Wastewater Disposal Report
For
Cloverleaf Filing No. 2

El Paso County, CO

October, 2021

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JR Project No. 25158.01

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Appendix

1.1. Purpose

This document is intended to serve as the Wastewater Disposal Report for Cloverleaf Filing No. 2. The purpose of this document is to show that the proposed wastewater discharge is within the acceptance criteria of the Woodmoor Water and Sanitation District. In addition, this report satisfies the requirements set forth by the El Paso County Land Development Code, Section 8.4.8.D (Wastewater Disposal - Public System).

1.2. Summary of Proposed Development

The proposed single-family residential subdivision, known as "Cloverleaf Filing No. 2" from herein, is a parcel of land located in Section 24 & 23, Township 11 South, Range 67 West of the 6th Principal Meridian in El Paso County, Colorado. Cloverleaf is a 38.28 acre, urban, single-family-development, and is comprised of 131 single-family residential units and associated infrastructure. Cloverleaf is bound by existing residential developments. Cloverleaf Road bounds the property to the east, Woodmoor Greens Fil. 1 & 2 a single-family residential subdivision borders the subdivision to the west & north, and Walters Commons Fil. No. 1 and Country Ridge Estates, multi-family residential subdivisions border the property to the south. A vicinity map of the area is presented in Appendix A.

1.3. Wastewater Service

The development will be served by standard 4-inch PVC service lines and 8-inch PVC (SDR 35) gravity sanitary sewer main lines. The primary sanitary service is an 8-inch sanitary sewer which ties into an existing manhole (connection point 1A) in Leggings St and will service 125 lots.

The existing 8 inch sanitary sewer that serves 6 existing lots in Woodmoor Greens and then crosses the proposed NE corner of Cloverleaf will be re-routed.

The 6 lots along Walters Point in the SE of the subdivision will tie into a new proposed 8" san sewer under Walters Point Road and ultimately outfall into an existing sewer main within Cloverleaf Road at connection point 2D.

Refer to Appendix B for the proposed sanitary collection utility plan for additional information.
The wastewater discharge was calculated on a single-family equivalent (SFE) basis. Wastewater System demands were established using 65 percent of the average daily water demand per lot listed in the Cloverleaf Water Resources and Water Quality Report. A summary of the wastewater calculations are shown below;

- Per lot average daily water demand: 320 gpd
- Per lot wastewater average daily loading: 208 gpd
- Peaking Factor: 5.0
- Infiltration of 200 gpd after peak factor

Based on the above criteria, the additional flow to the WWSD system will be;

- Connection Point 1A - Average Flow 26,000 gpd, Peak Flow 134,789 gpd
- Connection Point 2D - Average Flow 1,248 gpd, Peak Flow 6,694 gpd
- Total Additional Flow - Average Flow 27,248 gpd, Peak Flow 141,483 gpd

Refer to Appendix C for additional information such as loads, individual runs, peak factors, velocity, infiltration etc.

1.4. District Capacity

As shown in Appendix D, Woodmoor Water and Sanitation District is situated to serve the proposed development. The site is tributary to the Tri-Lakes wastewater treatment plant. The plant has adequate capacity to treat and discharge wastewater flows generated by Cloverleaf Filing No. 2 in conformance with current CDPHE standards and regulations. The overall capacity of the Tri-Lakes wastewater treatment plant is 4.6 MGD, Cloverleaf represents less than 1% of Tri-Lakes wastewater treatment plant capacity.

A commitment to serve letter for Cloverleaf Filing No. 2 has been issued by WWSD.

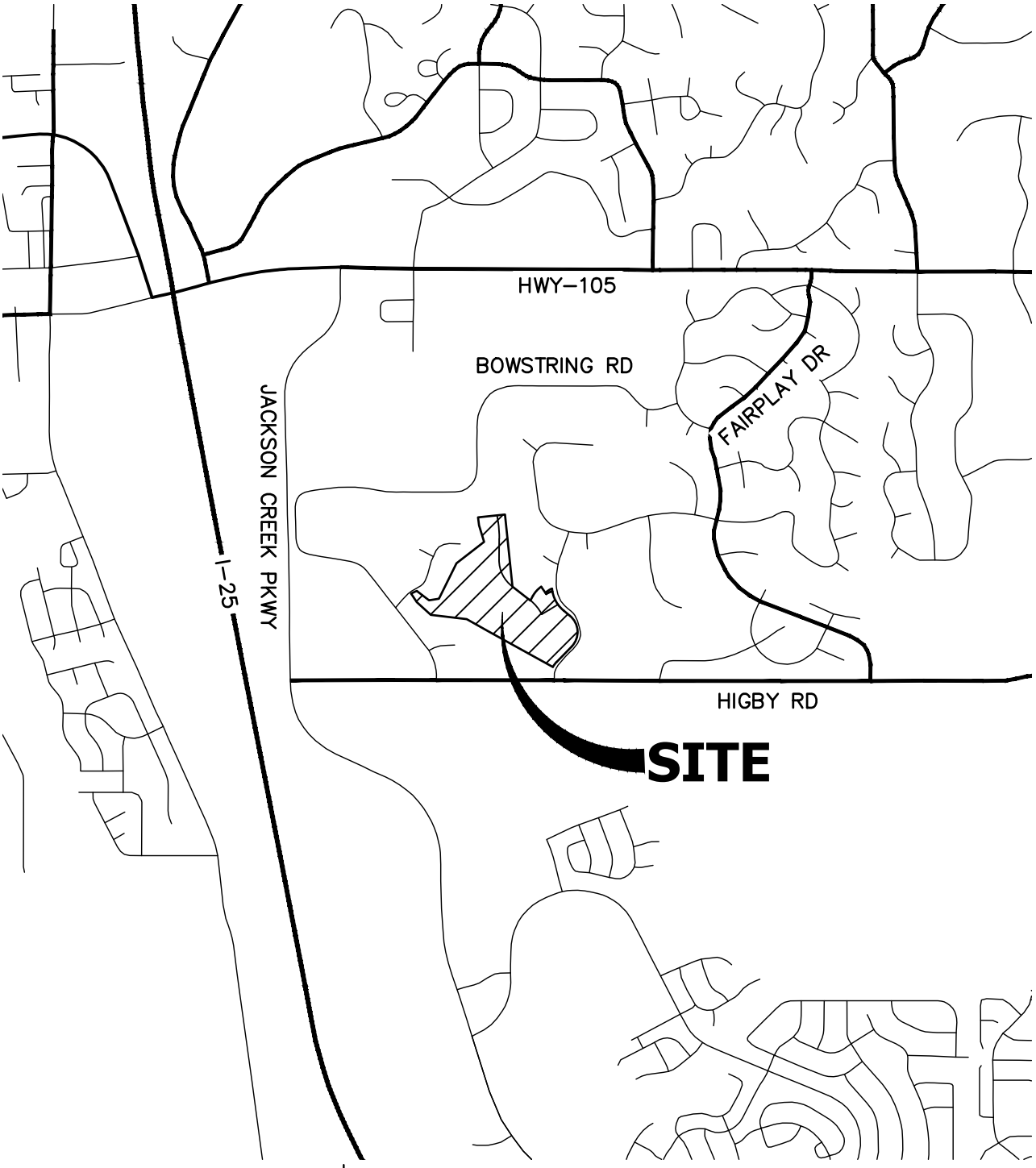
1.5. Waivers from Criteria

There are no waivers from the El Paso County Land Development Code or the criteria established by the Woodmoor Water and Sanitation District requested for this project.

1.6. Compliance with Standards

The sanitary sewer system, design, and modeling results conform to all applicable criteria set forth by El Paso County and the Woodmoor Water and Sanitation District.

APPENDIX A: VICINITY MAP



2000 1000 0 2000

ORIGINAL SCALE: 1" = 2000'

VICINITY MAP
CLOVERLEAF FILING NO. 2
JOB NO. 25158.01
08/19/2021
SHEET 1 OF 1

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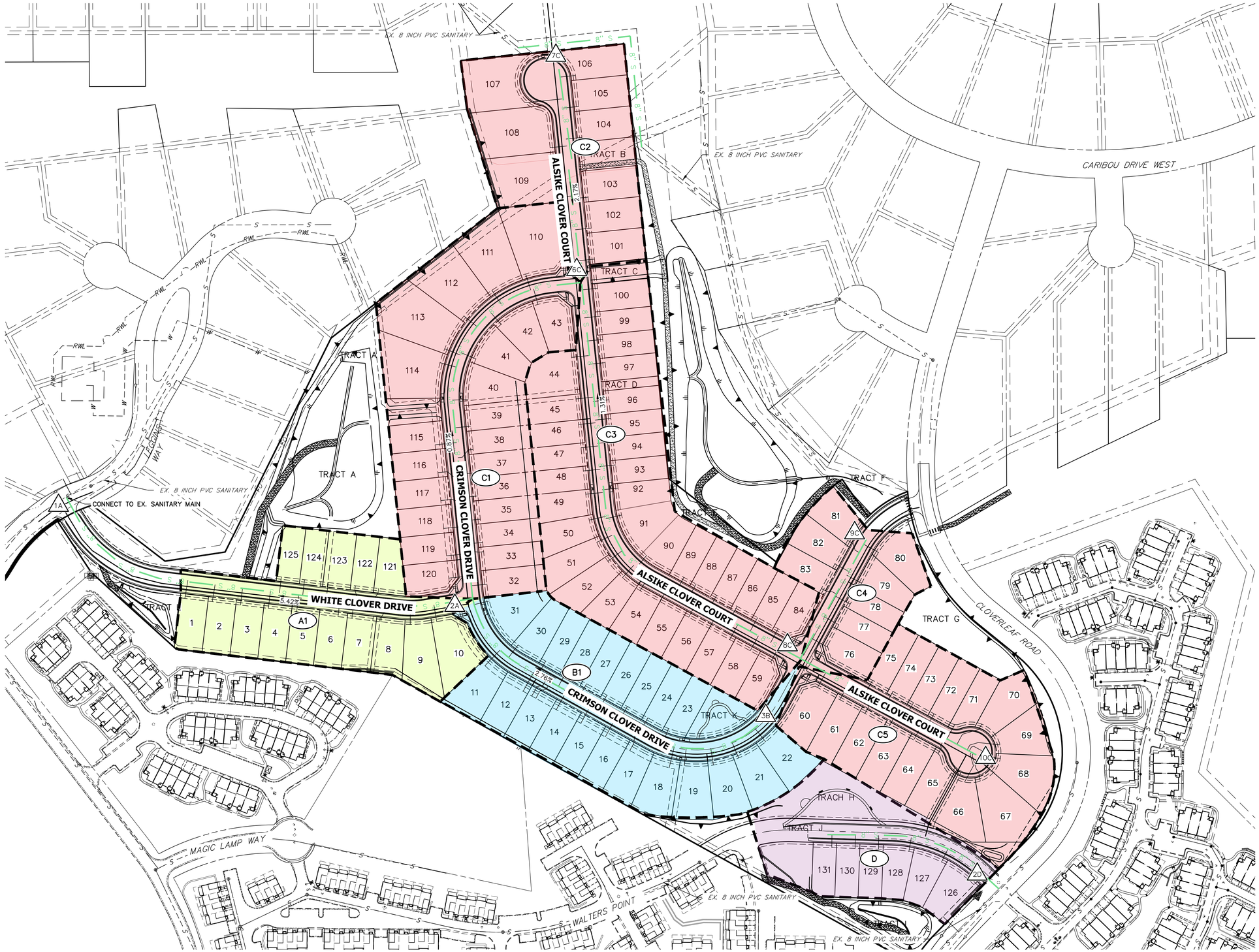
APPENDIX B: UTILITY SERVICE PLAN

CLOVERLEAF FILING NO. 2

SANITARY COLLECTION MAP



LEGEND

- 8" S — PROPOSED 8" SANITARY SEWER
- AREA DELINEATION
- # — DESIGN POINT
- X — BASIN DESIGNATION
- BASIN A DESIGNATION
- BASIN B DESIGNATION
- BASIN C DESIGNATION
- BASIN D DESIGNATION
- BASIN E DESIGNATION

N

100 50 0 100 200

ORIGINAL SCALE: 1" = 100'

SANITARY COLLECTION MAP
CLOVERLEAF FILING NO. 2
JOB NO. 25158.01
10-28-2021
SHEET 1 OF 1

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APPENDIX C: SANITARY SEWER COLLECTION ANALYSIS

ON-SITE SANITARY SEWER LOADING SUMMARY - CLOVERLEAF FILING NO. 2

Sewer Run (Trunk)	Sewer Run (Branch)	Pipe Size (in)	Pipe Slope (%)	Pipe Slope (ft/ft)	Full-Pipe Capacity (cfs)	Number of Lots Served	Full Pipe Velocity (fps)	Total Number of Lots Served	Load/Lot (162.5 gpd)	Base Flow (gpd)	Base Flow (cfs)	Avg. Daily Flow (gpd)	Avg. Daily Flow (cfs)	Area of Basin (Acres)	Area of Tributary (Acres)	Avg. Daily - Infiltration (gpd)	Avg. Daily - Infiltration (cfs)	Wetted Perimeter Avg Flow	Hydraulic Radius Avg Flow	Ave. Daily Flow Velocity (fps)	Peaking Factor	Peak Flow (gpd)	Peak Flow (cfs)	Depth in Pipe (ft)	Hydraulic Radius Peak Flow	Peak Flow Velocity (fps)	% of Pipe Capacity	Notes
	9C-8C	8	6.00	0.0600	3.50	8	10.02	8	208	1,664	0.0026	1,664	0.0026	1.71	1.71	341	0.0005	0.1875	0.0087	1.39	5.0	8,661	0.0134	0.03	0.0185	2.31	0.38	Crimson Clover Drive from Cloverleaf
	10C-8C	8	3.00	0.0300	2.47	16	7.09	16	208	3,328	0.0051	3,328	0.0051	3.64	3.64	728	0.0011	0.2610	0.0165	1.52	5.0	17,368	0.0269	0.05	0.0350	2.50	1.09	Part of Aleskie Clover Court
	7C-6C	8	2.50	0.0250	2.26	9	6.47	9	208	1,872	0.0029	1,872	0.0029	3.10	3.10	620	0.0010	0.2217	0.0120	1.12	5.0	9,980	0.0154	0.04	0.0258	1.86	0.68	Part of Aleskie Clover Court
	8C-6C	8	1.50	0.0150	1.75	33	5.01	57	208	11,856	0.0183	11,856	0.0183	6.96	10.06	2,013	0.0031	0.3085	0.0228	1.33	5.0	61,293	0.0948	0.08	0.0484	2.20	5.42	Aleskie Clover Court
6C-2A		8	0.50	0.0050	1.01	23	2.89	89	208	18,512	0.0286	18,512	0.0286	5.55	15.61	3,122	0.0048	0.4228	0.0412	1.14	5.0	95,682	0.1480	0.14	0.0865	1.87	14.66	West Half Crimson Clover Drive
3B-2A		8	2.70	0.0270	2.35	21	6.72	21	208	4,368	0.0068	4,368	0.0068	5.17	5.17	1,034	0.0016	0.3101	0.0230	1.80	5.0	22,874	0.0354	0.08	0.0489	2.97	1.51	East Half Crimson Clover Drive
2A-1A		8	3.00	0.0300	2.47	15	7.09	125	208	26,000	0.0402	26,000	0.0402	3.17	23.94	4,789	0.0074	0.3926	0.0359	2.55	5.0	134,789	0.2085	0.12	0.0757	4.19	8.43	White Clover Drive Trunkline
Connection Point 1A Totals								125		26,000												134,789						
	2D-1D	8	5.50	0.0550	3.35	6	9.59	6	208	1,248	0.0019	1,248	0.0019	2.27	2.27	454	0.0007	0.1723	0.0073	1.19	5.0	6,694	0.0104	0.02	0.0160	2.01	0.31	Walters Point
Connection Point 2D Totals								6		1,248												6,694						
Total Additonal Flow								131		27,248												141,483						

NOTES:

1. ALL PIPE SHALL BE PVC AND 8" IN DIAMETER, MIN.

2. MANNING'S ROUGHNESS COEFFICIENT FOR PVC PIPE IS 0.011

3. MAXIMUM PEAKING FACTOR OF 5 IS USED FOR PEAK FLOW; PF=3.53*(ADF/1,000,000)^-0.168

4. MINIMUM AND MAXIMUM VELOCITY IS 2FT/S & 10FT/S RESPECTIVELY PER South Adams Water & San District Criteria

Equations:

Equation of Continuity => vA

Manning Equation => $\frac{1.486 * R^{2/3} * S^{1/2}}{n}$ = V

Manning Coefficient , n : 0.011 = n (PVC pipe)

Hydraulic Mean Radius, R : A / P = R

Cross-sectional Wetted Area of Flow, A : D^2/8 * (a-sin(a)) = A (ft)

Wetted Perimeter of Flow Cross-section, P : a* D / 2 = P (ft)

Longitudal Slope, S : = S (ft/ft)

Velocity, v : (fps)

Pipe Diameter, D : = D (ft)

Depth in Circular Channel, d : $\frac{(0.972 * D) * (Q * n)^{0.488}}{(D^{2.67} * S^{0.5})^{0.488}}$ = d

Alpha (radians), a = PI + 2*ASIN ((2d/(D/12)-1) = a

Calculation References for Full-Pipe Capacity and Velocity:
Manning's Equation
HEC-22 Chart "Conveyance in Circular Channels"
Hydrology and Floodplain Analysis, 2nd Edition, Addison & Wesley Publishing Company, Figure 7.1, "Geometric properties of common open channel shapes"

APPENDIX D: DISTRICT MAP

MAP LEGEND

- WOODMOOR — SUBDIVISION NAME
- WOODMOOR DRIVE — STREET NAME
- 321 TRACT "A" — LOT INFORMATION
- DISTRICT BOUNDARY
- SECTION LINE
- SUBDIVISION BOUNDARY
- LOT LINE
- SURFACE WATER
- DETAIL BOUNDARY
- SEWER R&R BOUNDARY
- SEWER BASIN BOUNDARY
- SEWER LINE (PVC)
- SEWER LINE (STL)
- SEWER LINE (VCP)
- SEWER LINED W/ FOLD'N'FORM
- SEWER LINED W/ INSITUFORM
- SEWER LINED W/ HDPE
- SEWER FORCE MAIN (PVC)
- WATER PRESSURE ZONE BNDY.
- POTABLE WATER PIPE (PVC)
- POTABLE WATER PIPE (CIP)
- POTABLE WATER PIPE (HDPE)
- NON-POTABLE WATER PIPE (PVC)
- TRANSMISSION LINE (PVC)
- TRANSMISSION LINE (DIP)
- PRIVATE SYSTEM
- NOT FINAL ACCEPTED SYSTEM

- 5592 — SANITARY SEWER MANHOLE
- SANITARY SEWER CLEAN-OUT
- SANITARY SEWER LIFT STATION
- WELL HEAD
- XX — WELL TAG AND NUMBER
- BOOSTER STATION
- FACILITY / STRUCTURE
- 2 — BLOCK NUMBER
- FIRE HYDRANT
- 3K000 — AIR/VAC RELEASE VAULT
- GATE VALVE LEFT HAND
- GATE VALVE RIGHT HAND
- PSV — PRESSURE SUSTAINING VALVE
- PRV — PRESSURE RELIEF VALVE
- CV — CHECK VALVE
- BO — BLOW OFF
- ACCOUNT TAP

1 — SECTION NUMBER

2 — SEWER RENEWAL & REPLACEMENT ZONE NUMBER

3 — MAP PANEL NUMBER

4 — WATER PRESSURE ZONE NUMBER

5 — SEWER BASIN NUMBER

NOTES:
- SOME OBJECTS IN THIS LEGEND MAY NOT BE USED ON THIS PLAN.
- ALL WATER MAINS ARE 6" ø UNLESS NOTED OTHERWISE.
- ALL SEWER MAINS ARE 8" ø UNLESS NOTED OTHERWISE.

SUBDIVISION ABBREVIATIONS

- BMG'S = BOMGAAR'S REPLAT
- C-M = COOK-MALONEY SUBDIVISION
- CH3 = CHISHOLM SUB FIL. NO. 3
- COVE = THE COVE AT WOODMOOR
- CW = COUNTRY WOODMOOR
- G-D SUB = GILMORE-DANSKIN SUB
- KV 1 = KNOLLWOOD VILLAGE FIL. NO. 2
- KV 2 = KNOLLWOOD VILAGE FIL. NO. 2
- LPH = LOFTY PINE HEIGHTS
- NHN = NICHOLAS H. NANCE SUB FILING NO. 1
- LWR = A REPLAT OF LOT 58 LAKE WOODMOOR
- MA2 = MISTY ACRES FILING NO. 2
- MA2C = MISTY ACRES FILING NO. 2C
- S-M-V = SHIPLEY-MILLER-VANCE SUB
- SCH. EST. = SCHOELL ESTATES
- STEP. SUB = STEPHANI SUB
- TV 1A = TIMBERVIEW SUB FILING 1A
- VCW 1 = VCW 1 TRUST SUB
- VCW 3 = VILLAGE CENTER AT WOODMOOR NO. 3
- W1B = WOODMOOR FILING NO. 1B
- WESTVIEW = WESTVIEW AT WOOODMOOR
- WH III = WOODMOOR HIGHLANDS III
- WH2 = WINDING HILLS NO. 2
- WMV SUB = WOODMOOR MOUNTAIN VIEW SUB
- WN 1ST = WOODMOOR NUGGET 1ST AMD.
- WT = WOODMOOR WATER TANK SUB
- Y/N = YATES NIBLACK SUB

DISCLAIMER

THIS MAP IS ONLY A ROUGH DEPICTION OF THE ESTIMATED LOCATION OF WATER AND WASTEWATER INFRASTRUCTURE. ANYONE VIEWING THIS MAP IS HEREBY WARNED THAT THE DISTRICT DOES NOT WARRANT THE ACCURACY OF THIS MAP OR THE LOCATION OF WATER AND SEWER INFRASTRUCTURE.

WOODMOOR
Water & Sanitation District No. 1

2017 WALL MAP

DISTRICT OVERVIEW

500 0 500 1000
SCALE: 1" = 500'

APPENDIX E: WWSD LRP EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

A summary of the recommendations in the Long Range Plan (LRP) Update for 2017 are presented in this section. The LRP Update evaluates water supply, operations, treatment, water distribution, and wastewater collection. Growth projections used throughout the LRP Update were determined with input from District and Bishop Brogden and Associates (BBA) staff. The LRP update confirms and updates use-rate values for water demand and wastewater production throughout the District. Based on the growth projections and use-rate data, future water demands were determined and water supply alternatives were evaluated to determine what supplies will be used to meet future water demands. Based on the recommended water supply alternative, a Capital Improvements Plan (CIP) was developed that outlines the projects required to meet the District's future water demands. For the District to determine the costs associated with the CIP and continuing maintenance for the District, a cash flow model was developed for use in the District's rate model.

In the LRP Update, growth projections for the District were determined with input from the District staff to project future growth and to determine when the District will meet build-out of its existing boundary. The District currently has 4,192 SFEs and an average annual water demand of 1,376 af/yr. Between 2012 and 2017, the District has experienced an average growth rate of approximately 3.5 percent per year for the short term. Assuming the 3% long-term growth rate for the current and ultimate build-out scenario, the current buildout will occur in 2030 with 6337 SFEs and 2,080 af/yr, and the ultimate buildout will occur in 2038 with 7,801 SFEs and 2,560 af/yr. It is possible the District may expand its boundaries to serve surrounding developments that may petition for inclusion within the District and lead to an ultimate build out of the District. For planning purposes, the Wissler Trust and Home Place Ranch will be included into the District.

Water Projects

Average annual water demand and maximum monthly water demands were evaluated for the District. The average annual water demand decreased from the 2012 LRP Update from 305 gpd/SFE to 293 gpd/SFE likely due to water conservation Since the last LRP Update, all SCADA systems have been updated to enable the District to monitor water demand on a daily basis. Based on the daily demands, the peak day to average annual peaking factor was updated from 2.2 to 2.1

This LRP has two areas of focus for the water system which are the short term and long term water supply plan. Since the last LRP Update, a decree was entered in Case No. 12CW01 (Division 2) that changed the use of the Ranch water rights from irrigation to municipal and other uses included in the decree. The change of use will allow the Ranch water rights to be diverted from Fountain Creek at their current point of diversion, stored in a reservoir and ultimately delivered to the District via pipeline to meet municipal demands. A series of infrastructure improvements are needed to treat and convey the water from the Ranch to the District. Before the Ranch water is available as a long-term water supply, the existing groundwater supply must be maintained. The main goal of the short-term water supply projects is to maintain construction of new groundwater wells while implementing IPR at the District to sustain water supply. In the future, other long-term water supply projects will need to be considered, as well as resumed drilling of wells to maintain supply through buildout as well yield decreases. In order to supplement demand, Tetra Tech recommends the district begin construction of Indirect Potable reuse in the District starting in 2019 with a pilot project.

The long-term water supply plan is to construct storage and treatment facilities at the Ranch. The existing Callahan Reservoir at the Ranch should be expanded to 2,200 acre-ft to have enough operational capacity to store and deliver water to the District from the Ranch. The water from the reservoir will be treated at the new Water Treatment Plant before being pumped approximately 44 miles to the District. It is estimated that the earliest that the Ranch water supply can be delivered to the District is 2033 due to obtaining financing and constructing facilities.

The water level in the Denver Basin aquifers is declining which results in decreased production rates. To make up for the declining water supply without drilling additional wells, the Tri-Lakes Water Reclamation Plant will be constructed to enhance the supply in Monument Creek. The supply will be enhanced by providing advanced treatment of the effluent from the Tri-Lake Wastewater Plant so that the treated water can be discharged above the Monument Creek Exchange Pump Station. The exchanged and reclaimed water will be pumped to Lake Woodmoor which will provide natural attenuation before the water will be treated at the South Water Treatment Plant before being sent to the distribution system.

The capital improvements for the TL-WWTF were arranged in phases based on the Nutrient Engineering Report provided by Tetra Tech. Phase 1 focused on constructing processes that met Regulation 85 limits and was completed in 2017. Phase 2 and 3 are future phases that will meet upcoming regulations. Phase 2 primarily targets towards improving solids handling at the TL-WWTF. Phase 3 will address capital improvements required for Regulation 31 compliance. Miscellaneous projects are included to upgrade existing equipment and provide emergency power. Below is a summary description of the work for each phase.

TL-WWTF Phase 2 Improvements

- Decommission of the existing headworks and solids lagoon
- Construction of a new solids handling system including: gravity thickener, aerobic digester, dewatering equipment, solids handling building, solids loading station, and other ancillary equipment
- Construction of a new odor control system
- Construction of a new headworks facility including: fine mechanical bar screen, screenings handle equipment, and a vortex grit removal system in a new building

TL-WWTF Phase 3 Improvements

- Construction of a mixed liquor pump station
- Construction of new post-anoxic denitrification and reaeration basins
- Construction of chemical storage and feed pumps
- Construction of a tertiary filters

Miscellaneous Projects

- Upgrade blower system from multi-stage blowers to more efficient high speed turbo blowers
- Install an emergency generator for the activated sludge system

Based on the future well production projections and the exchange system yield, capital improvement projects are recommended in order to continue to meet the diminishing capacity and growing water demand. A list of the projects is presented in the table below.

Classification		Project Description	Opinion of Probable Cost in 2017 Dollars	Year of Start	Year of Completion
Water CIP	Water Treatment	South Filter Plant	$791,820	2018	2020
Water CIP	Groundwater Supply	Well AR-21	$2,700,000	2018	2019
Water CIP	Water Treatment	Pilot WTP for TL WTP and JV WTP	$191,232	2019	2020
Wastewater CIP	Wastewater Treatment	Tri-Lakes Wastewater Treatment Misc. Projects	$538,796	2020	2021
Water CIP	Surface Water Supply	Lake Woodmoor Pump Station Improvements	$532,000	2020	2021

Classification		Project Description	Opinion of Probable Cost in 2017 Dollars	Year of Start	Year of Completion
Water CIP	Groundwater Supply	Well AR-22	$2,700,000	2020	2020
Water CIP	Water Treatment	IPR at Tri-Lakes	$28,496,058	2020	2024
Water CIP	Water Treatment	CWTP Improvements and Surface Water Pipeline	$862,300	2021	2023
Water CIP	Groundwater Supply	Well DA-21	$450,000	2021	2021
Water CIP	Groundwater Supply	Well DE21	$1,100,000	2021	2021
Water CIP	Groundwater Supply	Well DA-22	$450,000	2021	2021
Water CIP	Groundwater Supply	Well DE-22	$1,100,000	2021	2021
Wastewater CIP	Wastewater Treatment	Tri-Lakes Wastewater Treatment Plant Phase 2 Improvement	$14,323,801	2022	2025
Water CIP	Groundwater Supply	Well AR-8R	$1,260,000	2022	2022
Wastewater CIP	Wastewater Treatment	Tri-Lakes Wastewater Treatment Phase 3	$7,503,637	2027	2032
Water CIP	Storage and Distribution	Ranch Transmission & Conveyance	$65,827,804	2027	2033
Water CIP	Water Treatment	Ranch WTP Design and Construction FAT Option	$45,000,000	2030	2033
Water CIP	Storage and Distribution	Calahan Reservoir Expansion	$20,286,000	2032	2035
Water CIP	Water Treatment	One MG Finished Water Storage Tank	$1,825,740	2033	2033
Water CIP	Groundwater Supply	Well DA-16	$450,000	2035	2035
Water CIP	Groundwater Supply	Well DE-16	$1,100,000	2035	2035
Water CIP	Groundwater Supply	Well DA-18	$450,000	2035	2035
Water CIP	Groundwater Supply	Well DE-18	$1,100,000	2035	2035
Water CIP	Groundwater Supply	Well DA-20	$450,000	2035	2035
Water CIP	Groundwater Supply	Well DE-20	$1,100,000	2035	2035
Water CIP	Groundwater Supply	Well DA-11	$450,000	2036	2036
Water CIP	Groundwater Supply	Well DA-1R	$450,000	2036	2036
Water CIP	Groundwater Supply	Well AR-23	$2,700,000	2036	2036

Wastewater Collection System

The WWSD sanitary sewer collection system was modeled under existing and future build out conditions to evaluate capacity of the gravity sewers, lift stations and force mains. The modeling was performed using a model maintained by the District with flows assumed to be applied in each scenario in a manner representative of existing and build-out planning. The modeling indicated that the system is able to accommodate the existing and planned taps at build out. Some gravity mains in the system approached design capacity at build out and bear further analysis as the system matures.

No capital improvements are recommended other than to continue the District's current annual manhole rehabilitation projects to further mitigate inflow and infiltration (I&I).

The following collection system studies are recommended as interim projects and/or as part of future LRP updates:

- Flow monitoring study targeting Inflow and Infiltration
- Sewer model calibration based upon periodic flow monitoring
- Lift station capacity analysis