

# Water and Wastewater System Standard Specifications



Adopted  
October 2007

Revised  
August 2011  
September 2014  
January 2019  
July 2020  
July 2022  
July 2025  
July 2026

# **Water and Wastewater System Standard Specifications**

## **Widefield Water and Sanitation District**

8495 Fontaine Blvd  
Colorado Springs, CO 80925

Phone (719) 390-7111

**Adopted October 2, 2007**

### **Revisions:**

**September 2008**

**July 2009**

**August 2011**

**September 2014**

**January 2019**

**July 2020**

**July 2021**

**July 2022**

**July 2023**

**July 2025**

**July 2026**

## **TABLE OF CONTENTS**

| <b><u>Section 1.0 General Standards</u></b>                             | <b><u>Page</u></b> |
|-------------------------------------------------------------------------|--------------------|
| <b>1.1 Purpose</b>                                                      | <b>1</b>           |
| <b>1.2 Revisions, Amendments, or Additions</b>                          | <b>1</b>           |
| <b>1.3 Effect of Specifications</b>                                     | <b>1</b>           |
| <b>1.4 Authority</b>                                                    | <b>1</b>           |
| <b>1.5 Interpretation of Specifications</b>                             | <b>1</b>           |
| <b>1.6 Definitions</b>                                                  | <b>1</b>           |
| <b>1.7 Abbreviations</b>                                                | <b>2</b>           |
| <b>1.8 Reference Specifications</b>                                     | <b>3</b>           |
| <b>1.9 Requirements to Extend, Construct, or Modify System</b>          | <b>3</b>           |
| 1.9.1 Request for Development Information                               |                    |
| 1.9.2 Preliminary Review for Large Projects                             |                    |
| 1.9.3 Request for Recovery Contract                                     |                    |
| 1.9.4 Plan Format, Submission, Review and As-builts                     |                    |
| 1.9.5 Pre-construction Conference                                       |                    |
| <b>1.10 Construction Matters</b>                                        | <b>7</b>           |
| 1.10.1 Conflicts Between Plans and Specifications                       |                    |
| 1.10.2 Construction Procedure                                           |                    |
| 1.10.3 Surveying                                                        |                    |
| 1.10.4 Placing Survey lines                                             |                    |
| 1.10.5 Inspection                                                       |                    |
| 1.10.6 Abandonments, Material Recovery, and Reuse of Installed Material |                    |
| 1.10.7 Warranty and Acceptance                                          |                    |
| <br><b><u>Section 2.0 Water System Line Design Standards</u></b>        |                    |
| <b>2.1 General</b>                                                      | <b>11</b>          |
| 2.1.1 Deviation from Standard                                           |                    |
| 2.1.2 Easements                                                         |                    |
| 2.1.3 Colorado Department of Health Regulations                         |                    |
| <b>2.2 Hydraulics</b>                                                   | <b>11</b>          |
| 2.2.1 Sizing of Water Mains                                             |                    |
| 2.2.2 Sizing of Services                                                |                    |
| <b>2.3 Water Mains</b>                                                  | <b>12</b>          |
| 2.3.1 Locations                                                         |                    |
| 2.3.2 Material                                                          |                    |
| 2.3.3 Corrosion Protection                                              |                    |
| 2.3.4 Profile                                                           |                    |
| 2.3.5 Looping                                                           |                    |
| <b>2.4 Valving</b>                                                      | <b>12</b>          |
| 2.4.1 Location                                                          |                    |
| <b>2.5 Appurtenances</b>                                                | <b>13</b>          |
| 2.5.1 Blow-off Valves                                                   |                    |
| 2.5.2 Air Release Valves                                                |                    |
| 2.5.3 Pressure Reducing and Regulating Valves                           |                    |
| 2.5.4 Fire Hydrants                                                     |                    |
| <b>2.6 Separation from Pollution Sources</b>                            | <b>13</b>          |
| <b>2.7 Casing</b>                                                       | <b>13</b>          |
| <b>2.8 Fire Lines</b>                                                   | <b>13</b>          |

|            |                             |           |
|------------|-----------------------------|-----------|
| <b>2.9</b> | <b>Water Main Crossings</b> | <b>14</b> |
| 2.9.1      | Asbestos Cement Water Mains |           |
| 2.9.2      | Irrigation Ditch Crossings  |           |
| 2.9.3      | Final Inspection            |           |

### **Section 3.0 Water System Installation Standards**

|             |                                                       |           |
|-------------|-------------------------------------------------------|-----------|
| <b>3.1</b>  | <b>General Construction</b>                           | <b>15</b> |
| 3.1.1       | Start of Construction                                 |           |
| 3.1.2       | Protection of Existing Underground Facilities         |           |
| 3.1.3       | Detours – Traffic Control                             |           |
| <b>3.2</b>  | <b>Excavation</b>                                     | <b>15</b> |
| 3.2.1       | Safety                                                |           |
| 3.2.2       | Construction Stakes                                   |           |
| 3.2.3       | Trench Width                                          |           |
| 3.2.4       | Over Excavation                                       |           |
| 3.2.5       | Blasting                                              |           |
| 3.2.6       | Sheeting and Bracing                                  |           |
| <b>3.3</b>  | <b>Pipe Bedding and Laying</b>                        | <b>17</b> |
| 3.3.1       | Imported Bedding Material                             |           |
| 3.3.2       | Laying of Pipe                                        |           |
| 3.3.3       | Length of Pipe                                        |           |
| 3.3.4       | Fittings                                              |           |
| 3.3.5       | Service Connections                                   |           |
| 3.3.6       | Water Sampling Stations                               |           |
| <b>3.4</b>  | <b>Backfill and Compaction</b>                        | <b>22</b> |
| <b>3.5</b>  | <b>Valve Installation</b>                             | <b>23</b> |
| 3.5.1       | Valves                                                |           |
| 3.5.2       | Valve Boxes                                           |           |
| <b>3.6</b>  | <b>Fire Hydrant Installation</b>                      | <b>24</b> |
| 3.6.1       | Installation                                          |           |
| 3.6.2       | Anchorage                                             |           |
| 3.6.3       | Drainage                                              |           |
| 3.6.4       | Hydrant Protection in Corrosive Soils                 |           |
| <b>3.7</b>  | <b>Blow-off Installation</b>                          | <b>25</b> |
| <b>3.8</b>  | <b>Air Release Valve Installation</b>                 | <b>25</b> |
| <b>3.9</b>  | <b>Pressure Reducing Valve Installation</b>           | <b>25</b> |
| <b>3.10</b> | <b>Disinfection</b>                                   | <b>25</b> |
| <b>3.11</b> | <b>Hydrostatic Testing</b>                            | <b>26</b> |
| 3.11.1      | General                                               |           |
| 3.11.2      | Procedure                                             |           |
| 3.11.3      | Allowable Leakage                                     |           |
| <b>3.12</b> | <b>Water Meter Installation</b>                       | <b>28</b> |
| 3.12.1      | General                                               |           |
| 3.12.2      | Inside Water Meter Installation                       |           |
| 3.12.3      | Water Meter Pit Installation (Other than Residential) |           |
| 3.12.4      | Combined Domestic and Fire Line Water Meters          |           |
| <b>3.13</b> | <b>Service Lines</b>                                  | <b>30</b> |
| 3.13.1      | General                                               |           |
| 3.13.2      | Service Lines                                         |           |

## **Section 4.0 Water System Material Standards**

|             |                                              |           |
|-------------|----------------------------------------------|-----------|
| <b>4.1</b>  | <b>Material Specification General</b>        | <b>33</b> |
| <b>4.2</b>  | <b>Pipe</b>                                  | <b>33</b> |
| 4.2.1       | Polyvinyl Chloride (PVC) Pipe                |           |
| 4.2.2       | Ductile Iron Pipe                            |           |
| 4.2.3       | Steel Pipe Fabrication                       |           |
| <b>4.3</b>  | <b>Cathodic Protection</b>                   | <b>34</b> |
| <b>4.4</b>  | <b>Valves</b>                                | <b>34</b> |
| 4.4.1       | Twelve-Inch (12”) Diameter and Smaller       |           |
| 4.4.2       | Fourteen-Inch (14”) Diameter and Larger      |           |
| <b>4.5</b>  | <b>Fire Hydrants</b>                         | <b>35</b> |
| 4.5.1       | General                                      |           |
| 4.5.2       | Acceptable Manufacturers                     |           |
| 4.5.3       | Size of Hydrant                              |           |
| 4.5.4       | Type of Hydrant                              |           |
| 4.5.5       | Inlet Connection                             |           |
| 4.5.6       | Main Valve Assembly                          |           |
| 4.5.7       | Operating Shaft Nut                          |           |
| 4.5.8       | Pumper Nozzle and Cap                        |           |
| 4.5.9       | Hose Nozzles and Cap                         |           |
| 4.5.10      | Color                                        |           |
| 4.5.11      | Location                                     |           |
| <b>4.6</b>  | <b>Pressure Reducing Valves</b>              | <b>36</b> |
| <b>4.7</b>  | <b>Air Release Valves</b>                    | <b>37</b> |
| <b>4.8</b>  | <b>Thrust Blocks</b>                         | <b>37</b> |
| <b>4.9</b>  | <b>Pre-Cast Concrete Vaults and Manholes</b> | <b>37</b> |
| <b>4.10</b> | <b>Services</b>                              | <b>37</b> |
| 4.10.1      | Service Lines                                |           |
| 4.10.2      | Corporation Stops and Curb Stops (or valves) |           |
| 4.10.3      | Meters                                       |           |
| 4.10.4      | Backflow Preventers                          |           |
| 4.10.5      | Water Sampling Stations                      |           |

## **Section 5.0 Wastewater System Design Standards**

|             |                                         |           |
|-------------|-----------------------------------------|-----------|
| <b>5.1</b>  | <b>Quality of the Collection System</b> | <b>41</b> |
| <b>5.2</b>  | <b>Sizing of Collection Mains</b>       | <b>41</b> |
| <b>5.3</b>  | <b>Layout of the Collection System</b>  | <b>41</b> |
| 5.3.1       | Sewer Service Lin                       |           |
| <b>5.4</b>  | <b>Manholes</b>                         | <b>41</b> |
| 5.4.1       | Manhole Sizes                           |           |
| 5.4.2       | Changing Pipe Size                      |           |
| 5.4.3       | Intersection                            |           |
| 5.4.4       | Manhole Channels                        |           |
| 5.4.5       | Manhole Ring and Cover                  |           |
| 5.4.6       | Drop Manholes                           |           |
| <b>5.5</b>  | <b>Minimum Sewer Depth</b>              | <b>42</b> |
| <b>5.6</b>  | <b>Slopes</b>                           | <b>42</b> |
| <b>5.7</b>  | <b>Construction Tolerances</b>          | <b>43</b> |
| <b>5.8</b>  | <b>High Velocity Protection</b>         | <b>43</b> |
| <b>5.9</b>  | <b>Relation to Water Mains</b>          | <b>43</b> |
| <b>5.10</b> | <b>Stub-outs From Manholes</b>          | <b>44</b> |

|             |                                              |           |
|-------------|----------------------------------------------|-----------|
| <b>5.11</b> | <b>Inverted Siphons</b>                      | <b>44</b> |
| <b>5.12</b> | <b>Stream and Drainage Channel Crossings</b> | <b>44</b> |
| <b>5.13</b> | <b>Crossing Under Railways and Highways</b>  | <b>44</b> |
| <b>5.14</b> | <b>Arial Crossings</b>                       | <b>44</b> |
| <b>5.15</b> | <b>Metering Manholes</b>                     | <b>44</b> |
| <b>5.16</b> | <b>Pumping Facilities</b>                    | <b>45</b> |
| <b>5.17</b> | <b>Force Mains</b>                           | <b>46</b> |
| <b>5.18</b> | <b>Swimming Pools</b>                        | <b>46</b> |

### **Section 6.0 Wastewater System Excavation and Site Standards**

|             |                                            |           |
|-------------|--------------------------------------------|-----------|
| <b>6.1</b>  | <b>Earthwork Defined</b>                   | <b>49</b> |
| <b>6.2</b>  | <b>Traffic Control</b>                     | <b>49</b> |
| <b>6.3</b>  | <b>Caution in Excavation</b>               | <b>49</b> |
| <b>6.4</b>  | <b>Excavation to Line and Grade</b>        | <b>49</b> |
| <b>6.5</b>  | <b>Trenching and Excavation Operations</b> | <b>49</b> |
| <b>6.6</b>  | <b>Blasting</b>                            | <b>50</b> |
| <b>6.7</b>  | <b>Dewatering</b>                          | <b>51</b> |
| <b>6.8</b>  | <b>Pipe Bedding</b>                        | <b>51</b> |
| <b>6.9</b>  | <b>Backfill and Compaction</b>             | <b>53</b> |
| <b>6.10</b> | <b>Cleanup</b>                             | <b>53</b> |
| <b>6.11</b> | <b>Surface Restoration and Maintenance</b> | <b>53</b> |

### **Section 7.0 Wastewater System Pipe Laying Standards**

|             |                                                        |           |
|-------------|--------------------------------------------------------|-----------|
| <b>7.1</b>  | <b>Handling of Materials</b>                           | <b>55</b> |
| <b>7.2</b>  | <b>Inspection and Preparation of Pipe and Fittings</b> | <b>55</b> |
| <b>7.3</b>  | <b>Cutting and Fitting of Pipe</b>                     | <b>55</b> |
|             | 7.3.1 Pipe Joint Lubrication                           |           |
|             | 7.3.2 Pipe Alignment and Grade                         |           |
|             | 7.3.3 Temporary Bulkheads                              |           |
|             | 7.3.4 Frost                                            |           |
|             | 7.3.5 Lowering of Material into the Trench             |           |
| <b>7.4</b>  | <b>Laying of Pipe</b>                                  | <b>56</b> |
| <b>7.5</b>  | <b>Ductile Iron Pipe</b>                               | <b>57</b> |
| <b>7.6</b>  | <b>Polyvinyl Chloride Pipe</b>                         | <b>57</b> |
| <b>7.7</b>  | <b>Tracer Wire for Wastewater Mains</b>                | <b>58</b> |
| <b>7.8</b>  | <b>Manholes</b>                                        | <b>58</b> |
| <b>7.9</b>  | <b>Bridging and Encasement of Pipe</b>                 | <b>59</b> |
| <b>7.10</b> | <b>Encasement or Sleeve Pipe</b>                       | <b>59</b> |
| <b>7.11</b> | <b>Corrosion Protection Systems</b>                    | <b>59</b> |
| <b>7.12</b> | <b>Cleaning</b>                                        | <b>61</b> |
| <b>7.13</b> | <b>Compaction Tests</b>                                | <b>61</b> |
| <b>7.14</b> | <b>Infiltration and Exfiltration Tests</b>             | <b>61</b> |
| <b>7.15</b> | <b>Deflection Test</b>                                 | <b>62</b> |
| <b>7.16</b> | <b>CCTV Inspection</b>                                 | <b>62</b> |
| <b>7.17</b> | <b>Vacuum Testing for Concrete Sewer Manholes</b>      | <b>63</b> |
| <b>7.18</b> | <b>Manhole Rim Elevations</b>                          | <b>64</b> |
| <b>7.19</b> | <b>Sewer Service Lines and Inspection</b>              | <b>65</b> |

### **Section 8.0 Wastewater Services Standards**

|            |                        |           |
|------------|------------------------|-----------|
| <b>8.1</b> | <b>Wastewater Taps</b> | <b>67</b> |
|------------|------------------------|-----------|

|             |                                                         |           |
|-------------|---------------------------------------------------------|-----------|
| <b>8.2</b>  | <b>Excavations</b>                                      | <b>67</b> |
| <b>8.3</b>  | <b>Abandoning Existing Connections</b>                  | <b>67</b> |
| <b>8.4</b>  | <b>Individual Service Pumps</b>                         | <b>67</b> |
| <b>8.5</b>  | <b>Wastewater Service Line Ditches</b>                  | <b>67</b> |
| <b>8.6</b>  | <b>Inline Wye</b>                                       | <b>67</b> |
| <b>8.7</b>  | <b>Installation Method</b>                              | <b>67</b> |
| <b>8.8</b>  | <b>Slope</b>                                            | <b>67</b> |
| <b>8.9</b>  | <b>Alignment</b>                                        | <b>67</b> |
| <b>8.10</b> | <b>Cleanouts</b>                                        | <b>68</b> |
| <b>8.11</b> | <b>Connecting Clamps</b>                                | <b>68</b> |
| <b>8.12</b> | <b>Repair and Replacement of Existing Service Lines</b> | <b>68</b> |
|             | 8.12.1 Responsibility                                   |           |
|             | 8.12.2 Surface Restoration and Maintenance              |           |

### **Section 9.0 Wastewater System Materials Standards**

|            |                                                     |           |
|------------|-----------------------------------------------------|-----------|
| <b>9.1</b> | <b>Polyvinyl Chloride (PVC) Pipe</b>                | <b>71</b> |
| <b>9.2</b> | <b>Ductile Iron Pipe</b>                            | <b>71</b> |
| <b>9.3</b> | <b>HDPE Pipe</b>                                    | <b>72</b> |
| <b>9.4</b> | <b>Polyethylene Encasement Material</b>             | <b>72</b> |
| <b>9.5</b> | <b>Concrete</b>                                     | <b>73</b> |
| <b>9.6</b> | <b>Concrete Reinforcement</b>                       | <b>74</b> |
| <b>9.7</b> | <b>Precast Reinforced Concrete Manhole Sections</b> | <b>74</b> |
| <b>9.8</b> | <b>24-Inch Diameter Manhole Ring and Cover</b>      | <b>74</b> |

### **Appendices**

Appendix A - Request for Deviation Form  
Appendix B - District Signature Blocks  
Appendix C - WWSD General Notes  
Appendix D - Grease Interceptor Standards  
Appendix E – Mercury Source Control Policy  
Appendix F- Underdrain Policy

## **Standard Drawings**

### **Water**

| <b><u>No.</u></b> | <b><u>Title</u></b>                                                      |
|-------------------|--------------------------------------------------------------------------|
| W-1               | Fire Hydrant Locations                                                   |
| W-2               | Fire Hydrant Installation                                                |
| W-3               | Fire Hydrant Specifications                                              |
| W-4               | Valve Installation and Location                                          |
| W-5               | Valve Box Installation                                                   |
| W-6               | Polyethylene Wrap                                                        |
| W-7               | Bonding Joint and Anode Installation                                     |
| W-8               | Insulator Installation                                                   |
| W-9               | Tracer Wire Installation Details                                         |
| W-10              | Thrust Block Data                                                        |
| W-11              | Thrust Blocks Required for Taps                                          |
| W-12              | Typical Trench Cross Section                                             |
| W-13              | Maximum Pipeline Deflection Data                                         |
| W-14              | Pipe Cutting                                                             |
| W-15              | Reverse Anchor Detail                                                    |
| W-16              | Water Line Lowering Detail                                               |
| W-17              | Pipe Bridging Detail                                                     |
| W-18              | Temporary and Permanent Blow-Off Assemblies for 6" and 8" Mains          |
| W-19              | Temporary and Permanent Blow-Off Assemblies for 12" and Larger           |
| W-20              | Blow-Off Assembly Dimension Data for 12-inch or Larger                   |
| W-21              | Pipe Tapping Detail                                                      |
| W-22              | Cul-de-Sac Blow Off Detail                                               |
| W-23              | Flange - Lug Detail                                                      |
| W-24              | Applications for Mechanical Joint Restraints                             |
| W-25              | Restrained M.J. Pipe Length Data                                         |
| W-26              | Pressure Relief Station                                                  |
| W-27              | 8" Size Pressure Regulator Station                                       |
| W-28              | 6" Size Pressure Regulator Station                                       |
| W-29              | Standard Concrete Vault for Valve Installations - Precast                |
| W-30              | Standard Concrete Vault for Valve Installations - Cast-in-Place Concrete |
| W-31              | Protecting Tie-Rods                                                      |
| W-32              | Tapping Detail - 3/4" through 2"                                         |
| W-33              | Typical Installation for Service Line and Stop Box                       |
| W-34              | Typical Service Line Trench - Common Ditch for Water or Sewer            |
| W-35              | Water Meter Loop for 3/4" through 1" Meters                              |
| W-36              | UNUSED                                                                   |
| W-37              | Irrigation Service Installation                                          |
| W-38              | Irrigation Meter Vault Installation                                      |
| W-39              | Air/Relief Vacuum Valve Pit                                              |
| W-40              | 1-1/2" & 2" Indoor Meter Installation                                    |
| W-41              | Service Line Lowering                                                    |
| W-42              | Meter Installation 3" through 10"                                        |
| W-43              | Cast in Place Concrete Vault 8" & 10" Meters                             |
| W44               | Cast in Place Meter Vault Lid                                            |
| W45               | Cast in Place Vault for Meters 3" through 6"                             |
| W46               | Typical Non-Single-Family Outdoor Backflow Assembly                      |
| W47               | Removable Backflow Prevention for Irrigation Systems                     |

## **Wastewater**

| <b><u>No.</u></b> | <b><u>Title</u></b>                                 |
|-------------------|-----------------------------------------------------|
| WW-1              | Pipe Bedding                                        |
| WW-2              | Typical Trench Cross Section                        |
| WW-3              | Precast Manhole                                     |
| WW-4              | Sanitary Sewer Manhole                              |
| WW-5              | Manhole Ring and Cover Adjustment                   |
| WW-6              | Sanitary Sewer Main Clean-out                       |
| WW-7              | Sanitary Sewer Service Connection                   |
| WW-8              | Typical Utilities Location                          |
| WW-9              | Pipe Bridging                                       |
| WW-10             | Shallow Sanitary Sewer Line Protection / Encasement |
| WW-11             | Pipe Cutting                                        |
| WW-12             | Polyethylene Pipe Wrap                              |
| WW-13             | Bonding Joint & Anode Installation                  |
| WW-14             | Maximum Pipeline Deflection Data                    |
| WW-15             | Grease Interceptor                                  |
| WW-16             | Sand / Oil Separator                                |
| WW-17             | Grease Separator = 250 lbs.                         |
| WW-18             | Grease Separator = 500 lbs.                         |
| WW-19             | Kor-N-Seal Boot Detail                              |
| WW-20             | Utility Separation for Parallel Utilities           |
| WW-21             | General Placement of Underdrain - Joint Trench      |
| WW-22             | Standard Ring and Cover                             |
| WW-23             | Tracer Wire                                         |





## **Section 1.0 General Standards**

- 1.1 Purpose** These Widefield Water and Sanitation Water System Standard Specifications (the "Specifications"), as they may be amended from time to time, are to provide guidance to Developers, Engineers, Contractors, Builders and other interested parties with respect to the design and construction of water and wastewater system improvements within the District's Service Area. These Specifications contain technical data for the design and specifications for the installation of the Water and Wastewater Systems within the District and its Service Area.

The purpose of these Specifications is to assure consistency in the design, and quality and uniformity in the installation of Water Mains, Wastewater Lines, and appurtenances within the District and its Service Area.

- 1.2 Revisions, Amendments or Additions** These Specifications may be revised, amended or added to as deemed prudent, in the sole discretion of the District. If a vendor or engineer wishes to submit a product or method of installation not covered by these Specifications he may do so by filling out a "Request for Deviation Form" included in the Appendices and submitting it to the District Manager with the back-up information required.

It is the goal of the District to review and approve water system plans and materials in the light of community values. Value engineering that can be shown to benefit the Developer, the District, rate payers, and future users of the system will be considered.

- 1.3 Effect of Specifications** These Specifications including any revisions amendments or additions shall be binding and in effect immediately upon adoption by the District Board of Directors. All parties using this document are responsible for determining that they have the most recent changes by contacting the District Manager. These specifications are made a part of and incorporated into the District's Rules and Regulations.

- 1.4 Authority** These Specifications are implemented by the District Manager, under the authority of the District's Board of Directors.

- 1.5 Interpretation of Specifications** These Specifications are composed of criteria for engineering design, District procedures and policies, construction and material specifications, and standard drawings. The interpretation of any section or the contradiction between sections, when applicable, shall be made by the District. Requests for interpretation shall be submitted in writing to the District Manager. The interpretation issued by the District shall be binding and controlling in its application.

- 1.6 Definitions** In addition to the definitions provided in the District's Rules and Regulations, the meaning of the terms used herein shall be as follows:

- a. Conditional Acceptance – Shall occur upon recommendation by the District Engineer and concurrence by the respective Operations Director for conditional acceptance of the Water Mains and/or Wastewater Lines, and upon provision to the District of all appropriate easements for the maintenance and operation of such facilities, payment of all fees and charges due hereunder, submission of As-Built Drawings, statement of costs, completion of an appropriate bill of sale dated subsequent to the expiration of the 24 month warranty period, and compliance with any other applicable requirements contained herein, the District shall conditionally accept the systems.

- b. Collection Main – Shall mean a twelve-inch (12") or smaller diameter pipe and appurtenances receiving wastewater being a part of the Wastewater System.
- c. Consulting Engineer – Shall mean the Developer's authorized utility design engineer.
- d. Contractor – Shall mean any person, firm or corporation authorized by the District to perform work and to furnish materials within the District.
- e. Developer – Shall mean any person, corporation, partnership, joint venture, local governmental entity or other entity.
- f. Distribution Main – Shall mean a ten-inch (10") or smaller diameter pipe and appurtenances receiving potable water and conveying it to individual Service Lines.
- g. Extensions – Shall mean District Wastewater and Water System extensions within the Service Area of the District shall further be defined as "District Mains" and "Private Mains".
- h. Inspector – Shall mean the person(s) duly authorized by the District to enforce these Specifications.
- i. Interceptor Main – Shall mean a wastewater pipeline larger than twelve-inch (12") and appurtenances receiving wastewater being a part of the Wastewater System. Interceptor Mains are not allowed to be tapped with individual services.
- j. Service Lines (Water) – Shall mean the pipe, line or conduit from the Water Main to an individual house or other structure.
- k. Service Line (Sewer) – Shall mean the Wastewater line extending from the premises up to and including the connection to the public Wastewater Main.
- l. Service Stub (Sewer) – Shall mean the Wastewater Service Line from the Main to a point inside the property.
- m. Transmission Main – Shall mean a twelve-inch (12") or larger diameter pipe and appurtenances receiving potable water and conveying it to Distribution Mains.
- n. Water Main or Main – Shall mean any water pipe, line or portion thereof, owned or to be transferred for ownership by the District.
- o. Water System – Shall mean all Mains, together with all appurtenances, materials, equipment and property receiving potable water and conveying it to individual consumers
- p. Wastewater System – Shall mean mains, together with all appurtenant and necessary manholes, services, taps, pump stations, and associated materials, property and equipment collecting wastewater from individual customers.

## **1.7 Abbreviations**

- a. ANSI - American National Standards Institute
- b. ARV - Air Release Vacuum Breaker Valve

- c. ASTM - American Society for Testing and Materials
- d. AWWA - American Water Works Association
- e. DIP - Ductile Iron Pipe
- f. GPM - Gallons per Minute
- g. PRV - Pressure Reducing and Regulating Valve
- h. PSIG - Pounds per Square Inch, Gauge
- i. PSI - Pounds per Square Inch
- j. PVC - Polyvinyl Chloride
- k. WWSD - Widefield Water and Sanitation District

**1.8 Reference Specifications** These standard specifications, listed below, shall be incorporated into these Specifications bound herein. Should a conflict arise between these specifications a written request for clarification shall be made to the District.

- a. Colorado Department of Transportation Standard Specification for Road and Bridge Construction, 2011.
- b. Manual of Uniform Traffic Control Devices for Streets and Highways, U.S. Department of Transportation, Latest Edition and Revisions Thereto.
- c. A.S.T.M., American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.
- d. A.W.W.A., American Water Works Association, 6666 West Quincy Ave., Denver, CO 80235.
- e. Site Application Process, The Code of Colorado Regulations 19CR6,6-96.
- f. Plumbing Code 2015 of Colorado.

## **1.9 Requirements to Extend, Construct, or Modify System**

### **1.9.1 Request for Development Information**

- a. Development information may be obtained at the offices of Widefield Water and Sanitation District, located at 8495 Fontaine Boulevard, Colorado Springs, Colorado 80925, between the hours of 8:00 a.m. and 4:00 p.m. on weekdays - holidays excluded, or by written request directed to the District Manager.
- b. Questions concerning these Specifications may be directed to the District via telephone or through a pre-arranged meeting between the hours of 8:00 a.m. and 4:00 p.m., weekdays and holidays excluded, or by written request directed to the District Manager.

- 1.9.2 Preliminary Review for Large Projects** The District shall establish, and may amend from time to time, procedures to be followed by applicants for extensions of District Mains or Private Mains. These procedures shall include all requirements for paperwork, submittals, engineering design, construction and acceptance.

Where a project is large scale, a preliminary submittal shall be made by the applicant, including an overall or master plan showing the area to be developed and any other adjoining proposed developments by the Owner/Developer. Large or difficult areas may require extensive study and analysis. The District will return to the applicant its requirements for:

- a. Points of connection to existing facilities
- b. Off-site Facilities required
- c. General locations of mains to be installed
- d. Size of Mains required

- 1.9.3 Request for Recovery Contract** If, in the sole opinion of the District, an increase in line size is necessary in order to provide an acceptable level of service to the Developer parcel or other Customers within the District, the Developer may be required to provide oversized pipelines and/or facilities. The cost for the "oversizing" of such pipelines and/or facilities shall be borne solely by the Developer. The basis for such costs shall be the difference in unit prices between the maximum line size which is the Developer's responsibility and the actual size to be constructed. The cost for the design and preparation of contract documents for these "oversized" pipelines shall be the sole responsibility of the Developer. If the District determines that it will construct the facilities, the Developer shall submit payment for the cost. The District will not issue a notice of award until such payment has been made. The District may collect fees or charges in the sole discretion of the Board from other Customers served by the "oversized" facilities and may, in the sole discretion of the Board, reimburse the Developer for all or a portion of the oversizing costs incurred by the Developer.

A request for recovery shall include:

- a. Contract holders name and address
- b. Proof of payment to contractors, engineer, attorney, construction director, etc.
- c. Easements granted
- d. Permits issued
- e. Conditional acceptance
- f. Bill of sale
- g. Map of Service Area, and
- h. Detailed cost summary

For a complete list of the required items and policy details refer to the recovery agreement policy, refer to the District Rules and Regulations.

#### **1.9.4 Plan Format, Submission, Review and As-Builts**

- a. The Developer or the Consulting Engineer shall submit, to the District, two (2) sets of design drawings for review. Construction of any portion of system improvements shall not begin until design drawings have been approved by the District's Engineer. A set of approved drawings and a copy of these specifications shall be available at the job site while system improvements are under construction. Subsequent to initial approval, any design changes shall also be submitted to the District for review and approval.

Where any easements are required other than those being platted, legal descriptions should be submitted to the District Engineer for review. Legal descriptions shall also include a sketch outlining the boundaries. The Developer/Owner shall provide an updated commitment for title insurance, prepared by a title company approved by the District, in accordance with the District Rules and Regulations.

- b. Drawings shall be twenty-four inches by thirty-six inches (24" X 36") overall. North shall be to top or right of sheet. Scale shall be one-inch equals fifty feet (1"=50') horizontal, one-inch equals five feet (1"=5') vertical. The cover sheet shall show the location map and proposed system plan indicating street names, pipe sizes, valves, fire hydrants, manholes, and all appurtenances. System shall also indicate the development name, name and address of the Developer, and the Consulting Engineer with Colorado P.E. seal and an index of sheets. After approval by the District, half size reproductions may be used for general purposes or in the field.

Drawings must contain both plan and profile of all lines. Drawings shall include adequate design information to include all lowering's, adjacent facilities (including but not limited to drainage facilities, grading, and other utility crossings). Drawings must include District General Notes (included in the Appendix), District signature blocks, manholes, crossings and all appurtenances. A utility plan shall show the location of all services.

Other elements of drawings must include the following:

1. Proposed plat showing location and dimensions of dedicated streets, alleys, rights-of-way and easements
2. Lots and blocks
3. All existing and proposed curb, gutter and pedestrian ramps
4. Sidewalk locations with respect to property lines
5. All existing or proposed utilities which cross or may conflict with District installations to include size, type and horizontal and vertical location
6. All existing or proposed obstructions such as vaults, catch basins, traffic islands, etc.

7. Drawings must be made from actual field surveys referenced to land corners or other survey control points and be of sufficient accuracy so that the facilities can be accurately staked for installation and can be readily located after installation for maintenance and operation. All elevations shall be N.G.V.D. '83
  8. Show sufficient adjacent area to give the relation of new facilities to existing facilities
  9. Proposed grading and drainage facility plans
- c. Two (2) complete sets of drawings and any special project conditions shall be submitted to the District for review. Normal review time will be two (2) weeks. Drawings are reviewed by both engineering and operations. One (1) marked set of the submittals will be returned to the applicant. If desired, a review conference may be scheduled. When revisions are required, two (2) sets of revised drawings shall be resubmitted to the District for subsequent review. When acceptable, the District Engineer will approve drawings, said approval indicating conformity with the Specifications and the District's Rules and Regulations, and return one approved set of the submittal. After approval and signature, four (4) sets of fully signed documents must be provided to the District. Half size drawings may be substituted in part upon approval. The Consulting Engineer shall also submit the design on CD in AutoCad or an AutoCad convertible format. PDFs will not be accepted.
  - d. Prior to any construction, the Contractor must schedule a pre-construction meeting with the District's Engineer. The pre-construction meeting must occur a minimum of seventy-two hours in advance of commencing work. See Section 1.9.5 herein regarding Pre-Construction Meetings.
  - e. Upon completion of construction and before acceptance, one (1) complete set of project as-builts, and a CD in electronic format of the same in AutoCad indicating all changes from original approval shall be submitted to District Engineer. If no changes have been made during construction, the sheet shall so indicate. The as-built Drawing and CD must contain the Consulting Engineer's as-built approval signature.
  - f. Unless construction commences within six (6) months from the date of plan approval, approval shall become null and void.

**1.9.5 Pre-construction Meeting:** Prior to beginning any work on the project, the Developer shall schedule a pre-construction meeting through the Water Operations Manager or District Engineer with at least seventy-two (72) hours' notice to the following:

- a. The Water Operations Managers
- b. The Contractor having on-site authority
- c. A representative of the Owner or Construction Manager;
- d. The consulting Design Engineer and soils/testing Engineer
- e. All existing utilities that will be involved in the project

- f. El Paso County Department of Transportation, or the appropriate City and/or State agency having right-of-way jurisdiction
- g. District Engineer
- h. Any third-party easement holder, if applicable; and
- i. Any other parties required by the District Engineer

## **1.10 Construction Matters**

**1.10.1 Conflicts Between Plans and Specifications:** When a conflict occurs between or within standards, specifications and drawings, a final interpretation shall be made by the District Engineer pursuant to these Specifications, subject to the following criteria:

- a. Addenda and modifications to the drawings and specifications take precedence over the original documents.
- b. Should there be a conflict within the Specifications or on the drawings, the District Engineer shall decide which stipulation will provide the best installation and this decision shall be final.
- c. In the drawings, calculated dimensions shall take precedence over scaled dimensions and noted material over graphic indication.

**1.10.2 Construction Procedure:** Following final approval of the plan(s), the applicant may proceed with construction. In addition to all construction requirements contained in other portions of these Specifications, the applicant and the Contractor shall observe the following:

- a. The applicant shall secure and pay for all licenses and permits required for the system extension;
- b. Materials needed to complete work shall be on hand so that the project may proceed without delay;
- c. Adequate provisions for notification of customers who may suffer outages must be developed. Outages shall be kept to a minimum; and,
- d. Mains and Service Stubs shall be tested to the satisfaction of the Inspector.
- e. All construction water connections will be provided with an approved backflow prevention with a District approved assembly or method.

**1.10.3 Surveying:** Line and grade for Mains and appurtenances shall be established by a professional engineer or by a land surveyor, licensed to practice in the State of Colorado. All work shall be done in a professional manner using the same degree of skill and knowledge customarily employed by other professionals performing the same or similar services in the State of Colorado. Correct alignment and grade staked alignment and elevations by the Inspector do not relieve the design engineer in any manner from the responsibility for field errors. Sufficient lines must be staked to ensure continual work progress. Under no circumstances shall pipe be installed without line and grade stakes set by the developer's engineer or surveyor and approved by the Inspector.

When a District Main is to be installed outside of the public street right-of-way, within an easement or right-of-way dedicated for utility Main installations, the limits of the easement or right-of-way shall be marked with permanent monuments placed by a licensed surveyor and the pipeline route shall be marked with buried pipeline markers when required. The Owner/Developer shall be responsible to provide restoration and landscaping adequate to prevent erosion caused by surface runoff. Landscaping and restoration construction shall be designed in such a manner that minimum future maintenance will be required. A landscaping and restoration design plan shall be submitted with the plan for approval and will be subject to the same guarantee, as described in these Specifications.

**1.10.4 Placing Survey Lines:** Hubs and stakes shall be set on an offset line to mark the location of the centerline of the Main. Centerline hubs and stakes may be used in addition to the offset hubs and stakes; however, they may not be set in place of the offset hubs and stakes. Notations on field stakes shall match approved plan and profile sheets.

Survey points shall be set a maximum distance of twenty-five feet (25') apart. All appurtenances and manholes shall be staked for location and grade. Points of curvature, points of tangency of curves, and points on the curve shall be staked. Property corner stakes or monuments shall be placed prior to construction and shall include all changes in direction and not exceed 100 feet between on-line stakes. This will include all permanent easements as well as interior property lines. All stakes shall be flagged to increase their visibility. Survey staking may be modified with the agreement of the design engineer, Contractor and the District.

#### **1.10.5 Inspection**

- a. New installation, replacement or relocation of existing facilities or any other work involving the District System shall be inspected and approved by an Inspector.
- b. After receipt of plans approved by the District, the Contractor shall give at least forty-eight (48) business hours' notice to the District's Inspector, telephone (719) 390-7111, prior to beginning construction. No construction shall commence sooner than forty-eight (48) business hours after receipt of approved plans, nor shall construction begin prior to arrival of a District Inspector at the project site. **All overtime work conducted before or after regular business hours or on District holidays shall be coordinated with the Inspector forty-eight (48) hours in advance.**
- c. All materials used shall be subject to the inspection and approval of the Inspector at all times. The Inspector has the right to perform any testing deemed necessary to ensure compliance of the materials with these Specifications. No materials shall be used before being inspected or approved by the Inspector. Failure or neglect on the part of the Inspector to condemn or reject inferior materials or work shall not be construed to imply their acceptance should their inferiority become evident at any time prior to completion of a twenty-four (24) month warranty period. Materials rejected by the Inspector shall be immediately removed from the project site.

#### **1.10.6 Abandonments, Material Recovery, and Reuse of Installed Materials**

- a. Abandonment/Material Recovery: The District owns all existing parts of the water and wastewater system and any removed pipe, equipment, and or other materials can be claimed as property of the District. If and when materials and/or equipment must be removed from the existing system, the Inspector will determine if the

District wishes to maintain ownership. Generally, pipe materials are not retained. However, valves, fittings, special equipment, manhole rings and covers will often be reclaimed by the District. If and when so directed by the Inspector, such items removed shall be delivered to the District shop at 480 Willow Springs Road. If the Inspector elects not to claim any removed items, they may become the property of the Contractor who must remove the items from the site.

b. Reuse of Installed Materials:

Used sewer pipe and manholes may not be re-installed and/or re-used. Water pipe that has been installed and used cannot generally be re-used except in unusual circumstances and only by permission of the Inspector. If and when water pipe is allowed to be re-used, the Inspector must review and approve each piece of pipe prior to re-installation. Gaskets must be replaced with new gaskets.

If an Inspector approves the reuse of any fitting, hydrant, and or valve, that unit must be examined and approved by the Inspector as well. All gaskets must be replaced with new gaskets.

If an Inspector approves the reuse of any sewer ring and/or cover, that unit must be examined and approved by the Inspector. Any and all Ramnek or sealants must be removed and re-applied with new material.

**1.10.7 Warranty and Acceptance:** The Developer, or the Contractor on behalf of the Developer, shall warrant the constructed facilities for a period of twenty-four (24) months after Conditional Acceptance. Conditional Acceptance will be granted by the District when the following conditions have been met by the Developer to the satisfaction of the District:

- a. The entire water system improvement has been constructed, pressure tested, disinfected, flushed, and the required number of negative standard bacteriological water tests results have been received from the laboratory.
- b. The entire wastewater system improvement has been constructed, pressure tested, vacuum tested, jet cleaned, and TV'd.
- c. All necessary approvals of design on construction, contracts, and agreements have been fully executed and delivered to the District. Lines that are in future rights-of-way, which are not yet recorded, the Owner/Developer must grant an easement to the District for operation and maintenance prior to either Conditional Acceptance or Final Acceptance, **in accordance with the District's Rules and Regulations**. Platting can occur over said easements.
- d. The project statement and certification of costs, and bill of sale, are submitted in tabular form listing pipe sizes and footage for different sizes, appurtenances with quantity and presented to the District.
- e. Record drawings (as-builts) have been presented to the District, in printed hard copy and AutoCAD on CD.
- f. During the warranty period, the Developer, or Contractor on behalf of the Developer, shall repair or correct all deficiencies which become known in a timely manner when notified by the District.

- g. Final acceptance by the District will be by letter at the end of the warranty period provided deficiencies have been corrected or repaired in a manner satisfactory to the District.
- h. If a cost recovery or reimbursement agreement is applicable, it should be executed prior to final acceptance.

## **Section 2.0 Water System Design Standards**

### **2.1 General**

**2.1.1 Deviation from Standard:** These design criteria shall be adhered to for all Water Main facilities to be installed within the District insofar as practical. If any deviation from these criteria is desired, a request must be submitted to the District in writing. See attached Deviation Request in Appendices.

The request will be evaluated, and the decision of the District shall be adhered to for the design of the project.

**2.1.2 Easements:** All public Water Mains and appurtenances not installed in public rights-of-way shall be installed in easements, in accordance with the District's Rules and Regulations. The minimum width of an easement shall be 20 feet (20'). The Water Main shall not be closer than 5 feet (5') to the edge of the easement. Depending on depth, size, and nature of water facilities more easement width may be required. Easements must be conveyed to the District pursuant to the District's form of easement.

**2.1.3 Colorado Department of Health Regulations:** It is not intended that any regulations promulgated by the Colorado Department of Health pertaining to public water systems be annulled by these design criteria. When the Department of Health regulations are more stringent they shall take precedence.

### **2.2 Hydraulics**

**2.2.1 Sizing of Water Mains:** All Water Mains shall be sized in accordance with the following:

- a. Flow velocity shall not exceed two feet (2') per second on a peak demand day.
- b. Flow velocity shall not exceed five feet (5') per second on a peak demand day during fire flow conditions. Fire flow requirements shall be determined by the Fire Protection District and submitted to the District in writing.
- c. Minimum design pressure shall be thirty-five (35) PSI, maximum design pressure shall be one hundred and twenty (120) PSI for all flow and static conditions.
- d. Minimum diameter of Water Mains is eight inches (8") wherever fire hydrants are connected. Smaller lines may be accepted only where no fire hydrants are located upon approval by the District Engineer.

**2.2.2 Sizing of Services:** Service lines, taps, and meters shall be sized in accordance with AWWA manual (M22), Sizing Water Service Lines and Meters. The standard size for single family residence is a three-quarter HDPE (3/4") line with a three-quarter inch (3/4") meter and meter setting. (3/4 Inch ID)

## 2.3 Water Mains

### 2.3.1 Locations

- a. Water Mains shall generally be installed ten feet (10') east of center line in north south streets, and ten feet (10') north of center line in east-west streets. The foregoing shall be adhered to insofar as practical on curved streets. Where curbed medians are proposed, the Water Main shall be under the pavement, no closer than five feet (5') to edge of concrete curb and/or gutter.
- b. Any request for deviation from the above shall be noted in the design request submittal to the District Engineer, including where public Water Mains are proposed to be installed in easements.
- c. Water Mains shall be designed for a minimum of four feet six inches (4'6") and a maximum of five feet (5') of cover, except where another utility causes a conflict, then the Water Main shall be lowered as necessary. For water distribution lines, lowering of 2 feet (2') or less shall be accomplished by deflection if possible. Lowering in excess of 2-feet (2') shall require a formal lowering that includes fittings (see standard drawing W-16) providing Note 8 on Standard Detail W-16 does not apply.
- d. Reverse anchors may be required at the discretion of the District Engineer.

**2.3.2 Material:** All Water Mains twelve-inch (12") and smaller in diameter shall be either C-900 PVC, DR18, DR 14 or AWWA C151 DI pipe Pressure Class 350. Lines between fourteen (14) and twenty-four (24) inches shall be either C-905 PVC, DR25, DR 18 or AWWA C151 DI pipe Pressure Class 250 as approved by the District Engineer. Material for pipelines in excess of twenty-four (24") in diameter must be approved by the District Engineer.

**2.3.3 Corrosion Protection:** Whenever metallic pipe is used, the pipe shall be double bonded, poly wrapped, and cathodically protected. The drawing notes must include the required anode sizing and spacing. Where PVC pipe is used with Ductile Iron Fittings, those fittings must be individually wrapped and cathodically protected.

**2.3.4 Profile:** Proposed water main drawings shall include a profile view which also shows the proposed finished surface above the Water Main and elevations and station of all fittings shall be noted. Elevation of the pipe flow line shall be noted.

**2.3.5 Looping:** Dead-end mains are generally discouraged. Looping shall be designed both in the project proposed and provision be made for looping as the mains are extended for adjacent projects.

## 2.4 Valving

### 2.4.1 Location

- a. Valves shall be placed at locations so as to least disrupt service should it be necessary to close a valve.

- b. In general, five hundred feet (500') shall be the maximum spacing on Distribution Mains. In distribution areas, valves should be clustered at intersections and block lengths should be taken into account. Depending on line size, and nature of land use, valve spacing on transmission lines may vary from 1,000 feet up to 2,500 feet. "Pup" sections from fittings to valves shall be thirty inches (30") long, minimum. All crosses shall have four (4) valves and all tees three (3) valves.
- c. A valve shall always be provided where a Main will be extended in the future to facilitate connecting to the existing Main without disrupting service. There shall be a twenty-foot (20') stub past the valve to facilitate ease of connection.
- d. Additional valves may be required at major stream or roadway crossings to isolate the crossing.
- e. Wherever a Water Main is installed in an easement, a valve may be required at each right-of-way line the Main crosses.

## 2.5 Appurtenances

- 2.5.1 Blow-off Valves:** Blow-off valves shall be provided at all dead ends if there is not a fire hydrant at the end of the Main. Refer to standard drawings W-18, W-19 and W-20.
- 2.5.2 Air Release Valves:** Air release valves in manholes shall be provided at all high points along transmission lines where services are not present. Refer to standard drawing W-39.
- 2.5.3 Pressure Reducing and Regulating Valves:** Pressure reducing and regulating valves in concrete vaults shall be provided as necessary to control the pressure within the allowable range.
- 2.5.4 Fire Hydrants:** The location of fire hydrants shall be as approved by the controlling fire protection agency. Fire Authority signature is required on water plans. A fire hydrant may serve as a blow-off valve on a dead end main if said main is 8 inches or greater.

- 2.6 Separation from Pollution Sources:** In general, Water Mains shall be designed to have ten feet (10') horizontal separation from possible sources of pollution. When the horizontal separation is not achievable, then the Water Main shall be designed so that the bottom of the Water Main is two feet (24") above the top of any sewer pipe. When two feet (2') of vertical separation cannot be achieved then the Water Main will be constructed in twenty feet (20') sections of ductile iron with no joints on the sewer pipe. The twenty feet (20') section shall be centered above the sewer pipe with ten feet (10') to each joint. When separation cannot be achieved, casing may be used upon written request to the District Engineer for consideration.

The foregoing separation provision applies to fire hydrants as well as to Water Mains.

- 2.7 Casing:** Where required by a highway authority or private utility, casing pipe for the Water Main shall be installed for the crossing as directed by the highway authority or private utility. Valves may be required near the ends of casings.
- 2.8 Fire Lines:** Private fire lines and fire sprinkler system connections shall require a backflow preventer to preclude reverse flow into the distribution system which could cause contamination of the system. Fire lines shall be metered.

## **2.9 Water Main Crossings**

- 2.9.1 Asbestos Cement Water Main:** When excavation crosses an existing asbestos cement (AC) water main, the AC main shall be removed from trench wall plus one foot (1') to trench wall plus one foot (1') by the Contractor and properly disposed of. The main shall be replaced with a Class 52 DIP, or similar PVC pipe, coupled to the remaining AC pipe using approved couplings. The trench around the pipe shall be properly compacted below and above the pipe in accordance with District specifications. The District may require special materials under (bedding) and above (backfill materials) the pipe at the discretion of the District Engineer or District Inspector. The District may require valves the same size as the AC pipe on both sides of the trench. The Contractor responsible for the excavation will supply all labor and materials and shall be responsible for the disposal of the asbestos cement pipe being replaced.
- 2.9.2 Irrigation Ditch Crossings:** In general, any excavation through an existing irrigation ditch will require written permission from the ditch owner. Clay dams and/or other design may be required to assure against leaking or "piping" within the ditch bank.
- 2.9.3 Final Inspection:** The crossing will be given a final inspection by the District before backfilling. Contractors will also give the District a two (2) year written warranty for work performed in accordance with the District's Rules and Regulations.

## **Section 3.0 Water System Installation Standards**

### **3.1 General Construction**

- 3.1.1 Start of Construction:** Contractors shall not begin construction of public mains without an approved plan and a pre-construction meeting. Construction of water services or extension shall not proceed without obtaining approval of the Water Operations Manager. Backfilling of water services shall not be initiated until the installation has been inspected and approved by the Inspector.
- 3.1.2 Protection of Existing Underground Facilities:** It shall be the responsibility of the Contractor to verify the existence and location of all underground facilities along the route of work. The omission or the inclusion of facility locations on the plans is not to be considered as the nonexistence of or a definite location of existing underground facilities. Whenever, in the opinion of the District, it is necessary to explore, pothole and excavate to determine the location of underground utilities and structures that may interfere with construction, the Contractor shall make the exploration and excavations for such purpose.
- The Contractor will take the necessary precautions to protect existing facilities from damage due to his operations. All damage to the facilities will be repaired at the Contractor's expense, and all claims for disruption will be settled by the Contractor at his expense.
- 3.1.3 Detours – Traffic Control:** Traffic control, signing, detours, and utilization of existing streets require approval by the controlling Right-of-Way Authority. Contractors and/or Developers must obtain adequate permitting and approvals from the controlling agency.

### **3.2 Excavation**

- 3.2.1 Safety:** The disturbed area due to construction shall be confined within the construction limits as required in the specifications or as shown on the plan. The length of trench to be opened at one time may be limited when, in the opinion of the Inspector, such limitation is necessary. The amount of open or unfilled trench shall not exceed five hundred linear feet (500'), unless ordered by the Inspector. Failure to comply with this requirement shall be cause for shut down of the entire project until such backfilling is accomplished.
- The sides of the trench shall be sloped or braced, and trench drained so that workmen can work safely and efficiently. All work must be done in a dry trench and no water will be permitted to discharge down the pipe previously laid. The discharge from groundwater pumps shall be laid to approved natural drainage channels or storm sewer. All OSHA regulations pertaining to trenching must be complied with.
- In all cases where the Water Main alignment is located so that space and access is very limited with respect to the safety and welfare of adjoining buildings, such as property lines between houses, the Contractor shall discontinue open trench excavation and shall jack and/or auger a liner pipe in place for an adequate length to safeguard against settlement and damage to these adjacent structures. All jacking methods and materials must be approved by the Inspector. Sheet piling and bracing as later described may be approved by the Inspector as an alternative.
- Pits of adequate size to accommodate necessary equipment shall be excavated, braced and drained so that workmen can work safely and efficiently.

- 3.2.2 Construction Stakes:** All work shall be constructed in accordance with lines and grades shown on the approved drawings and as established by the Engineer. These lines and grades may be modified by the Consulting Engineer only after approval by the Water Operations Manager or District Engineer.

The Contractor shall give the Consulting Engineer sufficient notice of his need for the establishment of line and grade so that the Consulting Engineer may have time to provide the same. The Consulting Engineer shall set all vault and manhole rim stakes at the finished street grade elevation. After lines and grades for any part of the work has been given by the Consulting Engineer, the Contractor will be held responsible for the proper execution of the work to such lines and grades and all stakes or other marks given shall be protected and preserved by him until he is authorized by the Inspector to remove them. The Contractor shall, at his own expense, correct any mistakes that may be caused by their unauthorized disturbance or removal. The Inspector may require that work be suspended at any time when, for any reason, such marks cannot be properly followed.

Line and grade stakes shall be set for each fitting and grade point shown on the drawings and at intervals necessary to maintain the pipe slope when so indicated on the drawings.

The method and equipment used to establish and check line and grade of the pipe shall be approved by the Inspector prior to the start of work.

- 3.2.3 Trench Width:** The trench width at the top of the excavation may vary depending upon the depth of the trench and the nature of material encountered. However, the maximum allowable width of trench is defined in the attached detailed drawing W-12.

For trench width greater than specified in the paragraph above, the Contractor may propose alternate strength of pipe to depth of cover relationships other than those specified. Such proposals must be submitted to the District Engineer for approval in writing and with pertinent pipe strength and soil weight data at least fourteen (14) days prior to the desired construction date. The trench bottom shall be brought to grade to provide a uniform and continuous bearing and support for the pipe on solid and undisturbed ground at every point between bell holes.

- 3.2.4 Over-excavation:** Care must be taken to avoid over-excavation, should any over-excavation exceeding two inches (2") be encountered, the material added shall be moistened and compacted to the satisfaction of the Inspector, or granular material placed with hand tools.

If, when dry, the bottom at subgrade is soft and in the opinion of the Inspector cannot support the pipe, a further depth shall be excavated as directed by the Inspector and refilled to pipe bedding grade as required under the above paragraphs, or other approved methods shall be adopted to assure a firm foundation for the pipe. The class or type of material which is to be used for refilling up to pipe grade shall be foundation material consisting of squeegee or bedding material as defined herein. In the case of rock excavation, the excavation shall be carried to a minimum depth of six inches (6") below grade and this material will be removed and the trench backfilled with granular material to give a suitable subgrade.

All excavated material shall be piled within the construction limits or in a location obtained by the Contractor in a manner that will not endanger the work and that will avoid

obstructing sidewalks, driveways, and fire hydrants. Gutters shall be kept clear or other satisfactory provisions made for street drainage at all times.

- 3.2.5 Blasting:** Blasting will be permitted for portions of the work which may be expedited thereby, provided that a written permit is given by the municipal authority having jurisdiction. The Inspector shall have the right to limit the use of explosives or to order the discontinuance of any blasting methods which, in his opinion, endanger any part of any public or private property tile safety of inhabitants of the area, or the traveling public.

The Contractor shall enlist the services of a professional explosives engineer. In addition to other insurance requirements, Contractor shall provide the District with sufficient blasting insurance as may be directed by the District.

All blasting shall be in accordance with the Explosive Statutes of Colorado. In addition to other insurance requirements, Contractor shall provide the District with sufficient blasting liability insurance as may be directed by the District.

Blasting shall be performed in such a manner that no damage will result to any building, structure, pipe line, or facility on or off the site of the work, or above or below ground line. Any damage caused as a result of blasting shall be repaired to the satisfaction of the property owner and the District at the Contractor's expense.

- 3.2.6 Sheeting and Bracing:** The Contractor, to confine his work within the construction limits and to prevent the disturbing or settlement of adjacent road surfaces, foundations, structures, utility lines or railroad tracks, shall furnish and place all sheeting and bracing necessary for safe conditions, and to prevent damage and delay to the work. The Contractor shall be responsible for the strength and sufficiency of all sheeting and bracing.

Any damage to the work or to adjacent structures or property caused by settlement water or earth pressures, slides, cave-ins, or other reasons due to failure or lack of sheeting and bracing or improper bracing, or through negligence, or fault of the Contractor in any manner shall be repaired by the Contractor at his expense without delay.

If, in the opinion of the Inspector, the sheeting and bracing at any point is deemed to be inadequate or improperly constructed, he may require additional sheeting and bracing be placed at the Contractor's expense. This shall not be construed to relieve the Contractor of sole responsibility of job site supervision.

Bracing shall be so arranged as to provide ample working space so as not to interfere with the work, and so as not place any strain on the structures being constructed, until such structures are, in the opinion of the Inspector, of sufficient strength to withstand such strain. No sheeting and bracing shall be removed until the construction has proceeded far enough to provide ample strength for its safe removal.

Sheeting or bracing may be left in place in the trench at the discretion of the Contractor. Any sheeting or bracing left in place shall lie cut off approximately ten feet (10') from the surface and the cut off portion removed, unless the Inspector gives permission to leave it in place.

- 3.3 Pipe Bedding and Laying:** It is up to the Inspector to determine if trench excavation will provide suitable bedding and backfill material. Wet, soft or frozen material, asphalt and concrete chunks, cinder ashes, refuse, vegetable or organic material, boulders, rocks, or other deleterious

substances shall not be used for bedding or backfill. The Inspector may require sieve analyses or other tests in order to make such judgment.

If the excavated material is not suitable for bedding or backfill as determined by the Inspector, suitable material shall be hauled in and utilized, and the rejected material hauled away and disposed of, at the Contractor expense.

If native material is not suitable for bedding, six-inches (6") of squeegee sand shall be placed on the trench bottom for support under the pipe and compacted. Bell holes shall be dug deep enough to provide a minimum of two-inches (2") of clearance between the bell and bedding material. All pipe shall be installed in such a manner as to ensure full support of the pipe barrel over its entire length. After the pipe is adjusted for line and grade and the joint is made, the bedding material (squeegee sand) shall be carefully placed and tamped under the haunches of the pipe and in the previously dug bell holes.

"Tamping" is herein defined as the act of placing approved bedding material under the haunches of pipe, paying particular attention to voids, bell holes, and sling holes. The purpose of Tamping is to ensure uniform support for the pipe.

- a. Pipes. Unless select bedding material is required, all pipelines shall be bedded by hand, from the bottom of the trench to the centerline of the pipe with sand, gravel or other approved material placed in layers of three-inches (3") and compacted. Bedding material shall be deposited in the trench for its full width on each side of the pipe, fittings and appurtenances simultaneously.

The pipe shall be bedded by approved mechanical methods from the centerline of the pipe, fittings and appurtenances to a depth of twelve-inches (12") above the top of the pipe. Special care shall be used in placing this portion of bedding so as to avoid disturbing the pipe.

PVC pipe shall be installed in accordance with AWWA C606/ASTM D2321 and the manufacturer's recommendations unless otherwise specified herein.

DIP pipe shall be installed in accordance with AWWA C600 and the manufacturer's recommendations unless otherwise specified herein.

The trench shall be backfilled by approved mechanical methods from twelve inches (12") above the pipe to the grade shown on the plans or specified herein.

- b. Structures. Backfill and fill within three-feet (3') adjacent to all structures and for full height of the walls shall be selected non-swelling material. It shall be relatively impervious, well-graded, and free from stones larger than three-inches (3"). Material may be job excavated, but selectivity will be required. No backfilling will be allowed in freezing weather except by permission of the District. No additional backfill will be allowed over any frozen material already in the trench.

**3.3.1 Imported Bedding Material:** When indicated on the plans or drawings or when, in the opinion of the Inspector, imported bedding material is required, preparation and installation shall be as follows:

- a. Installation of Bedding and Pipe. After completion of the trench excavation and proper preparation of the foundation, six-inches (6") of bedding material shall be placed on the trench bottom for support under the pipe and compacted. Bell holes

shall be dug deep enough to provide a minimum of two-inches (2") of clearance between the bell and bedding material.

All pipe shall be installed in such a manner as to insure full support of the pipe barrel over its entire length. After the pipe is adjusted for line and grade, and the joint is made, the bedding material shall be carefully placed and tamped under the haunches of the pipe and in the previously dug bell holes.

If approved by the District, material from the trench wall and soil pile may be used to provide uniform support for the pipe. No rock or stone larger than allowed by the sieve analysis, or any other detrimental substance, shall be placed closer to the pipe than six-inches (6"). The District reserves the right to require the use of select bedding material at any time.

For ductile iron and polyvinyl chloride pipe, the limits of bedding shall be from six-inches (6") below the bottom of the pipe to twelve-inches (12") above the top of the pipe.

1. Bedding Material. The bedding material shall be a clean squeegee sand free of corrosive properties and shall conform to the following gradation limits when tested by means of laboratory sieves:

***Squeegee Sand***

| <b>Sieve Size</b> | <b>Total Percent Passing by Weight</b> |
|-------------------|----------------------------------------|
| 3/8 Inch          | 100                                    |
| No.200            | 0-5                                    |

2. Stabilization Material. Stabilization material shall be uniformly graded washed rock conforming, to the following sieve analysis. A minimum of six-inches (6") of granular bedding material shall be placed over the foundation material.

***Stabilization Material***

| <b>Sieve Size</b> | <b>Total Percent Passing by Weight</b> |
|-------------------|----------------------------------------|
| 2-inch            | 95-100                                 |
| 1/2-inch          | 10-30                                  |
| #4                | 0-5                                    |

3. Flowable Fill. At the District's option, utility trench backfill meeting the following requirements (flowable fill), may be used in lieu of native backfilling in any excavation regardless of width or depth. Concrete slurry type full depth backfill will not be allowed within the public right-of-way. Compaction and testing of utility trench backfill will not be required if material meeting the following specification is used:

### ***Flowable Fill***

| <b>Ingredient</b>           | <b>lbs./cubic yard</b>        |
|-----------------------------|-------------------------------|
| Cement                      | 43 (0.47 sack)                |
| Water                       | 325 (39 gallons or as needed) |
| Coarse Aggregate (Size #57) | 1700                          |
| Sand (ASTM C-33)            | 1845                          |

If approved by the District, material from the trench wall and soil pile may be used to provide uniform support for the pipe. No rock or stone larger than that allowed by the sieve analysis, or any other detrimental substance, shall be placed closer to the pipe than six-inches (6"). The District reserves the right to require the use of select bedding material at any time.

- 3.3.2 Laying of Pipe:** Proper implements, tools, and facilities satisfactory to the Inspector shall be provided and used by the Contractor for the safe and convenient execution of the work.

Pipe materials shall be unloaded and distributed on the job in a manner approved by the Inspector. In no case shall materials be thrown or dumped from the truck.

Before lowering and while suspended, the pipe shall be inspected for defects to detect any cracks. Any defective, damaged, or unsound pipe shall be rejected and removed from the job site.

All foreign matter or dirt shall be removed from the inside of the pipe before it is lowered into its position in the trench, and it shall be kept clean by approved means, as determined by the Inspector, during and after laying. All openings along the line of Water Main shall be securely closed as directed, and in the suspension of work at any time, suitable plugs shall be placed to prevent earth or other substances from entering the pipe.

Pipes shall be laid to a true line and at uniform rates of grade between grade points as shown on the plans. Fine grading, to the bottom of the trench, shall proceed ahead of the pipe laying, and should any over excavation exceeding two-inches (2") be encountered, the material added shall be granular bedding or foundation material shall be added at the expense of the Contractor to the satisfaction of the Inspector.

Bell holes shall be provided for the pipe bells. The pipe shall be supported along its bottom as required by these Specifications and throughout its length except for the minimum distance necessary at the bell holes. Bell holes shall be adequate to make the joint, but no larger than necessary so that maximum support will be provided for the pipe. The remainder of the pipe shall be surrounded as required by the appropriate bedding shovel placed and hand tamped, to fill completely all spaces under and adjacent to the pipe.

No pipe shall be laid in water or when the trench conditions are unsuitable for such work.

When connecting to existing Water Mains, the Contractor shall take every precaution necessary to prevent dirt or debris from entering the existing lines. The Inspector may stop work if adequate protection is not being provided from groundwater, or other debris which might enter the pipeline.

When the design of a PVC waterline indicates laying the pipeline on a curve, it may be accomplished as follows.

| <i><b>Water Distribution Lines (sizes 8" thru 12")<br/>(Full laying length 19.5 feet)</b></i> | <b>8 Inch<br/>Laying<br/>Radius (ft)</b> | <b>10 Inch<br/>Laying<br/>Radius (ft)</b> | <b>12 Inch<br/>Laying<br/>Radius (ft)</b> |
|-----------------------------------------------------------------------------------------------|------------------------------------------|-------------------------------------------|-------------------------------------------|
| Without Fittings                                                                              | 685 min                                  | 795 min                                   | 925 min                                   |
| With MJ Couplings (each joint)                                                                | 300 to 550                               | 300 to 550                                | 300 to 550                                |
| With MJ Couplings (every second joint)                                                        | 550 to 685                               | 550 to 795                                | 550 to 925                                |
| With 11.25 (every third joint)                                                                | 280 to 450                               | 280 to 450                                | 280 to 450                                |
| With 11.25 (every other joint)                                                                | 180 to 280                               | 180 to 280                                | 180 to 280                                |

Any laying radius less than 300 feet water shall require full design, stationing of fittings on plans.

When laying DIP, the deflection in any bell/spigot cannot exceed the deflections allowed herein.

High Deflection PVC Couplings may be authorized at the Inspectors discretion.

When traversing a radius using the above specification, the fitting schedule must be adhered to, unless otherwise specifically designed on drawings.

- 3.3.3 Length of Pipe:** The laying length of each section of pipe may be cut to allow a greater number of MJ couplings to be installed. However, laying lengths of less than ten feet (10') will not be allowed except at ends and beginnings of curves or as necessary to place designed fittings. See also Laying of Pipe (3.3.2).
- 3.3.4 Fittings:** Fittings and MJ Couplings meeting the existing Widefield specification shall be installed where shown on the plans. Pipes shall be cut as necessary to install fittings at the proper locations. Fittings shall be provided with restraint and/or thrust blocking as necessary per these Specifications. Fittings shall be supported by a minimum of 6 inches (6") of granular bedding extending to the springline and a minimum of 18 inches (18") from the centerline of each fitting. Blocking is not permitted, unless directed by the Inspector where fittings and/or valves are being installed in existing pipe sections.
- 3.3.5 Service Connections:** No Service Lines shall be installed until front property corners have been located. Service Lines for each property shall be ten feet (10') uphill of the lower property pin and within 18" of front property line, or where otherwise shown on the approved drawings.

Length of Service Line from the Main to the house will be limited as follows:

|             |          |
|-------------|----------|
| 3/4" I.D.   | 100-feet |
| 1" I.D.     | 125-feet |
| 1-1/2" I.D. | 175-feet |

Lengths greater than one hundred and seventy-five feet (175') need an engineer's design for sizing. The design must be submitted in writing to the District Engineer for approval.

All service connections to Mains shall be made in the top one-half (1/2) of the pipe and upward at a 45° angle. Tapping of Mains for service connections shall only be accomplished with the use of an approved tapping machine and tapping saddle. **Romac 202 BS Tap saddle or equal.**

All service lines shall have an expansion loop of 1 to 2 feet of slack for settlement expansion.

See Standard Detail W-32 and W-33.

**3.3.6 Water Sampling Station:** A water sampling station shall be installed in every filing or for every 500 homes, whichever is greater. The sampling station shall be installed in an open area with a curb stop. The inspector may require bollards to be installed next to the sampling station when concerns of damage to the sampling station warrant.

**3.4 Backfill and Compaction:** No backfilling will be allowed until the pipe installed conforms to the specified requirements.

Backfill and compaction under the HDPE service line's upward bow at the connection to the corporation stop shall be achieved by tamping in suitable backfill material to the bottom of the service line trench.

Accepted on-site bedding or granular material shall be deposited in the trench simultaneously on both sides of the pipe for the full width of the trench to a height of six inches (6") above the crown of the pipe. Accepted on-site bedding or granular material shall be shovel placed and hand tamped to fill completely all spaces under and adjacent to the pipe.

All backfill shall be compacted to a minimum of ninety-five percent (95%) of standard proctor density at optimum moisture, ASTM D-1557, by tamping or other means approved by the Inspector. If the controlling Right-of-Way authority requires a greater compaction requirement, the requirement of the controlling Right-of-Way authority shall control. Tests shall be conducted on compacted materials as directed by the Inspector and/or Right-of-Way Authority. Jetting, puddling, or ponding will not be used except where approved by the District. Sufficient cover over the pipeline will be hand tamped to prevent flotation of the pipe.

Backfill for Water Main trenches shall be suitable and earth free from rocks over three-inches (3") in diameter, large roots or excessive sod or other vegetation.

Backfilling and compacting shall be done as thoroughly as possible so as to prevent after settlement. Depositing of the backfill shall be done so the impact of falling material will not injure the pipe or structures. Grading over and around all parts of the work shall be done as directed by the Inspector.

Backfilling shall be done in lifts of uniform layers not to exceed the depth shown in the compaction chart and each lift shall be completely compacted over the full width of the excavated area. Compacting shall continue until the specified relative compaction has been attained. (Three-feet (3') of material over the top of the pipe shall be required before a vibratory or sheepfoot roller is operated over the pipe).

## **COMPACTION CHART**

| <b>Compaction Type</b>                           | <b>Maximum Loose Soil Lift Height (ft.)</b> |                     |
|--------------------------------------------------|---------------------------------------------|---------------------|
|                                                  | <b>Sands</b>                                | <b>Plastic Soil</b> |
| Vibratory Roller<br>(Vibro-Plus CK-10) or equal  | 4.0                                         | Not allowed         |
| Sheepsfoot<br>(150 PSI Minimum)                  | Not allowed                                 | 2.0                 |
| Vibratory Sheepsfoot<br>(Essick Vf-54T) or equal | 4.0                                         | 2.0                 |
| Button Head Pneumatic                            | 0.5                                         | 0.5                 |
| Plate Temper                                     | 1.0                                         | 1.0                 |
| Plate Vibrator                                   | 1.0                                         | Not allowed         |

Succeeding layers of backfill may contain coarse materials, but shall be free from large pieces of rock, frozen material, concrete, roots, stumps, tin cans, rubbish, and other similar articles whose presence in the backfill, in the opinion of the Inspector, would cause settlement of the trench or damage to the pipe. No stone larger than six-inches (6") in diameter shall be placed within three-feet (3') of the pipe.

Wherever select material exists in place in the upper four-feet (4') of the finished grade of the paved or traveled portions of the street or roadway, is removed by the trench excavation, the Contractor shall replace said material (or material of equal quality) as backfill in the upper four-feet (4') of the finished grade. Where select material does not exist in place as described above, the material available from other excavations on the project may be used.

Special compaction shall be done around all valve boxes and vaults, manholes, curb boxes, water services, other structures, and utilities by the use of pneumatic tampers, plate tampers, or plate vibrators with lifts not to exceed that shown in the compaction chart.

Water service trenches must be compacted in the same manner as the Water Main trenches. All excavation in trenches shall be backfilled to the original ground surface or to such grades as specified or shown in the plans. The backfill shall begin as soon as practical after the pipe has been placed and shall thereafter be carried on as rapidly as the protection of the balance of the work shall permit.

Compaction tests at the expense of the Contractor shall be conducted by an independent testing laboratory to a depth not greater than two feet (2') above the pipe. One test shall be conducted for each run, or every four hundred feet (400'), whichever is greater, or as required by the controlling authority. Copies of each compaction test report will be given to the Inspector and the District prior to approval.

### **3.5 Valve Installation**

**3.5.1 Valves:** Valves shall be handled in such a manner as to prevent any injury or damage. All joints shall be thoroughly cleaned before installation.

Valves shall be located at the points on the Mains as indicated on standard drawing W-4, unless specified otherwise by the District Engineer.

Valves shall be set and joined to the pipe in the manner as laying and joining mechanical joint pipe.

Valves shall be set in such a manner that the valve stems are plumb. Valves will be supported by a minimum of six-inches (6") of granular bedding extending to the springline and a minimum of eighteen-inches (18") from the centerline of the valve. Blocking is not permitted unless directed by the Inspector where fittings and/or valves are being installed in existing pipe sections.

- 3.5.2 Valve Boxes:** A valve box shall be provided for every valve. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the operating nut of the valve, with the top of box set to the required elevation. It will be the responsibility of the Developer or his Contractor, to ensure that valve boxes are plumb and raised to the proper elevation.

Paving of any street requires that all existing valve boxes be located and prepared for final raising to the finish street surface as shown on the standard drawing W-5. Prior to paving, a final inspection is required. Inspections should be requested twenty-four (24) hours in advance.

### **3.6 Fire Hydrant Installation**

- 3.6.1 Installation:** All hydrants shall be staked for location and grade. Final location and grade shall be in accordance with the approved drawings. All hydrants shall stand plumb and be installed as indicated on standard drawing W-2. Each hydrant shall be connected to the Main by a six-inch (6") branch line. An independent six-inch (6") gate valve shall be installed on each fire hydrant branch. No Service Line connections shall be installed between the fire hydrant and the fire hydrant control valve.

- 3.6.2 Anchorage:** The bowl of each hydrant shall be well braced against the un-excavated earth at the end of the trench with a concrete thrust block. The bottom of the hydrant bowl and the hydrant valve shall be supported with an eighteen by eighteen by four-inch (18" by 18" by 4") pre-cast concrete blocking slabs. Anchor tees shall be used on all new installations, and stainless-steel tapping saddles w/valves shall be used to install hydrants on existing installations.

Whenever a fire hydrant is installed at the termination point of a Main extension additional concrete anchors and or MJ or joint restraints may be required at the direction on the Inspector. See standard drawing W-2.

If bends are needed to bring a hydrant to a desired horizontal or vertical position, special concrete reverse anchors, anchor pipe, and/or all-thread tie-back rods (or a combination of all of these) along with a riser may be required. In any case, a riser may be required that is no longer than two-feet (2'). It will be the Contractor's responsibility to set the safety flange at the proper grade.

The Hydrant Valve will be fitted with a "Mega Lug" fitting. Reverse anchors and all thread will no longer be used; except in such case as the Inspector deems necessary.

- 3.6.3 Drainage:** Wherever a hydrant is set, drainage shall be provided at the base of the hydrant by placing rock from the bottom of the trench to at least twelve-inches (12") above the barrel flange of the hydrant, and to a minimum distance of twelve-inches (12") around the elbow.

The minimum distance from the bottom of the trench to the bottom of the hydrant elbow shall be six-inches (6"). The minimum of rock placed shall be one third (1/3) of a cubic yard. The rock shall be a well graded gravel cobble, or crushed rock free of dirt. The rock shall be surrounded on all sides by a permeable Mirafi fabric to prevent the migration of soil into the drain rock area.

**3.6.4 Hydrant Protection in Corrosive Soils:** All ductile iron branch lines and hydrants shall be protected. All pipe, rods, and fittings, from finished ground level on the hydrant barrel up to and including the tee, shall be encased in poly wrap. The type of polyethylene and manner in which it is to be installed shall conform to these Specifications. Bedding material shall be as specified in these specifications. All fire hydrants shall be cathodically protected with a 9 lb. anode.

**3.7 Blow-off Installation:** All dead ends on new Mains shall be closed with cast iron plugs or caps; such dead ends shall be equipped with suitable concrete anchors and blow-off facilities.

The Contractor shall furnish, install or remove temporary blow-offs at locations shown on the drawings or designated by the District. See standard drawings W-18 and W-19. The Contractor shall install permanent blow-offs where indicated on the drawings. A permanent blow-off is defined as one which will be left in place at the completion of all proposed installations. Refer to standard drawings W-18, W-19, and W-20.

**3.8 Air Release Valve Installation:** Combination air relief-vacuum breaker valves shall be installed at all high points on twelve-inch (12") and larger Water Mains. The valves shall be installed in seventy two-inch (72") diameter concrete manholes with manhole rings and covers as shown in the standard drawing W-39. The valves shall be tapped into the top of the Water Main with a tap size in accordance with the air release valve size. Air valves shall be sized by the Design Engineer in accordance with AWWA Manual of Practice M51 and calculations shall be provided to the District Engineer for approval. The pipe stem between the Water Main and the air release valve shall contain a gate valve to isolate the air release valve for maintenance purposes. Pipe and fittings shall be threaded galvanized iron, standard weight; gate valve shall be bronze with a stem and riser to the surface.

**3.9 Pressure Reducing Valve Installation:** Pressure reducing and regulating valves shall be installed where directed by the District Engineer. The valve, piping, and appurtenances shall be installed in reinforced concrete vaults with access cover in the roof. The access cover shall be set to proposed final surface elevation and shall be adjusted for paving if necessary. All piping shall be supported within the vault to permit removal of components for servicing.

**3.10 Disinfection:** Pipe extensions shall be chlorinated in accordance with AWWA Standard C651, "Disinfecting Water Mains", prior to being put into service. The chlorination of the finished pipeline shall be done prior to installation of any service taps. Before filling the pipe with water, the pipe shall be clean and free of debris to the satisfaction of the Inspector. Disinfection by chlorination of the pipe shall be performed prior to the District's acceptance. The chlorinating agent, and method of application, shall be approved by the District Engineer in accordance with AWWA Standard C651. The Contractor shall provide material for disinfection of Water Mains. If chlorine tablets are used for disinfection, the tablets shall be attached to inside top of the pipe using a water based non-toxic glue (Dow 78) just prior to the pipe installation in the trench.

**NUMBER OF CALCIUM HYPOCHLORITE TABLETS OF 5g. STRENGTH  
REQUIRED TO GIVE 50 PPM PER 20 FOOT OF PIPELINE**  
(Based on 0.65g Available Chlorine per g)

| Pipe Size     | Number of 5g. Tablets<br>Required per 20 Ft.<br>Length of Pipe |
|---------------|----------------------------------------------------------------|
| 4"            | 1                                                              |
| 6"            | 2                                                              |
| 8"            | 4                                                              |
| 12"           | 7                                                              |
| 16" and above | Slug Only                                                      |

**Granular powder shall not be used for disinfection of water mains, unless specifically directed by the Inspector.**

After the calcium hypochlorite has been placed in the pipeline by the Contractor, disinfection must be completed within ten (10) calendar days. Should disinfection not be completed within this period, the District will void this method of chlorination and require that the Main be disinfected by mobile gas chlorinator, or slug method, at the expense of the Contractor.

After the pipe is filled with water and chlorine at less than one foot/second, and unless approved otherwise by the Inspector, chlorinated water of at least fifty (50) mg/l shall be held in contact with the pipe for twenty-four (24) hours. At the end of the twenty-four (24) hour period, the water in the pipeline shall be tested by the Inspector to insure a residual chlorine content of not less than twenty-five (25) mg/l. The pipeline shall then be thoroughly flushed to remove the heavily chlorinated water. Care shall be taken in flushing the pipeline to prevent property damage and danger to the public. Samples of water shall be collected by the District Inspector for bacteriological examination and residual chlorine content testing before the pipe is put into service. Testing of bacteriological evaluation and sampling shall be done by a state certified laboratory at the expense of the Contractor.

A new Main will be released for the tapping of services when disinfection and flushing to normal system operating residual and has been completed, bacteriological testing and a hydrostat has been done, it is acceptable to the Water Operations Manager, and the main has been flushed and charged.

### **3.11 Hydrostatic Testing**

**3.11.1 General:** No hydrostatic tests shall be made on any portion of the pipeline until field placed concrete has had adequate curing time.

The Inspector shall be notified twenty-four (24) hours in advance of testing. All testing shall be made **in the presence of the Inspector.**

Only the following methods are acceptable for supplying potable water for hydrostatic testing:

- a. Water may be taken from a nearby pressurized water source which has been previously chlorinated, tested and accepted, such as a fire hydrant.

- b. Water may be delivered to the site in a chlorinated water tank having a minimum capacity of three hundred (300) gallons. The water tank shall be used exclusively for the transportation of potable water.
- c. Any previously tested, chlorinated and accepted Water Main which is pressurized and is to serve the new Main extension may be tapped on the pressurized side of the closed valve.

In any event, the method of supplying water as well as the source of water for hydrostatic testing shall be as approved by the Inspector. Use of barrels, sanitary or otherwise, to supply water for hydrostatic testing is strictly prohibited.

All Water Mains shall be field hydrostatically tested to a minimum pressure not less than one and one half (1-1/2) times the working pressure or one hundred and fifty (150) psi, whichever is greater, for a minimum of two (2) hours. The test will fail if the pressure drops more than five (5) psi within the two (2) hour period.

**3.11.2 Procedure:** The pipeline shall be properly backfilled and shall be in a state of readiness for testing. All bulkheads, pumps, taps and appurtenances necessary to fill the pipeline and maintain the required pressure shall be in place. The pipeline shall be filled with water and the test pressure shall be applied to the pipeline by means of a continuously operating pump equipped with a bypass valve for regulating pressure. When filling the pipeline, it shall be filled at a rate which will not cause any surges, nor will it exceed the rate at which the air can be released.

All air in the line shall be properly purged. Where blow-offs or hydrants are not available or are not effective in purging air from the line, the Inspector shall require a tap at the Contractor's expense, to purge the line. The location and size of tap shall be at the Inspector's discretion.

Upon achieving test pressure, the pressurizing pump shall be turned off and disconnected from the pipeline.

While the test pressure is maintained, an examination shall be made of the pipeline in general, and any leaks shall be repaired. Any pipe or fitting found to be faulty shall be removed and replaced. No leakage is allowed through the bonnet of the line valve. Any valve leaking through the bonnet shall be repaired in place or removed and replaced. Cutting and replacing pavement, excavating and backfilling may all be necessary parts of locating and repairing leaks discovered by pressure testing of pipe.

Tests shall be conducted with fire hydrant auxillary valves open and the hydrants shut off.

After all visible leaks have been stopped, the full test pressure shall be maintained for two (2) continuous hours.

**3.11.3 Allowable Leakage** At completion of the test, the pipeline shall be returned to the test pressure and the amount of water metered into the pipeline. At the discretion of the Inspector, a leakage test is not required for water pipe sections less than 12 inches or less than 200 feet in length. The method of metering shall be a volumetric measurement taken from a tank no greater than 55 gallons. Under no conditions shall an excess of 5 psi be lost during the two-hour test. Allowable leakage (that amount used to re-fill the pipeline), gallons per hour per one thousand feet (1,000') of pipe, for

each section between line valves for mechanical joint or push-on joint pipe shall not exceed the following rates:

| Avg. Test<br>Pressure | Pipe Size – Inches<br>(Gallons) |      |      |      |      |      |      |
|-----------------------|---------------------------------|------|------|------|------|------|------|
|                       | 4                               | 6    | 8    | 12   | 16   | 20   | 24   |
| <b>PSI</b>            |                                 |      |      |      |      |      |      |
| <b>250</b>            | 0.47                            | 0.71 | 0.95 | 1.42 | 1.90 | 2.37 | 2.85 |
| <b>225</b>            | 0.45                            | 0.68 | 0.90 | 1.35 | 1.80 | 2.25 | 2.70 |
| <b>200</b>            | 0.43                            | 0.64 | 0.85 | 1.28 | 1.70 | 2.12 | 2.55 |
| <b>175</b>            | 0.40                            | 0.59 | 0.80 | 1.19 | 1.59 | 1.98 | 2.38 |
| <b>150</b>            | 0.37                            | 0.55 | 0.74 | 1.10 | 1.47 | 1.84 | 2.21 |

If testing indicates a leakage rate in excess of the rates above, the pipeline will not be accepted. The pipeline shall be repaired, re-chlorinated, and re-tested as described in this section until all test requirements are met.

### **3.12 Water Meter Installation**

#### **3.12.1 General**

- a. The acceptable location for three-quarter inch (3/4") through one-inch (1") water meters shall be limited to inside of building, unless otherwise approved. Locations for one and one-half inch (1 1/2") or larger water meters shall be approved by the District prior to installation of the water meter loop.
- b. Water meter locations selected shall provide adequate protection against freezing.

#### **3.12.2 Inside Water Meter Installations**

- a. Inside residential water meter locations must be in the basement or other lowest level of the residence excluding crawl space. A floor drain is to be located by the inside water meter unless otherwise approved by the District.
- b. Inside three quarter inches (3/4") through one-inch (1") water meter locations shall be such that the water meter is unobstructed on one side; i.e., easily accessible for reading or servicing with a minimum of twelve-inches (12") clearance around the remainder of the meter. Meter locations shall not require stooping or crawling to gain access to the meter.
- c. Inside three quarter inches (3/4") through one-inch (1") water meter loop installations shall include an inlet and outlet valve as shown on standard drawing W-35. Meter setters for three quarter inch (3/4") and one-inch (1") settings will be AY McDonald 740-2-FF33.

- d. Inside one and one-half inch (1 1/2") and larger. Plans for inside water meter set (to include support) installations for one and one-half inch (1 1/2") and larger water meters shall be submitted to the District for approval prior to installation of the meter set and should be similar in design to the meter set piping and support shown on standard drawing W-35A(Horizontal Set), except that the metered bypass piping may also be extended under or over the meter and that adequate meter loop support may require a different design.

### **3.12.3 Water Meter Vault Installations (Other than Residential)**

- a. The location of the meter for one-inch (1") water meters will be located within an easement near the property line. If a problem arises on the location, the decision will be determined by the District.
- b. The only vault acceptable to the District for one-inch (1") meters is a four-foot (4') concrete manhole with a thirty-six-inch (36") lid with rungs per W-37.
- c. The meter loop in the vault for three-quarters (3/4") and one-inch (1") water meters must be AY McDonald 732-4-WW22 44. The copper setter will be installed so that the loop is twenty-six inches (26") below the top of the meter vault lid. See standard drawing W-37 and accompanying general notes.
- d. The location of the meter vault for one and one-half inch (1 1/2") or larger water meters shall be approved in the field by the Inspector.
- e. Meter vaults for water meters one and one-half inch (1 1/2") or larger shall be 6' concrete manhole with a 36" lid with rungs. See standard drawing W-38 and accompanying general notes.
- f. Meter vaults must have an approved ring and cover of sufficient size per W-37 and W-38.
- g. Meter vault (one and one-half inch (1 1/2") and two-inch (2")) must set on the floor of pit, not on riser. The maximum depth of the meter pit shall be five feet six inches (5'6"). The minimum depth of the pit shall be four feet six inches (4'6"). See standard drawing W-38 and accompanying general notes.
- h. Water meters one and one-half inch (1 1/2") and larger may be required to have a metered bypass around the meter of sufficient size to supply the property while the meter is being serviced. This requirement shall be at the discretion and direction of the District. Contact the District prior to construction of meter loops of this size.
- i. When a bypass is allowed with a meter installation, the pressure regulator valve shall not be bypassed.
- j. Water meter loops 1 1/2" and larger must have both inlet and outlet valves.
- k. 36-inch steel manhole lids shall have a hole drilled in them to accommodate the meter transmitter. Aluminum or composite lids may be used instead of drilling the hole, as long as they are traffic rated. A 24-inch reducing ring that can accommodate a 24-inch opening.

#### **3.12.4 Combined Domestic and Fire Line Water Meters**

- a. Only meters approved by the National Board of Fire Underwriters shall be installed in water lines providing both domestic and fire demands. Requests to install a fire line and/or meter in a water line is handled in the same manner as a water line extension.
- b. Unless otherwise approved by the District, combined domestic and fire line meters must be installed in a vault large enough to accommodate the meter, meter bypass, and all valves and piping.
- c. The location of the meter pit must be approved by the District in advance of construction.
- d. Meter vaults must have an approved ring and cover of sufficient size (thirty-six inches (36") minimum) opening for installation and removal of the meter.
- e. The meter set (three-inch (3") through six-inch (6")) must set on the floor of vault, not on the riser. The maximum depth of the meter vault (inside dimension) shall be seven-feet (7'). The minimum depth of the meter vault (inside dimension) shall be five-feet (5').
- f. Water meter sets for combined domestic and fire line water meters must have both inlet and outlet valves.
- g. Water meters must have a metered bypass around the meter of sufficient size to supply the property while the meter is being serviced.

### **3.13 Services**

**3.13.1 General:** Hydrostatic testing, approved bacteriological testing, and conditional acceptance of the Water Mains must be made prior to the installation of any water taps.

Water service line locations shall be shown on the utility plans submitted to the District and shall be located ten feet (10') up from the downhill lot line and 18" or less inside the property line. Service Lines shall be installed in a continuous straight line. Service Lines shall be as close to ninety degrees from main line as possible. Tap saddles will be required. Service lines in driveways are not permitted. Tap saddles shall be Romac 202 BS or Equal. HDPE service lines shall be installed horizontally in a "snake-like" configuration to allow for both expansion and contraction of the line in the trench.

#### **3.13.2 Service Lines**

- a. HDPE service lines shall be the same size from the corporation stop to the curb stop or secondary valve. Then, if necessary, the size of the service line may be increased or reduced only after the curb stop or secondary valve to the meter by one size. HDPE service lines shall be installed horizontally in a "snake-like" laying configuration to allow for both expansion/contraction movement of the pipe in the trench. The HDPE service line shall consist of one (1) piece of continuous pipe from the corporation stop to the curb stop/secondary valve, no fittings or connections are allowed. The curb stop/secondary valve may not be placed under concrete or paved driveway areas. If the service line needs to be extended to accommodate moving the curb stop/secondary valve out of a concrete or paved area, the valve must be abandoned and repaired using butt fusion or heat socket

fusion by a certified installer and the new valve will be routed to the closest edge of the concrete.

- b. 12 gauge insulated solid core tracer wire, as specified herein, shall be extended from the main to the foundation of the house/structure. Tracer wire shall be extended up the outside of the curb stop box, as specified herein and approximately eighteen inches (18") at foundation.
- c. The location of service lines shall be shown permanently on the face of the concrete curb stamped with a "W" in the concrete.
- d. Service Lines other than residential may have meter vaults (see standard drawing W-38) at the property line or the meter may be inside the building and shall consist of a corporation stop at the main, plastic to a curb stop and plastic pipe to a point outside the foundation of the structure in compliance with the latest building code. The curb stop shall be within two-feet (2') of the sidewalk. The service shall be installed only after the building foundation has been constructed.
- e. All service lines shall have an expansion loop of 1 to 2 feet of slack for settlement.

THIS PAGE LEFT BLANK INTENTIONALLY

## **Section 4.0 Water System Material Standards**

### **4.1 Material Specifications-General**

All materials incorporated into the construction of the Water System shall be new and of first class quality. Used, damaged, sunburned, or imperfect materials will not be permitted and shall be removed from the job site by the Contractor when so directed by the Water Operations Manager/Inspector, District Engineer, or Inspector.

The Contractor shall be responsible for storing material at the job site in a manner to prevent damage or contamination of the material. Security is the Contractor's responsibility. The District is not responsible for loss of material from the job site.

All materials that will be in contact with drinking water shall be certified to meet the lead-free requirements of NSF/ANSI 61 and NSF/ANSI 371.

### **4.2 Pipe**

#### **4.2.1 Polyvinyl Chloride (PVC) Pipe**

- a. PVC may be used for water line up to 24 inches in diameter.
- b. For pipe diameter of 12 inches or less, pipe shall meet requirements of AWWA Standard C900 and shall be either DR 18 or DR 14 as approved on the drawings.
- c. For pipe diameter of greater than 12 inches through 24 inches, pipe shall meet requirements of AWWA Standard C905 and shall be either DR 25 or DR 18 as approved on the drawings.
- d. All pipe must have adjusted #12 tracer wire (solid core) with testing stations every 550' on transmission lines unless valves are specified.
- e. Fittings for all pipe shall be ductile iron meeting the requirements of AWWA Standards C104 and C110 and C153 for short body ductile iron. **PVC Fittings are not allowed.**
- f. All test stations not in roadways shall have a blue carsonite type marker post.

#### **4.2.2 Ductile Iron Pipe**

- a. DIP may be used for water line through 30 inches (30").
- b. Shall meet requirements of AWWA Standard C151.
- c. Pipe class shall be a minimum of C1 350 for all sizes, unless otherwise specified on the approved drawings.
- d. Joints shall be "push-on single gasket" type meeting requirements of AWWA Standard C111.

- e. Cement mortar lining shall be provided meeting the requirements of AWWA Standard C104.
- f. Fittings for all pipe shall be cement mortar lined ductile meeting the requirements of AWWA Standards C104 and C110 and C153 for short body ductile iron. **PVC Fittings are not allowed.**
- g. Pipe shall be poly wrapped.

#### **4.2.3 Steel Pipe Fabrication**

- a. General: All steel pipe, fittings and specials shall be fabricated in accordance with A.W.W.A. Standard C200, "Steel Water Pipe 6-Inches (6") and Larger," A.W.W.A. M-11 Steel Pipe Manual and the requirements on the drawings.

The District requirements for nominal diameter of fabricated steel pipe shall be as follows:

|                        |                         |
|------------------------|-------------------------|
| 4-inch though 12-inch  | I.D. (Inside Diameter)  |
| 14-inch though 30-inch | O.D. (Outside Diameter) |
| 32-inch and larger     | I.D. (inside Diameter)  |

Complete shop drawings shall be submitted to the District for approval prior to any fabrication.

- b. Material: All material used shall be acceptable under the "Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates of Structural Quality,". A.S.T.M. Designation A283, Grade C or D. Mill pipe shall meet A.S.T.M. A-53 or A139.

Steel pipe, fittings, and specials shall be fabricated to the sizes, dimensions, and shapes as indicated on the drawings. Specified pipe shall be to the nominal inside or outside diameter of the pipe as indicated above. All pipe shall have a wall thickness of at least one-half inch (1/2").

### **4.3 Cathodic Protection**

- a. Where DIP is used the entire pipe and fitting system shall be bonded continuously. A minimum of 17 lbs (sacrificial anode) per 400 feet of distribution line is required at separation not to exceed 400 feet. Additionally, fire hydrants sets and fitting and/or valve clusters must have a minimum of 9 lbs (sacrificial anode) per grouping with groupings not to exceed 4 fittings/valves. (See standard drawing W-7)
- b. Where PVC is used each fitting requires a minimum of 1 lb (sacrificial anode) per each fitting. Additionally, fire hydrants sets must have a minimum of 9 lbs (sacrificial anode). If fitting groups are bonded, each grouping must have a minimum of 9 lbs (sacrificial anode) per grouping with groupings not to exceed 4 fittings/valves. (See standard drawing W-7)

### **4.4 Valves**

#### **4.4.1 Twelve Inch (12") Diameter and Smaller**

- a. Twelve-inch (12") valves and smaller shall be gate valves meeting the requirements of AWWA Standard C509 "Resilient Seated Gate Valves."
- b. Stem shall be non-rising with a two inch (2") operating nut and O-ring seal.
- c. End connections shall conform to AWWA Standard C111.
- c. Only valves of the following manufacturers will be permitted:
  - Waterous (Series 2500)
  - Mueller (Series 2300)
  - AVK (Series 45)
  - Kennedy
- e. All valves shall be installed with a cast iron valve box of the three (3) piece type to the finished grade. Tyler Slip Type six-inch (6") cast iron valve box assembly series 6855, or equal.
- f. Valves shall open counterclockwise.
- g. If the dimension from final grade to the operating nut exceeds 5 feet (5'), a valve extension shall be installed.

**4.4.2 Fourteen Inch (14") Diameter and Larger:** Fourteen-inch (14") valves and larger shall be Gate Valves with side operator meeting requirements of AWWA Standard C515 modified to two-hundred and fifty (250) PSI working pressure. Valves shall be epoxy coated AWWA C550 and be equipped with beveled gear box.

## **4.5 Fire Hydrants**

**4.5.1 General:** All fire hydrants shall be designed and manufactured in strict compliance with AWWA Standard C502 for Dry-barrel Fire Hydrants. All references made in this specification are to the above standard unless otherwise noted.

### **4.5.2 Acceptable Brands:**

- American AVK Series 2700 (Modern)

**4.5.3 Size of Hydrant:** Hydrants shall have a Main valve opening size of five and one quarter inches (5 1/4") and shall have a five and one-half foot (5-1/2') bury unless otherwise approved by the District Engineer.

**4.5.4 Type of Hydrant:** All hydrants shall be the traffic model type. Hydrants shall be the three-way type with one (1) pumper nozzle and two (2) hose nozzles, all located on the same horizontal plane.

**4.5.5 Inlet Connection:** Hydrant base shall be provided with a mechanical joint inlet to accommodate six-inch (6") diameter ductile iron or PVC pipe, all in accordance with AWWA Standard C111/A21, "Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings". Incorporated into the base shall be two (2) lugs for rodding or strapping of pipe.

**4.5.6 Main Valve Assembly:** Main valve of the hydrant shall be five and one quarter inch (5 1/4") diameter compression type which closes with water pressure.

Gasket for valve shall be a replaceable type fabricated of a resilient material, with a threaded bottom plate or nut, complete with seal to prevent leakage of the hydrant.

The valve assembly shall include one (1) or more drain valves which will work automatically with the Main valve and drain the barrel when the Main valve is in the closed position.

All parts of the Main valve assembly shall be so designed that removal of the assembly from the barrel is accomplished without excavation.

**4.5.7 Operating Shaft Nut:** The operating nut shall be a pentagon in shape. The nut shall be one and one-half inches (1-1/2") from point to opposite flat. See standard drawing W-3. Bushings in the bonnet shall be constructed so that it will prevent the operating nut from traveling during opening or closing operation. Also, the bushing shall house a gasket or seal to prevent moisture or foreign material from entering the lubricant reservoir.

The hydrant shall open by turning the operating nut to the left in a counterclockwise direction and shall have an arrow on top of the bonnet to designate the direction of opening.

**Pumper Nozzle and Cap:** The pumper nozzle shall be four and one-half inch (4'-1/2") nominal diameter with four (4) threads per inch. Threads shall be right hand. See standard drawing W-3.

Nozzle caps shall be furnished with a synthetic rubber gasket installed in a retaining groove and the dimensions and shape of the nozzle cap nut shall be the same as the operating shaft nut as described in Section 4.5.7 of these Specifications.

Nozzle caps shall be furnished with security chains with one end of each securely attached to the upper barrel section of the hydrant.

All nozzle caps shall be removed by turning counterclockwise.

**4.5.9 Hose Nozzles and Caps:** The two (2) hose nozzles shall be two- and one-half inch (2 1/2") nominal diameter with seven and one half (7 1/2) threads per inch. Threads shall be right hand. See standard drawing W-3. Each hose nozzle shall include a nozzle cap with nut and security chain and shall be removed by turning counterclockwise as described in Sections 4.5.7 and 4.5.8 above.

**4.5.10 Color:** The upper exposed section of the hydrant above ground shall be painted Rustoleum 659 yellow or equal. The buried portion of the hydrant shall be given a bituminous coating in accordance with Section 10-8.1 of AWWA Standard C110.

**4.5.11 Location:** Where possible, fire hydrants shall be located in the northeast quadrant of the intersection. See standard drawing W-1 for typical installation. The location of all fire hydrants shall have the written approval of the appropriate Fire Protection District.

**4.6 Pressure Reducing Valves:** Pressure reducing and regulating valves shall be of a type capable of maintaining pre-adjusted downstream pressures, varying rates of flow and upstream pressure without causing water hammer. Valves shall be piston type, not spring operated, with flanged end connection, and shall be installed in concrete valve vaults of sufficient size to provide adequate

maintenance and operation. Valves shall have gate valves and pressure gauges on both upstream and downstream sides and shall have bypasses with smaller pressure reducing and regulating valves to handle minimum flows as determined by the District Engineer. All gate valves in the vaults shall be capable of being operated from above ground by use of two inch (2") square valve keys. Cla-Val or equal are acceptable.

- 4.7 Air Release Valves:** Valves shall be combination air release and vacuum valves. These shall be installed at each high point on all twelve inch (12") and larger water Mains and at all other locations as directed by the District Engineer. Air release and vacuum breaker valves shall be located in pre-cast concrete manholes in accordance with the standard drawing W-39 and shall automatically release air from the lines when the lines are being filled with water and shall admit air into the lines when water is being withdrawn in excess of the inflow.

Valves shall be iron body, with bronze trim. Floats shall be stainless steel. One-inch (1") valves shall be installed. Oil the stem between the pipe and release valve or as shown in the standard drawing W-39.

Pipe and fittings used in the release valve system shall be brass and connections shall be threaded. Gate valves shall be resilient-seated, threaded gate valve with a two-inch (2") standard operating nut.

Acceptable manufacturers are Apco, Crispin, Val-Matic, ARI, and Clow.

Four-inch (4") vents are required for ARV's less than two-inches (2"), and six-inch (6") vents are required for two-inch (2") ARV's or larger.

- 4.8 Thrust Blocks:** Concrete thrust blocks, in addition to rods and clamps and/or restrained fittings, shall be installed at all tees, plugs, bends, and fire hydrants in accordance with the standard drawing W-10. Where thrust blocks are used in conjunction with eight (8) mil thick polyethylene as a bond breaker, care shall be taken not to block weephole outlets or to cover bolts, nuts, clamps, or other fittings or to make them inaccessible. Size of thrust block, type of concrete, and dimensions shall be in accordance with the details in standard drawing W-10. Concrete shall be three thousand (3,000) PSI strength at twenty-eight (28) days.

- 4.9 Pre-Cast Concrete Vaults and Manholes:** All butterfly valve and air release and vacuum valve manholes, pressure reducing valve vaults, meter vaults, and other vaults shall be pre-cast or poured-in-place concrete. Design of manholes and vaults shall be for H-20 traffic loading and shall include aluminum rungs, cast iron rings and covers of a pattern approved by the District Engineer, with the word "WATER" cast thereon, and shall be in accordance with the details in standard drawing W-29.

#### **4.10 Services**

##### **4.10.1 Service Lines**

- a. All residential Service Lines shall consist of a corporation stop at the Main, continuous plastic pipe to a curb stop at the property line, and continuous plastic pipe up through the slab or floor of the structure in compliance with the latest building code. Meter pits are not permitted on residential services. Residential Service Lines shall be a minimum of three-quarter inch (3/4") diameter. Plastic pipe will be HDPE SIDR 7 Polyethylene line rated at two hundred (200) psi with stainless steel stiffeners of equal.

- b. The water meter and meter set are part of the service. Service Lines larger than two-inches (2") shall be ductile iron or polyvinyl chloride and shall have a gate valve at the Water Main.

No portion of the building electrical system and/or ground may be attached to the service line or internal plumbing such that current may be induced into or from the piping system.

- c. Water Service lines shall be a minimum of three-quarter inch (3/4") inside diameter.
- d. No flares will be allowed on any installations.

**4.10.2 Corporation Stops and Curb Stops (or Valves)** Corporation stops and curb stops shall meet the requirements of AWWA Standard C800. Curb stops shall include a curb box installed at the right-of-way line.

Corporation stops shall be McDonald 74701B.

Curb Stops shall be:

McDonald  
MCD 6100-33 3/4"  
MCD 6100-33 1"  
MCD 6100-33 1-1/2"  
MCD 6100-33 2"

For lines larger than two-inches (2"), curb stop valves shall be resilient-seated gate valve with epoxy-coating inside and out.

**4.10.3 Meters**

a. General

1. All water supplied by the District to a property must be metered.
2. All water meters shall be installed and furnished by the District at the expense of the property owner and shall become the property of the District.
3. Water meters will be serviced and maintained by the District.
4. Meters under one and one-half inch (1-1/2") shall be supplied with MXU.
5. One and one quarter inch (1-1/4") meters are not permitted.

b. Residential Meters up to one and one-half inch (1-1/2")

1. Shall be Badger Brass Recordall® Disc Series Meters
2. Shall be furnished with District's AMR system.
3. Shall be calibrated and furnished to indicate gallons

- c. Residential Meters two-inch (2") and larger
  - 1. Shall be compound meters in brass housing with a disc meter to record small flows and a turbine to record large flows.
  - 2. Shall be calibrated and furnished to indicate gallons.
  - 3. Shall be furnished with District's AMR system.
- d. Irrigation meters 1 1/2" and larger
  - 1. Shall be Badger Brass Recordall turbo series, Model T-160.
  - 2. Shall be calibrated and furnished to indicate gallons.
  - 3. Shall be furnished with District's AMR system.

#### **4.10.4 Backflow Preventers**

- a. Only the models of backflow prevention assemblies that are approved by the American Society of Sanitary Engineering (ASSE) are acceptable for use when installing assemblies and devices used to control cross-connections in accordance with CDPHE Regulation 11.
- b. Air gaps must be installed in accordance with standard ASME A112.1.2.
- c. Backflow prevention assemblies and air gaps used for containment shall be installed on the user's water service line as close as possible to the point of connection to the public water system and prior to any other connection or branch line. All backflow prevention assemblies shall be installed at a location that allows easy access to the assembly for maintenance and testing and that will not subject the assembly to excessive heat or freezing, and shall be installed in accordance with current Colorado Plumbing Code..
- d. No bypass piping shall be allowed around the backflow prevention assembly unless the bypass is equipped with the same degree of backflow prevention protection.
- e. All backflow prevention assemblies shall be installed at a location that allows easy access to the assembly for maintenance and testing and that will not subject the assembly to excessive heat or freezing
- f. Air gaps must be installed in accordance with standard ASME A 112.1.2.
- g. All backflow prevention methods should be installed in accordance with Colorado Plumbing Code and be approved by the Water Department Manager.
- h. All construction water connections will be provided with an approved backflow prevention with a District approved assembly or method.

**4.10.5 Water Sampling Station:** Water Sampling Station shall be five (5) foot burry with a  $\frac{3}{4}$ " FIP inlet and  $\frac{1}{2}$ " unthreaded blow off and sampling bibb. The Station shall be enclosed in a lockable non-removable aluminum box with hinged openings. When open, the Station shall require no key for operation and all water flow shall pass through an all-stainless-steel waterway. All working parts shall be serviceable from above ground with no digging or replacement needed. A pet cock will be located below the sampling bibb to allow pumping of any water remaining inside the station to insure non-freezing.

The Station shall be installed with a typical tap, service line and curb stop.

The Station shall be Kupferle Model #88 SS or approved equal. The station shall have the optional pedestal.

## **Section 5.0 Wastewater System Design Standards**

**5.1 Quality of the Collection System:** The purpose of these Specifications is to ensure that only proven high quality materials are installed using first-class workmanship. Determination of the best materials and construction methods are based upon lowest life cycle costs. Sizing and layout of the system are parts of the total consideration of design, operation and maintenance of a Wastewater Collection System that yields optimum quality service at the lowest total cost to the Customer.

**5.2 Sizing of Collection Mains:** All Mains shall be sized large enough to provide for sanitary sewer service for the entire basin area requesting service and shall meet the following requirements: The District reserves the right to size Mains to provide service for projected future needs.

No public sewer shall be less than eight inches (8") in diameter with the exception of small service areas where six-inch (6") sewers may be used with the approval of the District. No Service Line shall be less than four inches (4") in diameter. All sewer lines shall be sized to flow at seventy-five percent (75%) of the end area of the pipe or less during peak wet weather flow periods.

**5.3 Layout of the Collection System:** Width Requirements for District Main Installations: All District Mains shall be installed in dedicated public street rights-of-way. When the District determines it is not possible or feasible for an installation to be made in a dedicated street, the installation shall be made in a right-of-way or easement. The conditions under which such an exception will be allowed will be determined for each individual case, and only rights-of-way and easements which conform to the requirements of the District will be accepted. The minimum width right-of-way or easement which will be accepted by the District is twenty feet (20'). Depending on size of main and depth, additional width may be required.

**Dedicated Streets:** Pipe alignment shall be parallel to property lines. Normal practice is to lay the pipe on the center line of the street. In any case, pipe alignment shall always be within an established roadway, between the limits of the curb and gutter. Installation of curvilinear pipelines in sizes eight inches (8") through eighteen inches (18") is acceptable and necessary to obtain the standard location of Sewer Mains. Curvilinear sewers must be designed and constructed using a uniform slope between manholes and shall have a center line radius of one hundred feet (100') or greater. The necessary curvature shall be attained by deflection at joints not to exceed the manufacturer's recommendations or three degree (3°) preformed joints or couplings. Field bending of pipe shall not be permitted.

When streets and subdivisions fall in hillside overlay zones or areas of unique characteristics as identified by the Developer and the District: The Developer and his engineer shall meet with the District to address concerns of pipeline materials, pipe alignment, pipeline access, landscape restoration and surface monumentation.

**5.3.1 Sewer Service Lines** Sewer service lines shall be a minimum of four-inches (4") in diameter and shall be placed approximately in the middle of the lot and extended into the lot.

The location of each sanitary service line shall be shown permanently on the face of the concrete curb stamped with an "S" in the concrete.

Wastewater Service Lines shall be tapped a minimum distance of 5-feet from a manhole

**5.4 Manholes:** Manholes shall be installed at the end of each line, at all pipeline intersections, changes in grade, changes in size, alignment (except curvilinear sewers) and at distances of not

greater than four hundred feet (400'). Manholes must also be located to allow unassisted access by District maintenance vehicles. Lines and manholes located in areas where access, in the opinion of the District, is not possible will be reviewed on a case by case basis.

**5.4.1 Manhole Sizes:** The inside diameter (I.D.) of the manhole shall not be less than the following:

| Pipe Size (in) | Manhole Depth (ft) | Manhole Size (I.D.)              |
|----------------|--------------------|----------------------------------|
| 8" and 10"     | 0' to 12'          | 48" (where no more than 2 lines) |
| 8" and 10"     | 0' to 12'          | 60" (where 3 lines)              |
| 12" to 18"     | 13' to 19'         | 60"                              |
| 24" and larger | 20' to 25'         | 72"                              |

**5.4.2 Changing Pipe Size:** When sewers are changed in size at a manhole with no intersecting sewers, the manhole invert shall be designed with a one tenth of one foot (0.1') drop through the manhole.

**5.4.3 Intersection:** Pipelines deflecting twenty degrees (20%) or more shall have one tenth of one foot (0.1') drop in the invert through the manhole. Changes in direction at intersections shall not be greater than ninety degrees (90°). The slope through the manholes shall not be less than the most restrictive slope of the pipe in or out of the manhole. Intersecting pipelines at manholes with greater than one (1) pipe size difference shall be designed to match crown elevations. Pipelines passing straight through manholes without changes in grade, and alignment shall be laid through the manhole.

**5.4.4 Manhole Channels:** The flow channel shall be made to conform its slope and shape to that of the sewer pipe and wherever possible shall use the lower one-half (1/2) of the sewer pipe of the invert of the open channel. The completed channel shall be U-shaped, coming up as high as the top of the largest pipe. At intersections with other lines, channels shall be formed with a curve to minimize turbulence.

**5.4.5 Manhole Rings and Covers:** Manhole rings and covers shall conform to the attached detail sheets for ring and cover designs. All manholes located outside of dedicated street or alley rights-of-way will be designed and constructed with a locking type cover and the ring bolted to the concrete cone. Depending on the manhole location the District may require "self-sealing" or "self-sealing" bolt down lids. Grade adjustment rings or blocks between the ring and cover and the concrete cone cap shall not exceed eight inches (8").

**5.4.6 Drop Manholes:** Internal drop manholes with a minimum of five feet (5') diameter will be permitted only in special conditions where District approval has been granted. External drop manholes shall not be used.

**5.5 Minimum Sewer Depth:** In general, main line sewers should be designed deep enough to drain basements and to prevent freezing. No public Mains shall be less than five and one-half feet (5-1/2') deep measured from the top of the pipe. Sewer lines less than five and one-half feet (5-1/2') and greater than fourteen feet (14') shall be given special consideration and reviewed by the District on a case by case basis concerning pipe material and bedding requirements.

**5.6 Slopes:** All sewers should be designed to transport sewage flows at mean velocities of two feet (2') per second at seventy-five percent (75%) of the pipe end area based on a roughness coefficient of thirteen one-thousandths (.013).

The slope between manholes shall be uniform and the greatest slope physically possible. Slopes of one percent (1.0%) or greater are preferred due to practical constructability and construction tolerances.

Slopes less than one percent (1.0%) will require special bedding and compaction methods. In no case shall the slope be less than the following for Mains and services:

|     |       |
|-----|-------|
| 8"  | 0.35% |
| 10" | 0.29% |
| 12" | 0.29% |
| 15" | 0.23% |
| 18" | 0.17% |
| 24" | 0.13% |
| 30" | 0.11% |
| 36" | 0.10% |

**5.7 Construction Tolerance:** Vertical construction tolerances for pipe installation shall be one tenth of a foot (0.10') per one hundred feet (100') of pipe or per manhole run, whichever horizontal distance is greater and that no reduction of required flow rate below ultimate peak flow results and that the pipe slope does not fall below the minimum slope for the size of pipe used. In circumstances where it may not be feasible or practical to place pipe at the minimum slope, the Contractor may increase the pipe size to the nearest pipe size that will provide an equal flow quantity at an acceptable slope or have continuous on-site surveying for the setting of each joint of pipe. This option must be approved by the District prior to start of construction. Horizontal construction tolerances shall be one foot (1'), plus or minus, of the design centerline of the pipe.

**5.8 High Velocity Protection:** In the case of sewers where the slopes are such that over fifteen percent (15%) grades are attained, special provisions shall be made to prevent displacement by erosion and shock. Such high velocity protection shall be approved by the District Manager.

**5.9 Relation to Water Mains:** Sewers shall be located a minimum of ten feet (10') horizontally from existing or proposed Water Mains, and the sewer pipe shall be a minimum of eighteen-inches (18") clear distance vertically below the Water Main. If this clear distance is not feasible, the crossing must be designed and constructed so as to protect the Water Main. Such crossings shall meet Colorado Department of Public Health and Environment (CDPHE) requirements and be approved by the District. Minimum protection shall consist of the installation of an impervious and structural sewer as follows:

- a. One length of pipe at least eighteen feet (18') long centered over or under the Water Main. Joints between the existing sewer pipe and the new sewer pipe shall be made with a manufactured adapter approved by the District and made specifically for such joining.
- b. Existing concrete or vitrified clay pipe shall be protected with a full reinforced concrete encasement. Encasement shall be at least six-inches (6") thick and extend a distance of ten feet (10") on either side of the Water Main.
- c. Deviations from the 18-inch and 10-foot standards require specific District approval of the crossing. If an approved waiver includes less than a 1-foot vertical separation, an annular space shall be provided between the two pipelines. To create the annular space, a biodegradable cardboard or soft foam rubber shall be used as a spacer of length equal to or greater than the larger pipe diameter of the two pipe crossings. No crossing shall be made where the vertical clear separation is less than six-inches (6").

In all cases, suitable backfill or other structural protection shall be provided to preclude settling or failure of the higher pipe. Depending on pipe material, pier supports may be used.

- 5.10 Stub-outs From Manholes:** Stub-outs from manholes shall not be allowed except for lines which will be extended in the future. Designs to complete the manhole run shall be submitted for review to insure proper grade and alignment of future construction. Future extension of stub-outs shall be of like material using the same grade and alignment as designed. No service connections will be permitted on stub-outs.
- 5.11 Inverted Siphons:** Inverted siphons shall have not less than two (2) barrels of ductile iron pipe with a minimum pipe size of six-inches (6") and shall be provided with necessary appurtenances for flushing and maintenance. Sufficient head shall be provided, and pipe sizes selected to provide velocities of at least three feet (3.0') per second for average flow. The inlet and outlets shall be arranged so that the normal flow can be diverted to either barrel for cleaning and maintenance.
- 5.12 Stream and Drainage Channel Crossings:** All stream and drainage channel crossings shall be ductile pipe encased in reinforced concrete. Crossings of proposed channel bottoms shall be supported by reinforced concrete caissons drilled a minimum of five feet (5') into impervious soil or twenty feet (20') whichever is less. In the absence of impervious soils, caissons shall extend twenty feet (20') below the invert of the sewer main. A fifteen-foot (15') splash pan consisting of eighteen-inch (18") to twenty-four inch (24") grouted rip-rap shall be placed downstream tapering from six feet (6') deep at the crossing to three feet (3') deep at the end to prevent erosion. All stream and channel crossings shall be reviewed and approved by the District Engineer.
- 5.13 Crossings Under Railways and Highways:** Crossings under railways and highways will consist of pipe laid inside steel pipe conduits, which are jacked or placed by an approved method underneath the track or roadway. The steel conduit pipe shall be placed horizontally through the ground at substantially the grade of the sewer, with due allowance for the bells of the carrier pipe. As the pipe is moved along, the earth shall be excavated from the face and removed so that it will not be necessary to force the pipe through solid ground. The conduit shall be of the sizes shown on the plans. In any case, the conduit diameter shall be a minimum of twelve inches (12") larger than the carrier pipe. After the conduit has been completed, the carrier pipe shall be placed inside and blocked in exact position and grade with approved insulating skids. Each end of the conduit shall then be plugged tight around the ductile iron or steel carrier pipe and the conduit pipe.
- 5.14 Aerial Crossings:** Each aerial crossing shall be reviewed, modified and approved by the District depending on its location, size and clearances.
- 5.15 Metering Manholes:** Metering pits for the purpose of metering Wastewater flows shall be prepared and submitted to the District Engineer for his review and approval. All metering pits shall include, but not necessarily be limited to the following:
- a. The Parshall Flume shall be installed as per the flume's manufacturer's recommendations with the following criteria as minimum guidelines to insure the proper functioning of the flume:
    - Upstream pipe sections equal to a minimum of twenty-five (25) throat widths, shall be free of bends, dips, elbows, or flow junctions to insure subcritical flow.

The downstream pipe sections shall have slope greater than the upstream pipe to insure supercritical flow.

The flume itself shall be grouted into the block-out at zero percent (0.0%) slope as shown on the standard detail.

The flume shall be made of corrosion resistant materials and supplied with a manufacturer's rate curve. Shop drawings shall be submitted to the District Engineer for review and approval prior to installation.

- b. Concrete vault or minimum six feet (6') ID manhole
- c. Flow measurement, totalizing and recording devices
- d. The metering pit shall have a suitable and safe means of access
- e. Flow Level Sensor and Transmitter if required. The flow sensor shall be of a non-intrusive type and shop drawings for the level sensor and transmitter shall be submitted to the District Engineer for review and approval prior to installation.
- f. Manhole Ventilation: The District Engineer may require that the control manhole be vented if it is determined that it is needed to protect the monitoring equipment and ensure proper function of said equipment.

**5.16 Pumping Facilities:** Pumping facilities may be allowed on mains in the District Collection System only where specifically authorized by the District. The District will prohibit the installation of pumping facilities where, in its opinion, such installations would be injurious to the operation, or future operation of the District's Wastewater Collection system. All proposed pumping facilities shall be considered as a special feature and will be dealt with on an individual case basis. All proposed pumping stations and force mains shall be approved by the State of Colorado.

A basis for design for all wastewater pumping stations shall have the following features:

- a. Wastewater pumping stations shall not be subject to damage by flooding. A suitable superstructure located off the right-of-way of streets and alleys shall be provided and be readily accessible.
- b. Wastewater pumping stations shall not be subject to damage by flooding. A suitable superstructure located off the right-of-way of streets and alleys shall be provided and be readily accessible.
- c. Wastewater pump stations shall be of the dry well type.
- d. Wet and dry wells, including their superstructure shall be completely separated.
- e. At least two (2) pumps must be provided. If only two (2) pumps are provided, they shall have the same capacity. All pumping units shall be driven with three phase motors. Each shall be able to handle flows in excess of the expected maximum flow. Depending on the application, VFD motors may be required for flow control.

- f. Adequate ventilation shall be provided for all pump stations to mechanically ventilate the dry well. Wet well vents shall be provided. There shall be no interconnection between the dry well and the wet well ventilating systems.
- g. Liquid level controllers shall be located as not to be affected by flows entering the station. In small stations with duplicate units, provisions shall be made to alternate the pumps in use.
- h. Pumping stations shall be equipped with suitable devices for measuring, recording, and totalizing sewage flow and power consumption.
- i. Power supply shall be available from at least two (2) independent generating sources, or emergency power equipment shall be provided. Automatic starting of emergency power equipment shall be provided.
- j. Alarm systems shall be provided for all pumping stations. The alarm shall activate in cases of pump station malfunction.
- k. On-site retention for all Wastewater pumping stations shall be provided. The size and capacity of on-site retention will be determined by pump station size, distance from Wastewater treatment plant, and location of pump station site, etc.

**5.17 Force Mains:** All proposed pumping stations and force mains shall be approved by the State of Colorado. Force mains and all their appurtenances shall be designed and tested to conform to potable water line criteria and the following minimum requirements:

- a. Velocity: A design average flow velocity of at least two feet (2') per second shall be maintained.
- b. Air Relief Valves: An automatic air relief valve shall be placed at high points in the force Main to prevent air locking.
- c. Termination: The force main should enter the gravity sewer system at a point not more than two feet (2') above the flow line of the receiving manhole.
- d. Design Pressure: The force main and fittings, including reaction blocking, shall be designed to withstand normal pressure and pressure surges (water hammer).
- e. Design Friction Losses: Friction losses through force Mains shall be based on the HazenWilliams formula or other acceptable method. When initially installed, force Mains will have a significantly higher "c" factor. The higher "c" factor should be considered.
- f. Separation from Water Mains: The separation from Water Mains shall be the same as gravity sanitary Sewer Lines.
- g. Identification: Where force mains are constructed of material which might cause the force main to be confused with potable Water Mains, the force Main should be appropriately identified.

**5.18 Swimming Pools:** All non-residential swimming pools shall discharge directly into a Wastewater Service Line. Swimming pools shall be discharged at a rate that does not exceed 100-gallons per minute or at a rate that does not cause the downstream system, or any

appurtenance, to surcharge, whichever is less. A swimming pool may not discharge through a Grease Interceptor. A detailed drawing of the proposed outlet/drainage system shall be shown on the Approved Wastewater Construction Plan as well as the location of the connection to the Wastewater Main or Wastewater Service Line.

Residential swimming pools are not allowed to connect to a Wastewater Service Line.

THIS PAGE LEFT BLANK INTENTIONALLY



## **Section 6.0 Wastewater System Excavation and Site Standards**

- 6.1 Earthwork Defined:** Earthwork shall include all clearing, grubbing, grading, excavation, fill, backfill, excess excavation, bedding material, borrow material and surface restoration as may be required to complete the work.
- 6.2 Traffic Control:** Traffic control, signing, detours, and utilization of existing streets require approval by the controlling Right-of-Way Authority. Contractors and/or Developers must obtain adequate permitting and approvals from the controlling agency.
- 6.3 Caution in Excavation:** The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground utilities and structures, both known and unknown, may be determined and shall be held responsible for the repair of such structures when broken or otherwise damaged because of carelessness on his part.

The District cannot guarantee the accuracy of underground utilities and structures as shown on plans and will not be responsible for any damage that may occur during construction.

Whenever, in the opinion of the District, it is necessary to explore and excavate to determine the location of underground utilities and structures that may interfere with construction, the Contractor shall make the explorations and excavations for such purposes.

- 6.4 Excavation to Line and Grade:** All excavations shall be made to the lines and grades as established by the approved drawings and these Specifications. Pipe trenches shall be excavated to the depth required to provide a uniform and continuous bearing and support for the pipe on solid undisturbed ground at every point between bell holes. (Bell holes shall be provided at each pipe joint to permit the joint to be made properly.) Any part of the bottom of the trench excavated below the specified grade shall be corrected with approved material and thoroughly compacted as directed by the District. The finished grade of the trench shall be prepared accurately by means of hand tools. Deviation from line and grade may be allowed when approved by the Inspector, in accordance with these Specifications.
- 6.5 Trenching and Excavation Operations:** The trench shall be excavated in a manner that will allow the pipe to be installed to the alignment and depth required. The trench shall be excavated only so far in advance of the pipe laying as is necessary to expedite the work.

- a. **Trench Width.** All existing asphalt or concrete surfacing shall be cut vertically in a straight line and removed from the job site prior to starting the trench excavation. This material shall not be used in any fill or backfill.

The trench shall be excavated so that a minimum clearance of six-inches (6") shall be maintained on each side of the pipe for proper placement and densification of the bedding or backfill material. Ledge rock, boulders and large stones shall be removed to provide a clearance of at least six-inches (6") below and on each side of all pipe and fittings. The specified minimum clearances are the minimum clear distances that will be permitted between any part of the pipe and appurtenances being installed and any part, projection, or point of such rock, boulder or stone.

The maximum bottom of trench width, measured at the top of the pipe shall be the outside diameter plus forty inches (40") regardless of the type of pipe, type of soil, depth of excavation or the method of densifying the bedding and backfill.

Trenches may be of such extra width, when required, to permit necessary supports, sheeting or bracing and handling of specials.

- b. Trench Support. The trench shall be adequately supported and the safety of workers provided for, as required by the most recent standards adopted by the O.S.H.A. Standards Board. Sheeting and shoring shall be utilized where required to prevent any excessive widening or sloughing of the trench, which may be detrimental to human safety, to the pipe and appurtenances being installed, to existing utilities, to existing structures, or to any other existing facility or item.

Trench support is the sole responsibility of the Contractor. The District Inspector's presence in no way implies approval of trench support methods being utilized.

- c. Excavated Material. Excavated material shall not be placed closer than two feet (2') from the top edge of the trench. Heavy equipment should not be used or placed near the sides of the trench unless the trench is adequately braced.

All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing traffic. Hydrants under pressure, valve lid covers, valve boxes or other utility controls shall be left unobstructed and accessible until the work is completed.

- d. Excavation for Structures. Except as otherwise dictated by construction conditions, the excavation shall be of such dimensions as to allow for the proper installation and removal of concrete forms or precast structures, and to permit the construction of the necessary pipe connections. Care shall be taken to ensure that the excavation does not extend below established grades. If excavation is made below such grades, the resulting excess shall be filled in with approved material deposited in horizontal layers not more than six-inches (6") in thickness after being compacted, as directed by the District.
- e. Excavation in Poor Soil. If the bottom of the excavation at subgrade is found to be soft or unstable or to include ashes, cinders, refuse, vegetable or other organic material, or large pieces or fragments of inorganic material that, in the opinion of the Inspector, cannot satisfactorily support the pipe or structure, the Contractor shall further excavate and remove such unsuitable material to the width and depth specified by the Inspector.
- f. Protection of Existing Structures and Utilities. Adequate protection, temporary support and maintenance of all underground and surface structures, utilities and other obstructions encountered in the progress of the work shall be furnished by the Contractor at his expense and under the direction of the District. Any structures, utilities or obstructions disturbed or damaged shall be restored or replaced by the Contractor upon completion of the project.

**6.6 Blasting:** In general, blasting will be allowed in order to expedite the work if a permit by the local authority having jurisdiction is granted and a copy presented to the District. All explosives and appurtenances shall be transported, handled, stored and used in accordance with the laws of the local, state and federal governments, as applicable.

All blasting shall be controlled so as not to damage any existing structure or facility. The protection of life and property and all liability for blasting shall be placed solely on the Person or Persons conducting the blasting operation. The hours of blasting shall be fixed by the Inspector in accordance with the permit of the local authority.

Owners or occupants of nearby structures or facilities, within a minimum distance of five hundred feet (500') must be notified in writing by the Contractor at least seventy-two (72) hours in advance of blasting. The notice shall state the date, the time of blasting and who is responsible for the blasting. The District shall be notified a minimum of forty-eight (48) hours in advance of any blasting.

Blasting shall be controlled to avoid making any excavation unduly large or irregular and so as not to shatter the rock on the bottom or sides of any excavation or surface upon or against which concrete is to be placed. If, in the opinion of the District, blasting is liable to damage rock foundations or supports, concrete, other utilities or structures, all blasting shall be terminated and excavation shall be continued by jackhammering, barring, wedging or other methods.

- 6.7 Dewatering:** All pipe trenches or structure excavation shall be kept free from water during pipe laying and other related work. The method of dewatering shall provide for a completely dry foundation at the final lines and grades of the excavation.

**Dewatering may require a construction dewatering permit from the Colorado Department of Health & Environment (CDPHE).**

Dewatering shall be accomplished by the use of well points, sump pumps, rock or gravel drains placed below subgrade foundations or subsurface pipe drains. All water shall be disposed of in a suitable manner without being a menace to public health or causing public inconvenience. The dewatering operation shall continue until such time as it is safe to allow the water table to rise in the excavations. Pipe trenches shall contain enough backfill to prevent pipe flotation. When pipe is installed in a casing or tunnel longer than thirty (30) pipe diameters, the pipe inside and casing or tunnel shall be secured so flotation does not occur when the pipe is empty.

Water shall not be allowed to rise until any concrete has set and the forms have been removed. Water shall not be allowed to rise unequally against unsupported structural walls.

- 6.8 Pipe Bedding:** It is expected that the trench excavation will not provide suitable bedding and backfill material. A minimum of six-inches (6") of bedding material must be placed under the pipe and brought to 25% diameter up the side of the pipe around the pipe. (i.e. for 8-inch pipe this requires 2 inches; for 12-inch pipe this requires 3 inches). Wet, soft or frozen material, asphalt and concrete chunks, cinders ashes, refuse, vegetable or organic material, boulders, rocks, or other deleterious substances shall not be used for bedding or backfill.

If a question arises concerning the suitability of on-site bedding material the Inspector may require whatever testing he deems necessary to make consideration.

If the excavated material is not suitable for backfill as determined by the Inspector, suitable material shall be hauled in and utilized, and the rejected material hauled away and disposed of.

After completion of the trench excavation, bedding material shall be placed on the trench bottom for support under the pipe and compacted. Bell holes shall be dug deep enough to provide a minimum of two-inches (2") of clearance between bell and bedding material. All pipe shall be installed in such a manner as to ensure full support of the pipe barrel over its entire length. After the pipe is adjusted for line and grade and the joint is made, bedding material (squeegee sand) shall be carefully placed and tamped under the haunches of the pipe and in the previously dug bell holes.

"Tamping" is herein defined as the act of placing approved bedding material under the haunches of pipe, paying particular attention to voids, bell hole, and sling holes. The purpose of Tamping is to ensure uniform support for the pipe.

- a. Pipes. All pipelines shall be bedded from the bottom of the trench with sand, gravel or other approved bedding material. Bedding material shall be deposited in the trench for its full width on each side of the pipe, fittings and appurtenances simultaneously.

PVC pipe shall be installed in accordance with ASTM D2321 and the manufacturer's recommendations unless otherwise specified herein.

DIP pipe shall be installed in accordance with AWWA C600 and the manufacturer's recommendations unless otherwise specified herein.

- b. Structures. Backfill and fill within three feet (3') adjacent to all structures and for full height of the walls shall be selected non-swelling material. It shall be relatively impervious, well-graded, and free from stones larger than three inches (3"). On-site material may be used if approved by the District Representative. No backfilling will be allowed in freezing weather except by permission of the District. No additional backfill will be allowed over any frozen material already in the trench.
- c. Bedding Material. The bedding material shall be a clean squeegee sand free of corrosive properties and shall conform to the following gradation limits when tested by means of laboratory sieves:

***Squeegee Sand***

| <b>Sieve Size</b> | <b>Total Percent Passing by Weight</b> |
|-------------------|----------------------------------------|
| 3/8 Inch          | 100                                    |
| No. 200           | 0 – 5                                  |

1. Trench Stabilization Material: Trench stabilization material shall be uniformly graded washed rock conforming, to the following sieve analysis. A minimum of six inches (6") of granular bedding material shall be placed over the foundation material.

***Trench Stabilization Material***

| <b>Sieve Size</b> | <b>Total Percent Passing by Weight</b> |
|-------------------|----------------------------------------|
| 2 Inch            | 95 – 100                               |
| 1/2 Inch          | 10 – 30                                |
| #4                | 0 – 5                                  |

1. Flowable Fill: At the District's option, utility trench backfill meeting the requirements in the table below may be used in lieu of native backfilling in any excavation regardless of width or depth. Concrete slurry type full depth backfill will not be allowed within the public right-of-way.

Compaction and testing of utility trench backfill will not be required if material meeting the following specification is used:

***Flowable Fill***

| <b>Ingredient</b>            | <b>lbs./cubic yard</b>        |
|------------------------------|-------------------------------|
| Cement                       | 42 (0.47 sack)                |
| Water                        | 325 (43 gallons or as needed) |
| Course Aggregate (Size # 57) | 1700                          |
| Sand (ASTM C-33)             | 1845                          |

If approved by the District, fines from the trench wall and soil pile may be used to provide uniform support for the pipe. No rock or stone larger than that allowed by the sieve analysis, or any other detrimental substance, shall be placed closer to the pipe than six-inches (6"). The District reserves the right to require the use of select bedding material at any time.

- 6.9 Backfill and Compaction:** No section of Wastewater Main, Wastewater Main appurtenance or Wastewater Main structure shall be backfilled until the Inspector has examined and approved that section of the installation. Backfill is defined as the material placed from twelve inches (12") above the pipe to grade. **All backfill and compaction within the public right-of-way shall be in conformance with the excavation permit granted by the District Engineer or the controlling authority.**

Satisfactory compaction reports shall be submitted to the controlling authority prior to the completion of the project. The controlling authority (city, county, state) shall specify the exact number and locations of tests required. Railroad, airport and other private or special situations will require investigation and research to determine exact requirements and regulations.

All water required for backfill and compaction operations can be furnished from a designated fire hydrant near the project. The Contractor will be charged in accordance with the current cost for construction water. However, the Contractor will be responsible for furnishing all required personnel, valving, hose and other equipment needed to deliver the water to the desired location on the project. The District will designate the fire hydrant to be used and must be notified when water is required.

- 6.10 Cleanup:** Upon completion of the work, all rubbish, unused materials, concrete forms and other like materials shall be removed from the job site. All excess excavation shall be disposed of as specified and the areas shall be left in a state of order and cleanliness.

**6.11 Surface Restoration and Maintenance**

- a. **Surfaced Areas.** The Contractor shall obtain the necessary permits and remove pavement and road surfaces as part of the trench excavation. As a minimum, cuts in a public right-of-way shall be required to be restored per the conditions of the excavation permit issued by the District Engineer or the controlling authority. The Contractor shall restore all pavement, sidewalks, curbing, gutters or other surface structures removed or disturbed as part of the work to a condition meeting the standards of the governing authority and shall furnish all incidental labor and materials.

- b.     Unsurfaced Areas. All surface areas cuts shall be restored to a condition equal to that prior to construction.
- c.     Damaged Surfaces and Property. If any pavement, street, shrubbery, sod, rock, fences, poles or other property and surface structures have been damaged, removed or disturbed by the Contractor, whether deliberately or through failure to carry out the requirements of the controlling agency or the Specific directions of the District, or through failure to employ usual and reasonable safeguards, such property and surface structures shall be replaced or repaired, to the original condition, at the expense of the Contractor.

## **Section 7.0 Wastewater System Pipe Laying Standards**

**7.1 Handling of Materials:** Pipe and fittings shall be loaded and unloaded by lifting so as to avoid shock or damage. Under no circumstances shall such material be dropped. If, however, any part of the coating or lining is damaged, the replacement or repair of the damaged pipe shall be done to the satisfaction of the District. Any pipe or fittings that are not acceptable to the District shall be removed from the job site immediately. All pipe handling equipment and pipe handling methods shall be approved by the District in conjunction with the methods and equipment recommended by the manufacturer.

**7.2 Inspection and Preparation of Pipe and Fittings:** Before placing pipe in the trench, each pipe or fitting shall be thoroughly cleaned of all foreign material, kept clean at all time thereafter, and carefully examined for cracks and other defects before installation. Bell ends and spigot ends are to be examined with particular care. Defective pipe or fittings shall be laid aside for inspection by the Inspector who will prescribe corrective repairs or rejection.

All lumps, blisters and excess coatings shall be removed from the bell-and-spigot end of each pipe and fitting, and the outside of the spigot and the inside of the bell shall be wire brushed and wiped clean, dry and free from oil and grease before the pipe or fitting is installed. Dirt and any other material must be removed from the barrel of the pipe before installation.

**7.3 Cutting and Fitting of Pipe:** Pipe shall be cut, whenever necessary, to conform to location of fittings, line or grade. All cuts shall be straight and true, and in a workmanlike manner so as to leave a smooth end without damaging the pipe or its cement lining. 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 approved by the District.

**7.3.1 Pipe Joint Lubrication:** Joint lubricant shall be supplied by the pipe manufacturer, and approved by the District. Joint lubricant shall be non-toxic and water soluble.

**7.3.2 Pipe Alignment and Grade:** In laying pipe, the intent is to lay to set line and grade. Fittings and manholes shall be installed at staked locations and elevations.

Three-degree (3°) pre-manufactured fittings may be used to accomplish the curvature without exceeding individual deflections specified. The maximum deflection at any joint shall not exceed one-half (1/2) of the manufacturer's recommendation.

Molded three-degree (3°) fittings shall be composed of the same material and meet the same PVC standard as forth for the pipe material. Bends shall be plain end by bell and be laid in the same direction as the pipe laying operation.

When following a specified radius, the design and construction must follow the attached table of deflection: To achieve a laying radius less than those specified, the design must accommodate the deflections using manholes.

| <b><i>Sewer Collection Lines (sizes 8" thru 12")<br/>(Full laying length 13.5 feet)</i></b> | <b>8 Inch<br/>Laying<br/>Radius (feet)</b> | <b>10 Inch<br/>Laying<br/>Radius (feet)</b> | <b>12 Inch<br/>Laying<br/>Radius (feet)</b> |
|---------------------------------------------------------------------------------------------|--------------------------------------------|---------------------------------------------|---------------------------------------------|
| Without Fittings                                                                            | 875 min                                    | 985 min                                     | 1150 min                                    |
| With 3-degree bend at every fourth joint                                                    | N/A                                        | N/A                                         | 1000 to 1150                                |
| With 3-degree bend at every third joint                                                     | 750 to 875                                 | 750 to 985                                  | 750 to 1000                                 |
| With 3-degree bend at second other joint                                                    | 450 to 750                                 | 450 to 750                                  | 450 to 750                                  |
| With 3-degree bend at every joint<br><i>(Cut length min. 10 feet)</i>                       | 250 to 450                                 | 250 to 450                                  | 250 to 450                                  |
| With 3-degree bend at every joint                                                           | 200 to 250                                 | 200 to 250                                  | 200 to 250                                  |

**The engineer may use eleven and one-fourth degree (11.25°) bends on a case by case basis as approved by the District. These bends shall be shown on the design plans and staked in the field. At no time shall eleven and one-fourth degree (11.25°) bends be used to reduce the radius below the minimum of one hundred feet (100').**

Any changes in alignment and grade must be authorized by the Inspector and shall be approved by the District. Pipe shall be laid upgrade with the bell ends facing in the direction of laying, unless directed otherwise by the District. Where pipe is to be installed on a grade of ten percent (10%) or greater, the laying shall start at the bottom and shall proceed upward with the bell ends of the pipe upgrade.

**7.3.3 Temporary Bulkheads:** Whenever the pipe is left unattended, temporary plugs shall be installed at all openings to isolate existing pipelines from new construction until accepted by the District. Temporary plugs shall be of such design as to prevent water, debris, children and animals from entering the pipe. All temporary plugs shall be provided by the contractor and approved by the Inspector.

**7.3.4 Frost:** No pipe or appurtenant structure shall be installed upon a foundation into which frost has penetrated, or at any time when the Inspector deems there is danger of ice formation or frost penetration at the bottom of the excavation. No pipe or appurtenant structure shall be installed unless backfilling can be completed before the formation of ice and frost.

**7.3.5 Lowering of Material into the Trench:** Proper implements, tools and facilities satisfactory to the District shall be provided and used by the contractor for the safe and convenient performance of the work. All pipe, fittings, and manholes shall be carefully lowered into the trench piece by piece by means of a derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to Wastewater Main materials and their protective coatings and linings. Under no circumstances shall Wastewater Main materials be dropped or dumped into the trench.

If damage occurs to any pipe, fitting, manhole or Wastewater Main accessories in handling, the damage shall be immediately brought to the attention of the Inspector. The Inspector shall prescribe corrective repairs or rejection of the damaged items.

**7.4 Laying of Pipe:** All pipe laying methods shall conform to the manufacturer's recommendations for laying pipe. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. If the pipe laying crew cannot put the

pipe into the trench and in place without getting earth into it, the Inspector may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe.

As each length of pipe is placed in the trench, the spigot end shall be centered in the bell and the pipe forced home with a slow steady pressure without jerky or jolting movements and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the bells. Precautions shall be taken to prevent dirt from entering the joint space. No wooden blocking shall be left at any point under the pipeline.

No pipe shall be laid when, in the opinion of the District, trench conditions are unsuitable.

- 7.5 Ductile Iron Pipe: Push-On-Joint:** Immediately before two (2) lengths of ductile iron pipe, the inside of the bell, and the outside of the spigot end, and the rubber gasket shall be thoroughly cleaned to remove oil, grit, excess coating and other foreign mater. The rubber shall be flexed inward and inserted in the gasket recess of the bell socket. Since different manufactured brands of pipe require different types of gaskets, the Contractor shall exercise caution to ensure that the correct type of gasket is used.

A thin film of approved gasket lubricant shall be applied to either the inside face of the gasket, or the spigot end of the pipe, or both.

The spigot end of the pipe shall be placed in the bell end with care to prevent the joint from contacting the ground. Pipe furnished without a depth mark on the spigot end shall be marked before assembly to assure insertion to fill depth of the joint. The pipe shall be kept in straight alignment and the joint shall be completed by pushing the pipe home with a slow, steady pressure without jerky or jolting movements by using a forked took or jack-type tool or other device approved by the District Engineer. If pipe is pushed home with a backhoe bucket, a wooden shield must be placed between the backhoe bucket and the end of the pipe. The spigot end of field cut pipe lengths shall be filed or ground to resemble the spigot end of such pipe as manufactured.

- 7.6 Polyvinyl Chloride Pipe:** Upon completion of joining push-on joint pipe, an inspection shall be made to assure that the gasket is correctly aligned in the gasket recess of the bell socket and not twisted or turned.

When laying pipe on curves, the intent is to lay to the staked alignment. The pipe shall be kept in alignment by placing all deflecting joints or bends on the curve. Short lengths shall be used as necessary to accomplish the curvature without exceeding individual deflections specified. The maximum deflection at any joint shall not exceed one-half (1/2) of the manufacturer's recommendation.

- a. **Elastomeric Gasket Joint.** Immediately before joining two (2) lengths of PVC pipe, the inside of the bell or coupling, the outside of the spigot and the elastomeric gasket shall be thoroughly cleaned to remove all foreign material.

Lubrication of the joint and rubber gasket shall be done in accordance with the pipe manufacturer's specifications.

Care shall be taken that only the correct elastomeric gasket, compatible with tile annular groove of the bell, is used. Insertion of the elastomeric gasket in the annular groove of the bell or coupling must be in accordance with the manufacturer's

recommendations. Pipe that is not furnished with a depth mark shall be marked before assembly to assure that the spigot end is inserted to the full depth of the joint.

The spigot and bell or coupling shall be aligned and pushed until the reference line of the spigot is flush with the end of the bell or coupling. Pushing shall be done in a smooth, steady motion. Upon completion of joining the pipe, an inspection shall be made to assure that the gasket is correctly aligned in the gasket recess of the bell socket and not twisted or turned.

- b. **Pipe Storage.** Pipe stored outside and exposed to sunlight for more than thirty (30) days shall be covered with an opaque material such as canvas. Clear plastic sheets shall not be used to cover pipe. Air circulation shall be provided under the covering.
- c. **Handling of Pipe in Cold Weather.** PVC pipe has reduced flexibility and impact resistance as temperatures approach and drop below freezing. Extra care should be used in handling and installing PVC pipe during cold weather.

**7.7 Tracer Wire for Wastewater Mains:** Colorado State Regulations require all underground facilities to be electronically locatable. Tracer wire shall be installed on all PVC, HDPE, and DIP Wastewater Mains. Insulated tracer wire shall be taped every 10 feet to the top of the pipe. Tracer wire shall be terminated in a tracer wire station just outside each manhole. Tracer wire shall be #8 or 10 AWG solid copper or #8, 10 or 12 AWG copper clad steel with 30 mil HDPE jacket and comply with ASTM D1284.

Tracer wire should be as continuous as possible. Where splicing is necessary, the only approved splice method is to use a split bolt connector by Burndy. Once installed, the split bolt connectors should be encased in Polypropylene housing filled with dielectric silicone gel to protect the splice by King Innovation.

In addition, any exposed wire shall be wrapped with Scotch Linerless Rubber Splicing Tape to seal out moisture and then coated with Scotch Supper 33+ Vinyl Electrical tape to seal the rubber tape.

All new tracer wire installations shall be tested and located by the District. This verification shall be performed upon completion of wastewater system and again prior to final acceptance of the project at the discretion of the District. Continuity testing in lieu of actual line tracing shall not be accepted. Any deficiencies shall be addressed by the Contractor prior to final acceptance. Testing shall be noted on the Record Drawing by the District Inspector

**7.8 Manholes:** Manholes shall be precast and shall be constructed in accordance with these Specifications. Precast manholes shall be made **watertight** after installation or construction by use of Ram-Nek or other approved methods. All dimensions, locations and elevations shall be coordinated by the Developer and Contractor and meet the requirements of the District.

All manholes shall be constructed to meet H.S. 20-44 traffic loading conditions and 300 P.S.F. surcharge load.

The District may require installation of a precast manhole base when weather or field conditions warrant.

The base shall be placed on compacted or undisturbed earth. A reducing ring or cone shall be set on an eight-inch (8") adjustment ring.

All joints manhole rings and cone shall be made watertight by installation of Ram-Nek, or equal material in the joint.

Barrels shall be wrapped with RU116 – RUBR – NEK External Joint Wrap (or equivalent) and coated.

The manhole ring shall be set on the cone on a full bed of Ram-Nek.

Grade rings may be composed of concrete or HDPE material suitable to the Inspector. Ram-Nek shall be used in all grade rings and when joining to the ring and cover.

When inserting a new pipe into an existing manhole, the manhole should be cored, and the pipe shall be attached using a rubber boot.

The top manhole step shall be removed from pre-cast manholes.

- 7.9 Bridging and Encasement of Pipe:** Under certain conditions when the Wastewater Main is to be installed over or under an existing or proposed utility or structure, the District may require bridging or encasement of the pipe.

If, in the opinion of the District Engineer, there exists the possibility of settlement of the pipe being installed over and existing utility or structure, then bridging of the pipe shall become necessary. This condition shall also apply to other underground utilities or structures being installed over existing Wastewater Mains. The District Engineer shall determine the size and location of the concrete bridging.

Under certain conditions, the District may require complete encasement of Wastewater Mains with concrete. The District Engineer shall determine the size, length and location of these encasements.

- 7.10 Encasement or Sleeve Pipe:** Wherever it is necessary to provide an encasement or sleeve for the Wastewater Main, the Wastewater Main shall not be inserted into the encasement or sleeve pipe without providing insulating skids for each joint of the Wastewater Main. Insulating skids shall be of a type such as the "P.S.I. custom pull on (Model C)" or equivalent. Encasement pipes shall be protected both inside and out with corrosion resistant materials having a bituminous base. Encasement or sleeve pipe size, length, type and sidewall thickness will be determined by the District.

- 7.11 Corrosion Protection Systems:** The determination of the corrosiveness of the soil which a Wastewater Main passes through and the need for protection will be made and determined by the District. If metal pipe is required to be used, it must be protected against corrosion. All required corrosion protection shall be provided by the Contractor and the material shall be made up of all or part of the following:

- a. Polyethylene Encasement Material: The pipe fittings and appurtenances shall be wrapped in polyethylene, in accordance with the standard drawings. Polyethylene material shall conform to page MS-04 of the materials specifications.
- b. Coatings: Metal pipe and other appurtenances may require protective corrosion resistant coating. The following are approved for exterior use only:
  - Roskote A-51 Mastic
  - American Blackline Product #101 – Non-Fibrous Roof Coat

- Asphaltic Base Roofing Tar

Coatings must be of a consistency that is applicable by brush and cannot contain asbestos fiber. In all cases the Contractor must provide the Inspector an MSDS on the product to be used prior to application.

- c. Bonding Joints: All pipelines that require protection will be bonded at every joint and/or coupling. Bonding shall be accomplished by thermo-welding straps or wire across each joint or coupling. The Contractor shall furnish all material required for bonding.
- d. Anodes: Installation of seventeen-pound (17 lb.) magnesium anodes may be required for additional protection to the pipeline. All anodes shall be furnished and installed by the Contractor in conformance with these Specifications.
- e. Test Stations: Required electrolysis test stations will be provided, and it shall be the Contractor's responsibility to install the test station.
- f. Dissimilar Materials: Cathodic protection and insulation shall be installed as required by the District. Particular care shall be taken to insulate between dissimilar materials.
- g. Insulating Joints: Whenever it is necessary to join pipe of dissimilar metal, or when designated by the District, a method of insulating against the passage of electrical current, approved by the District Engineer, shall be provided. Special care shall be exercised during the installation of these joints to prevent electrical conductivity across the joints.
- h. Polyethylene Encasement Material: Whenever designated by the District, the metallic pipe and all appurtenances shall be wrapped in polyethylene. The polyethylene encasement shall prevent contact between the pipe and bedding material but is not intended to be a completely air-tight and water-tight enclosure.

Prolonged exposure to sunlight will eventually deteriorate polyethylene film. Exposure to sunlight shall be kept to a minimum.

The polyethylene shall have a minimum thickness of eight (8) mils and conform to the Materials Specification in MS-13 from AWWA C105.

A two-inch (2") wide, ten (10) mil thickness polyethylene pressure-sensitive tape shall be used to close seams, secure to pipe or hold overlaps.

Damage to polyethylene wrapped pipe in the trench prior to and during backfill shall be repaired to the satisfaction of the District.

- i. Insulating from Concrete: Areas of metal pipe and appurtenances which are to be in contact with concrete bridging blocks or encasement shall be protected against corrosion prior to installing concrete. The following types of protection systems are acceptable:
  - 1. Application of a cold-applied coating.

2. Application of a cold-applied primer and corrosion resistant pipe wrap with a minimum fifty percent (50%) overlap similar to the primer and pipe wrap manufactured by the Protecto Wrap Company.
3. Other proposed protection systems may be accepted following review and approval of the District and the District Engineer.

**7.12 Cleaning:** Prior to acceptance of each section of sewer main, the Contractor shall, at Contractor's expense, jet rod and/or vac each section. Larger sewers shall be cleaned by other appropriate methods approved by the Inspector. All dirt and debris shall be prevented from entering the active sewer system by means of watertight plugs or other methods approved by the Inspector.

**7.13 Compaction Tests** Compaction tests at the expense of the Contractor shall be conducted by an independent testing laboratory. The District shall be provided a minimum of 48 hour notice prior to any compaction test. One test shall be conducted for each manhole run, or every four hundred feet (400') whichever is greater, or as required by the controlling agency, and at every two-feet (2') of depth coming up the trench. Copies of each compaction test report will be given to the District Inspector prior to approval.

**7.14 Infiltration and Exfiltration Tests:** Infiltration and exfiltration tests conducted by and at the expense of the Contractor shall be performed on 100% of the project.

The allowable infiltration or exfiltration rate shall not exceed one hundred (100) gallons per inch of diameter per mile of pipe, per day **to include manholes.**

**Air Tests:** The Contractor shall perform these tests with suitable equipment specifically designed for air testing sewers. A suitable gauge shall be used for readings not to exceed 15 PSI maximum reading. The gauge shall be located at the surface. The Contractor shall provide the District a minimum of 48-hour notice prior to any air test. One test shall be conducted for each manhole run.

The air test shall be made when the sewer is clean. The pipe, or section of pipe to be tested may be wetted before the air test. The line shall be plugged at each manhole with pneumatic balls. Low pressure air shall be introduced into the plugged line until the internal air pressure reaches four (4.0) PSIG greater than the average back pressure of any ground water pressure that may submerge the pipe. At least two (2) minutes shall be allowed for the air temperature to stabilize before readings are taken and the testing started.

The portion of main (including stubs) being tested shall pass if it does not lose air at a rate to cause the pressure to drop from three and six-tenths (3.6) to three (3.0) PSIG (greater than the average back pressure of any ground water that may submerge the pipe) in less time than listed below:

| PIPE DIAMETER<br>(Inches) | MINIMUM ALLOWABLE TIME<br>(Minutes & Seconds)<br>3.6 - 3.0 PSIG Pressure |
|---------------------------|--------------------------------------------------------------------------|
| 4                         | 0-50                                                                     |
| 6                         | 1-10                                                                     |
| 8                         | 1-40                                                                     |
| 10                        | 2-00                                                                     |
| 12                        | 2-20                                                                     |
| 15                        | 3-00                                                                     |
| 18                        | 3-40                                                                     |
| 21                        | 4-10                                                                     |
| 24                        | 4-50                                                                     |

If the installation fails this test, the testing equipment shall be used to determine the location of the pipe leak. All service plugs shall be secured in place to prevent displacement during testing operations.

If results of these tests are not satisfactory, the Contractor, at his expense, will make the necessary repairs or pipe replacement until the Inspector is satisfied that the leakage requirements are being met.

- 7.15 Deflection Test:** Flexible conduits shall be tested by the Inspector. Representative samples will be tested to insure initial deflection does not exceed five percent (5%) of the inside diameter of the pipe. Failure of representative sections to pass the deflection limits will result in additional sections being tested at the discretion of the Inspector.

If the results of this test are not satisfactory, the Contractor at his expense, will make the necessary repairs or pipe replacement until the Inspector is satisfied that the deflection requirements are being met.

- 7.16 CCTV Inspection:** The Contractor shall camera by closed circuit television (CCTV) and provide to the District Inspector for inspection, all new public mains for deficiencies prior to any service connections being made and again prior to final acceptance of the wastewater main. The District Inspector may require that the Contractor add water to the pipeline prior to CCTV inspection to help identify deficiencies. All deficiencies found during the CCTV inspection shall be promptly corrected by the contractor in accordance with these rules.

The District will provide the CCTV results within 10 working days of the successful completion of the CCTV inspection.

The CCTV is the District's means for assessing wastewater mains for pipe deflection, deformations and deficiencies. The following shall be considered deficiencies that shall be corrected by the Contractor prior to preliminary and final acceptance:

- Any connection intrusions (service taps) where the connection or gasket extends past the inside diameter of the pipe
- Connections that are drilled larger than the required hole size
- Over insertion of the bell
- Due to unacceptable high operation and maintenance cost and poor system reliability, pipelines 12-inches in diameter or less with sags exceeding ½-inch in depth will not be accepted. Pipeline sags that are less than ½-inch in depth shall be noted at the time of preliminary acceptance and if at that time of CCTV for final acceptance, the sag has

increased in size, the Contractor shall repair the sag. This determination shall be made solely by District wastewater engineering staff. Pipelines greater than 12-inches in diameter will be evaluated on a case-by-case basis.

- Any debris
- Out of round more than 5% of the pipe diameter
- Any deformations such as rock dimples, pipe kinks, etc.
- Any joint defects such as rolled or improperly compressed gasket and joint gaps
- Any material damage such as cracks or gouges
- Any other defects as identified by the District that may cause future operation and maintenance issues

CCTV inspection deliverables shall be provided to the District per the transfer method requested by the District Inspector and shall be submitted in the NASSCO PACP Exchange Database utilizing the Version 7 template or the newer. If utilizing ITpipes, the Exchange Database may be submitted through the ITpipes platform as approved by the District Inspector.

**7.17 Vacuum Testing for Concrete Sewer Manholes** All manholes shall be vacuum tested with District staff present prior to CCTV inspection. The District shall be notified a minimum of 48 hours in advance of any vacuum test.

This test method covers procedures for testing pre-cast concrete manhole sections (and other manholes existing or in-situ) when using the vacuum test method to demonstrate the integrity of the installed materials and the construction procedures.

This test method is used for testing concrete manhole sections utilizing mortar, mastic or gasketed joints. This test method is intended to be used as a preliminary test to enable the installer to demonstrate the condition of the concrete manhole.

Contractor must follow OSHA requirements for confined spaces.

Contractor must use his own equipment for vacuum testing

**Each manhole shall be vacuum tested after backfilling.**

1. All lift holes and any pipes entering the manhole are to be plugged and sealed. A vacuum will be drawn, and the vacuum drop over a specified time period is used to determine the acceptability of the manhole. (ref: paragraphs 4 & 5 below)
2. The values recorded are applicable only to the manhole being tested and at the time of testing, and the recorded information, reported on the Vacuum Testing Result form, at the end of this section.
3. Preparation of the Manhole:
  - a. Care shall be taken to affect a seal between the vacuum base and the manhole rim. Pipe plugs shall be secured to prevent movement while the vacuum is drawn.
  - b. All pipes entering the manhole shall be temporally plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.
4. Typical Field Test Procedure:

- c. The test head gauge shall be placed at the top of the manhole or in accordance with the manufacturer's recommendations.
  - d. A vacuum of 10 in. of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop to 9 in. of mercury.
  - e. The manhole shall pass if the time for the vacuum reading to drop from 10 in. of mercury to 9 in. of mercury meets or exceeds the values indicated in the table below.
  - f. If the manhole fails the initial test, necessary repairs shall be made by a submitted approved method to the District Inspector. The manhole shall then be retested until a satisfactory test is obtained.
5. Minimum test time for all manholes is 60 seconds. Greater lengths of time shall be at the discretion of the inspector.

**7.18 Manhole Rim Elevations:** All manholes constructed shall have rim elevations set at final street, trail, or sidewalk grades, except in non-traffic areas where the rims shall be set at six inches (6") above the existing ground. Following the construction of curb and gutter in new streets or completion of manholes in streets with existing curb and gutter, the engineer will measure and certify all manhole rim elevations for proper grade, at no time shall the total of grade adjustment rings exceed eight inches (8"). When rim adjustments are being made, the Contractor must remove and replace any broken, cracked, or otherwise damaged grade rings already in place. Any manhole rims that do not meet the following policy for manhole adjustment will be promptly adjusted. Except within state and federal jurisdiction or rights-of-way.

- a. **Responsibility:** The applicant requesting approval for extension of wastewater collection lines shall be responsible for assuring sanitary sewer manholes are adjusted to final paving grade and are cleaned of dirt and construction debris. The applicant shall also:

Assure that such work is completed within the time periods noted below.

That all work is completed in compliance with these Specifications and all District requirements.

That such work has been inspected by the District.

That such work will be free of mechanics liens, judgment liens or other valid and enforceable liens.

- b. **Required Adjustments:** Manhole adjustments and cleaning must be completed within sixty (60) days following placement of paving. If street paving is not completed or manholes are not adjusted within one (1) year of the preliminary acceptance date, the District will extend the warranty period for one (1) additional year during which manhole adjustments must be completed as indicated above.
- c. **Location of Manholes to be Adjusted.** The District will attempt to provide surface location of manholes requiring adjustment within two (2) working days of request for location.

- d. Opening and Entry Permit and Inspection. The person or corporation performing the adjustment work must apply for a manhole opening and entry permit two (2) working days prior to beginning work and must notify the Inspector designated on the permit when the work is ready for inspection. The designated Inspector will perform the inspection within two (2) working days of the request for inspection and will provide the permittee a notice of acceptance or rejection of the work. Correction of rejected terms must be completed within the time frame noted by the Inspector.
- e. Failure to Perform Adjustments. Failure of the applicant for Wastewater collection extension to adjust the manholes in accordance with the requirements of this policy will result in the District exercising any combination of the following rights:

Withholding approval of additional connection permits within the project area and/or,

Extension of the warranty period until adjustments are completed.

-Performing the necessary manhole adjustments and cleaning work by contract or with District personnel and billing the expense plus administration, legal, overhead and other applicable expenses to the applicant.

**7.19 Sewer Service Lines and Inspection:** Sewer Service Lines shall be PVC SDR 35 using elastomeric gasketed joints. The specifications set forth in this Chapter 7.0 shall apply to sewer services as well as main lines.

Service stubs and building sewer lines shall not be backfilled until approval is given by the District Inspector. The District Inspector will note any deficiencies on the Regional Building Permit. Any deficiencies noted by the District Inspector shall be corrected by the Contractor prior to calling for re-inspection. The Contractor and builder or Developer will be notified in writing by the District Inspector of all deficiencies requiring correction. Once Contractor has made all corrections to the satisfaction of the Inspector, the District Inspector will sign off on the Regional Building Permit.

After approval is given for service stubs or building sewers, the Contractor shall commence backfilling in accordance with these Specifications, as soon as practical.

THIS PAGE LEFT BLANK INTENTIONALLY

## **Section 8.0 Wastewater Services Standards**

- 8.1 Wastewater Taps:** No wastewater taps shall be made unless property corners are clearly marked so measurements of taps can be made at the time of tapping.
- 8.2 Excavations:** Excavation of the tapping hole is the responsibility of the plumber or pipeline contractor.
- 8.3 Abandoning Existing Connections:** Where an existing Wastewater service is to be abandoned, the owner of the property shall be totally responsible for expenses. The Contractor shall expose the connection to be abandoned two feet (2') inside the property line unless otherwise specified by the District. Services found to be unacceptable shall be capped at the public main. The District shall inspect the work prior to backfilling of the excavation.
- Replacement procedures that anticipate lining and/or pipe bursting may be considered and approved by the District but only after review and approval of the proposed method by Engineering and Operations Depts.
- 8.4 Individual Service Pumps:** Where the conditions require the external installation of individual pumps to service a structure, the Contractor shall submit to the District a set of shop drawings detailing the installation and shall include:
- A site map showing the location of all the facilities to be installed including the location of the tap to the public Wastewater Main.
  - Equipment to be installed, including the number and type of pumps, controls, alarms and valves.
- 8.5 Wastewater Service Line Ditches:** Wastewater Service Line ditches must enter the lot as near ninety degrees (90°) to the street as is practical and not at an extreme angle unless otherwise approved. The standard location for the Service Line will be center of the lot unless it is in a hillside overlay zone and or approved by the District.
- 8.6 Inline Wye:** Wastewater Service Lines shall be constructed with an approved Wastewater service Inline Wye for all new construction. Where a tap is being installed on a previously accepted line that had completed the warranty period, a tapping saddle may be used having a rubberized gasket and stainless steel bands. Taps shall be installed at roughly a 30 to 45 degree angle (10:00 and 2:00 o'clock) from the centerline.
- 8.7 Installation Method:** All Wastewater Service Lines shall be installed using the same methods as the Public Main. This includes all requirements including bedding and backfill.
- 8.8 Slope:** Wastewater Service Lines shall be installed at the following minimum slopes:
- |                 |                        |
|-----------------|------------------------|
| 4" PVC          | 2.08% or 1/4" per foot |
| 4" Ductile Iron | 1.04% or 1/8" per foot |
| 6" Pipe         | 1.04% or 1/8" per foot |
- 8.9 Alignment:** Changes in alignment for Service Lines shall be accomplished with preformed bends not to exceed forty-five degrees (45°). When changes in direction exceed forty-five degrees (45°) a two-foot (2') section of pipe shall separate the fittings necessary to make the

needed change of direction. All services shall be extended five feet (5') inside the property line or easement line and be marked with a two by four (2x4).

- 8.10 Cleanouts:** All Wastewater Service Lines shall have a cleanout every one hundred feet (100'). All cleanouts shall be constructed with standard fittings and have a screw cap located at the ground or paving surface.

Cleanouts must be five feet (5') away from foundation and must be located directly above service. Double cleanouts are necessary if spacing between cleanouts exceeds one hundred feet (100'). Maximum spacing for double cleanouts is two hundred feet (200').

- 8.11 Connecting Clamps:** All Wastewater Service Line connecting clamps shall have the "UPC" designation and be made for the pipeline materials used.

## **8.12 Repair and Replacement of Existing Service Lines**

- 8.12.1 Responsibility:** The property owner is responsible for the repair and maintenance of the Wastewater Service Line from the house or other building to the public main. However, all connections to the system impact District service and systems. Therefore, all service repairs which may include repair/replacements using trenchless technology, must be approved by the District prior to construction.

All wastewater service line repairs with rubber coupling/Ferncos coupling shall be encased with six-inches (6") of concrete around the coupling on all sides. The coupling should be exposed when the District Inspector arrives to view the installation. After the Inspector approves the coupling installation, the Contractor can encase the coupling with concrete.

When Contractor slip-lines or provides cured-in-place pipe of the service line, the Contractor must provide the District Inspector with a video of the installation. If the liner protrudes into the sewer main, the Contractor must cut or remove any excess liner in the sewer main to the approval of the District Inspector.

Plumbing or Pipeline Contractor's Responsibility: In addition to coordinating approval of entry and service inspection with the District, the plumbing Contractor must obtain approval of any methods of repair/replacement that include trenchless technologies. Even with the use of approved trenchless technologies, the Plumbing Contractor must obtain connection inspection through the District. Failure to obtain the proper inspections and approvals may be cause for disconnection of the customer's sewer service. The plumbing or pipeline contractor shall make the necessary excavations and barricade all excavations in accordance with the barricading instructions of the governing body, make the necessary repairs and contact the District for inspection, telephone (719) 390-7111.

### **8.12.2 Surface Restoration and Maintenance**

- a. Surfaced Areas: The Contractor shall obtain the necessary permits and remove pavement and road surfaces as part of the trench excavation. **At a minimum, cuts in a public right-of-way shall be required to be restored per the conditions of the excavation permit issued by the controlling authority.**

The Contractor shall restore all pavement, sidewalks, curbing, gutters or other surface structures removed or disturbed as part of the work to a condition

meeting the standards of the governing authority and shall furnish all incidental labor and materials.

- b.     Unsurfaced Areas: All surface cuts shall be restored to a condition equal to that prior to construction.
- c.     Damaged Surfaces and Property: If any pavement, street, shrubbery, sod, rock, fences, poles or other property and surface structures have been damaged, removed or disturbed by the Contractor, whether deliberately or through failure to carry out the requirements of the controlling agency or the specific directions of the District, or through failure to employ usual and reasonable safeguards, such property and surface structures shall be replaced or repaired, to the original condition, at the expense of the Contractor.

THIS PAGE LEFT BLANK INTENTIONALLY

## **Section 9.0 Wastewater System Materials Standards**

### **9.1 Polyvinyl Chloride (PVC) Pipe Elastomeric Gasket Joint – 4-inch through 24-inch Diameter**

- a. General: All polyvinyl pipe shall be manufactured in accordance with A.S.T.M. Standard D3034, "Polyvinyl Chloride (PVC) Sewer Pipe and Fittings", and A.S.T.M. Standard F679 "Polyvinyl Chloride (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings" with the following additional requirements or exceptions:
- b. Size of Pipe: This specification shall cover polyvinyl chloride pipe in four-inch (4"), six-inch (6"), eight-inch (8"), ten-inch (10"), twelve-inch (12"), fifteen-inch (15") and eighteen-inch (18") nominal diameters. Pipe larger than eighteen-inch (18") diameter shall be reviewed and approved on a case by case basis.
- c. Joint Type: Pipe joints shall be made using an integral bell with an elastomeric gasket push-on type joint or using machined couplings of a sleeve type with rubber ring gaskets and machined pipe ends to form a push-on type joint. This specification applies to three-degree (3°) fittings allowed for the purpose of accomplishing street curvature.
- d. Class and Type: All sizes of pipe shall be SDR 35 or PS 46.
- e. Pipe Length: Each length of pipe will be a standard laying length of fourteen-feet (14') or twenty-feet (20).
- f. PVC materials shall be made from class 12364C, 12454C or 12454B virgin compounds as defined in A.S.T.M. F679 or A.S.T.M. D3034.
- g. Elastomeric gaskets shall conform to A.S.T.M. D32 or A.S.T.M. F477.

### **9.2 Ductile Iron Pipe**

- a. General: All ductile iron pipe shall be manufactured in accordance with A.W.W.A. Standard C151, "Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Line Molds, for Water or Other Liquids," with the following additional requirements or exceptions:
- b. Size of Pipe: This specification shall cover ductile iron pipe in four-inch (4"), six-inch (6"), eight-inch (8"), twelve-inch (12"), sixteen-inch (16"), twenty-inch (20"), twenty-four-inch (24"), thirty-inch (30") and thirty-six inch (36") nominal diameters.
- c. Joint Type: "Push-on single gasket" type conforming with applicable requirements of A.W.W.A. Standard C111 "Rubber-Gasket Joints for Cast-Iron and Ductile-Iron Pressure Pipe and Fittings."
- e. Class and Type: Pipe furnished under this specification shall conform to the following pressure classes as shown in A.W.W.A. Standard C-150, as a minimum.

| Size         | Pressure Class (P.S.I.) | Equivalent Thickness (In.) |
|--------------|-------------------------|----------------------------|
| 4" Diameter  | Class 350               | 0.25                       |
| 6" Diameter  | Class 350               | 0.25                       |
| 8" Diameter  | Class 350               | 0.25                       |
| 12" Diameter | Class 350               | 0.28                       |
| 26" Diameter | Class 330               | 0.34                       |
| 20" Diameter | Class 300               | 0.36                       |
| 24" Diameter | Class 250               | 0.37                       |
| 30" Diameter | Class 200               | 0.38                       |
| 36" Diameter | Class 200               | 0.42                       |

Higher pressure class pipe will be required when the District determines that excessive dead-load or other conditions warrant increased wall thickness.

- e. Pipe Length: Pipe furnished under this specification will have normal laying lengths of either eighteen feet (18') or twenty feet (20').
- f. Material Strength. Iron used in the manufacture of pipe furnished under this specification shall have 60/42/10 physicals.
- g. Cement Mortar Lining. Pipe furnished under this specification shall have standard thickness cement mortar linings in accordance with A.W.W.A. Standard C 104/A21.4, "Cement-Mortar Lining for Ductile-Iron and Gray-Iron Pipe and Fittings for Water."

**9.3 High Density Polyethylene (HDPE):** The District acknowledges the need and use of HDPE pipe in certain applications for main sewer. In specific situations, HDPE may be approved for use in sewer mains upon approval of the District and/or District Engineer. The specific laying requirements will meet or exceed those for open cut of PVC material. Such applications may be approved for trenchless technologies where approved.

#### **9.4 Polyethylene Encasement Material**

- a. General: A polyethylene encasement material shall be manufactured in accordance with A.W.W.A. Standard C105, "Polyethylene Encasement for Gray and Ductile Case Iron Piping for Water and Other Liquids," with the following additional requirements or exceptions:
- b. Materials: The raw material used to manufacture polyethylene film shall be Type 1, Class A Grade E1, in accordance with A.S.T.M. Standard Designation D-1248.
- d. Physicals: The polyethylene film shall meet the following test requirements:

|                                                                                              |                             |
|----------------------------------------------------------------------------------------------|-----------------------------|
| Tensile Strength                                                                             | 1200 PSI minimum            |
| Elongation                                                                                   | 300% minimum                |
| Dielectric Strength                                                                          | 800 V/Mil Thickness minimum |
| Thickness 0.008"                                                                             | 8 mils maximum              |
| (Nominal with minus tolerance.<br>Not exceeding ten percent (10%) of<br>nominal Melt Index.) |                             |
| Melt Index                                                                                   | 0.4 maximum                 |

## 9.5 Concrete

- a. Materials: Cement. All cement used shall be Portland Cement acceptable under the "Standard Specifications and Tests for Portland Cement," A.S.T.M. Designation C-150 of the A.S.T.M. and conform to the latest A.C.I. 318 building code requirements. Cement used shall be Type II.
- b. Aggregates: All the fine and coarse aggregates shall meet soundness requirements, deleterious substance limits and grading limits as set forth in the latest edition of "Standard Specifications for Concrete Aggregates," A.S.T.M. Designation C-33. The limits for deleterious substances and physical property requirements of the coarse aggregates shall be selected for the applicable class designation from those listed under severe weathering regions, Table 3, A.S.T.M. Designation C-33. The maximum size aggregate that is practical for the structure design and placing conditions shall be used in the concrete.
- c. Water: The water used in all concrete shall be free from objectionable quantities of silt, organic matter, alkali, salts, and other impurities.
- d. Admixtures: An air-entraining agent shall be used in all concrete. The agent used shall conform to "Standard Specification for Air-Entraining Admixtures for Concrete," A.S.T.M. Designation C-260. The amount of air-entraining agent shall be such as will affect the entrainment of five percent (5%) plus or minus one percent (+ or – 1%) of volume of the concrete. A water reducing admixture (WRA) may be used unless otherwise noted by the District. The admixture shall conform to A.S.T.M. Designation C-494 for Type A, or Type D chemical admixture, shall contain no calcium Chloride, and shall be compatible with the cement being used.
- e. The Contractor shall be responsible for any difficulties arising or damages occurring as a result of the selection and use of any admixture such as a delay or difficulty in concrete placing or damage to concrete during form removal.
- f. Concrete Quality:

All cast-in-place concrete shall have a minimum twenty-eight (28) day compressive strength of three thousand (3,000) PSI and maximum slump of four inches (4").

All pre-cast concrete shall have a minimum compressive strength of four thousand (4,000) PSI.

Unless otherwise directed, the concrete shall be consolidated with suitable mechanical vibrators operating within the concrete. Vibrators shall be so manipulated as to work the concrete thoroughly around the reinforcement and imbedded fixtures and into corners and angles of the forms. The vibration at any point shall be sufficient to accomplish consolidation, but not prolonged to the point where segregation occurs.

Testing: When determined necessary by the District, field control tests consisting of aggregate gradation tests, slump tests, air content tests, and making compression test cylinders, shall be performed by qualified personnel in the presence of the Inspector.

## **9.6 Concrete Reinforcement**

- a. General: Reinforcements shall be accurately formed and shall be free from loose rust, scale and contaminants which reduce bond. Unless otherwise shown on the drawings or specified herein, all requirements shall conform to the latest A.C.I. Standard 318 and the Uniform Plumbing Codes.

Reinforcements shall be accurately positioned on supports, spacers, hangers or other reinforcements and shall be secured in place with wire ties or suitable clips.

- b. Material: All deformed reinforcing bars shall conform to A.S.T.M. Standard A-615, minimum grade 60.

## **9.7 Precast Reinforced Concrete Manhole Sections**

- a. General: All precast reinforced manhole sections shall be manufactured in accordance with A.S.T.M. Standard C478, "Precast Reinforced Concrete Manhole Sections", with the following additional requirements or exceptions.
- b. Size: This specification shall cover precast reinforced manhole sections in four-foot (4'), five-foot (5') and six-foot (6') nominal inside diameters.
- c. Joint Type: Manhole joints shall be made using male and female ends so that when assembled, they make a continuous and uniform manhole.
- d. Joint Sealant: Manhole joints shall be watertight and tilled with Resilient "O" rings per A.S.T.M. C923, "Ram-Neck" or equal.

## **9.8 24-Inch Diameter Manhole Ring and Cover**

- a. General: All twenty-four-inch (24") manhole ring and covers shall be manufactured to meet H-20 traffic load conditions and have a minimum inside ring clearance of twenty-two and one-eighths inches (22-1/8").
- b. Material: All rings and covers shall be cast iron, manufactured in accordance to A.S.T.M. Designation A48, Class 30, or better. In cases where traffic loading is impossible, the District may allow for aluminum covers to be substituted. However, the substitution is only allowed where the drawings specifically indicate and approve aluminum covers.
- c. The manhole lid shall be drilled with a one-half inch ( 1/2") hole, six inches (6") off center to the right of the word SEWER.
- d. Depending on the location of the manhole the District will require "self-sealing" lids or "self-sealing" bolt down lids. Deeter Foundry 1257B or equal.
- e. Manufacturer: All manhole assemblies shall be stamped with the name and model identification of the approved manufacturer. The following are approved for installation within the District Wastewater Collection System.
- f. Approved Manufacturers are:

**Manufacturer**  
D&L Supply Co.  
Deeter Foundry, Inc.

**Model No.**  
A-1041  
1257