

ARTICLE 9 USER REQUIREMENTS

PART C TECHNICAL STANDARDS AND SPECIFICATIONS

9C-1 SEWER COLLECTION SYSTEM MATERIALS: The sewer (sanitary) standards set forth in this Part 9C-1 and the Sewer Notes in Part 9C-6 and District Standard Details are the minimum standards of the Cherry Creek Valley Water and Sanitation District. These standards are to be enforced by the Design Engineer as a minimum but do not restrict the use of more stringent design criteria and do not relieve the Design Engineer of responsibility for errors or omissions in plans or specifications.

9C-1-1 SEWER PIPE - Sewer pipelines and services shall be constructed of polyvinyl chloride (PVC) pipe, or ductile-iron pipe (DIP). All pipe and other material shall be checked at the jobsite for out-of-round joints, surface damage, gasket damage, cracks or other defects. Any pipe or materials found to be defective shall be rejected and shall be removed immediately from the job site.

9C-1-1.1 Polyvinyl Chloride Pipe - PVC pipe shall meet or exceed all material requirements of ASTM D3034 for sizes 4-inch through 15-inch and ASTM F679 for larger than 15-inch diameters. Provide SDR 35 (PS46 for F679) for burial depths of up to 20-ft of cover, and SDR 26 (PS115 for F679) for burial depths greater than 20-ft of cover. PVC material shall be Classified 12454 B or 12454 C in accordance with ASTM D1784, and gaskets shall conform to ASTM F477. Each length of PVC pipe and each PVC fitting shall have marked on the exterior the following.

National Sanitation Foundation seal for:

- ▶ Gravity Sewer Pipe
- ▶ Class and Size
- ▶ Pressure Rating
- ▶ Name or Trademark of Manufacturer

9C-1-1.2 Ductile Iron Pipe - DIP shall be Class 52 in accordance with ANSI A 21.51 and shall have a lining of ceramic-epoxy equal to or exceeding that of Protecto-401. The pipe exterior shall have a standard 1 mil bituminous coating. All DIP joints shall be push-on type with nitrile gasket, conforming to the requirements set forth in ANSI A 21.11.

9C-1-2 MANHOLES - Length between manholes shall not exceed 400 feet. Manholes may not be located in line with curb and gutter or in sidewalks or under parking. Service lines may not tie into or within 5-ft of manholes unless specifically allowed in writing by the District Engineer.

9C-1-2.1 Bases - Bases to manholes shall be constructed of cast-in-place concrete with No. 4 reinforcing bars placed in accordance with the District

Standard Details. Precast bases shall not be used unless specifically approved in writing by the District Engineer.

9C-1-2.2 Invert Channels and Benches - Manhole invert channels may be formed in the concrete of the manhole base, or, if straight through, by embedding a section of pipe with the top half cut off in the manhole base. The invert channels shall be smooth and "U" in shape extending up to the level of the pipe crown. Changes in pipe size and grade shall be made gradually and uniformly, and changes in direction shall be made with as large of a swept radius as possible.

9C-1-2.3 Barrel Sections - Concrete barrel sections shall be precast conforming to ASTM C478. Manholes shall have a 4-foot inside diameter for pipe size 15-inch diameter and smaller and 20-ft or less in depth from rim to invert, and a minimum of 5-ft inside diameter for pipe size larger than 15-inches or depths greater than 20-ft, or as otherwise directed by the District Engineer in special cases.

9C-1-2.4 Manhole Cone Sections - Cone sections shall conform to ASTM C478 and shall be eccentric. In striped collector or arterial roadways, rotate the cone to place the manhole cover outside the wheel path centered in the traffic lane, or on the edge of the traffic lane; whichever is closer. In residential streets, rotate the cone to place the manhole cover on the uphill side of the street cross section if located near the gutter, or as directed by the District Engineer. Flat-top slabs with eccentric opening in accordance with ASTM C478 may be considered for shallow manhole installations if approved in advance by the District Engineer.

9C-1-2.5 Manhole Joints - Intermediate joints between all manhole barrel, cone, and adjustment ring sections shall be sealed by two concentric rings of K. T. Snyder RUB/R-NEK and provided with perimeter wrap around the exterior in accordance with the District Standard Details. Joints shall not be grouted. The joint between the manhole base and the first manhole section shall be sealed with three concentric rings of K. T. Snyder RUB/R-NEK or approved equal and grouted around the exterior perimeter only.

9C-1-2.6 Manhole Inlet/Outlet Pipe Connections - Pipe pieces shall be cut as necessary and installed to provide a gasketed joint on all sewer pipelines entering and exiting manholes within 18-inches of the manhole concrete base. A rubber gasket designed specifically for use as a waterstop shall be installed around the outside of all pipes where embedded in the concrete base to provide a leak-tight seal.

9C-1-2.7 Manhole Ring and Cover - Manhole rings and covers shall be 24-inch diameter, manufactured of cast or ductile iron, with the word "SEWER" cast on the cover. Manhole rings and covers shall be NEENAH R-1706 or approved equivalent and meet standard Denver Public Works traffic tread pattern.

The manhole ring and cover shall be parallel to the finished road surface. The cover shall be not more than 18 inches or less than 12 inches above the top of the concrete cone section.

Adjustment of the ring and cover shall be by the use of precast concrete adjusting rings per ASTM C478 and shims placed underneath the ring only.

Drop-in steel adjusting "mud" rings are strictly prohibited and will be rejected by the District.

9C-1-2.8 Manhole Steps - Manhole steps shall be structural steel rod fully and completely encapsulated within textured polypropylene plastic manufactured specifically for sanitary manhole use in accordance with ASTM C478. Steps shall be placed at 12-inch vertical intervals. The top step shall not be more than 18-inches below the rim, and the bottom step shall not be more than 12-inches above the bench.

9C-1-2.9 Drop Manholes - Drop manholes are required where the difference in manhole inverts exceed 18 inches. Drop manholes shall use exterior "wye" pattern fittings of the same type and classification of the pipe for the drop transitions. Larger drop distances may consider the use of exterior vertical pipe that transitions via a "wye" fitting, or interior pipe utilizing the use of a drop bowl, subject to approval and direction of the District Engineer. Drop manholes shall be subject to approval by the District.

9C-1-2.10 Concrete and Reinforcement - Concrete for manhole bases, sewer pipeline encasement, and similar items shall have a 28-day compressive strength of not less than 4,000 psi.

Reinforcement shall be standard deformed reinforcement, conforming to the requirements set forth in ASTM A615, Grade 40.

9C-1-3 SEWER SERVICES - Standards for sewer service lines and taps are set forth in Part 9C-9 herein.

9C-2 SEWER PIPELINE INSTALLATION: The installation standards set forth in this Part 9C-2 and in Part 9C-6 and associated District Standard Details are the minimum standards of the Cherry Creek Valley Water and Sanitation District. These standards are to be enforced by the Design Engineer as a minimum, but do not restrict the use of more stringent design criteria and do not relieve the Design Engineer of responsibility for errors and omissions in plans or specifications.

9C-2-1 FOREIGN MATERIAL IN PIPELINE - All pipe joints, interior surface of sockets, exterior surface of spigots, and fittings shall be cleaned of foreign material prior to placement in the trench, and pipe shall remain clean at all times thereafter. Whenever the pipe is left unattended or pipe laying is not in progress, temporary plugs shall be installed at all openings. All sewer pipelines shall be flushed with water until clean before final acceptance. The resulting flushing water shall not be introduced into the existing sewer pipeline.

9C-2-2 SEWER MAIN TIE-INS AT MANHOLES - The manhole into which the proposed sewer line is to be tied shall have the outlet sealed with a temporary leak-proof mortar plug or other approved plug. This plug shall remain in place until after the final inspection and final acceptance of the sewer line by the District. It shall be completely removed prior to placing the sewer pipeline in service. If a stub-out has not been previously provided when connecting a new sewer to an existing sewer manhole the incoming invert shall be neatly and smoothly cut into the existing concrete base pad. Entrance to the manhole through the barrel section is prohibited unless written approval is obtained from the District.

9C-2-3 SEWER PIPE LAYING DIRECTION - Pipe laying shall proceed upgrade, with the spigot ends of the pipe pointing in the direction of the flow. Each pipe length shall be laid true to line and grade.

9C-2-4 SEWER SEPERATION FROM ADJACENT UTILITIES - Adequate separation of sanitary pipelines from all other utilities shall be maintained for the ease of access, excavation, installation of shoring, rehabilitation, maintenance, and repair of the sanitary system, and for protection of the potable water supply from potential contamination.

9C-2-4.1 Protection of Treated (Potable) Water Pipelines - When a new sanitary sewer pipeline is laid parallel to an existing or new water pipeline, the distance between the pipelines shall be 10 feet. When the pipelines are 12-inches and smaller in diameter, the District generally considers a spacing of 10-feet measured center-to-center horizontally to meet this criterion which also satisfies horizontal spacing criteria within standard 30-foot water and sewer easements. When pipelines are larger than 12-inches in diameter, the edge-to-edge clear separation distance of 10 feet should generally be considered.

If a new sanitary pipeline is less than 10 feet horizontally from a water pipeline that is parallel or converging to the sewer pipeline, and the sewer alignment cannot be moved to an approved new alignment that is 10 feet from the water pipeline, then extra protection shall be provided for the sewer pipeline. Extra protection may consist of encapsulating the sewer pipeline within diggable flowfill or flashfill encasement or installing it within a casing pipe sleeve continuous for the limits within 10 feet of the water pipeline, or constructing the sewer pipeline with restrained joint pressure-rated Class 305 C-900 PVC or lined ductile iron pipe for the affected section of sewer pipeline

for the full length between manholes (i.e., no intermediate pipe material changes allowed between manholes), or other appropriate method, subject to the approval and direction of the District.

Vertical separation at pipeline crossings shall maintain a minimum of 18-inches (1.5-ft) of clearance as measured between the outside of pipes. When a new sanitary sewer pipeline crosses an existing or new water pipeline and the sewer is above or less than 18 inches below the water pipeline, the Contractor shall center a full 18 or 20-ft "stick" of sewer pipe on the water pipeline such that there shall be no sewer pipeline joints within 9-ft of the waterline and provide extra protection for the sewer pipeline. Extra protection may consist of either of the following, subject to approval of the District:

- ▶ Reinforced concrete encasement around the entire length of the 18 or 20-ft stick of sewer pipeline (exclusive of the joint at each end, provide formwork to exclude concrete from the joint area). This option is available only if the sewer pipeline crosses below the water pipeline.
- ▶ Or, continuous (without joints) 20-ft long welded steel or ductile iron casing pipe sleeve (centered on the waterline) through which the carrier sewer pipe is installed on skids and provided with end seals.
- ▶ The above criteria assume the water and sewer pipeline crossing is at a right angle, perpendicular. If the crossing angle is oblique, the concrete encasement or casing sleeve length shall be extended to a point measured 10 feet horizontally and perpendicular to both sides of the water pipeline.

9C-2-4.2 Sewer Separation from Dry and Other Utilities - Sanitary pipelines installed adjacent to other utilities such as buried electrical, telecommunications, natural gas lines, storm drains, etc., shall maintain a minimum of 5-feet of horizontal clearance. When lines are installed in parallel, the distance between alignments shall be such that the 5-feet of clearance is measured from the outside edge of manholes, inlets, and junction structures. Horizontal clearance from the base of overhead power poles, traffic signal poles, and other overhead utility and light poles shall be 10 feet minimum. Vertical separation at crossings shall maintain a minimum of 18-inches (1.5-ft) of clearance as measured between the outside of pipes, ducts, or encasements. If 18-inches of clearance is not feasible in any manner, then extra protection shall be provided for the sanitary line, for the other utility, or both, as directed by the District on a case-by-case basis and in accordance with the District Standard Details. All dry and other utilities must maintain a 5-ft radius clearance from the edge of manholes, cleanouts, and lamp holes for system repair and maintenance.

9C-2-5 DESIGN-PHASE POTHOLING AND SUE REQUIRED - All existing and proposed utilities that the proposed sewer pipeline will cross – wet and dry, including traffic and street lighting utilities and utility service lines – shall be shown accurately in the design profile on the sewer plans. Label depths of cover over pipelines, and vertical clearance distances measured between outside of pipes at crossings. Show existing and proposed future grade as applicable. Identify extra protection measures at crossings, limits of

flowfill backfill, location of trench dams, and other design elements as required or applicable to the design.

Unless otherwise allowed by the District, all existing utilities shall be shown at their actual top and bottom elevation based on potholing data collected by the Design Engineer or developer during design. If Subsurface Utility Engineering (SUE) law requirements apply to the project, then potholing will be conducted as part of the SUE design as Quality Level A information and stamped by the Engineer of Record accordingly. If SUE requirements do not apply to the project, potholing of crossing utilities during design shall occur regardless and the information shall be reflected in the design. If the proposed sewer will cross an existing storm drain or other gravity pipeline with more than 2.0-ft of vertical clearance, edge to edge, then the existing gravity pipeline may be portrayed in the profile at the elevation determined by survey of invert elevations at nearby manholes subject to approval of the District Engineer. If the clearance will be less than 2.0-ft, then the gravity pipeline shall be potholed consistent with Quality Level A information. The Design Engineer's survey files shall be provided to the District for informational purposes only with the plan review.

9C-3 SEWER PIPELINE EXCAVATION, BEDDING, BACKFILL, AND

COMPACTION: The installation standards set forth in this Part 9C-3 and in Part 9C-6 and associated District Standard Details are the minimum standards of the Cherry Creek Valley Water and Sanitation District. These standards are to be enforced by the Design Engineer as a minimum, but do not restrict the use of more stringent design criteria and do not relieve the Design Engineer from responsibility for errors and omissions in plans or specifications. Backfill shall meet the requirements, as indicated in the following sections, or the requirements of the entity controlling the roadway being excavated, whichever is more stringent.

9C-3-1 TRENCH EXCAVATION WIDTHS - The minimum clear trench width measured at the top of the pipe barrel shall be not less than the outside pipe diameter, plus 16 inches, nor greater than the outside pipe diameter plus 20 inches.

9C-3-2 SEWER PIPELINE BEDDING - Sewer pipe shall be bedded from a point 6 inches below the invert of the pipe, to a point at least 12 inches above the top of pipe. The bedding material shall consist of imported concrete coarse aggregate, meeting the requirements of ASTM C33 and D448, Gradation No. 67. Bedding material shall be placed in 6-inch lifts (maximum) and compacted around the pipe by hand using tamping bars or shovel handles.

9C-3-3 BACKFILL MATERIAL - The remainder of the trench above the bedding material shall be backfilled with material from the excavated earth, unless a more stringent material is required by the agency having jurisdiction over the roadway. The backfill material shall not contain frozen material, rubbish, broken pavement, rocks greater than 6 inches in diameter, or other debris.

9C-3-4 TRENCH COMPACTION - Bedding and backfill material shall be compacted, and percentage compaction requirements shall be in accordance with ASTM D698 (Standard Proctor). The specified aggregate bedding to 12 inches above the pipe shall be compacted to 95 percent of maximum dry density (70 percent relative density). The remaining backfill material above the bedding material shall be compacted to 95 percent of maximum dry density as determined by ASTM method D698, except when more stringent compaction is required by the governmental entity controlling the roads and streets. Backfill shall be carefully placed at maximum 8-inch lifts.

9C-3-5 COMPACTION TESTING - The Contractor and Owner shall arrange to have compaction tests made by a registered soils engineer and submitted to the District for approval.

9C-4 TESTING OF SEWER AND MANHOLES: All tests must be passed prior to placing any new sewer in service. All sewer pipelines and manholes shall be tested in the following manner:

9C-4-1 TELEVISIONING - All sewer pipelines shall be televised in the presence of a representative of the District. If pipelines show deflection, poor alignment, displaced joints, debris or other defects, the defects shall be corrected. Video recordings shall be given to the District.

9C-4-2 LEAKAGE TEST - An infiltration and/or exfiltration test for pipeline watertightness shall be performed by the Contractor in the presence of a District representative. Infiltration tests shall be used if the groundwater is more than 1 foot above the highest point of the finished pipeline; otherwise, only the exfiltration test will be used. An alternate air test for PVC pipe may be used in lieu of the exfiltration test for pipelines. Air test shall be in conformance with UNI-BELL UNI-B-6 unless exceeded herein.

PVC SEWER PIPELINE AIR TEST

**Minimum Test Time for a 0.5 PSIG (Maximum) Pressure Drop for (3.5 PSIG to 3.0 PSIG)
for Size and Length of Pipe Indicated**

1 Pipe Diam . (In)	2 Min. Test Duration (Min:Sec)	3 Test Duratio n (Sec)	Representative Minimum Testing Time Duration Required (Min:Sec)							
			100 Ft.	150 Ft.	200 Ft.	250 Ft.	300 Ft.	350 Ft.	400 Ft.	450 Ft.
4	1:53	0.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	0.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	0.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17

The minimum head for the water exfiltration test shall be 2 feet above the top of the pipe at its highest point in the test section. The sewer and connections shall not leak water in excess of the following rate for a 24-hour test period.

PIPE SIZE INCHES	ALLOWABLE LEAKAGE IN GAL/FT. OF SEWER/24HRS
8	0.30
10	0.38
12	0.45
15	0.57
18	0.68
21	0.80
Larger than 21"	As Determined by the District

At the sole discretion of the District, the time for the leakage test may be shortened to 4 hours. Any section of pipeline failing to pass the appropriate test shall be repaired and re-tested by the Contractor until satisfactory results are obtained.

Infiltration test shall be considered failing if infiltration is observed in the pipeline.

9C-4-3 MANHOLE LEAKAGE TEST - An exfiltration test shall be conducted in the presence of a District representative for each manhole, prior to backfilling.

All lines leading into or out of the manhole shall be tightly plugged. The manhole shall be filled with water to at least 1 foot above the bottom of the cone section. If, at the end of a 2-hour stabilization period the water level has dropped, additional water will be added to bring the level above the joint as before. Any visible external leakage noted within the next 1-hour test period shall constitute failure. Repair the manhole and retest until satisfactory tightness is obtained.

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

The test head shall be placed at the top of the manhole and the seal inflated in accordance with the manufacturer's recommendations.

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

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

<i>DEPTH (FEET)</i> <i>(Vertical Length of Manhole)</i>	<i>TIME (Seconds)</i>		
	<i>48" Diameter</i>	<i>60" Diameter</i>	<i>72" Diameter</i>
<i>8</i>	<i>20</i>	<i>26</i>	<i>33</i>
<i>10</i>	<i>25</i>	<i>33</i>	<i>41</i>
<i>12</i>	<i>30</i>	<i>39</i>	<i>49</i>
<i>14</i>	<i>35</i>	<i>46</i>	<i>57</i>
<i>16</i>	<i>40</i>	<i>52</i>	<i>67</i>
<i>18</i>	<i>45</i>	<i>59</i>	<i>73</i>
<i>20</i>	<i>50</i>	<i>65</i>	<i>81</i>
<i>22</i>	<i>55</i>	<i>72</i>	<i>89</i>
<i>24</i>	<i>59</i>	<i>78</i>	<i>97</i>
<i>26</i>	<i>64</i>	<i>85</i>	<i>105</i>
<i>28</i>	<i>69</i>	<i>91</i>	<i>113</i>
<i>30</i>	<i>74</i>	<i>98</i>	<i>121</i>

9C-5 SEWER APPROVALS REQUIRED: All sewer main utility designs shall be reviewed and approved by the District prior to construction. Plans submitted shall have the approval forms in the following language placed on the cover sheet of the plans:

DISTRICT APPROVAL

Approved this ____ day of _____ A.D., 20____, for engineering conformity only, and does not relieve the Design Engineer from responsibility for errors or omissions in plans, specifications, or field survey.

District Engineer

Approved this ____ day of _____ A.D., 20 ____, by the Cherry Creek Valley Water and Sanitation District for construction of sewer main lines as shown hereon.

District Manager

9C-6 SEWER NOTES REQUIRED ON PLANS: The following SEWER NOTES shall be predominantly displayed on the plans. These notes shall not be construed to relieve the Design Engineer or the Contractor from conformance with the full requirements of those Rules or Regulations, or the design specifications. These are to be constructed as only a minimum summary of the Rules and Regulation and design specifications.

SEWER NOTES

1. Pre-Construction Conference: At least 48 hours before the start of construction, the Contractor, Cherry Creek Valley Water and Sanitation District (District, 303-755-4474), District Engineer (303-964-3333), Arapahoe County (720-874-6500), Developer/Owner, and other interested parties shall meet for a pre-construction conference at the location of the District office. The Contractor shall have the foreman who will be performing the work present at the meeting. The Contractor shall be responsible for setting up the meeting and for notifying the interested parties to coordinate a time. The Contractor shall bring 6 full-size approved drawing sets to the meeting for distribution to attending parties. No field work shall occur prior to the pre-construction conference.
2. Construction Inspection: All work shall be performed under full time construction observation of the District. The Contractor shall notify the District (303-755-

4474) and District Engineer (303-964-3333) at least 48 hours prior to the start of construction to coordinate field inspection. District inspection is full time and is paid for on a time and materials basis by the Developer from the escrow account held by the District. Work that is backfilled or covered by the Contractor prior to District approval shall be uncovered for inspection at the Contractor's expense.

3. Sanitary sewer pipe shall be PVC conforming to ASTM D3034 for pipe sizes 15-inches and smaller, and ASTM F679 for pipe sizes larger than 15-inches. Wall thickness shall correspond to SDR 35 (PS46 for F679 pipe) for depths of burial up to 20-ft of cover, and SDR 26 (PS115) for burial depths greater than 20-ft of cover. PVC material shall conform to ASTM D1784 classification 12454B or 12454C, and gaskets shall conform to ASTM F477. All fittings, tees, and plugs shall be of the same pipe specification and classification as the pipe to which they are attached. In special circumstances where extra strength or protection is required, or where directed by the District Engineer, Class 52 ductile iron pipe with Protecto-401 ceramic epoxy lining and nitrile gaskets may be used and shall meet the requirements specified by the District Engineer.
4. PVC pipe shall not be "over-belled". The factory "insertion line" shall be visible against the bell entrance for proper assembly. For field-cut pipe sections, the spigot end shall be beveled by abrasive disc and marked by hand at the proper distance from the pipe end prior to bell insertion. The making of all joints shall be witnessed by the District Inspector. If CCTV inspection upon job completion reveals over-belled joints, the Contractor will be required to re-excavate and re-lay the pipe to the satisfaction of the District prior to acceptance.
5. Service taps for new sewer mains shall only be made with tee fittings installed on the main. Tee pattern service saddles are allowed only when connecting to a previously installed (existing) sewer main. Wye pattern tap connections are not allowed. Service lines shall not connect to manholes or connect to the main within 5 feet of manholes unless specifically allowed in writing by the District Engineer. Service taps shall be spaced no closer than 3 feet apart, center-to-center.
6. Service lines shall have a minimum slope of 2%. Service lines shall be installed perpendicular from the main to the easement or right-of-way line when viewed in plan; no horizontal bends or deflections of any kind are allowed under any circumstances within the easement or right-of-way. 45-degree maximum bend fittings are allowed outside the easement or right-of-way in accordance with the District Standard Details. In no circumstances are 90-degree fittings ever allowed, either horizontally or vertically, in buried piping outside of the building. If the service from the main is to be temporarily stubbed at the right-of-way line, provide a temporary watertight plug. In front of the plug, install a steel fence post or 2x4 lumber in a vertical orientation prior to backfilling, with the top located 12-inches below finish grade. The post shall remain in place until the service location is marked by an "X" on the curb face as described in a later note herein.

7. An exterior two-way sanitary cleanout is required 5 feet outside of the building for all service lines, including on residential construction. Wing-nut style elastomeric plugs shall be used; threaded cleanout plugs are not allowed. Cleanout plugs shall be located under traffic-rated cast iron frames and covers marked "CLEANOUT" or equivalent centered within a concrete slab as shown on the District Standard Details. Round plastic boxes without a concrete slab are acceptable in landscaped areas for residential construction only.
8. Trench width measured at the top of the pipe shall not be less than the outside pipe diameter plus 16 inches, nor greater than the outside pipe diameter plus 20 inches.
9. Bedding for all pipe and fittings shall be No. 67 Coarse Aggregate (AASHTO M 43). The bedding zone shall extend from 4 inches below the pipe invert to 12 inches above the pipe crown. Bedding shall be placed and compacted in 6-inch maximum lifts. Compaction shall include tamping under the haunches of the pipe for the entire pipeline length using the handle end of a shovel or by other mechanical means acceptable to the District Inspector. Bedding compaction shall achieve a minimum equivalent to 95% of maximum dry density per ASTM D698 (Standard Proctor). Placement by dumping or spreading without compaction or tamping will not be accepted.
10. Backfill above the bedding zone may be suitable native material, unless required otherwise by the County, Developer, or other entity having jurisdiction. Backfill shall be compacted to a minimum of 95% of maximum dry density per ASTM D698 (Standard Proctor) unless more stringent compaction is required. Backfill shall be placed and compacted in maximum 12-inch lifts. Contractor or Developer shall provide the services of an independent third-party licensed compaction testing firm at their cost to verify compaction of all backfill, which shall be subject to approval by the District Engineer. Submit test results to the District.
11. Manholes shall have a minimum inside diameter of 4 feet. Provide larger diameter manholes for pipe sizes larger than 15-inches in diameter or for depths greater than 20-ft, or where directed by the District Engineer. Manhole spacing shall not exceed 400-feet.
12. Manhole bases shall be cast-in-place concrete with No. 4 reinforcing bar spaced at 12 inches on-center in both directions, plus bottom and top perimeter hoops and diagonal reinforcing at pipe penetrations. The subgrade shall be mechanically well compacted. Reinforcing bar shall be chaired 3" above the subgrade with "Dobie" supports. Concrete shall have a minimum 28-day compressive strength of 4,000 psi, and reinforcing bar shall comply with ASTM A615 Grade 40 (minimum). Moistened blankets shall be used for concrete curing. Precast concrete manhole bases are not allowed unless approved by the District Engineer in writing.
13. Barrel sections shall be precast concrete meeting the requirements of ASTM C478. Bottom and intermediate joints shall be sealed by two rings of K.T. Snyder RUB/R-NEK or equal stacked vertically. Wrap exterior perimeter of each joint

with RUB/R-NEK External Joint Wrap and primer, or equal. Grout only the exterior perimeter of the bottom section where it meets the cast-in-place base or use External Joint Wrap if a good seal can be achieved. Specialty grouting of interior joints may be considered by the District Engineer for the purposes of repairing a manhole that failed the initial infiltration test..

14. Manhole cone sections shall be eccentric. In striped collector or arterial roadways, rotate the cone to place the manhole cover centered in the traffic lane or on the edge of the traffic lane (whichever is closer); outside the wheel path. In residential streets, rotate the cone to place the manhole cover on the uphill side of the street cross section if located near the gutter, or as directed otherwise by the District Engineer or agency having jurisdiction over the roadway.
15. Manhole frames and covers shall be 24-inch nominal diameter, traffic rated, manufactured of cast or ductile iron and coated with asphalt or coal tar, with the word "SEWER" cast on the cover. Frames and covers shall be NEENAH R-1706 or equivalent. Frames and covers shall be adjusted to finish grade prior to acceptance of the project. Adjustment shall be made with precast concrete adjusting rings (ASTM C478), no less than 3 steel shims spaced equally around the perimeter, and a continuous bed of high strength grout placed beneath the frame only. The maximum grout bed thickness allowed is 1.5-inches; if a greater thickness is needed then provide an additional precast concrete adjusting ring instead. Provide RUB/R-NEK joint sealant between each adjusting ring and wrap the perimeter of all rings with RUB/R-NEK External Joint Wrap and primer. Adjustment using drop-in metal ring inserts is not acceptable and will be rejected by the District. The rim shall be between 8 inches (minimum) and 16 inches (maximum) above the top of eccentric cone section. Frames and covers shall be parallel to the plane of the street surface and shall be 1/8-inch minimum to 1/4-inch maximum below the surface.
16. Manhole pipe connections shall be made with short spool pieces of the specified sewer main pipe cast in the base, which shall result in a flexible gasketed bell joint located no more than 18 inches from the outside face of the manhole base for all pipe that enters/exits the manhole. Bell ends shall face upstream. A rubber gasket designed specifically for use as a waterstop shall be installed around the outside of all pipe where embedded in the concrete base to provide a leak-tight seal.
17. Invert channels and benches shall be formed in the concrete of the manhole base. Invert channels shall be "U"-shaped in cross section, with a width and depth equal to the pipe diameter. Channels shall be smooth and semicircular in shape, and changes in size, direction, and grade shall be made gradually and uniformly. Bench surfaces shall slope at 2% towards the invert channel for drainage of standing water. In straight-through manholes, invert channels may be made by embedding a section of sewer main pipe in the manhole base with the top half cut off, as long as the waterstop gasket and flexible gasketed bell joint criteria specified above are met.

18. Manhole steps shall be structural steel rod fully and completely encapsulated within textured polypropylene plastic manufactured specifically for sanitary manhole use in accordance with ASTM C478. Steps shall be placed at 12-inch vertical intervals. The top step shall not be more than 18-inches below the rim, and the bottom step shall not be more than 12-inches above the bench.
19. Drop manholes shall be provided where the difference in pipe inverts in a manhole exceeds 24 inches. Drop manholes shall use a "wye" pattern fitting for the drop transition, unless a "tee" pattern is approved by the District Engineer for higher drops. Drop manholes shall provide in-line access to the upper pipe (i.e. both upper and lower pipes shall penetrate into the manhole).
20. Tracer wire and warning tape are required for all sanitary mains and services. Warning tape shall be non-metallic highly stretchable plastic, green in color and marked with the text "CAUTION – SEWER LINE BELOW" or equivalent, installed continuously on top of the aggregate bedding 12-inches over the pipe. Tracer wire shall be #12 solid core copper wire with green-colored insulation rated for direct burial. Tape to the top of the pipe and service lines at 10-foot intervals. Splices shall be made with silicone-filled splice kits as manufactured by 3M. Tracer wire access shall be provided at manholes and cleanouts as shown in the District Standard Details. Electronic signal continuity testing shall be successfully demonstrated to the District for all mains and services prior to project acceptance.
21. In all cases, sewers shall maintain a 10-foot horizontal distance from, and 1.5-foot vertical clearance below, potable water lines. Provide extra protection in accordance with CDPHE requirements at potable water crossings when the minimum distances cannot be achieved, subject to the review and approval of the District Engineer.
22. Pipe laying shall proceed upgrade, with the bell ends facing upstream (spigot ends point downstream). Each pipe length shall be laid true to line and grade using a laser or professional survey equipment. Cover all pipe openings whenever the pipe is left unattended or pipe laying is not in progress.
23. A letter "X" shall be permanently etched or cut onto the face of the concrete curb over all sewer service laterals. Service locations shall be as marked by the buried steel fence post described previously. If the post is missing or has been disturbed, or when directed by the District Engineer, the Contractor shall re-excavate or pothole to locate the service line at no expense to the District so that the "X" can be accurately located.
24. Flushing: All sewer pipelines shall be flushed with water until clean before final acceptance. The flushing water shall not enter the District's existing sewer system unless approved in advance by the District in writing. Capture and remove solid debris at the downstream manhole.
25. Testing: All sewer pipelines and manholes shall be tested for leakage by infiltration or exfiltration methods in accordance with the District Rules and Regulations. The testing requirements may be obtained from the District. All

tests must be passed prior to acceptance and placing any new sewer system into service. Testing shall be done in the presence of the District Inspector.

26. All sewer pipelines shall be televised by robotic CCTV prior to final acceptance. All service taps and pipe penetrations at manholes shall be thoroughly videotaped from multiple angles. Videotaping shall be performed in the presence of the District Inspector. If pipelines show deflection, poor alignment, over-inserted joints, displaced joints, debris, or other defects, the defects shall be corrected prior to final acceptance. Provide electronic video files to the District.
27. A set of record drawings on electronic media compatible with the District standards, reflecting the as-built condition, shall be provided to the District prior to final acceptance of this project. All other utilities crossing the trench shall be accurately labeled and stationed on the plan and on the profile. An electronic file of the drawings shall be provided to the District. All data shall be tied into the Arapahoe County control system.

9C-7 WATER DISTRIBUTION SYSTEM: Water system construction shall conform to the standards of the Denver Water Department Engineering Standards, Capital Projects Construction Standards (CPCS) Specifications and Standard Drawings, latest issue, or the Cherry Creek Valley Water and Sanitation District's requirements which include those specified in Part 9C-7-4 herein, whichever is more stringent. The standards set forth represent the minimum standards of the Cherry Creek Valley Water and Sanitation District, and the Denver Water Department. These standards are to be enforced by the Design Engineer as a minimum, but do not restrict the use of more stringent design criteria, and do not relieve the Design Engineer of responsibility for errors and omissions in plans or specifications.

9C-7-1 FOREIGN MATERIAL IN WATER PIPELINE - Pipe shall be stored off the ground on pallets and with all open ends capped or tightly covered with plastic and secured with tape to omit dust, insects, animals, and other debris that may contaminate the public water supply. All pipe joints, interior surface of sockets, exterior surface of spigots, and fittings shall be cleaned of foreign material prior to placement in the trench, and pipe shall remain clean at all times thereafter. Visually verify the interior of each length of pipe is free of any foreign objects prior to lowering into the trench. Whenever the pipe is left unattended or pipe laying is not in progress, temporary plugs shall be installed at all openings. Do not allow standing water in the trench to enter the pipe.

9C-7-2 WATER SEPARATION FROM ADJACENT UTILITIES - Adequate separation of water pipelines from all other utilities shall be maintained for the ease of access, excavation, installation of shoring, rehabilitation, maintenance, and repair of the water utility system, and for protection of the potable water supply from potential contamination.

9C-7-2.1 Protection From Contamination - When a new water pipeline is laid parallel to an existing or new sanitary or storm drain pipeline, the distance

between the pipelines shall be 10 feet. When the pipelines are 12-inches and smaller in diameter, the District generally considers a spacing of 10-feet measured center-to-center horizontally to meet this criteria which also satisfies horizontal spacing criteria within standard 30-foot utility easements. When pipelines are larger than 12-inches in diameter, the edge-to-edge clear separation distance of 10 feet should generally be considered. If a new water pipeline is less than 10 feet horizontally from a new or existing sanitary or storm pipeline that is parallel or converging to the water pipeline, and the water alignment cannot be moved to an approved new alignment that is 10 feet from the sanitary or storm pipeline, then extra protection shall be provided for the sanitary or storm pipeline as described in Part 9C-2-4.1. If the sewer or storm pipeline is existing, then replacement or retrofitting of extra protection on the existing pipeline may be necessary at the time the new water pipeline is installed, subject to the approval and direction of the District. Vertical separation at pipeline crossings shall maintain a minimum of 18-inches (1.5-ft) of clearance as measured between the outside of pipes. Water pipelines shall endeavor to cross above (over) sanitary and storm pipelines when possible. If a new water pipeline crosses under a new or existing sanitary sewer or storm pipeline, or if there is less than 18 inches of vertical clearance, extra protection shall be provided. Extra protection may consist of either of the following, subject to approval or direction of the District:

Install reinforced concrete pipe encasement around the lower pipeline of the crossing which shall extend to 10-ft on each side of the pipeline crossing. And, in addition:

- ▶ If the lower pipeline is existing and the upper pipeline is new: the new pipeline shall be installed with one full 18 or 20-ft "stick" of pipeline centered over the crossing such that it has no joints within 9-ft of the crossing.
- ▶ If the lower pipeline is new and the upper pipeline is existing: center a full 18 or 20-ft "stick" of pipeline centered under the crossing such that it has no joints within 9-ft of the crossing. The concrete encasement shall be formed short of the joints on each end.
- ▶ If both pipelines are new: Center a full stick of pipe for both pipelines on the crossing such that all joints are as far as possible from the crossing. Concrete encasement on the lower pipeline shall be formed short of the joints on each end.

Or install a continuous (without joints) 20-ft long welded steel or ductile iron casing pipe sleeve (centered on the crossing) through which the carrier pipeline is installed on skids and provided with end seals. The casing may be provided for either the upper or lower pipeline of the crossing. If both crossing utilities are new, then the pipeline that is not cased (sleeved) shall have a full stick of pipe centered on the crossing such that its joints are as far as possible from the crossing location.

The above criteria assume the pipelines are crossing at a right angle, perpendicular. If the crossing angle is oblique, the concrete encasement or casing sleeve length shall be extended to a point measured 10 feet horizontally and perpendicular to both sides of the pipeline that it crosses.

9C-7-2.2 Water Separation from Dry Utilities - Water pipelines, water meter pits and vaults, valves, valve boxes, fire hydrants, blowoffs, and the like installed adjacent to other utilities such as buried electrical, telecommunications, natural gas lines, etc. shall maintain a minimum of 5-feet of horizontal clearance, measured edge-to-edge. Horizontal clearance from the base of overhead power poles, traffic signal poles, and other overhead utility and light poles shall be 10 feet minimum. Vertical separation of water pipelines at dry utility crossings shall maintain a minimum of 18-inches (1.5-ft) of clearance above or below as measured between the outside of pipes, ducts, or encasements. If 18-inches of clearance is not feasible in any manner, then extra protection shall be provided for the water pipeline, for the other utility, or for both, as directed by the District on a case-by-case basis and in accordance with the District Standard Details. All dry and other utilities must maintain a 5-ft radius clearance from vaults, fire hydrants, meter pits, valves, valve boxes, and blowoffs for system repair and maintenance.

9C-7-3 DESIGN PROFILE, POTHOLING, AND SUE REQUIRED: Unless otherwise allowed by the District, all water pipeline designs shall be accompanied by an accurate and scaled design profile on the plans. The profile may be included on the "utility plan" sheet of the standard Denver Water plan preparation format. The profile shall call out stations, elevations, depths of cover over pipelines, and vertical clearance distances measured between outside of pipes at utility crossings. Show existing and proposed future grade as applicable. Show existing and proposed utilities, wet and dry, including traffic and street lighting utilities and utility service lines. Identify valves, points of connections, horizontal and vertical bend fittings and thrust blocks, proposed rotations of horizontal bends to achieve vertical deflection, and straight pipe joint deflections. Identify extra protection measures at crossings, limits of flowfill backfill, extents of mechanical joint restraints, location of trench dams, and other design elements as required or applicable to the design.

Crossing utilities shall be shown in the profile at their actual top and bottom elevation based on potholing data collected by the Design Engineer or developer during design. If Subsurface Utility Engineering (SUE) law requirements apply to the project, then potholing will be conducted as part of the SUE design as Quality Level A information and stamped by the Engineer of Record accordingly. If SUE requirements do not apply to the project, potholing of crossing utilities during design shall occur regardless and the information shall be reflected in the design, with the exception that surveyed invert elevations at adjacent gravity pipeline manholes (i.e. storm and sanitary) may be used for portraying the elevations and sizes of gravity pipelines at crossings subject to approval of the District. The Design Engineer's survey files shall be provided to the District for informational purposes only with the plan review.

9C-7-4 WATER NOTES REQUIRED ON PLANS: The following WATER NOTES shall be prominently displayed on the plans. These notes shall not be construed to relieve the Design Engineer or the Contractor from conformance with the full requirements of these Rules and Regulations or the design requirements. These are to be construed as only a minimum summary of the Rules and Regulations, and design specifications. The standards set forth are the minimum standards of the Cherry Creek Valley Water and Sanitation District, and the Denver Water Department. Their standards are to be enforced by the Design Engineer as a minimum, but do not restrict the use of more stringent design criteria, and do not relieve the Design Engineer or responsibility for errors and omissions in plans or specifications.

WATER NOTES

1. All materials and workmanship shall be in conformance with the Denver Water Engineering Standards, Denver Water Capital Projects Construction Standards (CPCS) Specifications and Standard Drawings (latest editions); or the Cherry Creek Valley Water and Sanitation District (District) requirements, whichever is more stringent.
2. The Contractor shall have in their possession at all times one signed copy of the Plans which have been approved by Denver Water and the District.
3. Pre-Construction Conference: Before the start of construction, the Contractor, District (303-755-4474), District Engineer (303-964-3333), Arapahoe County (720-874-6500), Denver Water (see DWD notes for contact info), Developer/Owner, South Metro Fire Rescue, and other interested parties shall meet for a pre-construction conference at the location of the District office. The Contractor shall have the foreman who will be performing the work present at the meeting. The Contractor shall be responsible for setting up the meeting and for notifying the interested parties to coordinate a time. The Contractor shall bring 6 full-size approved drawing sets to the meeting for distribution to attending parties. No field work shall occur prior to the pre-construction conference.
4. Construction Inspection: All work shall be inspected and approved by personnel of the District and Denver Water. The Contractor shall notify Denver Water (303-628-6606) and the District Engineer (303-964-3333) at least 48 hours prior to the start of construction to coordinate field inspection. District inspection is full time, and is paid for on a time and materials basis by the developer from the escrow account held by the District. Work that is backfilled or covered by the Contractor prior to Denver Water or District approval shall be uncovered for inspection at the Contractor's expense.
5. Water mains and services 3" and larger shall be ductile-iron pipe, Class 52, with push-on single gasket type joints per AWWA C150 and C151. Fittings shall be gray-iron or ductile iron and furnished with mechanical joint ends per AWWA C110 or C153. All fittings shall have a minimum pressure rating of 250 psi. Pipe

and fittings shall be furnished with an exterior asphaltic coating and an interior standard thickness cement mortar lining. All stored pipe or laid pipe left unattended shall have all open ends capped or covered with plastic secured with tape. Wrap all pipe and fittings with an 8 mil minimum thickness polyethylene material per AWWA C105.

6. Water service lines 2" and smaller shall be Type K copper. Connections shall be by the flared or brazed silver solder method; compression fittings are not allowed. Joints shall be leak tight and shall be verified under pressure by the District Inspector prior to backfill. A continuous length of unbroken copper shall be provided between corp and curb stops; splices or couplings are not allowed in this reach under any circumstances. Conductivity insulators shall be provided at corp stops and at changes in pipe material.
7. Service Taps: Taps 2" and smaller shall be made by Denver Water for developer projects. Combination fireline/domestic services per Denver Water CPCS Detail 33262 are not allowed in the District; two separate taps from the main are required. Service taps shall not be located less than 5 feet from each other and from adjacent fittings or joints on the main. In special circumstances the District may allow reducing this distance to no less than 3 feet.
8. Meter pits: Meter pits and curb stops shall generally be located in landscaping areas behind sidewalks or between the sidewalk and curb in the tree lawn in accordance with the Denver Water CPCS details. Meter pits for service sizes 3/4" and 1" shall be clear of all permanent obstructions and utilities within a 5-foot radius measured in all directions around the center of the lid. Meter pits for service sizes 1-1/2" and 2" shall be clear within a 7-foot radius of the center of the lid, and meter vaults for service sizes 3" and larger shall be clear within 5-feet in all directions measured from the belowground walls of the vault. Permanent obstructions and utilities include buildings, structures, walls, fences, transformers, utility pedestals, trees, woody nursery stock, street and site light poles, signs, utility poles, all buried utilities, and the like. Small landscaping shrubs, clump grasses, and groundcovers shall be at least 2 feet clear of lids.
9. Fireline Services: The minimum line size within the right-of-way or easement shall be 4" DIP. The Fireline service size may reduce outside of these limits if desired. Firelines shall meet the District standards for mains, except that all joints shall be mechanically restrained regardless of location. District jurisdiction for design review and construction inspection extends to the flange in the riser room. Comply with the District standard detail for risers. Firelines shall be disinfected and pressure tested as specified. Design review, construction inspection, and testing shall also be provided by South Metro Fire Rescue in accordance with their requirements.
10. Fire hydrants shall be Watrous Pacer WB-67-250, no equal. Fire hydrant assemblies shall include all pipe, fittings, valves, materials, and labor which are necessary to install the hydrant complete in place. Fire hydrants shall be clear of all permanent obstructions and utilities within a 5-foot radius measured in all directions around the center of the hydrant. Permanent obstructions and utilities

include buildings, structures, walls, fences, transformers, utility pedestals, trees, nursery stock, street and site light poles, signs, utility poles, all buried utilities, and the like.

11. Gate valves shall be Mueller A-2360 Resilient Wedge Gate Valve conforming to AWWA C509 or District approved equal. Valves shall have an upgraded stem alloy option as required by the latest CPCS specifications. Valves shall open to the right (clockwise open).
12. Bedding: Water pipelines shall be bedded from 6 inches below the pipe bottom to a minimum of 12 inches above the top of pipe. The bedding material shall consist of a clean, free draining well graded rounded squeegee pea gravel and conform to the gradation limits as set forth in the Denver Water Engineering Standards. Bedding shall be stockpiled separately on a hard surface (i.e. asphalt) and shall be kept strictly clean of contamination by native soil, broken asphalt, rocks, trash, and other debris prior to and after installation around the pipe. Bedding shall be tamped under the haunches of the pipe for the entire pipeline length using the handle end of a shovel or by other mechanical means acceptable to the District Inspector. Placement by dumping or spreading without compaction or tamping will not be accepted.
13. Cover: There shall be a minimum cover of 4.5 feet over all water mains unless approved otherwise in writing by the District Engineer.
14. Thrust Restraint: All horizontal and vertical bends, tees, fire hydrants, blow-offs, valves, and plugs at dead end mains shall be protected from thrust by using both concrete thrust blocks AND mechanical restraints.
Mechanical Restraints: All restraints shall terminate behind the first available fitting or joint that meets or exceeds the Denver Water standards for length of restrained pipe (Denver Water CPCS Detail 33144). All bend fittings shall have a 15-foot (minimum) length of pipe immediately adjacent to each side of the bend fitting. Mechanical restraint devices on ductile iron shall be Megalug Series 1100 (mechanical joint) or Series 1700 (push-on joint) as manufactured by EBAA Iron, Inc, or equivalent product by Star with upgraded epoxy coating; no equal.
Restraint devices on existing cast iron mains shall be traditional rods and bell clamps only. When connecting to existing cast iron pipelines, hand tighten blue Megalug bolts snugly against the outside of the cast iron pipe; do NOT break off.
Concrete Thrust Blocks: Comply with the District Standard Details for horizontal and vertical thrust blocks. Ninety degree bends shall use 1.4 times the area for tee or dead ends. Concrete thrust blocks for upper vertical bends shall be based on the mass weight of concrete required to secure the bend, not on bearing surface area. Such thrust blocks shall be located beneath the bend and securely tied up to the bend with epoxy-coated rebar or stainless steel straps.
15. Connecting to Existing Mains: Tapping sleeves and valves are not allowed in the District unless approved in writing by the District Engineer. All tie-ins shall be made by cutting in the appropriate fitting into the existing main, with long pattern mechanical joint solid sleeve and new ductile iron pipe closure piece if necessary. "Wedding bands" shall be provided to close pipe gaps greater than

1/4-inch within solid sleeves. Where tees are to be cut in, the run of the tee shall be restrained in addition to the tee branch. The run along the existing pipeline on each side of the new tee shall be exposed and restrained a minimum of two pipe lengths. Split ring EBAA Iron Megalug or equivalent Star restraints may be used on ductile iron pipelines only. Traditional tie rods and bell clamps shall be used on cast iron pipelines.

16. Utility Crossings: A minimum vertical clearance of 1.50 feet shall be maintained between outside of pipes at all wet and dry utility crossings, unless otherwise approved by the District Engineer in writing. Provide extra protection in accordance with CDPHE requirements at sanitary sewer crossings when applicable. Vertical offsets utilizing fittings per Denver Water CPCS Detail 33216 are not allowed in the District unless approved on a case-by-case basis in writing by the District Engineer. Instead, pipe joints upstream and downstream of the crossing shall be deflected to achieve the required clearance above or below the conflicting utility. During design, the Design Engineer or Developer shall pothole all crossing utilities and provide design profiles of the proposed pipeline grades and crossing clearances for District review and approval.
17. Tracer Wire: All water mains, fire hydrant branches, and fire line services shall have installed a 12-gauge single strand tracer wire taped to the pipe. Wire shall have blue-colored insulation. Splice with silicone-filled kits rated for direct burial. Tracer wire shall terminate at test stations adjacent to fire hydrants, within fire riser rooms, or as directed by the District. Comply with Denver Water CPCS Detail 33225. Test station boxes shall be 18 inches long by 5-inch diameter as manufactured by C.P. Test Services Inc., Model NM-4. Test stations shall be H-20 traffic rated.
18. Compaction of trench backfill must be attained and certified compaction test results submitted to the Denver Water Construction Inspection Division and the District Engineer. Compaction in landscaped areas shall achieve a minimum of 90% per Standard Proctor Density, and a minimum of 95% under roadways, unless the agency having jurisdiction over roadways has more stringent requirements. Contractor or Developer shall provide an independent third-party licensed compaction testing firm, which shall be subject to approval by the District Engineer. Submit test results to the District.
19. Chlorination and Flushing: All water mains and fire lines shall be cleaned, chlorinated and flushed per Section 8.24 of the Denver Water Engineering Standards. The lines shall be chlorinated in accordance with AWWA C651, "Disinfecting Water Mains." Chlorination and flushing shall be provided by the Contractor. The approved method is to mix an approved chlorination agent with potable water as it is filling the main (slurry method). Chlorine tablets adhered to the pipe with adhesive are not permissible and will not be allowed. The residual chlorine concentration shall be at least 25 mg/l following the 24-hour contact period. The Contractor shall contact the District Engineer to take samples and confirm the concentration prior to flushing. The chlorination of any finished pipeline shall be done prior to the hydrostatic testing. A state-certified

independent testing laboratory or Tri-County Health Department (341-9370) shall perform the bacteriological testing. Their written release shall constitute acceptable disinfection. Submit their written test results to the District. Bacteriological testing services shall be coordinated and paid for by the Contractor. Swabbing is an acceptable means of disinfection in certain cases when approved by the District. Chlorination agent for swabbing shall be "Pure Bright" only; Clorox or common bleach is not allowed.

20. Hydrostatic Testing: Water mains shall be tested per the requirements of Section 8.22 of the Denver Water Engineering Standards. All pipe shall be field pressure tested to a minimum of 150 psi. All testing shall be done in the presence of the Denver Water Inspector and the District Inspector. Testing equipment shall include both a pressure gauge and a flow meter to monitor the test pressure and gallons of water added to the pipeline. Allowable leakage for each section of pipe between line valves shall not exceed the leakage rate set forth below. Leakage for sizes not shown shall be determined by the District.

Pipe Sizing Inside Diameter	Allowable Leakage per 1000 ft. Gal. per Hr
4"	0.33
6"	0.50
8"	0.66
12"	0.99
16"	1.32
20"	1.66
24"	1.99

21. Only one connection to the existing water system shall be allowed until all new facilities are tested, disinfected and accepted.
22. All valves are to be located on property line extensions. Other valve locations may be required as shown on the plans. Valves shall be fully wrapped in 8 mil polyethylene per AWWA C105 to just below the nut and secured around the valve body and adjacent pipe with multiple passes of tape.
23. All valve boxes shall be raised to final grade prior to acceptance of water mains by the District. Adjustment of boxes shall be by rotation of the screwed top piece. Adjustment using drop-in inserts is not acceptable and will be rejected by the District. Valve boxes shall be installed plumb and centered over the valve nut. Clean valve boxes after installation to remove debris and ensure the valve nut is fully exposed.
24. A letter "V" shall be permanently etched or cut onto the face of the concrete curb over all water service pipelines.
25. The design drawings approved by the District and Denver Water shall be corrected to reflect the as-built condition and shall be delivered to the District on electronic media compatible with the District standards prior to final acceptance of the job. All utilities encountered during the construction shall be stationed and shown accurately (horizontally and vertically) on the plans and profiles. An

electronic file of the plans shall be provided to the District in AutoCAD format. The data shall be tied to the Arapahoe County control system.

9C-7-5 FIRE LINES: Fire lines shall be designed by the Owner's Engineer. Fire lines shall at a minimum meet the District Standards for potable water mains. All fire lines shall be capable of flushing without alarm activation. Refer to the District Standard for fire line flushing inside the building. The District shall inspect installation of fire lines into the building to the first joint. South Metro Fire Rescue Authority shall inspect the fire system inside the building. All fire lines shall have the appropriate backflow prevention device to meet the degree of hazards as designated by the Denver Water Department.

9C-7-6 RE-USE OF FIRE HYDRANTS: Fire hydrants shall comply with the latest District requirements at the time of installation. If an existing fire hydrant is to be "relocated", this shall generally be interpreted to mean removal and delivery of the existing hydrant to the District and furnishing and installing a new hydrant at the new location. Re-use of existing fire hydrants in relocations or elsewhere shall not be allowed unless the District inspects and gives written permission in advance to reuse an existing hydrant on a case-by-case basis.

9C-8 WATER APPROVALS

9C-8-1 DISTRICT WATER APPROVALS - All designs for water utility extensions, fire hydrant relocations, and pipe and service sizes 3-inches and larger shall be reviewed and approved by the District and Denver Water prior to construction. Designs shall also be reviewed by and bear the approval stamp of the South Metro Fire Rescue Authority acknowledging the stated fire flow requirement and hydrant spacing and layout is correct and acceptable prior to submittal to the District.

Plans submitted shall have approval forms in the following language placed on the cover sheet of the plans:

DISTRICT APPROVAL

The fire flow requirement stated below, number of fire hydrants and hydrant locations as shown on this water main installation are correct and adequate to satisfy the fire protection requirements as confirmed by the South Metro Fire Rescue District.

Signature of Fire Chief or Designated Representative

Required Fire Flow (gpm)

Approved this ____ day of _____ A.D., 20____, for engineering conformity only, and does not relieve the Design Engineer from responsibility for errors or omissions in plans, specifications, or field survey.

District Engineer

Approved this ____ day of _____ A.D., 20 ____, by the Cherry Creek Valley Water and Sanitation District for construction of water main lines and sewer main lines as shown hereon.

District Manager

9C-8-2 DENVER WATER DEPARTMENT APPROVALS - All water utility extensions, fire hydrant relocations, and designs for piping and services 3-inches in diameter and larger shall be reviewed and approved by the Denver Water Department. The developer will submit plans and other required files to the District, and the District will submit the files to Denver Water on behalf of the developer. Denver Water review comments will be received by the District and will be clarified or revised for consistency with District requirements prior to return to the developer. Expenses and logistics of the Denver Water Department approval process are the responsibility of the party requesting utility extensions.

9C-9 WATER AND SEWER SERVICES: All cost and expense incident to the installation and connection of the water and sewer service shall be borne by the

Owner/Developer. The installation of a water or sewer service shall be by open-cut trench installation methods unless otherwise approved by the District.

9C-9-1 WATER SERVICES - Water service lines are owned by, and are the responsibility of, the individual service tap owner, who is responsible for installation and maintenance. Installations shall comply with the applicable District and Denver Water Standard Details.

9C-9-1.1 Water Service Materials - For service sizes 2.5-inches and smaller in diameter, the water service line shall be Type K soft copper. Fittings shall be flared or silver-soldered brass or copper alloy. Compression style fittings are not allowed.

Service sizes 3-inches and larger in diameter shall be ductile iron pipe of the same requirements specified for water mains in Part 9C-7-4 herein.

Squeegee shall be used for bedding service lines of all sizes, placed from 6-inches below to 12-inches above the service line.

9C-9-1.2 Water Service Installation - All construction shall be done by personnel experienced in work for this kind. Water services shall be brought to and into the building at an elevation that will allow a minimum of four and one-half feet (4.5-ft) of cover for its entire length. The service line may not be routed closer than 5 feet to any building wall (other than as it enters the building it serves), fence or other wall and bearing wall (except for nearly perpendicular crossings), light pole, utility vault, or other structures and the like. The water service shall be laid at uniform grade and in straight alignment. The straight alignment shall be perpendicular to the main and property or easement line within the right-of-way or easement. Pipe laying and backfill shall be performed in accordance with specifications in Part 9C-7 herein.

Copper services shall have a continuous, unjointed length of copper line between the corporation stop at the main and the curb stop. If an existing meter pit is being relocated further from the roadway, the entire length of copper to the main must be replaced. No unions or splices are allowed. No unions, fittings, increasers, or changes in horizontal direction are allowed within 5-ft downstream of the meter.

9C-9-1.3 Water Service Taps - Materials and installation shall comply with District and Denver Water requirements, Denver Water CPCS specifications, and applicable standard details.

Taps for services 2.5-inches in diameter and smaller shall utilize a double strap tapping saddle on the main, corporation stop ball valve, and insulator fitting.

Taps shall be installed by Denver Water forces, unless approved otherwise by the District in writing.

Taps for services 3-inches in diameter and larger shall utilize a mechanical joint ductile iron tee fitting on the main, with swivel branch or anchor coupling

attachment to gate valve. If a new service is added to an existing main, a mechanical joint swivel tee and solid sleeve fitting shall be cut in along the main. Tapping sleeves and tapping valves are not allowed in the District. Adjacent taps shall not be located closer than 5-ft apart along the main, center-to-center. In special cases, the District may consider reducing the spacing to 3-ft minimum, if approved in advance and permission is given by the District in writing.

9C-9-1.4 Water Meter Pits and Vaults - Meter pits shall be located in landscaped areas, outside of sidewalks, driveways, and curbs. In special cases where no alternative is possible, the District may consider placing meter pits in driveways if approved in advance by the District in writing. Such installations shall utilize Denver Water CPCS Detail 33084 "Manhole Ring and Cover Over Meter Pit" or current equivalent detail in effect at the time of the installation. Meter pits shall be precast concrete and domes shall be ductile iron in accordance with the current Denver Water CPCS Specifications. Composite (plastic) pits and domes are allowed upon approval from the District depending on location. Meter pits shall be 24 inches inside diameter. Dome lids and meter vault covers shall be compatible with the latest District requirements for electronic AMI meter reading equipment antennas.

9C-9-1.5 Water Service Separation From Other Utilities - Separation of water service lines from other utilities shall comply with the separation requirements specified in Part 9C-7-2 herein, including 10-ft separation requirement from adjacent sewer mains and sewer service lines. Clearance from meter pits and vaults shall be measured from the outside edge of the structure.

9C-9-2 SEWER SERVICES - Sewer service lines are owned by, and are the responsibility of, the individual service tap owner, who is responsible for installation and maintenance. Installations shall comply with the applicable District Standard Details.

9C-9-2.1 Sewer Service Materials - Sewer Service lines and fittings shall be plastic pipe consistent with the current District specification for sewer mains in Part 9C-1-1 herein, or Schedule 40 PVC. Fitting and pipe joints may be solvent-welded or gasketed. All joints shall be watertight and shall be leak tested with the main as set forth in Part 9C-4 herein. Bedding shall be No. 67 coarse aggregate (3/4" washed rock) from 6" below to 12" above service line.

9C-9-2.2 Sewer Service Installation - Service lines shall be laid in a straight line perpendicular to the sewer main and easement or property line, or as otherwise approved by the District. The service line may not be routed closer than 5 feet to any building wall (other than as it exits the building it serves), fence (except for nearly perpendicular crossings), light pole, utility vault, or other structures and the like. The grade shall be a constant 2% or greater downslope or may be

flatter if allowed by the adopted version of the Plumbing Code only when a 2% grade is not feasible, subject to the approval of the District.

Within the right-of-way or easement, service lines shall generally be kept as deep as possible and shall be laid on a straight and constant line and grade. Once into the property, fittings can be used to adjust the vertical or horizontal grade and alignment of the service line. Fittings shall not be located closer than 3-ft to each other (except that cleanout fittings may be spaced closer). The maximum allowable bend angle is 45-degrees. 90-degree fittings shall not be allowed in service lines outside the building footprint. The minimum burial depth allowed for services is 3-ft.

9C-9-2.3 Sewer Service Taps - Sewer service lines shall connect to the sewer main at a tee-pattern fitting or saddle tee. Tee fittings shall match the type and classification of the pipe on which they are installed. Saddle tees shall be permitted only in cases where a connection is being made to a previously installed (existing) sewer line or if approved in writing by the District. Wye pattern taps are not allowed in the District.

Taps shall not be spaced closer than 3-ft apart from each other along the main, center-to-center, nor closer than 5-ft to a manhole. Service connection taps shall not be made directly to manholes.

9C-9-2.4 Sewer Service Cleanouts - An exterior two-way cleanout shall be provided within 5-ft of the building it serves for ALL sewer services. Interior cleanouts installed per the Plumbing Code will not be accepted as a substitute for the District-required exterior cleanout. Cleanout ends shall be closed by removable elastomeric wing-nut plugs; threaded cleanout plugs shall not be acceptable. For long services, intermediate cleanouts are required at a spacing not to exceed 100-ft. For commercial and multi-family construction, cleanouts shall be enclosed within traffic-rated cast iron boxes with covers marked "cleanout" at grade. A 2-ft concrete collar shall be provided where located in landscape areas. For single family residential construction, traffic-rated cast iron boxes and covers shall be provided where located in a driveway, or round plastic boxes and covers without a concrete collar are acceptable in landscape areas.

9C-9-2.5 Sewer Service Tracer Wire - Tracer wire shall be installed on all services continuous from the sewer main to the building line. Wire shall be accessible from the cleanout adjacent to the building it serves, and continuous with the tracer wire installed along the main. Tracer wire shall be made continuous with the wire along the main by looping tracer wire up and back along services, or by silicon-filled splice kits made specifically for that purpose. Tracer wire shall be #12 solid core burial-rated copper, green colored insulation.

9C-9-2.6 Sewer Service Separation From Other Utilities - Separation of sewer service lines from other utilities shall comply with the separation requirements

specified in Part 9C-2-4 herein, including 10-ft separation requirement from adjacent potable water mains and service lines.

9C-9-3 RE-USE OF EXISTING WATER AND SEWER SERVICES: When an existing building is changed, remodeled, or replaced, the water and sewer service to the new or changed building, up to and including the tap at the main, must meet the current requirements and specifications of these Rules and Regulations that are in effect at the time of the work, as they are amended from time to time. If an enlargement and/or increase in the service taps is required, the Property Owner shall receive credit for the tap equivalency previously purchased.

Existing water meter pits, curb stops, meters and yokes that are to be relocated shall not be reused unless they are inspected and approved by the District on a case-by-case basis and meet the current requirements for backflow prevention and other District and Denver Water requirements in effect at the time of the relocation.

9C-9-4 PLUMBING WORK DONE ON WATER OR SEWER SERVICE NOTIFYING DISTRICT: Work on water or sewer service lines shall be done by licensed and bonded plumbers or apprentices, except that plumbing work contracted for by a licensed plumber may be performed by them through journeymen plumbers or apprentices under their direct supervision and shall meet the Colorado Department of Public Health and Environment's requirements and Technical Plumbing Code.

9C-9-5 CONSTRUCTION AND MATERIAL STANDARD: All construction work and materials shall meet the most stringent requirements of all entities involved, whether these are standards and specifications of the Cherry Creek Valley Water and Sanitation District, the City and County of Denver, the Denver Water Department, the Technical Plumbing Code of the Colorado Department of Public Health and Environment, or the Metro Wastewater Reclamation District.

All contractors, plumbers and others doing work on any water or sewer main, service lines, or structures in the District shall comply with Arapahoe County, the CCVW&SD, or the Colorado Department of Transportation regulations and excavation, backfill, compaction and restoration of surfacing, whichever is more stringent.

9C-10 BACKFLOW PREVENTION: See Section 10.

9C-10-1 METER YOKE DOUBLE CHECK VALVE: All meter yokes require a double check valve. The District will provide the yoke at the customer's expense.

9C-10-2 LOW HAZARD APPLICATION: Fire lines to sprinkler systems without pressure boosting pumps, chemical additives, anti-freeze, or other foreign substances, shall be considered low hazard. These fire lines shall be constructed with a double detector check assembly backflow prevention device installed between the area to be served by the fire line and the water main. The installation shall be in a vault at the property line, or in the building to be served.

9C-10-3 HIGH HAZARD APPLICATION: Fire lines to sprinkler systems with booster pumps, chemical additives, anti-freeze or other foreign substances shall be considered high hazard. These fire lines shall be constructed with a reduced pressure backflow prevention device installed between the pipelines so contaminated, and the water mains. The installation shall be in a vault at the property line or in the building to be served. Installations shall have drains to daylight.

9C-10-4 LANDSCAPE IRRIGATION: Landscape irrigation systems shall be equipped with reduced pressure backflow prevention devices at or near the point of connection to the potable water service, upstream of the irrigation control valve station, to prevent contamination of the potable water service and distribution system.

9C-11 WATER TAP AND METER SIZING PROCEDURE: All water taps and meters are to be sized by a Registered Professional Engineer in accordance with criteria presented in the American Water Works Association Manual No. M22, Sizing Water Service Lines and Meters, 2024 (Fourth) edition. Calculations shall be summarized on the District’s form and should be supplemented by spreadsheet or manual calculations prepared by the Professional Engineer as an attachment to justify the summarized values.

9C-11-1 WATER TAP AND METER SIZING PROCEDURES

1. Determine and tabulate the total Fixture Value for the building being served utilizing AWWA M22 Table 4-1.
2. Determine the peak fixture demand in gpm utilizing AWWA M22 Figure 4-2 or 4-3. Buildings that utilize flush valve (“flushometer valve”) type toilets or urinals shall utilize the “upper” curve. Buildings that utilize gravity tank type or pressure-assisted tank toilets and flushless urinals may utilize the “lower” curve.
3. Add demand in gpm from hose bibs, cooling systems, and commercial or industrial process equipment to get total peak flow for the service. Assume a flow of 5 gpm for a typical residential style hose bib. Subject to the District’s discretion, it may be acceptable to assume use of only one hose bib at a time for buildings equipped with multiple hose bibs. Submit manufacturer’s product data sheets of process equipment showing max water flow and usage requirements.
4. Assume a tap and meter (service) size according to the following table, subject to District approval:

SERVICE SIZE (INCHES)	MAX TOTAL PEAK FLOW (GPM)
¾	15
1	25
1 ½	55
2	80

*Refer to Denver Water Standards for sizes 3 inches and larger.

5. Calculate the pipe friction and total minor losses at peak flow between the main and 5-ft downstream of the meter pit, and from 5-ft downstream of the

meter pit to the building.

- a. The pipe size from the main to 5-ft downstream of the meter pit shall be the same as the service size.
 - b. In "Trial 1", assume the pipe size from 5-ft downstream of the meter pit to the building is the same as the service size. If the total friction and minor losses exceed the indicated requirements, then in "Trial 2" upsize the pipe by one standard size from 5-ft downstream of the meter pit to the building.
 - c. The total pipe friction and minor losses at peak flow between the main and building shall be less than 25 psi.
6. Determine the headloss at peak flow of the backflow prevention device proposed for use. The headloss shall be as indicated in a chart or table on a data sheet published by the device manufacturer; submit a copy to the District. Sizing of the backflow prevention device shall comply with Denver Water standards and shall not have a velocity of more than 7.5 feet per second at peak flow. The size of the backflow preventer is often times larger than the service size based on those sizing requirements. The type of backflow prevention device shall be consistent with the hazard potential of the building served and other District requirements; refer to Article 10 Backflow Prevention.
 7. Calculate the pressure at the building in psi. Unless specified otherwise by the District, assume a "Main Pressure" of 80 psi in the District high pressure zone, and 60 psi in the mid and low pressure zones*. It is the Design Engineer's responsibility to determine the requirements for minimum flows and pressures, and to satisfy these requirements based on anticipated pressure fluctuations. If the resulting pressure in the building at peak flow is less than 40 psi (or lower depending on Owner requirements, with a minimum of 25 psi allowable), or if the total headloss in the service line between the main and building exceeds 25 psi, it will be necessary to upsize the line size downstream of the meter pit, or upsize the service size, subject to District discretion.
 - * The pressure zone boundary is the East leg of the Highline Canal as it passes through the District, with the mid and low zones being located west of the Canal.
 8. Submit the above calculations, along with a project site plan, showing the size and location of all service lines and meters, prepared by a Registered Professional Engineer, to the District for review. Submit available plumbing plans and a tabulation of plumbing fixtures. The initial review submittal may be unsealed. The final calculation shall bear the seal and signature of the Professional Engineer and shall be submitted with the tap application.

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Total Fixture Value, Table 4-1¹ (1) _____

Fixture Demand, Figure 4-2 or 4-3¹ (2) _____ gpm Circle: Lower or Upper Curve

Hose Bib, Cooling Water, and Process Equipment Demand (3) _____ gpm

Total Peak Demand, (2) + (3) (4) _____ gpm

Assumed Tap and Meter (Service) Size (refer to Article 9C-11-1-4) _____ inch

Calculate Head Losses:

Main to 5-ft Downstream of Meter Pit

Calculate pipe friction loss

Length of _____" pipe (same pipe size as Service Size) (5) _____ ft

Add 10-ft of pipe equivalent for meter yoke setter losses (6) 10 ft

Total pipe length, (5) + (6) _____ ft

Pipe friction loss, at (4) gpm (7) _____ psi
 (Table 5-1¹, Type K copper or Class 52 DIP, C=130)

Calculate minor losses

Default K value (8) K = 4.2
 (use for 2" and smaller services only, total K value for flush entrance tap, exit loss, ball corp stop, ball curb stop, two long radius 90d bends, and District-required double check valve in meter yoke)

K value designated by designer P.E. (9) K = _____
 (3" and larger services, Table 5-2¹, attach tabulation)

K value for meter loss (10) K = _____
 (Table 5-3¹, use Positive Displacement for 2" and smaller services, Class II Turbine for 3" and larger)

Total K value, (8) or (9), + (10) K = _____

Total minor losses, at (4) gpm (11) _____ psi

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Calculate Head Losses:

5-ft Downstream of Meter Pit to Building

	<u>Trial No. 1</u> (Pipe size same as service size)	<u>Trial No. 2</u> (If needed, upsize pipe by one standard size)
Calculate pipe friction loss		
Pipe size	_____ inch	_____ inch
Length of pipe	_____ ft	_____ ft
Pipe friction loss, at (4) gpm (12)	_____ psi	_____ psi
(Table 5-1 ¹ , Type K copper or Class 52 DIP, C=130)		
Calculate minor losses		
Total K value	K =	K =
(Increaser if applicable, bends and fittings into Building, Table 5-2 ¹ . Attach tabulation)		
Total minor losses, at (4) gpm (13)	_____ psi	_____ psi
Total pipe headloss, Main to Building, (7) + (11) + (12) + (13)	(14) _____ psi	_____ psi
Select the value of (14) of either <u>Trial No. 1</u> or <u>Trial No. 2</u> , based on (14) shall not exceed 25 psi	(15) _____ psi	
Backflow preventer headloss, at (4) gpm (16)	_____ psi	
(refer to Article 9C-11-1-6. Attach manufacturer's data sheet indicating type, size, and manufacturer's headloss table or curve)		
Main pressure (refer to Article 9C-11-1-7)	(17) _____ psi	
Residual pressure in Building, (17) – (15) – (16)	(18) _____ psi	

Note: If (18) is less than 40 psi (or lower depending on Owner requirements with a minimum of 25 psi allowable), or if (14) exceeds 25 psi, it will be necessary to upsize the service line downstream of the meter pit as reflected in Trial No. 2, or upsize the service size, subject to District discretion.

¹From Sizing Water Service Lines and Meters, AWWA Manual M22, 2024 (Fourth) edition.

P.E. Name and Contact

P.E. Signature and Stamp

9C-12 GREASE INTERCEPTOR SIZING AND DESIGN PROCEDURE: The design for grease interceptors required in Section 9A-3 shall be submitted to and approved by the District prior to installation. Submit electronic PDF plans and design data showing the size, design, and location of each interceptor and associated drainage and vent piping. Provide plumbing plans and/or schematics and schedules showing pipe sizes and fixtures served. Submit sizing calculations.

Grease interceptors shall be designed and sized in accordance with the following provisions:

1. Grease interceptors shall be of watertight and impervious construction capable of withstanding abrupt and extreme changes in temperature. They shall be suitable for Traffic-Rated loading (AASHTO HS-20 or better load rating). If cast-in-place concrete is used, the walls and floors shall be of a single pour. Detailed drawings and the load rating shall be submitted to the District for review and approval.
2. Grease interceptors shall have two (2) vent pipes, one shall vent the body of the interceptor and one shall connect to the effluent piping downstream of the interceptor. Vent pipes shall remain independent to a location above finished grade. Vents shall be independent of any other building venting system and shall be in accordance with local building and plumbing codes.
3. Grease interceptors shall be located outside buildings on private property, not closer than 3 feet to any building or property line. They shall be easily accessible at all times for inspection and maintenance. They shall not be located within drive-through lanes or main entrance driveways. A site plan showing the interceptor location, maintenance access ports, relevant dimensions, and inlet and outlet sewer alignments shall be submitted to the District for review and approval.
4. Garbage disposal grinders are required to discharge to the grease interceptor.
5. Property Owners shall consider upsizing grease interceptors to a size larger than the calculated minimum to accommodate unforeseen future renovations or additions or other tenant improvements that add fixture load or throughput to the interceptor. If future renovations occur, the required interceptor size shall be re-computed at that time and if necessary the District will require removal and replacement with a larger interceptor accordingly.
6. The minimum grease interceptor capacity shall be 500gallons.

9C-12-1 Calculating Grease Interceptor Size

Size calculations shall be prepared by the Property Owner and submitted to the District for review and approval per the following methods:

1. Where the establishment is a restaurant or similar dine-in setting and the seating capacity or number of meals can be determined, compute:
 - a. Number of seats x a full capacity factor of 0.9 x turnover rate of 2.2 per meal period = number of meals served per meal period.
 - b. Number of meals served per meal period x 2.5 gallons per meal = volumetric water capacity of the grease interceptor.
2. Where seating capacity or number of meals cannot be adequately determined for the establishment, the following rule shall apply:
 - a. The following table establishes the fixture unit values for various drainage fixtures that are connected to the grease interceptor.
 - b. The total number of fixture units connected to the grease interceptor shall be multiplied by 7.5 gpm to determine the maximum rate of flow into the grease interceptor. The volumetric water capacity of the unit (gallons) shall be 8 times the maximum rate of flow.

Fixture Type	Drain Size	No. of Fixture Units
Floor drains	1-1/2" to 3"	2
Laundry tubs	1-1/2"	3
Clothes Washers	2"	3
Receptors (floor sinks) receiving waste from refrigerators, coffee urns, water stations	1-1/2"	1
Receptors receiving waste from commercial sinks, dishwashers, etc.	1-1/2" to 2"	3
	3"	6
	4"	8
Service sinks, dishwashers (direct connection): commercial, industrial, schools, etc.	1-1/2" to 2"	3
Bar sinks and hand sinks	1-1/4" to 1-1/2"	2
Mop sink	1-1/2" to 2"	3

9C-13 OIL, SAND/SEDIMENT TRAP SIZING AND DESIGN PROCEDURE

Oil and sand/sediment traps required in Section 9A-4 shall be sized in accordance with the following provisions.

1. All traps shall be constructed of impervious materials capable of withstanding abrupt and extreme changes in temperature. They shall be watertight, and if necessary, gastight and vented. They shall be suitable for Traffic-Rated loading (AASHTO HS-20 or better load rating). If cast-in-place concrete is used, the walls and floors shall be of a single pour. Detailed drawings and the load rating shall be submitted to the District for review and approval.

2. All traps shall be located outside buildings on private property, not closer than 3 feet to any building or property line. They shall be easily accessible at all times for inspection and maintenance. A site plan showing the interceptor location, maintenance access ports, relevant dimensions, and inlet and outlet sewer alignments shall be submitted to the District for review and approval.
3. The minimum oil and sand/sediment trap capacity shall be 1,500 gallons.

9C-13-1 Calculating Oil, Sand/Sediment Trap Size

Size calculations shall be prepared by the Property Owner and submitted to the District for review and approval per the following method:

1. Total fixture units connected x 7.5 gpm x 5 minutes = minimum volumetric trap size.
2. The total fixture unit values shall be based on the following table:

Facility or Fixture	No. of Fixture Units
Floor drain 3" trap size	6
Floor drain 4" trap size	8
Vehicle wash drain	8
Service bay with Trench Drain 380 sq. ft. or less	6
Service bay with Trench Drain 381 sq. ft. through 760 sq. ft.	12
Service bay with Trench Drain 761 sq. ft. through 1,140 sq. ft.	18
Service bay with Trench Drain 1,141 sq. ft. and larger	Follows the same calculation pattern

9C-14 DISTRICT STANDARD DRAWINGS

Please contact the District at 303-755-4474 for engineer standard drawings.

9C-14.1 Sanitary Standard Details

- S-01 1 of 2, Sanitary Manhole
- S-01 2 of 2, Sanitary Manhole
- S-02 Sanitary Main Bedding & Trench Backfill
- S-03 Sanitary Tracer Wire
- S-04 Sanitary Main Bell Joint Insertion Requirements
- S-11 Typical Sanitary Sewer Service Detail
- S-12 Sanitary Cleanout
- S-21 Grease Interceptor
- S-22 Oil and Sand/Sediment Trap

9C-14.2 Water Standard Details

W-01 (To be added later, inquire with the District)

W-02 (To be added later, inquire with the District)