and slope rounding shown. Grade to produce a well-drained surface.

D. Restoration of permanent improvements within District Easements: The District is not responsible for restoration of any permanent improvements that are located within the District’s Easements. Such improvements could consist of but are not limited to sidewalks, asphalt, landscaping, etc.

5.3.9 CLEANUP: Prior to final inspection and acceptance, remove all trash and excess materials and leave area in a neat, satisfactory condition.

5.3.10 MAINTENANCE OF BACKFILL: All backfill shall be maintained in a satisfactory condition

and all places showing signs of settlement shall be filled and maintained during the life of the Contract and for a period of two years following the date of final acceptance of all work performed under the Contract. When the Contractor discovers or is notified by the Engineer or the District that any backfill is not in compliance with the provision of this Contract, the Contractor shall correct such conditions at once. Any utilities and road surfacing damaged by such settlement shall be repaired by the Contractor to the satisfaction of the District and Engineer. In addition, the Contractor shall be responsible for the cost to the District of all claims for damages filed with the Court, actions brought against the said District for, and on account of, such damage.

- END OF SECTION -

SECTION 6 INSTALLATION OF BURIED WATER PIPELINES

SECTION 6.1 GENERAL

6.1.1 SCOPE: The work of this section includes providing and installing buried ductile iron, PVC, and fitting for water service. All materials shall be new. All material used shall be manufactured and supplied according to the latest revised standards of the American Water Works Association, the American National Standards Institute, and the American Society for Testing and Materials, or as mentioned hereinafter. Miscellaneous valves and fittings shall be as called out on the Drawings.

6.1.2 REFERENCES:

A. American Society for Testing and Materials (ASTM)

B. American National Standards Institute (ANSI)

C. American Water Works Association (AWWA)

D. Federal Specifications (FS)

6.1.3 CONTRACTOR SUBMITTALS: Contractor shall submit all cut sheets for proposed materials to be constructed in conjunction with the District's water system.

6.1.4 PRODUCT HANDLING:

A. Pipe, fittings, valves, hydrants, and all other accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage to them. Under no circumstances shall any materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground. Skidding which damages protective coatings will not be permitted.

In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench to prevent moving more than once.

All pipe and fittings shall be so handled that the coating and lining will not be damaged. If, however, any part of the coating or lining is damaged, the repair shall be by the Contractor at his expense in a manner satisfactory to the Engineer. Any pipe with damage beyond repair must be completely removed and discarded.

B. Do not store materials directly on the ground.

SECTION 6.2 PRODUCTS

6.2.1 DUCTILE-IRON PIPE, FITTINGS, AND APPURTENANCES: Unless approved by the District the pipe shall be ductile-iron pipe, conforming to ANSI A21.51/AWWA C151, Class 52 thickness. The interior of each length of pipe shall have a cement-mortar lining, conforming to the requirements set forth in ANSI A21.4, of standard thickness. The exterior of the pipe shall be coated with standard bituminous coating approximately one mil thick.

Unless otherwise specified the pipe joint shall be the "push-on" type, made in accordance with ANSI A21.11, and the gaskets shall be standard for buried water service and as provided by the pipe manufacturer.

The fittings shall be ductile-iron conforming to the requirements set forth in ANSI A21.10/AWWA C110 or ANSI 21.53/AWWA C153. Ductile-iron fittings 12-inch size and smaller shall be Class 250, and

fittings larger than 12 inches shall be Class 150. The interior of the fittings shall be cement-mortar lined, as is required for the pipe with a 1 mil bituminous exterior coating. The fittings shall have mechanical joints in accordance with ANSI A21.11. The gaskets for the joints shall be suitable for potable water service.

A. Conductivity Connections: Pipeline conductivity is not allowed.

B. Tracer Wire: Provide copper tracer wire 12 gauge or larger, insulated and stranded copper on all water mains, services and fire hydrants. All splices shall be watertight and underground. Tape wire to pipe and outside of valve boxes.

C. Polyethylene Encasement: When required, the ductile-iron pipeline and fittings shall be encased in polyethylene film in accordance with the following requirements of ANSI A21.5/AWWA C105. See Standard Detail W01.

1. Polyethylene: The polyethylene film shall be manufactured of virgin polyethylene material conforming to the requirements of ASTM D-1248. The raw materials shall be Type 1, Class A (natural) or C (Black), Grade E-1 with flow rate of 0.4 maximum and dielectric strength of 10^{15} ohm-cm^3 minimum.

2. Polyethylene Film: The finished polyethylene film shall have a minimum nominal thickness of 0.008-inch (8 mil), and the minus tolerance on thickness shall not exceed 10 percent of the nominal thickness. The film shall have a minimum tensile strength of 1200 psi with an elongation of 300 percent minimum. The dielectric strength shall be 800 volts/mil thickness minimum.

3. Tube Size or Sheet Width: The tube size of sheet width for each pipe diameter shall be as listed in the following table: Nominal Minimum Width (In.)

Nominal	Maximum Width (In.)	
Pipe Diameter (In.)	Flat Tube	Sheet
4	16	32
6	20	40
8	24	48
10	27	54
12	30	60
14	34	68
16	37	74

D. Thrust Restraint: Where designated on the Drawings or where existing conditions do not permit the use of concrete thrust blocks, fitting restraints shall be made with tie rods and pipe clamps or special fitting bolts. Tie rod restraint systems shall have a minimum of 2 bolts or rods per joint or clamp. Minimum tie bolt sizes are as follows: See Standard Details W02 and W03.

Pipe Size	Bolt Diameter
4" - 8"	5/8”
10" - 14"	3/4”
16"	1"

The tie bolts shall be fabricated from “Cor-Ten” steel or equal according to the requirements of ASTM A242 with a minimum yield stress of 46,000 psi. Retainer clamps shall be equal to “socket clamp,” Figure 595, as manufactured by ITT-Grinnell.

D. Mechanical Joint Retainer Glands: On all fittings, bends, tees, and other appurtenances that require a mechanical joint retainer gland, a Mega-Lug MJ ring is required to be used. Mega-Lug shall

be cast from 60-40-12 ductile iron and shall have bolt circles, bolt holes, and dimensions which will permit the glands to be used with standard mechanical joint bells and standard length bolts, as per ANSI A21.11 and AWWA C111. All special tools recommended by the manufacturer shall be used during installation and shall be supplied to the District. Retainer glands shall be as manufactured by EBAA Iron, Inc.

E. Restrained Joint Pipe: Restrained joint pipe shall be ductile iron manufactured in accordance with the requirements of ANSI A21.51/AWWA C151. Push-on joints for such pipe shall be in accordance with ANSI A21.11/AWWA C111. Pipe shall be Griffin Snap Lok or equal. Unless otherwise shown on the Drawings the pipe shall be Class 52 thickness.

Restrained joint fittings shall be ductile iron in accordance with applicable requirements of ANSI 21.10/AWWA C110 with the exception of the manufacturer's proprietary design dimensions. Push-on joints for such fittings shall be as specified above for the pipe. Fittings shall be provided by the pipe manufacturer.

Cement mortar lining and bituminous outside coatings for pipe and fittings shall be as specified above for ductile iron pipe.

Restrained push-on joint pipe and fittings shall be capable of being deflected after assembly. Any special assembly tools recommended by the manufacturer will be supplied to the District.

6.2.3 GATE VALVES AND BOXES: Where designated on the drawings, gate valves for buried pipelines two inches and larger shall be iron-body, resilient seat, parallel-seal conforming to AWWA C509 for buried service, open CCW, non-rising stem, 2-inch operating nut, for a working pressure of 250 psi. See Standard Detail W06.

The joints for valves connected to the ductile-iron pipe shall be mechanical joints in accordance with ANSI A21.11. All gaskets shall be for standard water service. Snowmass Water and Sanitation District employees are the only people authorized to operate valves on the water distribution system. (Note: The service line starts after the corporation valve and is the responsibility of the property District and is not part of the water distribution system). It is unlawful for any persons other than SWSD personnel to operate any SWSD water system appurtenances.

At intersections, all gate valves shall be installed within three feet of a tee, cross, or bend and all connections shall have Mega-Lug on the fittings. All mechanical joint fittings including those with tie rods will have Mega-Lug fittings and concrete thrust blocks.

Valve boxes shall be Cast Iron with screw-type adjustment, 5¼ inches shaft for pipe burial of 8 feet minimum and the cover shall have the word WATER cast in metal. The top of the valve boxes shall be set 1.75 inches below final grade asphalt surface with a 1 inch removable solid ring.

Valve Boxes shall be three-piece Tyler Pipe cast iron or pre-approved valve boxes, to accommodate 4 inches through 16 inches valves. Shaft size shall be 5.25 inches, screw type 6850 Series- 668-S and/or 6865 Series-F. Complete extension shall be 62-82 inches. Bases shall be 20 ½ inches wide, Tyler model 160 or pre-approved equal. Parts for these *must be* interchangeable for the different valve boxes. Lids shall be flat shallow or ribbed and are to be marked with WATER. Two operating keys or wrenches shall be provided.

For valves that are on lines greater than 9 feet in depth, extension rods with a rod centering ring and set screw are required to bring valve nut within 5 feet of final grade. In addition, for valves over 9 feet deep, solid pipe is required instead of sectional valve boxes, these will incorporate valve box tops with standard water lids.

At the completion of all tests, the contractor, in the company of the engineer shall inspect to ascertain that the valve boxes are plumb, the valve-operating nuts are centered in the valve boxes and that the

key will fit over the entire operating nut and insure all valve boxes are clean of obstacles preventing operation. Otherwise the installation will not be accepted.

6.2.5 FIRE HYDRANTS: The fire hydrants shall be the Mountain Spec Kennedy Guardian Model, or Mueller Centurian with traffic flange having bronze fittings, bronze to bronze seating with O-rings, and other optional materials of bronze. Fire Hydrants provided shall be for minimum 8.5-feet of bury with 2.5 feet to the breakaway flange. See Standard Detail W05.

Valve: 5.25-inch
Inlet: 6-inch with mechanical joint
Trench Depth: 8 feet minimum cover
Operating Nut: 1.5" Pentagon or as required by Fire Department
Open: CCW
Nozzles: 2 – 2.5-inch, 1 – 4.5-inch pumper nozzle
Threads: National Standard
Working Pressure: 150 psi

All nozzle caps shall have nut identical to operating nut. Hydrant shall be provided with indicating arrow for opening direction.

Two operating wrenches, two valve seat wrenches, one collision repair kit, and one set of tools required for repair of hydrant shall be provided.

6.2.6 COUPLINGS: The pipe couplings shown on the Drawings to be used when connecting new pipes or pipes into existing buried pipelines with varying outside diameters shall be with solid sleeves with Mega-Lugs and transition gaskets. Couplings shall have an interior coating of an epoxy suitable for use with potable water. Exterior coating shall be equivalent to the attached new pipeline.

Coupling bolts shall be high strength, low alloy steel meeting the requirements of ASTM A325, Type 3.

6.2.7 AIR RELEASE/VACUUM VALVES: If required by the Drawings, the Contractor shall install combination air release/vacuum valves. The valves shall be contained within a precast concrete manhole section as detailed. Valves shall be “Val-Matic” Model 201.C for 1/2-inch inlet size Model 202.C for 1-inch and 2-inch inlet size, combination air release valves as manufactured by Val-Matic Corporation. ARV shall be installed in the top of main line with a 4 inches tee turned vertical to allow the air to pool for discharge by the ARV. Orifice discharge size on the ARV shall be per the manufacturer’s recommendations. See Standard Detail W07.

6.2.8 WATER SERVICES: Materials for water service connections shall be new and the best available. In the absence of detail information the requirements of AWWA C800 shall be followed. See Standard Detail W04.

A. Corporation Stops: All corporation stops for copper pipe shall be similar and equal to B-25008, threaded inlet, compression coupling outlet, as manufactured by Mueller Company.

B. Copper Pipe: The copper pipe for all service connections shall conform to the requirements set forth in ASTM B-88, or its latest revision, and shall be Type K, soft annealed.

C. Curb Valve and Box: The curb valve shall be equivalent to Mueller B-25209 ball type, compression connection on both sides, without drain. The curb stop valve box shall be similar and equal to #10336 as manufactured by Mueller Company, and shall be complete with #89981 and stationary rod.

D. Service Saddles: The service saddles shall be a bronze service clamp, ‘O’ ring gasket, epoxy coated, stainless steel double straps and IPS thread.

E. Tracer Wire: Provide copper tracer wire 12 gauge or larger, insulated and stranded copper on all services. All splices shall be watertight and underground. Tape wire to pipe and outside of valve boxes.

6.2.9 INSULATION: Insulation where shown on drawings shall be Type SM rigid blue closed cell foam or Type HI-40 as manufactured by the DOW Chemical Corporation or approved equal. See Standard Detail W11.

6.2.10 CASING PIPE: Where casing pipe is bored and jacked as located on the drawings it shall be full or split casing of smooth, uncoated welded steel pipe with not less that ¼" thick walls and free of obstructions. The interior diameter of the casing pipe shall not vary more than 1 inch from the inside diameter specified. Joints shall be made by butt-welding the pipe sections before jacking in to final location. See Standard Detail W15.

6.2.11 CASING SPACERS: Casing spacers shall be of the projection type, non-metallic spacers constructed of preformed sections of high density polyethylene or an approved equal. The spacers shall be of a sufficient number of projections to adequately support the carrier throughout the installation process and in service. Each casing spacer shall be capable of providing support for the carrier pipe in service at a maximum spacing of 10 feet. Calculations shall be provided showing that the casing spacer will support the service load at the recommended spacing, including a factor of safety of two. See Standard Detail W14.

Carrier pipe joints shall be installed with self-restraining casing spacers at each joint. Restraining casing spacers at joints shall provide axial thrust restraint to prevent pipe joint separation during and after installation and during removal. They shall also provide dielectric insulation between carrier pipe and the casing and facilitate installation of the carrier pipe by allowing the carrier pipe to be placed without undue stresses.

Spacers shall be Cascade Manufacturing T304 Stainless Steel (14 Ga.) minimum, Model CCS-ER and CCS-JR (joint restraint) or approved equal.

6.2.12 URECON INSULATED PIPE: URECON Pipe and Insulated Jacket & fittings shall be DIP pipe Class 52. The insulation is to be Urecon "U.I.P."® void free insulation process, with a suitable outer jacket. Polymer coated, form fitting insulation kits shall be used to insulate elbows, tees and other fittings, according to the manufacturer's recommendations. The U.I.P. insulation shall be rigid polyurethane foam, factory applied. The insulation shall be a 2-inch void free polyurethane foam (ASTM D1622) with a compressive strength of 19 to 23 lbs/sq-in (ASTM D 1621) and have a closed cell content of 90% minimum. DIP pipe and insulation shall be wrapped in an outer jacket of 22 gauge Aluminum Spiwrap.

Heat tracer wire shall be provided with the insulated DIP pipe that is continuous for the length of the insulated pipe. Heat tracer wire will be capped at both ends before pipe enters the ground for its burial run.

6.2.13 FLEXIBLE PIPE JOINTS: All pipes entering buildings, passing through concrete walls, bridge abutments, or other structures shall have an Ebaa Iron Flex-Tend joint installed within 3-feet of the wall. The flex-tend joint shall be the same size as the main line piping, double ball, mechanical joint by mechanical joint. The mechanical joint connects with the buried dip on one end and the other end connects with the wall spool installed in the wall of the structure. For bridge abutment penetrations the pipe connects to the plain end section of Urecon pipe with a Mega-Lug. Flex-Tend shall be a single ball model for 8-inch expansion from Ebaa Iron or approved equal for bridges. Flex-Tend shall be a double ball model for 8-inch expansion from Ebaa Iron or approved equal for entrances into buildings and other structural walls.

SECTION 6.3 EXECUTION

6.3.1 INSTALLATION OF DUCTILE-IRON PIPELINES: Except as specified herein or unless specifically authorized by the Engineer, all installation of pipe shall conform to the recommendations contained in "A Guide for Installation of Ductile-Iron Pipe," published by the Ductile Iron Pipe Research Association (DIPRA). A copy shall be available at the job site.

A. Pipe Laying: Pipe shall be laid with bell ends facing in the direction of laying, unless directed otherwise by the Engineer. Pipe shall be laid on the bedding with support over the full length of the pipe barrel. Pipe joint deflections shall not exceed the amount shown in the following table. The manufacturer's recommendation for deflection will be the guiding document if different from table below.

DUCTILE-IRON PIPE HORIZONTAL & VERTICAL DEFLECTION			
Size of Pipe	Bend in One Joint	Deflection in One 18-Foot Length	Approx. Radius of Curve Produced by Succession of 18-Foot Joints
4"	4°	15"	250'
6"	4°	15"	250'
8"	4°	15"	250'
10"	4°	15"	250'
12"	4°	15"	250'
14"	2°	7.5"	510'
16"	2°	7.5"	510'

The information in the columns referring to the deflection and the approximate radii shall be adjusted for pipe lengths different than 18-foot lengths. To lay pipelines on curved alignment with shorter radius if called for on the Drawing, the Contractor will be required to use shorter pipe lengths.

Vertical deflections shall not exceed any of the above values.

When pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or by other means approved by the Engineer.

The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or cement lining so as to leave a smooth end at right angles to the axis of the pipe. The flame cutting of pipe by means of an oxyacetylene torch will not be allowed. The pipe end shall be beveled and free of sharp edges that could damage the gasket during installation.

B. Jointing of Mechanical Joints: The last 8 inches of the pipe spigot and the inside of the bell of the mechanical joint shall be thoroughly cleaned to remove oil, grit, tar (other than standard coating), and other foreign matter from the joint, and then painted with a manufacturer supplied lubricant or soap solution made by dissolving one-half cup of granulated soap in one gallon of water. The cast-iron gland shall then be slipped on the spigot end of the pipe with the lip extension of the gland toward the spigot end. The gasket shall be painted with the lubricant or soap solution and placed on the spigot end of the pipe to be laid, with the thick edge toward the gland.

The entire section of the pipe being laid shall be pushed forward to seat in the spigot end of the bell of the pipe in place. The gasket shall then be pressed into place within the bell, being careful to have the gasket evenly located around the entire joint. The iron gland shall be moved along the pipe into position for bolting, all of the bolts inserted, and the nuts screwed up tightly with fingers. All nuts shall then be tightened with a torque wrench. The torque for various sizes of bolts shall be as follows:

Size (Inches)	Range of Torque (ft-lbs)
5/8	45 – 60
3/4	75 – 90
1	100 – 120
1-1/4	120 - 150

Nuts spaced 180 degrees apart shall be tightened alternately in order to produce an equal pressure on all parts of the gland.

C. Jointing of Push-On Joints: In jointing the pipe, the exterior 4 inches of the pipe at the spigot end and the inside of the adjoining bell and particularly the groove for the gasket shall be thoroughly cleaned to remove oil, grit, tar (other than standard coating), and other foreign matter. The proper gasket supplied with the pipe shall be placed in the bell as described by the pipe manufacturer so it will spring into its proper place inside the pipe bell. A thin film of the pipe manufacturer's joint lubricant shall be applied to the gasket over its entire exposed surface. The spigot end of the pipe shall then be wiped clean and inserted into the bell to contact the gasket. Then the pipe shall be forced all the way into the bell by crowbar, or by jack and choker slings. The location of the gasket shall be checked with a gauge or tool designed for that purpose to assure that the gasket is in the proper position.

D. Installation of Polyethylene Encasement: The polyethylene encasement shall prevent contact between the pipe and the surrounding backfill and bedding material, but is not intended to be a completely air and watertight enclosure. Overlaps shall be secured by the use of 2-inch wide, 10 mil thick, polyethylene pressure sensitive tape. See Standard Detail W01.

Any of the three different methods for the installation of polyethylene encasement on pipe are acceptable as described in AWWA C105. Methods A and B are for use with polyethylene tubes and Method C is for use with polyethylene sheets.

All fittings shall be covered in the same manner as the pipe. Where appurtenances are odd-shaped, they shall be covered with flat sheet, wrapped with seams doubled over, and taped. Branch services and other extensions shall be provided for with an X-shaped cut in the film, and then the ends taped in place. At connections with unwrapped pipe or service pipes, the polyethylene shall extend 3 feet onto the unwrapped pipe and securely taped in place. Repair any damage encasement prior to backfill using polyethylene sheet and adhesive tape to secure all edges of the repair sheet.

E. Conductivity Connections: The conductivity connection for joints shall NOT be installed.

F. Installation of Special Restrained Joints: Restrained-joint pipe and ductile-iron retainer glands shall be installed according to manufacturer's recommendations. Torque wrenches and any recommended special tools shall be used during installation. Any special tools shall be supplied to the District.

G. Line Location Tape: Tape shall be installed 2-foot above water line. The tape shall be colored polyethylene with a metalized core.

6.3.2 INSTALLATION OF CASING PIPE: Placement of casing pipe shall be made at locations and grades shown on the drawings. It is extremely important that casing pipe be placed at the grades shown to avoid conflicts utilities or other pipelines or structures. Casing pipe shall be installed with a positive grade so that it will drain.

6.3.3 INSTALLATION IN CASING PIPE: Install water pipeline carrier pipe inside a casing pipe in accordance with details on the detail drawings. The carrier pipe shall be supported along its entire length using casing spacers in accordance with the manufacturer recommendation so that pipe bells remain clear of the casing pipe. It is the Contractors responsibility to determine if the specified

minimum clearance between the outside bell diameter of the carried pipe and the inside diameter of the casing pipe is adequate for proper installation of the carrier pipe. The casing spacers shall be plastic or polymer and have a low coefficient of friction to allow the installation of the carrier pipe without binding. The casing spacers shall have a sufficient number of projections so that the pipe is properly supported should twisting occur. Casing spacers shall be fastened tightly to the carrier pipe and grip the carrier pipe to eliminate slipping during installation. The casing spacers shall provide a minimum safety factor of 2 to support the service load. The spacers shall be ISO 9002 certified for strength and quality. See Standard Detail W15.

Carrier pipe shall be jointed outside the casing and moved into place by placing a brace across the bell furthest from the casing and moving the pipe with a jack behind the brace or winch and cable from the opposite end of the casing pipe. Pulling the pipe through the casing from the leading bell shall not be permitted. As each length of pipe enters into the casing, a new length shall be laid adjacent, jointed and moved into place in the same manner. The pipe bells shall not be permitted to contact the casing pipe.

After the carrier pipe is entirely in place, the ends of the casing pipe shall be sealed with a rubber end seal. The end seal shall form a continuous seal around and be clamped to the casing pipe and the carrier pipe so that surrounding material does not enter the pipe casing.

6.3.5 INSTALLATION OF VALVES AND BOXES: Valves shall be installed where shown on the Drawings or as directed by the Engineer in the field and shall be set with the operator nut plumb. Valve boxes shall have the interior cleaned of all foreign matter before installation. Valves shall be operated to open and closed positions to insure that all parts are in working condition before installation. Installation and jointing procedures shall be similar to the attached piping installation. See Standard Detail W06.

Unless otherwise noted, a valve box shall be provided for every valve. The box shall not transmit shock or stress to the valve or operator and shall be centered and plumbed over the operating nut of the valve, with the box cover 1.75 inches below the surface of the finished grade. A 1 inch steel riser ring shall be installed in valve box. The adjustable valve box shall permit at least 3 inches of adjustment either direction when in place.

Valves over 9 feet in depth shall have valve nut extensions to within 5 feet of final grade and the valve boxes shall be solid steel pipe.

6.3.6 INSTALLATION OF FIRE HYDRANTS: Fire hydrants and auxiliary gate valves shall be installed at the locations shown on the Drawings or as directed by the Engineer in the field. Concrete thrust blocks shall be installed at the hydrant and at the line branch tee. The hydrant shall be set on a base as shown on the detail and a gravel drain provided. Fire hydrants shall be set plumb at the finished grade line, unless otherwise instructed by the Engineer. See Standard Detail W05.

No part of the fire hydrant assembly shall protrude over the edge of sidewalks. Unless in the opinion of the Engineer it is not practical to do so, the pumper nozzle (which shall be facing the street) shall be 12 inches behind the edge of the sidewalk. The hydrant shall be set with the traffic flange from 6 inches above finished grade. Each hydrant shall be operated to opened and closed positions prior to installation.

6.3.7 SEWER CROSSINGS: Whenever any sewer line is crossed such that they are above and less than 18 inches apart from the water line, the sewer line shall be installed with one full 20 foot stick of Class 150 PVC (AWWA C900) with solid sleeves and transition gaskets. The C900 shall be centered over the water line. The waterline shall also be centered under the sewer line. When a sewer line is below the waterline and is less than 18 inches apart, the water line and sewer line shall be centered over each other so that the joints are as far as possible apart; the sewer line does not have to be in C900 for this situation. See Standard Detail W13.

6.3.8 INSTALLATION OF THRUST RESTRAINT: The movement of fittings shall be restrained by use of concrete thrust blocks or steel clamp and tie bolt assemblies. The thrust blocks shall be poured between undisturbed solid ground and the fitting to be anchored; the area of bearing on the undisturbed trench wall shall be that shown on the thrust block detail or directed by the Engineer. The concrete shall be so placed that the pipe or fitting joints will be accessible for repair. Thrust blocks or other thrust restraint where thrust blocks cannot be used shall be required at all the fittings unless otherwise shown on the drawings. A bond breaker shall be placed over the fitting before placing concrete. See Standard Details W03 & W04.

Thrust restraint clamps and tie bolts shall be assembled using clamps on each side of pipe bells with tie rods extending full pipe length for the dimensions shown on the detail drawings each direction from the restrained fitting. Clamp shall be installed tight enough to prevent twisting around the pipe. Two tie bolts per clamp with washer at clamp shall be located on side of pipe. Tighten tie bolt nut to hand-tight with 12-inch wrench (approximately 50-100 foot-pounds torque). Threaded tie rod ends shall extend two full threads past nut in final position.

6.3.10 FLUSHING, TESTING, AND DISINFECTING:

A. Pipeline Flushing: The Contractor shall flush the pipelines as the work progresses by a means in accordance with good practice to insure that sand, rocks or other foreign material are not left in any of the pipelines. If possible, the flushing shall be made through an open pipe end; otherwise, use of a fire hydrant may be acceptable, but only on approval of the Engineer.

B. Pressure Test: After each section of pipeline has been laid and partially backfilled (except for the joints or when the Engineer directs the trench to be backfilled for reasons of public safety, or if the Contractor elects to backfill prior to testing, as permitted), the pipe shall be slowly filled with water and tested. All pipe shall be tested at a pressure of 150 psi or 1.5 times the static pressure of the system at the lowest point in each section, whichever is greater. Each section shall be tested separately, but outside transmission mains may be tested in convenient lengths. The duration of each pressure test shall be at least two continuous hours. All water used in testing the pipelines shall be taken from a potable water supply.

Each section of pipeline being tested shall be slowly filled with water and all air removed. The specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. The Contractor shall furnish all necessary labor, equipment and connection corporation stops to the pipeline to perform the test.

All exposed pipes, fittings, valves, hydrants, and joints will be carefully examined during the test. Any cracked or defective pipe, fittings, valves or hydrants discovered during the pressure test shall be removed and replaced by the Contractor with sound material. The test shall be repeated until it is satisfactory to the Engineer.

C. Leakage Test: A leakage test shall be conducted after the pressure test has been completed unless the pressure test indicates that there are no leaks. The Contractor shall furnish the pump, pipe, connections, meters, and all other necessary apparatus, and shall furnish all necessary assistance to conduct the test. The duration of each leakage test shall be two hours, and, during the test, the main shall be subjected to a hydrostatic pressure of 150 psi or 1.5 times the static pressure of the system at the lowest point in each section, whichever is greater.

No pipeline installation will be acceptable until the leakage is less than the amount computed by the following formula:

$$L = \frac{SD\sqrt{P}}{148{,}000}$$

L = Allowable leakage (gallons per hour)
S = Tested length of pipe (feet)
D = Nominal diameter of pipe (inches)
P = Average test pressure during the test (psi)

Should any test of pipe laid disclose leakage greater than that specified above, the Contractor shall, at their own expense, locate and repair the points of leakage until the leakage is within the specified allowance.

The pipe may be subjected to hydrostatic pressure, inspected, and tested for leakage at any convenient time after the trench has been partially backfilled, except at the joints, or backfilled as permitted by the Engineer. Where any section is provided with concrete thrust blocks, the pressure test shall not be made until at least two days have elapsed after the concrete was installed. The Engineer shall be notified at least 48 hours before the pipe is to be tested so that he may be present during the test.

D. DISINFECTION. The following procedure shall apply to all main extensions within the District service area. Pipe extensions shall be chlorinated in accordance with AWWA C600 and C651 *Standard for Disinfecting Water Mains. The intended high chlorine with any method of chlorination is to be 25 mg/l.*

Before filling the pipe with water, the pipe shall be clean and fr*ee of* debris to the satisfaction of the District.

Disinfecting by chlorination of the pipe shall be performed prior to acceptance by the District. The chlorinating agent and method of application shall be in accordance with AWWA C651. The Contractor shall provide material for disinfecting of water mains.

If the tablet method of chlorination is used, during construction, calcium hypochlorite granules shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main at 500 foot intervals. The quantity of granules shall be as shown in the table below.

This method may be used only if the pipes and appurtenances have been kept cleaned and dry during construction. This method is **not to be used** on solvent welded plastic or on screwed joint steel pipe because of the danger of fire or explosion from the reaction of the joint compound with the calcium hypochlorite.

1.0 METHOD. Placing of calcium hypochlorite tablets. During construction, 5-g calcium hypochlorite tablets shall be placed in each section of pipe. Also, one tablet shall be placed in each hydrant, hydrant branch, and other appurtenance. The number of 5-g tablets required for each pipe section shall be $0.0012\ d^2\ L$ rounded to the next higher integer, where *d* is the inside pipe diameter, in inches, and *L* is the length of the pipe section, in feet. Table 2 shows the number of tablets required for commonly used sizes of pipe. The tablets shall be attached by a food-grade adhesive. There shall be adhesive only on the broadside of the tablet attached to the surface of the pipe. Attach tablets inside and at the top of the main, with approximately equal numbers of tablets at each end of a given pipe length. If the tablets are attached before the pipe section is placed in the trench, their position shall be marked on the section to indicate that the pipe has been installed with the tablets at the top.

Table 1 Ounces of calcium hypochlorite granules to be placed at beginning of main and at each 500-ft interval.

Pipe Diameter *(d)*	Calcium Hypochlorite Granules
in.	*oz.*
4	1.7
6	3.8
8	6.7
10	10.5
12	15.1
14 and larger	D^2 x 15.1

Where D is the inside pipe diameter in feet $D = {}^{d}/_{12}$

Table 2 Number of 5-g calcium hypochlorite tablets required for dose of 25mg/L*

	Length of Pipe Section, *ft*
Pipe Diameter	20
in.	Number of 5-g Calcium Hypochlorite Tablets
4	1
6	1
8	2
10	3
12	4
16	7

*Based on 3.25-g available chlorine per tablet; any portion of tablet rounded to the next higher integer.

2.0 TESTING. After the pipe is filled with water and chlorine, and unless approved otherwise by the District, the chlorinated water shall be held in contact with the pipe for 24 hours. At the end of the 24 hour period, the water in the pipeline shall be tested by the District to ensure a residual chlorine content of not less than 25 mg/l. The pipeline shall then be tested by the District thoroughly flushed to remove the heavily chlorinated water and/or debris. Care shall be taken in flushing the pipeline to prevent property damage and danger to the public. Discharge of highly coordinated water shall not be released to any stream or watercourse. Samples of water will be collected for bacteriological examination and residual chlorine content testing before the pipeline is put into service. Testing of residual chlorine and bacteriological sampling and testing will be done by the District.

No main which has been disinfected and flushed shall stand stagnant for more than 15 days without being re-flushed and a new disinfecting test performed, passed and approved by the District.

3.0 DISCHARGING CHLORINATED WATER. After the applicable retention period, heavily

chlorinated water should not remain in prolonged contact with pipe. In order to prevent damage to the pipe lining or to prevent corrosion damage to the pipe itself, the heavily chlorinated water shall be flushed from the main fittings, valves, and branches until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system or that is acceptable for domestic use. The environment to which the chlorinated water is to be discharged shall be inspected. If there is any possibility that the chlorinated discharge will cause damage to the environment, a neutralizing chemical shall be applied to the water to be wasted to thoroughly neutralize the residual chlorine. Where necessary, federal, state, local, or provincial regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water. The chlorinated water shall not be discharged to the District's sewer collection system.

4.0 DISINFECTION PROCEDURES WHEN CUTTING INTO OR REPAIRING EXISTING MAINS. The following procedures apply primarily when existing mains are wholly or partially dewatered. After the appropriate procedures have been completed, the existing main may be returned to service prior to the completion of bacteriological testing in order to minimize the time customers are without water. Leaks or breaks that are repaired with clamping devices while the mains remain full of pressurized water may present little danger of contamination and therefore may not require disinfection.

1.0 *Trench treatment*. When an existing main is opened, either by accident or by design, the excavation will likely be wet and may be badly contaminated from nearby sewers. Liberal quantities of hypochlorite applied to open trench areas will lessen the danger from this pollution. Tablets have the advantage in this situation, because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation.

2.0 *Swabbing with hypochlorite solution*. The interior of pipe and fittings (particularly couplings and sleeves) used in making the repair shall be swabbed or sprayed with a 1 percent hypochlorite solution before they are installed.

3.0 *Flushing*. Thorough flushing is the most practical means of removing contamination introduced during repairs. If valve and hydrant locations permit, flushing toward the work location from both directions is recommended. Flushing shall be started as soon as the repairs are completed and shall be continued until discolored water is eliminated.

4.0 *Slug chlorination*. Where practical, in addition to the procedures previously described, the section of the main in which the break is located shall be isolated, all service connections shut off, and the section flushed and chlorinated as described in previous section. The dose may be increased to as much as 300 mg/L and the contact time reduced to as little as 15 min. After chlorination, flushing shall be resumed and continued until discolored water is eliminated and the chlorine concentration in the water exiting the main is no higher than the prevailing water in the distribution system or that which is acceptable for domestic use.

5.0 Bacteriological Tests. After final flushing and before the new water main is connected to the distribution system, 2 consecutive sets of acceptable samples, taken at least 24 hr apart, shall be collected from the new main. (NOTE: The pipe, the water loaded into the pipe, and any debris exert a chlorine demand that can interfere with disinfection.) At least one set of samples shall be collected from every 1,200 ft of the new water main, plus one set from the end of the line and at least one set from each branch. Samples shall be tested for bacteriological (chemical and physical) quality in accordance with *Standard Methods for the Examination of Water and Wastewater*; and shall show the absence of coliform organisms; and, if required, the presence of a chlorine residual. Turbidity, pH, and a standard heterotrophic

plate count (HPC) test may be required at the option of the purchaser because new material does not typically contain coliforms but does typically contain HPC bacteria.

1. *Special conditions*. If trench water has entered the new main during construction or if, in the opinion of the Engineer, excessive quantities of dirt or debris have entered the new main, bacteriological samples shall be taken at intervals of approximately 200 ft, and the location shall be identified. Samples shall be taken of water that has stood in the new main for at least 16 hr after final flushing has been completed.

2. *Sampling procedure*. Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate, as required by *Standard Methods for the Examination of Water and Wastewater*. No hose or fire hydrant shall be used in the collection of samples. (NOTE: For pipe repairs, if no other sampling port is available, well-flushed fire hydrants may be used with the understanding that they do not represent optimum sampling conditions.) There should be no water in the trench up to the connection for sampling. The sampling pipe must be dedicated and clean and disinfected and flushed prior to sampling. A corporation cock may be installed in the main with a copper-tube gooseneck assembly. After samples have been collected, the gooseneck assembly may be removed and retained for future use.

3. *Sample results.* If sample results from the lab indicate a measured HPC greater than 500 colony-forming units (cfu) per mL, flushing should be resumed and another coliform and HPC set of samples should be taken until no coliforms are present and the HPC is less than 500 cfu/mL.

4. *Record of compliance*. The record of compliance shall be the bacteriological test results certifying that the water sampled from the new water main is free of coliform bacteria contamination and is equal to or better than the bacteriologic water quality in the distribution system.

6.0 REDISINFECTION. If the initial disinfection fails to produce satisfactory bacteriological results or if other water quality is affected, the new main may be reflushed and shall be resampled. If check samples also fail to produce acceptable results, the main shall be rechlorinated by the continuous-feed or slug method until satisfactory results are obtained—that being two consecutive sets of acceptable samples taken 24 hr apart.

NOTE: High velocities in the existing system, resulting from flushing the new main, may disturb sediment that has accumulated in the existing mains. When check samples are taken, it is advisable to sample water entering the new main to determine the source of turbidity.

D. Disinfecting: All water piping installed under this Contract shall be disinfected in accordance with AWWA C601 after all construction work has been completed. Chlorine shall be added to the water at the necessary locations in the amount to form a 25 ppm free chlorine residual. The chlorine solution shall be left in the pipelines for not less than 24 hours, during which time all valves and fire hydrants shall be operated in order to disinfect the appurtenances. After that length of time, the chlorine residual of the solution at any place in the system shall not be less than 10 ppm. As required, the Contractor shall make all necessary taps for inserting the chlorine solution in the pipeline and venting and draining pipelines using approved corporation stops. After the disinfection has been completed and approved, the corporation stops shall be closed, left in place, and sealed with a cap. All chlorination work must be done under the supervision of the Engineer.

After approval of the disinfection operations, the Contractor shall flush the new system until the chlorine residual is less than 1.0 ppm and a clear water test made. After flushing a bacteriological test is to be performed and must be passed by the local health authority to insure adequate disinfection prior to the line being placed into service and approved.

6.3.11 CONNECTIONS TO THE EXISTING SYSTEM: The existing system must at all times remain under the control of the District. The Contractor shall operate no valves or hydrants on the system without permission of the District.

All points at which the existing water systems are to be disconnected and connected to the new mains are shown on the Drawings. Connections to the existing system shall be completed after new pipeline, valves, thrust blocks and other appurtenances are installed and tested. Connections shall be done in accordance with the details given for each point of disconnection or reconnections. At each point of connecting new pipes to existing pipes, the Contractor shall expose the existing pipe and locate a good sound point at which to cut the existing pipe off square. The contractor shall then provide and install a transition coupling which has been designed and manufactured explicitly for the purpose of joining together the two types and sizes of pipe which he must connect.

The Contractor shall take precautions as necessary to minimize interruption of all utility services and will be responsible for restoration of service.

Unless otherwise specified, at any time that a customer on the existing system will be deprived of a supply of water, the Contractor shall advise such customer at least 24 hours in advance when the supply will be discontinued and when the supply will again be available. Service shall not be disrupted for more than a four hour period.

6.3.12 INSTALLATION OF WATER SERVICES: The water services shall be installed at locations in accordance with the Drawings. All pipe shall be copper unless designated otherwise on the drawings.

Curb valve boxes shall be located within roadway if possible. Curb valve boxes shall be set plumb, centered over the valve stem. Where required by the Drawings, the bricks supporting the curb box must be solid units set on undisturbed soil. Dielectric couplings shall be used between services of varying materials. All corporation stops require the installation of service saddles.

All bedding, pipe zone backfill, compaction, polyethylene sheathing and other details of the water pipeline construction shall be returned to original condition after service connections are completed.

6.3.13 ABANDONMENT OF SYSTEM APPURTENANCES

1. Abandoned main lines are to be left in place, and plugged at both ends of abandonment unless otherwise specified. All valves are to be closed and valve boxes pulled off within 2' of grade & filled with dirt/concrete.

2. Fire Hydrants and associated valves shall be removed; the tee shall be capped and or plugged with proper appurtenances.

3. Service lines shall be abandoned at their source prior to or during the tapping of a new service. Abandonment will include turning off the corporation valve and cutting the old service above the compression nut or capping the tee at the source. This shall be inspected by SWSD Staff before burying the work.

4. Tee's need to be capped and or plugged with proper appurtenances.

5. Branch Valves need to be removed and the line shall be properly capped or plugged at the tee.

A SWSD representative shall inspect all abandoned appurtenances.

- END OF SECTION -

SECTION 7 INSTALLATION OF BURIED SANITARY SEWER PIPELINES

SECTION 7.1 GENERAL

7.1.1 SCOPE: The work of this section includes providing and installing Polyvinyl Chloride (PVC) pipe, and fittings for sanitary sewer service. All materials shall be new. All material used shall be manufactured and supplied according to the latest revised standards of the American Water Works Association, the American National Standards Institute, and the American Society for Testing and Materials, or as mentioned hereinafter. Miscellaneous valves and fittings shall be as called out on the Drawings.

7.1.2 REFERENCES:

A. American Society for Testing and Materials (ASTM)
B. American National Standards Institute (ANSI)
C. American Water Works Association (AWWA)
D. Federal Specifications (FS)

7.1.3 CONTRACTOR SUBMITTALS: Contractor shall submit all cut sheets for proposed materials to be constructed in conjunction with the District's sanitary sewer system.

7.1.4 PRODUCT HANDLING:

A. Pipe, fittings, and all other accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage to them. Under no circumstances shall any materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground. Skidding which damages protective coatings will not be permitted.

In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench to prevent moving more than once.

All pipe and fittings shall be so handled that the coating and lining will not be damaged. If, however, any part of the coating or lining is damaged, the repair shall be by the Contractor at his expense in a manner satisfactory to the Engineer. Any pipe damaged beyond repair must removed entirely and discarded.

B. All pipes will be field inspected at the job site and checked for conformance to these specifications. Pipe and fittings will be checked for out-of-round or damaged joints, interior and exterior surface damage, gasket damage and the other requirements listed herein. Any pipeline or appurtenant material found defective will be rejected. Any material rejected at the job site shall be marked "Rejected," and the Contractor shall remove it immediately from the job site.

The Contractor shall provide results of tests required by the various standard specifications listed herein.

The Contractor shall provide the Engineer with 1 copy of the standard specifications covering the manufacture and testing procedures of the pipelines and other materials. The submittal shall be made prior to delivery of the materials.

C. Do not store materials directly on the ground.

SECTION 7.2 PRODUCTS

7.2.1 PIPELINE MATERIALS:

A. General: The Contractor shall install the pipeline material according to the requirements below by pipeline size or as designated on the Drawings. The Contractor shall furnish pipeline materials meeting applicable requirements of this Specification.

1. Polyvinyl Chloride Pipe (PVC), 18 inch or less.

The internal diameter of the pipe shall not be less than the diameter shown on the drawings.

B. Polyvinyl Chloride Pipe: The 4 to 15-inch diameter pipe shall be type PSM polyvinyl chloride pipe (PVC) and shall be suitable for gravity sewer service. The pipe material shall be made of PVC plastic having a cell classification of 12454-B or 12364-C or 12454-C or 13364-B (with a minimum tensile modules of 500,000 psi) as defined in ASTM D1784. All PVC pipe and fitting shall meet or exceed all of the material requirements of ASTM D3034 and thickness requirements of SDR-26 (4-inch to 15-inch diameter).

The 18 to 27-inch diameter pipe shall be polyvinyl chloride suitable for gravity sewer service with the PVC having a cell classification of 12454-C as defined by ASTM D1784. The pipe shall conform to the requirement of ASTM F679 (latest revision) with dimensions, pipe stiffness, and minimum wall thickness, T-1, designated in Table 1.

Provisions must be made for contraction and expansion at each joint with a rubber ring and integral thickened bell as part of each joint. Gaskets shall conform to ASTM F477. Pipe shall be supplied in laying lengths of 19 ½ to 20 feet. All pipe and fittings shall be assembled with a non-toxic lubricant. Each length of pipe and all fittings shall have marked on the exterior the following:

1. 4-inch to 15-inch
   a. Manufacturer's Name or Trademark
   b. Nominal Pipe Size
   c. PVC Cell Classification (e.g. 12454-B)
   d. Legend - Type PSM SDR-26 Sewer Pipe
   e. ASTM-D3034

2. Service lines
   a. Manufacturer's Name or Trademark
   b. Nominal Pipe Size
   c. PVC Cell Classification (e.g. 12454-C)
   d. Pipe Stiffness Classification: PS 46 PVC Sewer Pipe
   e. ASTM F679, AWWA C-905: SDR - 26 Class 200 or C900

All fittings to be used with the PVC pipe shall be those manufactured by the manufacturer of the pipe. Each special fitting shall be a completely manufactured unit with either bells or spigots on each connection that are an exact duplication of the bells and spigots on the pipeline. Fittings with any other type of connections will not be accepted.

C. Class 200 Polyvinyl Chloride Pipe: The pipe shall be Class 200 polyvinyl chloride (PVC) pipe meeting the requirements of AWWA C900, DR 26 for PVC pipe with cast-iron pipe equivalent O.D.

Provision shall be made for the contraction and expansion of each joint with an integral rubber ring and integral thickened bell as part of each joint. Pipe shall be supplied inlaying lengths of 20 feet. All pipe and fittings shall be assembled with a non-toxic lubricant. Each length of pipe and all fittings shall have marked on the exterior the following:

Class and size
Pressure rating
Name and Trademark of Manufacturer

D. Ductile-Iron Pipe: Ductile-iron pipe (DIP) shall be Class 52 in accordance with ANSI A21.51 and shall have a forty mil nominal (0.040 inch) lining of polyethylene. The lining shall be a blend of high-density polyethylene powders complying with ASTM D1248 compounded with an inert filler and carbon black. The pipe shall be preheated in a furnace to an adequate temperature to provide uniform fusing of the polyethylene powders and proper bonding to the ductile-iron pipe. See Section 02510 Installation of Buried Water Pipelines for information on fittings, gaskets, and restrained pipe.

Ductile iron pipe shall be used only with prior approval of the District. Ductile iron pipe may be required in certain circumstances, such as under roads or rivers. Buried Ductile iron pipe which may be subject to corrosive soil action shall be protected by a seamless polyethylene tube. All openings shall be taped water tight using an appropriate tape.

E. Restrained Joint PVC Pipe: Restrained joint PVC pipe shall be Class 200 polyvinyl chloride (PVC) pipe meeting the requirements of AWWA C900, DR 14 for PVC pipe with cast-iron pipe equivalent O.D.

The restrained joint PVC pipe shall be Certa-Lok C-900/RJ PVC restrained joint pipe from CertainTeed Corporation, or approved equal.

Provision shall be made for the contraction and expansion of each joint with an integral rubber ring and integral thickened bell as part of each joint. Pipe shall be supplied in laying lengths of 20 feet. All pipe and fittings shall be assembled with a non-toxic lubricant. Each length of pipe and all fittings shall have marked on the exterior the following:

Class and size
Pressure rating
Name and Trademark of Manufacturer

7.2.2 CONCRETE: Concrete for manhole bases, securing clean-out access castings, and other similar items shall have a 28-day compressive strength of not less than 3,000 psi. All reinforcement required shall be standard deformed reinforcement conforming to the requirements set forth in ASTM A615, Grade 60.

7.2.3 MISCELLANEOUS:

A. Plugs: Plugs shall be specifically manufactured for the pipelines in which they are to be installed. The plug shall be constructed of a material approved by the Engineer and shall provide a permanent water-tight installation without permanently sealing the joint.

B. Couplings: Couplings shall be used only where shown on the drawings or where approved in writing by the Engineer. The Contractor shall provide a description of and exact location of any couplings used. All couplings shall be solid sleeve type PVC couplings of the same specification and material as the new main line.

Flexible couplings will normally not be acceptable and only to be used with SWSD written approval. If used without approval, contractor will be required to remove and replace coupling with approved type and material. If approved, they shall consist of a rubber gasket or boot, stainless steel shear ring, and 300 series stainless steel tightening bands. The coupling shall conform to requirements of ASTM C425 or approved equal.

C. Fittings: Fittings shall be of the same material and to the same requirements, including coatings and linings, as the pipeline in which they are installed.

The fittings shall be standard manufactured form with the same type of joint as the pipe.

D. Grout: Grout shall be a non-shrink type with aluminum filings; grouts with iron filings are not acceptable. Grout shall be “Five Star Grout,” “Embeco Grout” or equal. The Contractor may substitute a 2-component, 100% solids epoxy resin (Sikadur Hi-Mod LV) for the specified grout.

Grout used for sealing service connections shall be a 2-component, waterproof epoxy grout specifically manufactured for this application. The grout shall adhere to any of the dissimilar materials.

E. Sealants: Sealants used on manholes or pipe connections shall be equal to SIKAFLEX-la, a one component polyurethane base, elastomeric sealant. When required due to moisture or immersion, provide SIKAFLEX 429 primer for application onto the substrate according to manufacturer’s recommendation.

7.2.4 SEWER SERVICE LINES: Sewer service lines, including joints and plugs, shall be constructed of materials AWWA C-900, Class 200 DR 14. Sewer service lines shall connect to the sewer main at either a tee or full body wye, unless specifically permitted by the Engineer, then the Contractor will be allowed to use saddles.

Saddles shall be manufactured of the same materials as the sewer pipeline or of PVC. Saddles shall provide for a right-angle entry into the sewer main. The saddle shall be contoured to fit the sewer main pipe and shall be permanently attached thereto with an epoxy glue or stainless steel bands. Saddles shall be specifically constructed to connect the service line to the main line without modification of either. All services shall have tracer wire installed per detail.

All service branches installed for future connection shall be marked at the property line with a 2- inch steel pipe, 6 feet long, buried 3 feet and encased with concrete. Paint exposed pipe green.

7.2.5 CASING PIPE: Where casing pipe is bored and jacked as located on the drawings it shall be full or split casing of smooth, uncoated welded steel pipe with not less that ¼” thick walls and free of obstructions. The interior diameter of the casing pipe shall not vary more than 1 inch from the inside diameter specified. Joints shall be made by butt-welding the pipe sections before jacking in to final location. See Standard Detail W15.

7.2.6 CASING SPACERS: Casing spacers shall be of the projection type, non-metallic spacers constructed of preformed sections of high density polyethylene or an approved equal. The spacers shall be of a sufficient number of projections to adequately support the carrier throughout the installation process and in service. Each casing spacer shall be capable of providing support for the carrier pipe in service at a maximum spacing of 10 feet. Calculations shall be provided showing that the casing spacer will support the service load at the recommended spacing, including a factor of safety of two (2). Carrier pipe joints shall be installed with self-restraining casing spacers at each joint. See Standard Detail W14.

Restraining casing spacers at joints shall provide axial thrust restraint to prevent pipe joint separation during and after installation and during removal. They shall also provide dielectric insulation between carrier pipe and the casing and facilitate installation of the carrier pipe by allowing the carrier pipe to be placed without undue stresses.

Spacers shall be Cascade Manufacturing T304 Stainless Steel (14 Ga.) minimum, Model CCS-ER and CCS-RJ (restrained joint) or approved equal.

7.2.7 URECON INSULATED PIPE: URECON Pipe and Insulated Jacket & fittings shall be C-900 CL 200 PVC. The insulation is to be Urecon “U.I.P.”® void free insulation process, with a suitable outer jacket. Polymer coated, form fitting insulation kits shall be used to insulate elbows, tees and other fittings, according to the manufacturer’s recommendations. The U.I.P. insulation shall be rigid polyurethane foam, factory applied. The insulation shall be a 2- inch void free polyurethane foam

(ASTM D1622) with a compressive strength of 19 to 23 lbs/sq-in (ASTM D 1621) and has a closed cell content of 90% minimum. DIP pipe and insulation shall be wrapped in an outer jacket of 22 gauge Aluminum Spiwrap.

Heat tracer wire shall be provided with the insulated DIP pipe that is continuous for the length of the insulated pipe. Heat tracer wire will be capped at both ends before pipe enters the ground for its burial run.

7.2.8 FLEXIBLE PIPE JOINTS: All pipes entering buildings, passing through concrete walls, bridge abutments, or other structures shall have a Flex Tend joint installed within 3-feet of the wall. The Flex-Tend joint shall be the same size as the main line piping, Double Ball, Mechanical joint by Mechanical Joint. The mechanical joint connects with the buried DIP on one end and the other end connects with the wall spool installed in the wall of the structure. For Bridge abutment penetrations the pipe connects to a Plain End section of URECON pipe with a Mega-Lug. Flex Tend shall be a Single Ball Model for 8-inch expansion from EBAA Iron or approved equal for Bridges. Flex-Tend shall be a Double Ball Model for 8-inch expansion from EBAA Iron or approved equal for entrances into buildings and other structural walls.

SECTION 7.3 EXECUTION

7.3.1 A. GENERAL INSTALLATION REQUIREMENTS: Each pipe length and fitting interior, interior surface of bells, and exterior surface of spigots shall be cleaned of all foreign material before placing it in the trench and shall be kept clean all times thereafter. Each item must also be examined for cracks and other defects before installation.

Pipe shall be cut, only whenever necessary, to conform to location of manholes or connections. All cuts shall be straight, true, and at right angles to the axis of the pipe unless otherwise noted or directed by the Engineer. The cutting process shall leave a smooth end without damaging the pipe. All burrs shall be removed from the ends of cut pipe, and the end lightly rasped or filed. All tools used in cutting pipe shall be subject to the Engineer's approval.

Pipe laying shall proceed upgrade with the spigot ends of pipe pointing in the direction of the flow, unless otherwise approved by the Engineer. Each pipe length shall be laid true to line and grade in such manner as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets to the flow line. Pipe shall be laid in a de-watered trench and shall not be used for draining water from the trench.

Whenever the pipe is left unattended or pipe laying is not in progress, temporary plugs shall be installed at all openings. Temporary plugs shall be watertight and of such design as to prevent debris and animals from entering the pipe. All temporary plugs shall be subject to approval of the Engineer.

The Contractor shall obtain from each pipe manufacturer complete installation instructions. The Contractor shall provide the Engineer with 1 copy of those instructions and shall have additional copies at the site of the work. The Contractor shall install the materials in accordance with the manufacturer's recommendations. If there is a conflict between the Contract Documents and the manufacturer's instructions, the Contractor shall obtain resolution from the Engineer before proceeding with the work.

Maximum depth of sewer mains is to be 12-feet and minimum depth is to be 5-feet unless otherwise approved in writing by the SWSD Engineer.

A District approved copy of the project plans, drawings and specifications shall be kept on the job site at all times during construction. If either the contractor or the District Engineer, as work progresses, finds any discrepancies between the plans, drawings, and specifications and the physical conditions, the discovering party shall inform the other party immediately in writing. Any work done after such discovery will be done at the contractor's expense. Any deviations from the approved plans and

additional compensation to the contractor shall be authorized in writing by the District Engineer along with copies to the District and the District. The drawings shall show the existing utilities to the best of knowledge, based on the best current information, and are schematic in nature. Final staking may not reflect the changes due to existing utilities. These conditions do not constitute design changes and are not extras.

Piping shall be laid to the lines and grades indicated on the approved drawings. The pipe shall be laid with straight and true alignment. No lateral or vertical deflection will be allowed. Lateral displacement of the pipe shall be prevented during bedding operations. Pipe shall not be laid in water, or under unsuitable weather or trench conditions.

All pipe laid in the District shall be laid with a properly calibrated self leveling laser. The contractor shall be responsible for having both a laser and target to lay the pipe, and a transit with rod set up on each and every section of pipe to be laid so the SWSD Engineer can periodically check grade and alignment. No batter boards or string lines will be allowed.

B. VIDEO INSPECTION

The contractor shall be required to video all sewer mains proposed for replacement and/or relocation prior to commencement of construction to locate and record all sewer service taps, including 1 MH upstream from the upper most MH from the proposed project and 1 MH below the lowest MH from the proposed project prior to construction. The camera can be sent through the line with the assistance of a high pressure sewer jet machine with the water turned on to de-water the sewer line so as to be able to see each tap that may be in a low area. A copy of the log record and electronic video shall be provided to the District prior to starting the work on each section of line to be replaced.

All new sewer lines to be accepted by the District for ownership and maintenance shall be televised by the Contractor. A copy of the log record, report and electronic video shall be provided to the District upon completion of the work on each section of new line installed. The lines shall be videoed when the District has been notified by the contractor that all work on the main sewer line installation is complete. The main sewer line shall be re-videoed before the expiration of the contractors two year maintenance bond. The contractor shall bear all costs incurred in correcting deficiencies found during the video inspection, including the cost of additional video inspection required to verify correction of noted deficiencies.

C. LINE LOCATOR TAPE:

Tape shall be installed 2-feet foot above all sewer lines. The tape shall be colored polyethylene with a metalized core.

7.3.2 INSTALLATION OF PVC PLASTIC PIPE:

A. Pipe Laying: No deflection in the joints shall be allowed. All pipe shall be fully supported by the full length of pipe barrel without support by the bell mounding.

B. Jointing the Pipe: The outside of the spigot and the inside of the bell shall be thoroughly wiped clean. Set the rubber ring in the bell with the marked edge facing toward the end of the bell. Lubricate the spigot end using a thin film of the manufacturer-supplied lubricant. Push the pipe spigot into the bell. Position the completed joint so that the mark on the pipe end is in line with the end of the bell.

Bevel the end of the pipe with a beveling tool after the pipe is field cut. Place a clearly visible position mark at the correct distance from the end of the field-cut pipe.

C. Connection of PVC Pipe to Concrete Manhole Base: The PVC pipe shall be connected to the manhole base by a Kor-N-Seal boot or approved equal inserted and held in place by an internal expanding clamp as detailed on the Drawings. See Standard Detail S01.

D. Service Lines Sub outs: Stub-outs for future service connection must have prior approval by the District Manager and shall be 4 or 6 inches in diameter. An full body "wye" shall be used for all

future service line stub-outs unless approved otherwise by the District Engineer. Stub-outs shall be installed at the stations indicated on the approved plans for future service connections. Addition or deletion of stub-outs during construction must be approved by the District Engineer. Stub-outs shall be positioned 45 degrees above the horizontal and connected to the service line stub using a 45 degree vertical bend. Stub-outs shall be brought to the surface using the same material and shall terminate at least one foot above the surface. Marker posts in other areas shall terminate within one foot of the ground surface and have a cast iron top. All stub-outs shall be accurately located on the record drawings by "swing ties" to both the upstream and downstream manholes. All stub-outs reserved to future use shall be plugged with a removable, gasketed water tight plug. All fittings and pipe used for future services shall be C-900 CL 200 PVC. The contractor shall hand tamp the bedding and backfill under every "wye" branch after installation.

Sanitary sewer service lines shall be located downstream from or below grade of as well as a minimum of 10 feet horizontal distance from any water lines and a minimum of three feet from any manhole or structure. The service connection must be observed by the District Engineer and documented on the plans kept in the field. Service charges shall begin once the stub-out has been connected to the building sewer service line.

The contractor shall be responsible for locating existing services including videoing the system, and connecting the services to the new main sewer line. The connection shall be made with a full body "wye". In special circumstances the District Engineer may approve the use of a "Tee" saddle w/ rubber gasket approved by the District, drilling the main with a 4-1/2 inch hole saw, and securing the saddle with two stainless steel clamps. Since the service lines will vary in size and material, the contractor shall have on hand a variety and range of all C-900 CL 200 fittings and pipe required to reconnect the services in a timely manner. The contractor shall hand tamp the bedding and backfill under every "Tee" branch after installation.

E. Insulation: All pipelines in roadways where snow will be removed or there is a likelihood of deep frost penetration shall have a minimum cover of 5 feet measured from the top of the pipe. Pipe lines in other areas shall have a minimum cover of 5 feet. All pipelines with insufficient cover, (less then 5-foot), shall be insulated in a box on top of and on both sides with 2 inch blue board insulation. Two inches of insulation shall be required for every two foot of inadequate cover. The acceptable thickness of insulation shall be bedded in pea gravel a minimum of 2 inches top and each side, and the bottom uniformly supported to prevent breakage. 2 inches of pea gravel shall be hand placed over the top of the insulation. All seams shall be securely taped with duct tape or equivalent. Under no circumstances shall there be less than four feet of cover over any pipeline. See Standard Detail W11.

F. Abandoning Sewer Mains: The contractor shall be responsible for abandoning the existing sewer main as the new line is installed or after the new system is installed. The contractor shall clean and remove debris in the system to be abandoned, plug both ends of old sewer main, remove the top, rings, cover, and 7 feet of any manhole material, including the base if necessary, fill the manholes from the invert to 24 inches from finish grade with compacted flow fill to 95% density, compact the remaining 24 inches with Class 6 road base to 95% density, complete the surface restoration as required, and deliver any reclaimed materials to the District as directed.

7.3.3 PROTECTION OF TREATED WATER PIPELINES: Whenever any sewer line is crossed such that they are above and less than 18 inches apart from the water line, the sewer line shall be installed with one full 20 foot stick of Class 150 PVC (AWWA C900) with solid sleeves and transition gaskets. The C900 shall be centered over the water line. The waterline shall also be centered under the sewer line. When a sewer line is below the waterline and is less than 18 inches apart, the water line and sewer line shall be centered over each other so that the joints are as far as possible apart; the sewer line does not have to be in C900 for this situation. See Standard Detail W13.

7.3.4 FLUSHING AND TESTING SEWER PIPELINES:

A. Pipeline Flushing: The Contractor shall flush the pipelines, as the work progresses to insure

that earth, sand, rocks or other foreign materials are removed from the interior of the pipeline.

B. Alignment and Grade: Sewer pipelines will be inspected by video to determine whether any displacement of the pipe has occurred after the trench has been bedded to final grade. Video inspection will include a report narrating the results of the video inspection. The video inspection shall be in electronic format and is the responsibility of the Contractor.

C. Leakage: Air tests for water tightness shall be made by the Contractor in the presence of the Engineer. The Contractor will use equipment specifically designed for air testing sewers. The air test shall be made when the sewer is clean and lateral services properly plugged. The line shall be plugged at each manhole with pneumatic balls and low pressure air may be introduced through either end. At least two (2) minutes shall be allowed for the air temperature to stabilize, then the internal pressure shall be allowed to drop to the test pressure of 5 psig. At this point the internal line pressure is monitored. The line pressure shall not drop more than 0.5 psig or to 4.5 psig in less time than specified in the table or the pipe fails the test and shall be repaired and retested. The Contractor is responsible for locating the leaks, repairing them, and re-testing the line.

Minimum Duration For Air Test Pressure Drop

Pipe (in)	Time (min)
6	4.0
8	5.0
10	6.5
12	7.5
15	9.5

7.3.5 SEWER SERVICE PIPELINES: When new sewer service pipelines or reconnection of existing services are to be installed as a portion of the Contract, these pipelines are to be installed in accordance with the details set forth on the Drawings and with appropriate installation requirements of this Specification.

The general location of the service lines is shown on the Drawings. Actual locations of these pipelines are to be determined in the field by the Engineer prior to main pipeline construction. It shall be the Contractor's responsibility to notify the Engineer prior to constructing each main pipeline so that the Engineer may have adequate time to determine the final location of each service tee or wye fitting to be installed in the main pipeline. Failure of the Contractor to properly notify the Engineer as noted above will result in the Contractor's removal of any portion of the main pipeline which is necessary to install the fittings in their proper location as determined by the Engineer.

The Contractor will be allowed to install a service saddle to new sewer pipelines only at those locations approved in writing by the Engineer.

Service line saddle connections shall be attached to the main line with an epoxy bonding agent. The bonding agent shall be applied to a clean, dry surface. The connection shall remain dry until the bonding material has set, depending upon environmental conditions. Backfill around the connection shall not be attempted until the material has hardened and been accepted by the District. The Contractor shall repair any damage to the main pipeline lining after the connecting PVC saddle has been bonded to the pipe. The lining shall be repaired with materials furnished by the manufacturer of the main pipeline.

The Contractor shall connect new service pipelines to fitting or saddle with the same material as the existing. Flexible couplings shall be used only to connect dissimilar piping materials or reconnecting

existing services.

7.3.5.1 CLEANOUTS
All service lines shall have a minimum of 1 cleanout, and then one cleanout per one hundred feet of pipeline length or at bends whichever occurs first. A cleanout consisting of a vertical 90˚ tee the diameter of the service line shall be provided at the property line between the building being served and the main line. The upper 24 inches of the vertical riser shall be installed in a ductile iron valve box marked “Sewer” installed at final grade (see Standard Detail S08).

7.3.6 GREASE INTERCEPTORS

7.3.6.1 GENERAL. Because of the impact of grease on the District's lines and treatment plant, grease interceptors are required on establishments preparing or serving food. See Standard Detail S10 for a typical grease interceptor.

All grease interceptors shall be new and the interceptor and its installation shall be in conformance with the latest edition of the Uniform Plumbing Code except as modified herein.

7.3.6.2 REQUIREMENTS FOR GREASE INTERCEPTORS. An approved type grease interceptor complying with the provisions of this section shall be installed in the waste line leading from sinks, drains and other fixtures or equipment in the following establishments: Restaurants, cafes, lunch counters, cafeterias, bars and clubs; hotels, hospitals, factory or school kitchens, or other establishments where grease may be introduced into the drainage or sewage system. Grease interceptors are to be pumped as often as needed. A letter will be sent January 1 of each year requiring a record of pumping, or be subject to the fines described in Appendix A. A grease interceptor is not required for individual dwelling units or for any private living quarters.

7.3.6.3 SPECIFICATIONS AND PROCEDURES FOR GREASE INTERCEPTORS.

A. Plans shall be submitted to and approval obtained from the District prior to the installation of any grease interceptor in any establishment set forth in Subsection 6.2.

B. No grease interceptor shall be installed which has an approved rate of flow of more than 55 gallons per minute, except when specially approved by the District.

C. No grease interceptor shall be installed which has an approved rate of flow of less than 20 gallons per minute.

D. Each plumbing fixture or piece of equipment connected to a grease interceptor shall be provided with an approved type flow control or restricting device installed in a readily accessible and visible location in the tail piece or drain outlet of each such fixture. Flow control devices shall be so designed that the total flow through such device or devices shall at no time be greater than the rated capacity of the interceptor. No flow control device having adjustable or removable parts shall be approved.

E. Each grease interceptor required by this section shall have an approved rate of flow which is not less than that given in the District's EQR schedule for the total number and size of fixtures connected thereto or discharging thereunto. The total capacity in gallons from fixtures discharging into any interceptor shall not exceed 2.5 times the flow rate of the subject interceptor.

Any grease interceptor installed or located in such a manner that the inlet is more than 4 feet lower in elevation than the outlet of any fixture discharging into such interceptor, shall have

an approved rate of flow which is not less than 50 percent greater than that given in the District's EQR schedule.

F. No more than 4 separate fixtures shall be connected to or discharged into any 1 grease interceptor.

G. For the purpose of this section, the term "fixture" shall mean and include each plumbing fixture, appliance, apparatus or other equipment required to be connected to or discharged into a grease interceptor by any provision of this section.

H. Each grease interceptor shall be vented as required by the Uniform Plumbing Code and each fixture discharging into a grease interceptor shall be individually trapped and vented in an approved manner, expect that an approved type grease interceptor may be used as a fixture trap for a single fixture when the horizontal distance between the fixture outlet and the grease interceptor does not exceed 4 feet and the vertical tail pipe or drain does not exceed 2 feet.

I. Each grease interceptor shall be installed and connected so that it shall be at all times easily accessible for inspection, cleaning and removal of the intercepted grease.

J. Interceptors shall be maintained in efficient operating conditions by periodic removal of the accumulated grease. No such collected grease shall be introduced into any drainage piping, public or private sewer and it shall be disposed of in an environmentally safe manner.

K. Each grease interceptor shall be constructed of durable material satisfactory to the District and shall have a full size, gas tight cover which can be easily and readily removed.

L. No water jacketed grease interceptor shall be approved or installed.

M. Each grease interceptor shall have an approved water seal of not less than 2 inches in depth or the diameter of its outlet, whichever is greater.

N. No grease interceptor required by this section shall be installed until the type and model of each size thereof has been approved by the District.

O. The District may require such tests as may be necessary to determine the grease collecting efficiency of the various types and kinds of grease interceptors to establish the rate of flow or other rating thereof. Such test requirements may be revised or modified from time to time as may be deemed necessary by the District. A design shall be provided to the District’s Engineer for approval.

P. No grease interceptor shall be installed which does not comply in all respects with a type or model of each size approved and accepted by the District. Whenever it shall come to the attention of the District that any grease interceptor does not so comply, the District shall immediately suspend or revoke such approval.

- END OF SECTION -

SECTION 8 MANHOLES

SECTION 8.1 GENERAL

8.1.1 SCOPE: The work of this section consists of furnishing, installing and testing cast-in-place bases with reinforcement, precast concrete risers, frames, covers, and installation materials, and appurtenances.

8.1.2 REFERENCES:

A. American Society for Testing and Materials (ASTM)

8.1.3 CONTRACTOR SUBMITTALS: Contractor shall submit furnish manufacturer's literature on manholes, joint material, frame and cover, and steps.

SECTION 8.2 PRODUCTS

8.2.1 GENERAL: Manholes shall be constructed of pre-cast concrete riser sections, in accordance with the details shown on the Drawings. The concrete sections shall conform to ASTM C478. The top section required for change of diameter shall be eccentric cone or flat slab if permitted by the Engineer. See Standard Details S01, S02, S03 and S04.

To bring the manhole cover to the correct elevation, the adjustment section of each manhole shall be pre-cast concrete. These rings shall not be less than 6 inches wide and furnished in heights to allow for 1-inch adjustment. Maximum adjustment height shall not exceed 12 inches.

Stub outs for future planned connections shall be provided at manholes when shown on the Drawings. Stubs shall be sealed with a removable watertight plug.

Gaskets for connecting PVC pipe to manhole sections shall be specifically manufactured for that purpose. The gasket shall be provided by the pipe manufacturer.

8.2.2 JOINTS: Precast manhole joints shall be made watertight with Ram-Nek material or equal. Diameter of gasket shall be as recommended by the manufacturer.

8.2.3 FRAME AND COVER: The frames and solid covers shall be standard heavy duty Denver Heavy or equivalent and the frame shall be 8 inches high. The covers shall be designed for use in high traffic areas and have an external notch for lifting.

Where required by the District Engineer the contractor shall furnish bolt down frames, bolt down covers, and gasketed lids watertight, as manufactured by D and L Supply (Number E1926 or equal). Aluminum covers are not allowed.

Cover shall have the word "SEWER" clearly cast on its surface.

8.2.4 MANHOLE STEPS: Manhole steps shall be M.A. Industries PS2-PF 6 polymer polypropylene plastic with 1/2 inch grade 60 reinforced steps or approved equal. Manhole steps shall be every one foot and must line up vertically from the bottom section to the cone. Manhole steps shall not be used to lift manhole sections. Maximum Distance from top of lid to first MH step is 18-inches.

8.2.5 GROUT: Grout shall be non-shrink type with aluminum filings; grout with iron filings are not

acceptable. Grout shall be "Five Star Grout," "Embeco Grout" or equal.

8.2.6 CONCRETE: Concrete for cast-in-place manhole bases shall have a 28-day compressive strength of not less than 3,000 psi. The maximum water content shall be 0.5 pounds of water per pound of cement. Entrained and entrapped air shall be between 4 and 9 percent. All reinforcement shall be standard deformed reinforcement conforming to the requirements set forth in ASTM, A615, Grade 60.

SECTION 8.3 EXECUTION

8.3.1 GENERAL: Manholes shall be constructed to conform to the details shown on the Drawings. The invert channels shall be smooth and semi-circular in shape, conforming to the inside of the incoming and outgoing sewer pipelines. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. Where differences in invert elevations exist, sloped flow channels shall be formed so the sewage does not undergo a vertical drop. The invert channels may be formed directly in the concrete of the manhole base. The floor of the manhole outside of the channel shall be smooth and shall slope toward the channels at not less than 1 inch per foot and not more than 2 inches per foot. The manhole covers shall be set with their tops at the ground line, compacted backfill shall be placed around the exposed section as shown on the Drawings. The site shall be graded so that drainage is away from the manhole.

Each joint of the precast manhole barrel shall have at least one continuous gasket placed on the lower ledge before the barrel immediately above is lowered into place.

Maximum distance to first step is18 inches from top of MH ring.

Manholes shall be constructed of precast concrete bases and rings, designed for H-20 traffic loading as shown on the drawings. Four foot inside diameter manholes may be used with 15 inches or smaller pipe and have a minimum wall thickness of 5 inches. Five foot inside diameter manholes must be used for pipe 18 inches or larger and have a minimum wall thickness of 6 inches. Six foot diameter manholes may be required by the District Engineer where applicable. All manhole sections shall incorporate a vertical keyed joint. Manholes shall be coated on the outside with two coats of coal tar paint. The paint shall be Koppers "Bitumastic Super Service Black," Porter "Tarmastic 103," Tnemec "450 Heavy Tnemeco," or approved equal. The inside of the manholes shall be completely sealed with two coats of RHOPLEX AC 630 two part emulsion. The top section shall be a precast concrete eccentric cone with 24 inch opening. Manhole bases shall be precast with integrally cast-in water stop boot. The top of the base section shall be at least 12 inches above the top of the pipe. All other connections to the manhole base shall be made by coring and using a Kor-N-Seal boot or approved equal inserted and held in place by an internal expanding clamp. All openings shall be completely grouted full using a non-shrink grout. Manhole steps shall be M.A. Industries PS-2 PF steps or approved equal. In no case shall the top step be greater than 18 inches from the top of the manhole.

Concrete grade rings shall be precast of the same material as the manhole barrel sections and may be used in frost free areas. Aluminum or cast grade rings must be used in paved areas and in any area where there is a possibility of frozen ground. Regular and beveled plastic grade rings using manufacturers approved mastic can be substituted with the SWSD Engineer’s approval.

Poured in place manhole bases shall not normally be alllowed and when required shall have prior approval by the District Engineer. Only precast manhole bases are approved for use in the SWSD. Poured in place manhole bases must be pre-approved by the District Engineer, and will only be approved in unusual and special instances.

Drop manholes shall not normally be installed and when required must be approved by the District Engineer. See Standard Detail S02.

The distance between manholes shall not be greater than 400 feet for sewers 18 inches in diameter or less. On lines with steep grades, the District Engineer may require manholes at less than 400 foot increments. Spacing may be increased to 500 feet for sewers 21 to 30 inches in diameter. Manholes shall be installed at the end of each line, at all grade changes, size changes or change in alignment. Manholes shall be used at all collector/interceptor sewer intersections. No manholes shall be placed on road shoulders, in narrow ditches or in water courses. All pipes entering a manhole or other structure shall have a flexible joint (Kor-N-Seal).

Manholes shall not be placed where the resulting connection collection lines will have an angle of less than 90 degrees. An additional manhole must be installed so that the resulting angles for each manhole will be greater than 90 degrees.

Precast concrete sections shall be handled carefully and shall not be bumped or dropped. Hooks shall be delivered and installed. All cracked or otherwise defective or substandard units will be marked, rejected and removed from the construction site. Circular precast sections shall be sealed at the joints with an approved rubberneck sealer installed prior to assembly.

Private service taps are not allowed into manholes except at the discretion of the District Engineer.

Only eccentric cone sections will be used.

Precast manhole bases shall be placed on level compacted subgrade (95% modified proctor density) to the grade and alignment shown on the construction drawings. The contractor must place at least 8 inches of 1-1/2 screened rock under the base for leveling and stability. All manholes must be level. Holes for field connections shall be carefully cored or drilled. In no case shall holes be made in manholes with pneumatic hammers or similar devices. After installation of the pipe through the Kor-N-Seal the pipe shall be grouted, filling the annular space between the boot and the pipe with an approved non-shrink grout. Lifting ring holes must be fully grouted with a non-shrinking grout.

Inverts in all manholes shall be formed such that no turbulent flow is allowed. Engineered bases may be required on steep slopes. Inverts shall be designed with at least two tenths of a foot drop through the manhole. Three and four way manholes shall be designed so that inverts with lesser flows shall enter the manhole at an elevation higher than the invert with greatest flow. This elevation shall be approved by the District Engineer. Pre-poured inverts in pre-cast bases shall be smooth and clean. At the direction of the District engineer, additional work may be required on the inverts. The area around the boot and pipe will be grouted with an approved non-shrink grout. Inverts shall be carefully poured and troweled into the shape of the pipes through the manhole. The inverts shall be constructed of 4,000 PSI concrete using Portland type II cement. Side branches shall be connected on as large a radius curve as practicable. All inverts shall be troweled to a smooth clean surface. All manhole bases shall be precast with 6 inches minimum space between the invert of the PVC sanitary sewer pipe and the top of the floor, and reinforced with GR 60 #4 rebar 12 inches each way.

Benches shall be designed so that a good working platform is formed. The troughs shall be formed deep enough to contain the expected wastewater velocity and flow. The troughs shall be designed to accept a video camera 24 inches long and 6 inches in diameter. Unless approved differently by the District Engineer, the troughs should be designed to have vertical walls the same width or wider than the inside pipe diameter.

In frost free areas precast concrete grade rings may be installed between the top of the cone and the manhole frame if necessary. The rings shall be sealed with two parallel strips of approved joint mastic between each layer. No more than 18 inches of grade rings will be allowed. If the manhole must be adjusted more than 18 inches, the eccentric cone shall be removed and the appropriate barrel section added. However, if the tongue and groove of the sections do not match, the entire manhole must be rebuilt. The lid frame shall be sealed to the grade rings with two parallel strips of rubberneck. Metal and plastic grade rings must be used in paved areas and in any area where there is a possibility of frozen ground.

Non traveled areas: manhole cover shall be 4 to 8 inches above finished grade.
Non paved traveled areas: manhole cover shall be 2 to 4 inches below finished grade.
Paved areas: manhole covers shall be 1/2 inch below grade with at least 4 inches of metal manhole riser rings added to cast frame. Additional metal grade rings may be required at the discretion of the District or the District's engineer.

All work performed by the contractor in a SWSD confined space shall be performed according to OSHA permit required confined space regulations.

All new holes required in existing manholes to facilitate installation of additional pipes or replacement of existing pipes shall be core drilled in the manhole wall and base to facilitate a smooth invert transition. A Kor-N-Seal boot shall be installed by the contractor. Holes shall not be made by hammering or jack hammering. All possible areas of leakage shall be grouted with a non-shrink grout. All such connections shall be observed by District personnel or the District Engineer. When required the contractor shall be responsible for installing a new manhole on the existing sewer line. The sewer main must be kept in operation and the sewage bypass pumped if required. The contractor shall uncover the existing main, the District Engineer shall determine the elevation of the invert to be used for the next grade and alignment, the contractor shall cut out the line in a clean manner and the manhole shall be installed according to these specifications and the approved drawings.

Normally a new manhole shall be required when tying into the existing sewer system. In some cases the District Engineer shall instruct the contractor to tie into an existing manhole. Where there is not a line coming into the manhole, the manhole shall be core drilled, a flexible joint manhole coupling with rubber boot, KOR-N-SEAL or approved equal installed. The bench shall be grouted with a non shrink grout to divert the flow into the downstream pipe with a smooth transition that does not create turbulence.

If one pipe is to be abandoned, a plug of two thicknesses of grouted brick and a 6 inches solid plug of non shrink grout shall be installed in the pipe. Existing invert and trough shall be filled with an approved non-shrink grout and benches formed to match existing.

8.3.2 GROUTING: Any opening between manhole walls and pipe made by the Contractor, and lifting holes or as designated elsewhere, shall be closed watertight with grout. The opening shall be of sufficient size to accommodate the pipe, "O"-rings, and grout. The grout shall extend no less than the full width of the manhole barrel. Use grout to make a watertight seal in and around existing pipes which are removed from service.

Channels that have been cut into existing concrete bases shall be smoothed to the specified contour with grout.

8.3.3 TESTING MANHOLES: During the construction of the manholes, the Contractor shall insure that no earth, sand, rocks or other foreign material exists on the joint surfaces during assembly of the sections. The Engineer shall check each manhole to determine whether the manhole fulfills the requirements of the Drawings and Specifications. The Visual Examination and Vacuum Test are required.

A. Visual Examination: The Engineer shall visually check each manhole, both exterior and interior, for flaws, cracks, holes, or other inadequacies which might affect the operation or watertight integrity of the manhole. Should any inadequacies be found, the Contractor shall make any repairs deemed necessary by the Engineer.

B. Vacuum Testing: All pipes entering and exiting the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.

The test head shall be placed at the top of the manhole and the seal inflated in accordance with the

manufacturer's recommendations.

A vacuum of 10-inches of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head shall be closed, and the vacuum pump shut-off. The time shall be measured for the vacuum to drop to 9-inches of mercury.

The manhole will be declared unacceptable if the time to drop from 10-inches of mercury to 9-inches of mercury is less than the time shown in the following table:

Manhole Depth (feet)	**Test Time (seconds)**		
	4 ft. Diameter	**5 ft. Diameter**	**6 ft. Diameter**
10 ft. or less	60	75	90
>10 ft. but < 15 ft.	75	90	105
>15 ft. but < 25 ft.	90	105	120

The minimum test time shall be one minute. If the manhole fails the initial tests, the manhole shall be repaired and re-tested until a satisfactory test is obtained.

8.3.4 EXISTING SANITARY MANHOLES ABANDONED IN PLACE: Existing manholes to be abandoned in place shall be backfilled with squeegee material, grout plugs of abandoned inflow and outflow pipes are not required. The lid and grade rings of the manhole shall be removed and disposed of.

- END OF SECTION -

SECTION 9 CONNECTION PERMIT REQUIREMENTS

As stated by the Rules and Regulations dated October 2013, the following items are specified by the District for final inspections approval. All new, relocated, or replaced service lines are required to use the following guidelines.

THESE ITEMS SHALL BE INSPECTED BY DISTRICT PERSONNEL WHEN INSTALLATION IS COMPLETE & BEFORE THE BUILDING IS OCCUPIED.

Section 9.1 SERVICE LINE SPECIFICATIONS

9.1.1 SEWER SERVICE LINE

C-900 Class 150 or SDR 26 water pipe must be used from the tap into the structure. At least 5 feet of cover over line is required, with at least 6 inches of road base compacted under the line and 6 inches of road base compacted on top of the line. District personnel shall perform a line inspection, prior to backfill. A clean out is required every 100 feet along the service line, if it is over 100-feet in length.

9.1.2 WATER SERVICE LINE

Use only Soft K-type copper line with compression fittings. A minimum of 8 feet of cover over line is required, with at least 6 inches of road base compacted under the line and 6 inches of road base compacted in top of the line. The line inspection shall be performed by District personnel prior to backfill. The line must be pressure tested to 150 PSI or 1.5 times the static pressure in the system at the site for 1 hour. Pressure tests are to be completed by a contractor or plumber with District personnel present.

Section 9.2 PLUMBING MATERIALS SPECIFICATIONS

Customers who are obligated to obtain a connection permit from the TOSV due to an alteration, renovation of, or an addition to an existing property, whether or not the installation, addition, or relocation of any plumbing fixtures is required for the proposed, are required by the Rules and Regulations to have or install all plumbing items, as listed below.

9.2.1 WATER METERS

Residential Meters are required to be a Neptune T-10 size 5/8 inch to 2 inch Meter, with ProRead AutoDetect register. Radio unit must be Neptune wall mount “MIU”, wire from register to wall unit must be 3-wire. Readout located outside on the side of the house closest to the driveway. Meter Remote wiring must have water proof connections.

Commercial Meters and meters larger than 2 inches are required to be a Neptune TruFlo Compound meter with ProRead AutoDetect with Remote Readout similar to Residential meters above.

9.2.2 PRESSURE REDUCING VALVE

Watts 25AUB-Z3 with strainer or equal. PRV must be set at no greater than 50 PSI.

9.2.3 BACKFLOW PREVENTION VALVE

Hersey brand, model FRP-II or Febco brand, model 825Y or 860Y for 3/4 inch to 2 inch lines, Hersey brand, model 6CM for 2.5 inches to 10 inches lines.

9.2.4 PLUMBING

See Standard Details W18 & W19 for installation schematic.

STANDARDS FOR FIXTURES, METER, PRV and BACKFLOW INSTALLATION

- All potable and irrigation water services shall be metered.
- Installation of water meters and remotes and maintaining access to them will be the responsibility of the property District. All meters installed will meet the standards as specified by the SWSD.
- All meters, PRV's, and backflow devices shall be installed in the mechanical room, which is required to have a floor drain. The device must be installed in the horizontal position, 12 to 30 inches above the floor and 12 inches away from the wall.
- All meters will be set as close as possible to the point where the service enters the premises.
- Meters shall be protected from freezing.
- All meters will be installed horizontally no more than 36 inches above the floor or work surface with a minimum clearance of 12 inches above the meter.
- The meter shall have a remote reader installed near the front of the home or driveway, at a minimum height of 48 inches above grade and a maximum height of 80 inches or as determined by Water Department personnel.
- Meters 2 inches and larger will be Neptune single register compound meters with bronze flanges using brass nuts and bolts or stainless steel nuts and bolts.
- The meter will be the same size as the domestic service line. A 3/4 inch meter is the smallest meter allowed.
- Toilets are to be 3.5-gallon maximum flush type.
- All faucets are to have aerators in the spigots (water saver type) with a flow capacity of 2.5 gallons per minute.
- Shower heads are to have water savers in them and deliver no greater than 2.5 GPM at 50 PSI.

- END OF SECTION -

SNOWMASS WATER AND SANITATION DISTRICT
CHLORINATION/ BACTERIOLOGICAL
HYDROSTATIC AND LEAKAGE PERFORMANCE SUMMARY

Location/Name of Project:_____
Contractor:_____

PRESSURE AND LEAKAGE TEST

Pipe Material:_____ Pipe Length:_____ft.
PSI Test At:_____ For:_____hrs.
Leakage:_____gal/hr (per 1,000 feet of pipe)
Test Pass/Fail:_____
Test Taken By:_____ Date/Time:_____

DISINFECTION OF WATER LINES

Chlorination Method Used:_____
Chlorine Contact Time:_____ Chlorine Rate:_____mg/l
Flushing Time:_____ Chlorine Residual:_____mg/l
Test Taken By:_____ Date/Time:_____

BACTERIOLOGICAL TEST

Sample Location:_____
Colorado State Test Number:_____
Bacterial Results:_____ Pass/Fail:_____
Taken By (Contractor):_____ Date/Time:_____
SWSD/Engineer Representative:_____
State Laboratory Utilized:_____
Test Certification Received:_____ Date/Time:_____

PROCEDURE:
TEST PRESSURE = 1.5 x WORKING PRESSURE (MIN. 150 PSI)
TEST DURATION = 2 HOURS
ALLOWABLE PRESSURE LOSS = 5 PSI

Allowable Leakage in Gallons per Hour per 1000 ft of DIP

Test Pressure PSI	Pipe Size (inches) 6	8	10	12	14	16	18
150	0.50	0.66	0.83	0.99	1.16	1.32	1.49
175	0.54	0.72	0.89	1.07	1.25	1.43	1.61
200	0.57	0.76	0.96	1.15	1.34	1.53	1.72
225	0.61	0.81	1.01	1.22	1.42	1.62	1.82
250	0.64	0.85	1.07	1.28	1.50	1.71	1.92
275	0.67	0.90	1.12	1.34	1.57	1.79	2.02
300	0.70	0.94	1.17	1.40	1.64	1.87	2.11

Snowmass Water & Sanitation District

Sanitary Sewer Manhole Leakage Test

Project:	________	Date:	________
Developer:	________	Location:	________
Contractor:	________		________

Vacuum Test Method

Manhole Designation:	________	**Results (circle one)**		**Pass**	**Fail**
Manhole Diameter:	ft.	Allowable Loss:	1 inch HG		
Time Started:	________	Test Vacumm Start:	________ in Hg		
Time Complete:	________	Test Vacumm Finish:	________ in Hg		
Test Duration:	________	Vacumm Loss:	________ in Hg		

Vacuum Test Method

Manhole Designation:	________	**Results (circle one)**		**Pass**	**Fail**
Manhole Diameter:	ft.	Allowable Loss:	1 inch HG		
Time Started:	________	Test Vacumm Start:	________ in Hg		
Time Complete:	________	Test Vacumm Finish:	________ in Hg		
Test Duration:	________	Vacumm Loss:	________ in Hg		

Vacuum Test Method

Manhole Designation:	________	**Results (circle one)**		**Pass**	**Fail**
Manhole Diameter:	ft.	Allowable Loss:	1 inch HG		
Time Started:	________	Test Vacumm Start:	________ in Hg		
Time Complete:	________	Test Vacumm Finish:	________ in Hg		
Test Duration:	________	Vacumm Loss:	________ in Hg		

Vacuum Test Method

Manhole Designation:	________	**Results (circle one)**		**Pass**	**Fail**
Manhole Diameter:	ft.	Allowable Loss:	1 inch HG		
Time Started:	________	Test Vacumm Start:	________ in Hg		
Time Complete:	________	Test Vacumm Finish:	________ in Hg		
Test Duration:	________	Vacumm Loss:	________ in Hg		

Vacuum Test Method

Criteria:	Time (sec)	Criteria
4 Ft MH		
0 - 10 Ft	60	Test starts at 10 inch HG
10 - 15 Ft	75	Allowable loss is 1 inch HG
15 - 20 Ft	90	

Comments: ________________________________

____

Owner/Engineer: ________________ **Contractor:** ________________