EAST CHERRY CREEK VALLEY WATER AND SANITATION DISTRICT

ARAPAHOE COUNTY, COLORADO

SANITARY SEWER SYSTEM SPECIFICATIONS

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EAST CHERRY CREEK VALLEY WATER AND SANITATION DISTRICT

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SANITARY SEWER SPECIFICATIONS

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SECTION 1 - GENERAL

1.1 PURPOSE

This publication provides information relative to engineering, design, materials specifications and construction procedures for sanitary sewer systems within the East Cherry Creek Valley Water and Sanitation District, and is an integral part of the District's Rules and Regulations. These Specifications may be purchased at the East Cherry Creek Valley Water and Sanitation District office, located at 6201 South Gun Club Road, Aurora, Colorado 80016, at cost.

1.2 DISTRICT SERVICE AREA

The East Cherry Creek Valley Water and Sanitation District Service Area is located in Arapahoe County, Colorado. Generally, the District is located west of Gun Club Road and south of Hampden Avenue.

1.3 AUTHORITY

These Specifications shall be administered by the District and shall include all interpretation, enforcement, revision, waiver and variance, with all such actions being finally determined by the District.

1.4 REVISIONS

These Specifications are effective as of January 1, 2000. Revisions to these Specifications may be made from time to time by the District. Any revision shall be in effect at the date of issuance by the District. Any person using these Specifications should contact the District for information relative to revisions.

1.5 DEFINITION OF TERMS

As used in these Specifications and the District Rules and Regulations, unless the context clearly indicates otherwise, the words defined below shall have the respective meanings set forth for them:

1.5.1 Actual Costs

All direct and indirect costs attributable to any project or undertaking. Actual costs to the District shall include its engineering, legal, labor, material, equipment, administrative, and overhead expenses, calculated in accordance with the Rules and Regulations, and all direct payments to third parties, at cost.

1.5.2 Board or Board of Directors

The duly constituted Board of Directors of the District.

1.5.3 City of Aurora

The City of Aurora, Colorado.

1.5.4 Contractor

Any person who performs any work, either for himself or another, on any sewer facilities, public or private, within the District, including all subcontractors, agents, employees, officers and other representatives of such person.

1.5.5 Construction Plans

Plans and Specifications for the construction of a specific Developer/Owner sanitary sewer system project which have been reviewed and signed by the District and the District's Consulting Engineer.

1.5.6 District

East Cherry Creek Valley Water and Sanitation District, Arapahoe County, Colorado, its employees, agents, officers, directors, insurers, and professional consultants.

1.5.7 District Engineer

The District's Staff Engineer and/or the District's Consulting Engineer.

1.5.8 District Manager

The Manager of the East Cherry Creek Valley Water and Sanitation District appointed by the Board of Directors, or any other person duly authorized to perform the duties of the District Manager.

1.5.9 District System

The Plant, facilities, systems, assets, and appurtenant property rights owned or directly controlled by the District.

1.5.10 Foreign Materials

Objects or substances not appropriate for transmission by a sanitary sewage system, including without limitation paving or construction materials, debris, furniture, appliances, clothing, bicycles, rocks, dirt, trash, grease, oil, sand, and grass, bush or tree clippings.

1.5.11 Main or Sewer Main

Those pipes and appurtenant facilities used for carrying wastewater along public streets or easements or rights of way deeded or licensed to the District.

1.5.12 Main Extension

The construction of any facilities, or the facilities themselves, which are intended to become a part of the District System upon acceptance by the District in accordance with the Rules and Regulations.

1.5.13 Metro Wastewater Reclamation District

The Metro Wastewater Reclamation District, for itself and as operator of the Metro Wastewater Reclamation District treatment facilities.

1.5.14 Permitted Premises

The land area and improvements thereto to which sewer service is limited under any particular Tap Permit.

1.5.15 Person

Associations, corporations, firms, partnerships and bodies politic and corporate, as well as individuals.

1.5.16 Property Owner/Owner/Developer

All of these terms shall be synonymous with each other and shall mean any person who, whether solely or with others, owns real property within the District: When property is owned by more than one person, the term includes all owners thereof. As used in these Specifications, the term shall apply to such person only in connection with his ownership of any specific parcel of real property involved in any specific matter governed by these Specifications or Rules and Regulations. For purposes of clarity, the masculine singular pronoun is used in these Specifications to refer to Property Owner.

1.5.17 Record Drawings

A separate set of full-scale construction plans marked to indicate completely and accurately the field-installed condition of facility construction in progress, as required by these Specifications.

1.5.18 Rules and Regulations

The comprehensive set of operating rules and requirements, as now or hereafter constituted, adopted by the Board of Directors for the purpose of regulating the design, construction, operation, maintenance, use, repair and replacement of the District System.

1.5.19 Service Lines

Any sewer lines or portions thereof located upstream from the upstream end of the wye or saddle fitting on the District's Main, and intended or used to convey wastewater from Permitted Premises to the District System.

1.5.20 Sewage

See "Wastewater."

1.5.21 Swimming Pool Discharge

Wastewater from any swimming pool carried by the District System, including swimming pool filter backwash effluent and water drained directly from the swimming pool itself.

1.5.22 Tap or Service Connection

The physical connection to a District Main which, together with the Tap Permit for same, effects sewer service to any Permitted Premises.

1.5.23 Tap Permit

The written authority to make a Tap for sewer service to Permitted Premises from the District System.

1.5.24 User

Any person who discharges or causes the discharge of wastewater to the District System.

1.5.25 Wastewater or Sewage

The combination of the liquid and water-carried wastes from residences, commercial buildings, industrial plants and institutions, including polluted cooling water.

A. Sanitary Wastewater The combination of liquid and water-carried wastes discharged from toilet and other sanitary plumbing facilities.

B. Industrial Wastewater The combination of liquid and water- carried wastes discharged from any industrial establishment and resulting from any trade process carried on in that establishment, including the wastewater from pretreatment facilities and polluted cooling water.

1.5.26 Wastewater Utility Ordinance

East Cherry Creek Valley Water and Sanitation District Rules and Regulations.

1.6 ABBREVIATIONS

These Specifications utilize and otherwise make reference to other Standards and Specifications. Where these references are made, they shall refer to the latest edition or revision thereof.

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AISC	American Institute of Steel Construction, Inc.
ANSI	American National Standards Institute, Inc.
ASA	American Standards Association
ASTM	American Society of Testing Materials
AWWA	American Water Works Association
OSHA	Occupational Safety Health Administration
UL	Underwriter's Laboratories
UNI	Uni-Bell Association
UPC	Uniform Plumbing Code

SECTION 2 - SANITARY SEWER DESIGN CRITERIA

2.13 PROTECTION OF WATER SUPPLIES
- 2.13.1 Water Supply Inter-Connections
- 2.13.2 Relationship to Water Supply Sources

2.14 ENCASEMENTS AND CASINGS
- 2.14.1 Concrete Encasements
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SECTION 2 - SANITARY SEWER DESIGN CRITERIA

2.1 GENERAL

All sanitary sewer lines, manholes, service connections, and related public facilities within the East Cherry Creek Valley Water and Sanitation District shall be designed in accordance with these Specifications and the Specifications of, Arapahoe County and the Colorado State Highway Department, where applicable. Any deviation from these Specifications shall require written permission from the District, prior to design or construction. Design of all sanitary sewer system construction plans shall be performed under the direct supervision of a Professional Engineer, registered in the State of Colorado. The intent is to provide a consistently designed, long-term, reliable system which can be easily located and maintained by the District.

2.2 PLAN REQUIREMENTS

Construction plans for sanitary sewer system shall meet the guidelines set forth in the Sanitary Sewer System Plan Requirements Check List and General Notes for Sanitary Sewer System Plans found in the Appendix. The checklist and general notes are guidelines and as such, some items may not be applicable to all projects as determined by the District.

2.3 FLOW DEVELOPMENT CRITERIA

Sanitary sewer lines shall be designed to transport average and peak sewage flows in accordance with these Specifications. Average and peak flow development criteria presented in following Table 2.1 are minimum criteria, and the District reserves the right to modify flow criteria, at any time, for the design of specific projects. Flow development criteria for proposed uses not shown in Table 2.1 (i.e. car-wash, laundries, auto service stations, supermarkets, places of assembly, hospitals, etc.) shall be determined by the District on a case-by-case basis using generally accepted planning criteria.

Peak sanitary sewer flows shall be calculated as follows:

Peak Flow = (Avg. Flow x Peak Factor) + Infiltration/Inflow

Infiltration and inflow is ten percent (10%) of the Average Flow.

TABLE 2.1 – FLOW DEVELOPMENT CRITERIA

USE	OCCUPANCY	AVERAGE DAILY SEWAGE FLOW	PEAK FACTOR*
Single-Family	3.2 Persons	100 GPCD	4.0
Townhome	2.1 Persons	100 GPCD	4.0
Multi-Family	1.7 Persons	100 GPCD	4.0
Retail/Commercial	N/A	0.3 GPD/SF	4.0
Office	N/A	0.1 GPD/SF	4.0
Elementary School	700 Students/Staff	10 GPCD	4.0
Middle School	1070 Students/Staff	10 GPCD	4.0
High School	2470 Students/Staff	15 GPCD	4.0
Restaurants	N/A	1.5 GPD/SF	4.0

ABBREVIATIONS

GPCD	Gallons Per Capita Per Day
GPD/SF	Gallons Per Day Per Square Feet Developed Floor Space
N/A	Not Applicable
SF	Square Feet Developed Floor Area
Single-Family:	Detached Single-Family Residential Dwelling (Owned)
Multi-Family:	Attached Single-Family Residential Dwelling (Rented)
Townhome:	Attached Single-Family Residential Dwelling (Owned)
*Peak Factor:	Use ASCE Curve "A" for Peak Factor of Outfall Sewers (P.F. max = 4, P.F. min. - 1.7)

2.4 SANITARY SEWER SYSTEM HYDRAULIC DESIGN CRITERIA

2.4.1 General

The sanitary sewer system shall be designed to transport average and peak sewage flows in accordance with these Specifications, and shall prevent deposition of suspended materials within the system.

2.4.2 Sanitary Sewer Lines

No public sanitary sewer line shall be smaller than eight (8) inches in diameter. Sanitary sewer lines shall be designed to provide peak flow velocities between two (2) feet per second (fps) minimum and ten (10) feet per second (fps) maximum using Manning's Formula as follows:

$$V = \frac{1.49}{n} R^{2/3} S^{1/2}$$

Where:

V	-	Flow Velocity (ft/sec)
R	-	Hydraulic radius (ft), determined by dividing the flow area by the wetted perimeter.
S	-	Slope (Ft/Ft) of the energy grade line, which is approximately equal to the sanitary sewer line design slope.
n	-	Manning's Pipe Roughness Coefficient or "n" Factor = 0.011

The maximum design flow depth at peak flow shall not exceed 83% of the internal pipe diameter (i.e. d/D = 0.83, ratio flow depth to internal pipe diameter).

Hydraulic characteristics shall be calculated for each reach of the sanitary sewer system to show conformance with these Specifications. Table 2.2 outlines minimum and generally acceptable maximum slopes for sanitary sewer lines as follows.

TABLE 2.2

Nominal Pipe Diameter (Inches)	Minimum Slope (Ft/100Ft)	Maximum Slope At d/D = 0.82 (Ft/100Ft)
8	0.50	10.0
10	0.35	6.0
12	0.25	4.0
15	0.20	3.0
18	0.20	2.2

It should be noted that the maximum slopes are based on d/D = 0.83. As flow depth decreases, the allowable maximum slope may also increase, as long as velocities do not exceed 10 fps. The minimum slopes indicated are absolute minimums.

All dead end sanitary sewer lines (i.e. cul-de-sacs) shall have a minimum slope of one percent (1%).

Construction plans shall develop and show average flows, peak flows, and other information at all points of connection to the existing sanitary sewer system as follows:

Q_{PEAK} - Peak Sanitary Sewer Flow

Q_{AVG} - Average Sanitary Sewer Flow

V_{PEAK} - Peak Flow Velocity

d_{PEAK} - Peak Flow Depth in Line at Point of Connection

d/D_{PEAK} - Ratio of Peak Flow Depth to Inside Pipe Diameter

S - Slope of sanitary sewer line

n - Manning's "n" = 0.011

Development - Number and type of total ultimate planned units tributary to the point of connection.

Sanitary sewer system layout shall provide a system of lines which generally increase in diameter from higher to lower areas within the basin. Once a line size is increased at any point in the system, it shall not be reduced in size at any downstream location, regardless of available line slope.

2.4.3 Manholes

Manholes shall be designed to promote smooth, continuous flow between adjacent reaches of sanitary sewer lines. The minimum drop from any pipe invert upstream and the pipe invert "out" shall be 0.2 feet. Where manholes are designed to collect flows from two or more incoming lines, the design "in" inverts shall be set to keep the largest incoming line (i.e. line contributing the largest flow) lower in the manhole than the other incoming lines. The other, generally smaller incoming line(s) shall enter the manhole a minimum of 0.1 Ft. higher than the invert of the largest line. Maximum inside drop from upstream invert to downstream invert shall be twelve inches (12").

Where new lines are proposed to connect to the District's outfall lines, (i.e. lines 15-inches in diameter or greater), the crown of the incoming line shall match the crown of the outfall line.
Manholes shall have a minimum inside diameter of four (4) feet. Manhole sizing for various line sizes and multiple inlet configurations is presented on the "Standard Manhole" construction detail.

Sanitary sewer lines shall be designed so the angle between any upstream line and the downstream line is 90°, minimum

2.5 SANITARY SEWER SYSTEM LOCATION AND ALIGNMENT

2.5.1 General Location in Streets

Where sanitary sewers are located in the street right-of-way, they shall be designed to the following guidelines.

In streets running generally north and south, the sewer line shall be placed ten feet (10') west of the street centerline.

In streets running generally east and west, the sewer line shall be placed ten feet (10') south of the street centerline.

In streets which "meander" in each direction, the sewer line will conform to the above Specifications as near as is practical, but shall not "zig-zag" across the street centerline. An offset from the centerline shall be selected and shall be followed within the street. The final location shall be as determined by the District during plan review.

Curvilinear sewer mains are not allowed. Designs shall attempt to minimize the numbers of manholes. In no case shall the sewer line be designed closer than three (3) feet to the lip of a crosspan, or gutter, or ten (10) feet to any right-of-way line.

The District will not permit construction of a project until all plats and rights-of-way to be dedicated that are related to the project are fully signed and recorded by the County.

2.5.2 General Location in Easements

Where sanitary sewer lines are proposed in easements, they shall be designed within the easement boundary to the following minimum requirements. Sanitary sewer easements shall be a minimum of thirty feet (30') wide and shall have legal descriptions and drawings prepared in accordance with these Specifications. Wider easements will be required for sewers installed with other utilities or where sewer depth exceeds 12'. Easement widths are subject to review by the District. Manholes shall be provided at each end of any easement. Easements shall provide easy access to manholes by a tandem wheeled maintenance truck. If the sanitary sewer line is the only utility proposed to be constructed within the easement, the alignment shall be on the easement centerline. Where easements straddle property lines, the sanitary sewer alignment shall be a minimum of ten feet (10') from one edge of the easement and a minimum of ten feet (10') from the property line. When selecting the location of utility lines within an easement, consideration shall be given to excavation, maintenance, and repair requirements. In no case shall the sewer line be designed closer than 10 feet to any easement boundary. Sewer lines in unpaved easements shall be AWWA C 900 Class 150 PVC, polyvinyl chloride pipe.

A copy of the Grading Plan and Landscaping Plan showing the proposed conditions at the easements shall be submitted for review by the District.

The district requires that all utility easements be contained within one lot or parcel i.e. easements that straddle a lot line will not be accepted.

2.5.3 Easement Legal Descriptions and Drawings

Easement legal descriptions and drawings shall be prepared under the direct supervision of a Professional Land Surveyor, Registered in the State of Colorado. Legal descriptions and drawings shall be prepared on letter sized (8-1 /2" X 11") paper, and shall be referenced to the nearest Section Corner. The legal description shall be a "meets and bounds" description, accurately describing to a hundredth of a foot, the point of beginning, each easement line bearing and distance, and the total area contained in acres.

Easement drawings shall be presented at a scale sufficient to clearly show all easement boundaries. The drawing shall show the north arrow, referenced section corner, all bearings and distances, total acres, adjacent property identification, street names, and date of preparation.

Easement legal shall bear a professional land surveyor (State of Colorado) seal and signature. The easement legal and drawing shall be included with the District's Standard Easement Deed. A sample copy of the Standard Deed is included in the Appendix. The District reserves the right to modify the conditions of the Easement Deed, at any time, for specific projects.

Legal descriptions and drawings should be submitted to the District for review along with a Title Insurance Commitment covering the subject right-of-way. A copy of each documented listed in the Title Commitment must be included. All expenses incurred