

Master Utility Report

Aurora Metro Center Aurora, Colorado

Project No. 1064-01

Submittal: 1st: August 14, 2020
 2nd: November 18, 2020
 3rd: February 22, 2021

Approved For One Year From This Date

City Engineer

Date

Water Department

Date

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Engineer's Statement:

This "Master Utility Report for Aurora Metro Center Development" was prepared under my direct supervision in accordance with the provisions of the City of Aurora Standards and Specifications Regarding Water, Sanitary Sewer and Storm Drainage Infrastructure. I understand that the City of Aurora does not and will not assume liability for facilities designed by others.

Teresa Rae Hogan, PE
Registered Professional Engineer
State of Colorado No. 28789

Date

Timothy Russell Pyle
Civil Designer

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I. General Location & Description

A. Site Location

The Aurora Metro Center project site is located south of E. Alameda Parkway, west of S. Chambers Road, east of S. Sable Boulevard, and north of E. Walsh Drive and E. Centre Avenue in the city of Aurora, Colorado. See the Vicinity Map below for reference.



Figure 1 – Vicinity Map

i. Township, Range, Section, One-Quarter Section

The site is within the northeast quadrant of Section 18, Township 4 South, Range 66 West of the 6th Principle Meridian, in Aurora, county of Arapahoe, State of Colorado.

ii. Streets Within and Adjacent to the Subdivision

E. Alameda Avenue is north of the site and has a 110' public right-of-way width. S. Chambers Road is east of the site and has a 110' public right-of-way width. S. Sable Avenue is west of the site and has a varying public right-of-way. E. Centre Avenue is south of the site and has a 70' public right-of-way width. E. Centrepont Drive has an 80' public right-of-way width that bisects the site from the west to the south and trifurcates the site.

iii. Major Facilities and Easements Within and Adjacent to the Site

In the northwest corner of the site, there is a 60' utility easement that runs through the site in a southwest to northeast alignment. Along the western edge of the site, there is a 10' public service company easement. There are 6' gas easements on both sides of E. Alameda Drive and E. Centrepont Drive. There

are 6' gas easements directly south of E. Alameda Ave. and north of E. Center Ave.

B. Description of Property

The Aurora Metro Center project site is approximately 60 acres. The site is zoned for Mixed-Use Transit-Oriented Developmental District. Currently, the site is vacant and covered in natural grasses with a meandering walkway from the RTD station on S. Sable Boulevard to the intersection east of the Aurora Public Library. There are twelve total planning areas, A1, A2, A3, B1, B2, B3, B4, B5, B6, C1, C2, and C3. The Metro Center Master Plan has a conceptual layout which includes 26.5 acres of commercial/mixed use areas, 32.2 acres of multi-family areas, public park space, a multi-use trail, sidewalks, drainage ponds, and public rights-of-way.

II. Water Distribution System

A. Existing System

The existing water supply and distribution system is owned and maintained by the City of Aurora. According to the previous Master Sanitary Sewer and Water Report, prepared by Martin/Martin, Inc. and approved by Aurora on June 29, 2005 (COA #205115), henceforth referred to as the 2005 Master Utility Report, the existing infrastructure adjacent to and within the site is in Pressure Zone 3 which has a hydraulic grade line of 5,720 ft. There are existing 12" water mains located within E. Centrepont Dr., E. Alameda Dr., and E. Center Ave., an existing 8" water main under the existing portion of S. Fraser Ct., and an existing 24" DIP water main in S. Chambers Rd. In the existing 60' utility easement located between Planning Areas A1 and A2 there is an existing 36" steel water main with 12" water stubs to the east and west of the main for water connections to the project site. For Planning Area A1 there is a 12" water main stubbed to the site from the north from E. Alameda Pkwy. that will provide a loop for that planning area. The existing water infrastructure will provide all necessary connections for the project site for looping.

B. Water Design Criteria

Design criteria for the water distribution system is based upon Section 5 of the Water, Sanitary Sewer & Storm Drainage Infrastructure Standards & Specifications from Aurora Water.

The City of Aurora requirements for the water system are as follows:

- i. Residential Use
 - o An average of 2.77 people/unit
 - o 101 gpcd
 - o Maximum Day Demand = 2.8 x Average Day Demand
 - o Peak Hour Demand = 4.5 x Average Day Demand
- ii. Commercial Use
 - o Average Day Demand = 1,500 gpd/acre

- Maximum Day Demand = 4,200 gpd/acre
- Peak Hour Demand = 6,750 gpd/acre
- iii. Hotel Use
 - Average Day Demand = 98 gpd/room
 - Maximum Day Demand = 2.8 x Average Day Demand
 - Peak Hour Demand = 4.5 x Average Day Demand
- iv. Fire Flow
 - Commercial/Multifamily Demand = 2,500 gpm for 2 hrs
 - Minimum residual pressure = 20 psi
- v. Peak Hour Demand
 - For 8" to 12" pipes, the maximum flow velocity = 3 ft/s
 - For 16" to 24" pipes, the maximum flow velocity = 4.5 ft/s

Using the Aurora Water criteria, the below table shows the Average Day Demand (ADD), Maximum Day Demand (MDD), and Peak Hour Demand (PHD) for the entire Aurora Metro Center project. Refer to Appendix A for a detail report of the demand calculations.

Water Demand Calculations		
Average Day Demand (gpm)	Maximum Day Demand (gpm)	Peak Hour Demand (gpm)
323.39	905.48	1455.24

C. Proposed Water System

The proposed system will be looped via multiple connections to the existing water infrastructure. All proposed water lines are 12" pipes generally located under every proposed street in the project site. Water loops are available for every planning area to connect to.

D. Water Analysis

Analysis of the water supply and distribution system for the Aurora Metro Center was performed using Bentley WaterCAD V8i. Per section 5.02.1 of the Water, Sanitary Sewer & Storm Drainage Infrastructure Standards & Specifications from Aurora Water, analysis was performed on the network for the Average Day, Peak Hour and Maximum Day plus Fire Flow per currently adopted fire code. The maximum and minimum system pressures and the maximum pipe velocities for each of the scenarios modeled are presented at the top of the next page. Refer to Appendix B for a detailed report of the analyses done for each scenario.

System Conditions			
	Average Day	Max Day + Fire Flow	Peak Hour
Minimum System Pressures (psi)	J-3: 87	J-3: 86	J-3: 87
Maximum System Pressures (psi)	J-1: 115	J-1: 115	J-1: 115
Maximum Pipe Velocities (ft/s)	P-7: 0.25	P-5: 4.21	P-7: 1.11

In the WaterCAD model, the planning areas were separated into groups based upon their location to the nearest junction. Fire flow demand for the project is 2,500 gpm for 2 hours based upon the requirements specified in the Water, Sanitary Sewer & Storm Drainage Infrastructure Standards & Specifications from Aurora Water. The fire flow demands were modeled at Junction J-3, which is the node with the highest elevation. This location was chosen as it represents the area of the site where pressure requirements would be of highest concern. During the fire flow scenario, the lowest nodal pressure in the system is 86 psi; well above the minimum allowable system pressure. During the peak hour flow condition, the maximum flow velocity is 1.11 fps, which is well below the allowable maximum velocity.

III. Sanitary Sewer System

A. Existing System

The site has existing sanitary mains located under the existing streets, some of which provide stub connections to the planning areas for development. In Planning Area A1, there is an existing 15" VCP sewer main within the 60' utility easement that conveys flows to the north, where they outfall to a 21" sanitary sewer main. From the 15" VCP sewer main, an 8" sanitary sewer stub has been provided to the west into Planning Area A1 and another 8" sanitary sewer stub has been provided to the east for Planning Areas A2 and A3. Along the eastern property line of Planning Areas B2 and B4 and along the northern property line of Planning Areas B1 and B2, an existing 12" sanitary sewer directs flows to the north and west from the "B" Planning Areas. North of Planning Area C1, there is an existing 10" sewer main in E. Centrepont Dr. that directs flows to the west and then north to the existing 15" VCP sewer main. There is an existing 12" sanitary sewer in E. Centrepont Dr. adjacent to Planning Areas C2 and C3 that directs flows northwest to the existing 12" sanitary sewer pipe in E. Alameda Dr. Southwest of the intersection of E. Centrepont Dr. and E. Alameda Dr. is an existing 12" sanitary sewer stub that has been provided into Planning Area C2. Although there are multiple existing sanitary sewer mains within and around the project area, all ultimately outfall to the existing 21" VCP, located at Design Point 1 (DP1) which flows north through the Aurora Municipal site.

B. Sanitary Sewer Design Criteria

Design criteria for the sanitary sewer system is based upon Section 5 of the Water, Sanitary Sewer & Storm Drainage Infrastructure Standards & Specifications from Aurora Water. Per section 5.03.6 of the standards and specifications from the City of Aurora, sanitary sewer mains that are 12" diameter and smaller are designed to carry the peak discharge with the pipe operating at no more than 75% of the maximum flow capacity; 80% maximum flow capacity for larger diameter pipes. Per email communication with Engineer Casey Ballard with the City of Aurora on October 9th, 2020, prior hotel water demands have been estimated assuming an average of 98 gpd/room which approximately equates to one guest per room.

The City of Aurora requirements for the sanitary sewer system area as follows:

- i. Loading Rates
 - o Residential Population = 2.77 People/Unit
 - o Residential Demand = 68 gpcd
 - o Commercial Population Equivalence = 22 People/Acre
 - o Commercial Demand = 1,500 gpd/Acre
 - o Infiltration = 10% of the Average Loading
- ii. Peaking Factor
 - o Peaking Factor = $5 \div p^{0.167}$ where p = population in thousands
 - o Maximum Peaking Factor = 4.0
 - o Minimum Peaking Factor = 1.7
- iii. Materials and Velocities
 - o Manning's n = 0.011 for PVC & n = 0.013 for RCP or VCP
 - o Minimum Pipe Slope = 0.4%
 - o Minimum Velocity = 2 ft/s at least once per day
 - o Maximum Velocity = 10 ft/s flowing full or ½ full

C. Proposed Sanitary Sewer System

There are four sanitary outfall locations being utilized for this project. Planning Area A1 outfalls to the 8" sanitary pipe stub located west of the adjacent existing 15" VCP sewer main within the 60' utility easement. Additionally, there is an existing 8" sanitary stub on the east side of the same existing 15" VCP main that provides service for Planning Areas A2 and A3. Planning Areas B1, B3, and B5 split flows, with a portion of each area outfalling west to a proposed 8" sanitary main in S. Fraser Ct. The Fraser main flows north and connects to an existing 12" sanitary sewer in the northwest corner of Planning Area B1. Planning Areas B2, B4, B6, and the remaining areas of the other "B" Planning Areas flow east to outfall to the existing 12" sanitary main along the eastern property line for the project site. This existing sewer main flows north and west to connect to the same existing 12" sanitary main in Planning Area B1. The existing 12" sanitary sewer pipe southwest of the intersection of E. Centrepont Dr. and E. Alameda Dr. provides stub connections for Planning Areas C2 and C3. Finally, Planning Area C1 outfalls to the existing 10" sanitary sewer in E. Centrepont Dr. north of Planning Area C1. A

combination of 8" and 12" sanitary pipes will be used to provide service throughout the site.

D. Sanitary Sewer Analysis

Analysis of the sanitary sewer system was done by calculating the flows generated by each planning area and comparing these values to those in the approved 2005 Master Utility Report, to confirm that the proposed sanitary loading values are less than originally anticipated. The following tables show the average flows, infiltration flows, peaking factors, and peak flows generated by each planning area. Refer to Appendix A for detailed sanitary demand calculations. Off-site sanitary loading values from the 2005 Master Utility Report were used to evaluate the available pipe capacity as these values are more conservative than those generated by the current standards.

Proposed Sanitary Flow Calculations by Planning Area				
PLANNING AREA	A1	A2	A3	B1
AVERAGE LOADING (MGD)	0.016	0.008	0.063	0.004
INFILTRATION (MGD)	0.002	0.001	0.006	0.000
PEAKING FACTOR USED	4.0	4.0	4.0	4.0
PEAK FLOW (MGD)	0.062	0.033	0.254	0.018
PEAK FLOW + INFILTRATION (MGD)	0.064	0.033	0.260	0.018
PEAK FLOW + INFILTRATION (cfs)	0.098	0.052	0.402	0.028

Proposed Sanitary Flow Calculations by Planning Area				
PLANNING AREA	B2	B3	B4	B5
AVERAGE LOADING (MGD)	0.005	0.014	0.012	0.038
INFILTRATION (MGD)	0.001	0.001	0.001	0.004
PEAKING FACTOR USED	4.0	4.0	4.0	4.0
PEAK FLOW (MGD)	0.021	0.054	0.048	0.151
PEAK FLOW + INFILTRATION (MGD)	0.021	0.056	0.049	0.154
PEAK FLOW + INFILTRATION (cfs)	0.033	0.086	0.075	0.239

Proposed Sanitary Flow Calculations by Planning Area				
PLANNING AREA	B6	C1	C2	C3
AVERAGE LOADING (MGD)	0.019	0.066	0.042	0.042
INFILTRATION (MGD)	0.002	0.007	0.004	0.004
PEAKING FACTOR USED	4.0	4.0	4.0	4.0
PEAK FLOW (MGD)	0.075	0.264	0.170	0.170
PEAK FLOW + INFILTRATION (MGD)	0.077	0.270	0.174	0.174
PEAK FLOW + INFILTRATION (cfs)	0.119	0.418	0.269	0.269

Off-Site Sanitary Flows per the 2005 Master Utility Study			
PLANNING AREA (OFF-SITE)	1	2	3
AVERAGE LOADING (MGD)	0.403	0.035	0.047
INFILTRATION (MGD)	0.040	0.004	0.005
PEAKING FACTOR USED	4.0	4.0	4.0
PEAK FLOW (MGD)	1.610	0.140	0.188
PEAK FLOW + INFILTRATION (MGD)	1.650	0.144	0.193
PEAK FLOW + INFILTRATION (cfs)	2.553	0.222	0.298

Hydraulic analysis of the sanitary system for the Aurora Metro Center was performed using Flowmaster. Per the City of Aurora criteria, an analysis was performed on the proposed sanitary sewer system for the peak flow condition. Existing slopes across the site range from 2% to 7%; based on these existing slopes, it is not anticipated that there will be any issues with meeting minimum pipe slopes in the sanitary sewer. Refer to Appendix C for the sanitary hydraulic calculations.

E. Conclusions

This Master Utility Report is generally in conformance with Section 5 of the Water, Sanitary Sewer & Storm Drainage Infrastructure Standards & Specifications by the City of Aurora and the 2005 Master Utility Report. The water and sanitary sewer systems proposed in the Aurora Metro Center are designed to effectively serve the proposed development based on the standards set forth by the City of Aurora.

IV. References

1. Aurora Water, Sanitary & Storm Drainage Infrastructure Standards & Specifications, by Aurora Water, September 2019, by Aurora Water, September 2019.
2. Centrepont Master Sanitary Sewer and Water Report, prepared by Martin/Martin, Inc., COA# 205115, approved June 29, 2005.

APPENDIX A

Demand and Flow Calculations

Aurora Metro Center - Water Demand Calculations				
Single Family Residential Units		Average Day Demand (gpd / person)	Maximum Day Demand Factor	Peak Hour Demand Factor
Occupancy per Unit:	2.77	101	2.8	4.5
Hotel Rooms		Average Day Demand (gpd / room)	Maximum Day Demand Factor	Peak Hour Demand Factor
Occupancy per Room:	+/-1	98	2.8	4.5
Commercial Lots		Average Day Demand (gpd/acre)	Maximum Day Demand Factor (gpd/acre)	Peak Hour Demand (gpd/acre)
Occupancy per Unit:	+/- 22	1,500	4,200	6,750

Planning Area	Junction	Single Family Units	Hotel Rooms	Commercial Planning Area (acres)	Average Day Demand (gpm)	Maximum Day Demand (gpm)	Peak Hour Demand (gpm)
A1	J-7	0	100	1.23	8.09	22.64	36.39
A2	J-2	0	0	5.44	5.67	15.87	25.50
A3	J-2	300	0	4.60	63.08	176.62	283.85
B1	J-5	0	0	2.91	3.03	8.49	13.64
B2	J-5	0	0	3.44	3.58	10.03	16.13
B3	J-5	72	0	0.00	13.99	39.17	62.95
B4	J-5	63	0	0.00	12.24	34.27	55.08
B5	J-6	200	0	0.00	38.86	108.80	174.86
B6	J-6	100	0	0.00	19.43	54.40	87.43
C1	J-3	350	0	0.00	68.00	190.40	306.00
C2	J-10	225	0	0.00	43.71	122.40	196.71
C3	J-10	225	0	0.00	43.71	122.40	196.71
Total =					323.39	905.48	1,455.24

Proposed Sanitary Flow Calculations by Planning Area				
PLANNING AREA	A1	A2	A3	B1
NUMBER OF DWELLINGS UNITS	0	0	300	0
HOTEL ROOMS	100	0	0	0
COMMERCIAL AREA (acres)	1.23	5.44	4.60	2.91
EQUIVALENT NUMBER OF RESIDENTS	127	120	932	64
RESIDENTIAL DEMAND (gpd)	68	68	68	68
AVERAGE LOADING (MGD)	0.016	0.008	0.063	0.004
INFILTRATION (MGD)	0.002	0.001	0.006	0.000
PEAKING FACTOR USED	4.0	4.0	4.0	4.0
PEAK FLOW (MGD)	0.062	0.033	0.254	0.018
PEAK FLOW + INFILTRATION (MGD)	0.064	0.033	0.260	0.018
PEAK FLOW + INFILTRATION (cfs)	0.098	0.052	0.402	0.028
PIPE DIAMETER AT OUTFALL (in.)	8	8	8	12
ALLOWABLE OUTFALL PIPE CAPACITY (%)	75	75	75	75
ALLOWABLE CAPACITY OF EXISTING OUTFALL PIPE (cfs)	0.824	0.824	0.824	2.428
PIPE (%) FULL PER ALLOWABLE CAPACITY	11.9	6.3	48.8	1.2

Proposed Sanitary Flow Calculations by Planning Area				
PLANNING AREA	B2	B3	B4	B5
NUMBER OF DWELLINGS UNITS	0	72	63	200
COMMERCIAL AREA (acres)	3.44	0.00	0.00	0.00
EQUIVALENT NUMBER OF RESIDENTS	76	199	175	554
RESIDENTIAL DEMAND (gpd)	68	68	68	68
AVERAGE LOADING (MGD)	0.005	0.014	0.012	0.038
INFILTRATION (MGD)	0.001	0.001	0.001	0.004
PEAKING FACTOR USED	4.0	4.0	4.0	4.0
PEAK FLOW (MGD)	0.021	0.054	0.048	0.151
PEAK FLOW + INFILTRATION (MGD)	0.021	0.056	0.049	0.154
PEAK FLOW + INFILTRATION (cfs)	0.033	0.086	0.075	0.239
PIPE DIAMETER AT OUTFALL (in.)	12	8	12	8
ALLOWABLE OUTFALL PIPE CAPACITY (%)	75	75	75	75
ALLOWABLE CAPACITY OF EXISTING OUTFALL PIPE (cfs)	2.428	0.824	2.428	0.824
PIPE (%) FULL PER ALLOWABLE CAPACITY	1.4	10.5	3.1	29.0

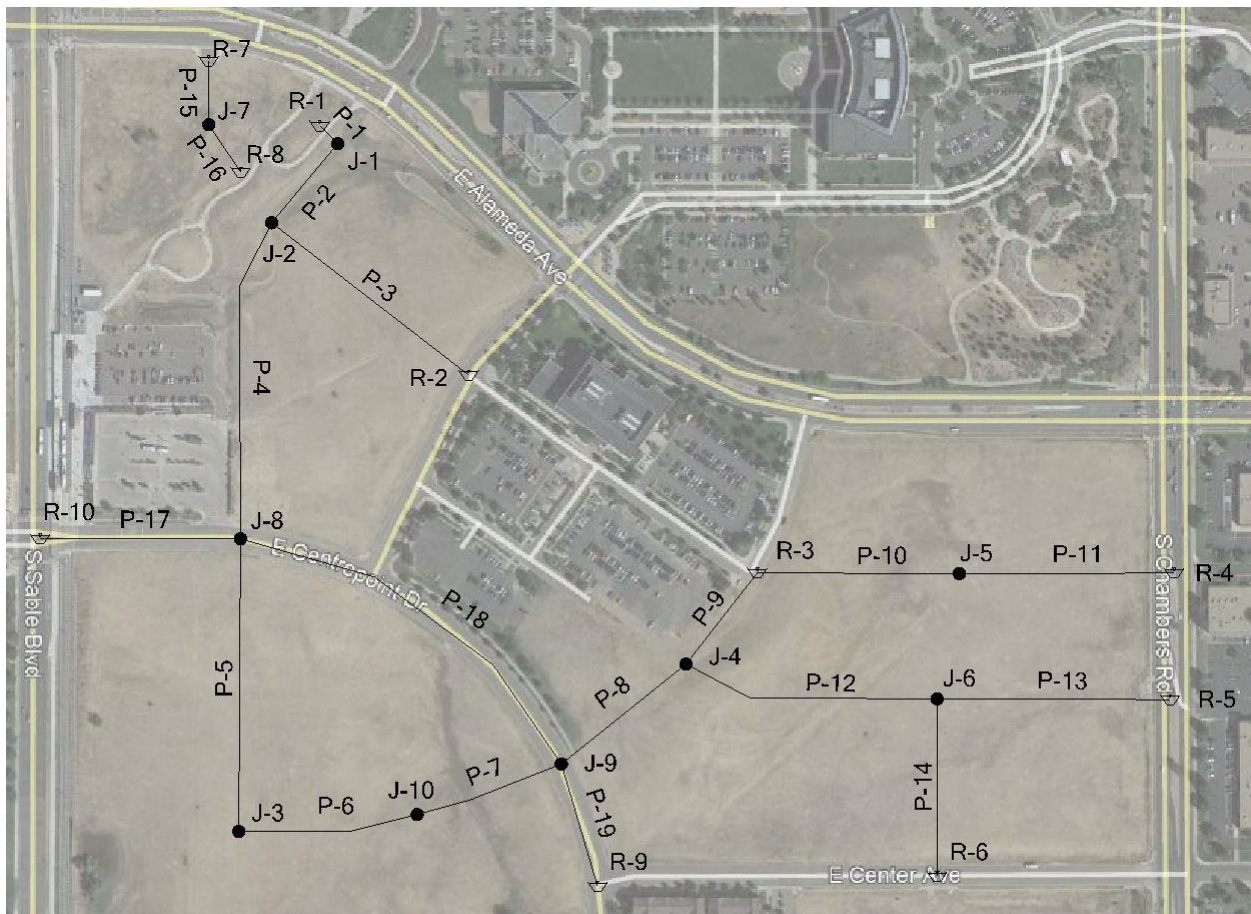
Proposed Sanitary Flow Calculations by Planning Area				
PLANNING AREA	B6	C1	C2	C3
NUMBER OF DWELLINGS UNITS	100	350	225	225
COMMERCIAL AREA (acres)	0.00	0.00	0.00	0.00
EQUIVALENT NUMBER OF RESIDENTS	277	970	624	624
RESIDENTIAL DEMAND (gpd)	68	68	68	68
AVERAGE LOADING (MGD)	0.019	0.066	0.042	0.042
INFILTRATION (MGD)	0.002	0.007	0.004	0.004
PEAKING FACTOR USED	4.0	4.0	4.0	4.0
PEAK FLOW (MGD)	0.075	0.264	0.170	0.170
PEAK FLOW + INFILTRATION (MGD)	0.077	0.270	0.174	0.174
PEAK FLOW + INFILTRATION (cfs)	0.119	0.418	0.269	0.269
PIPE DIAMETER AT OUTFALL (in.)	8	10	12	12
ALLOWABLE OUTFALL PIPE CAPACITY (%)	75	75	75	75
ALLOWABLE CAPACITY OF EXISTING OUTFALL PIPE (cfs)	0.824	1.493	2.428	2.428
PIPE (%) FULL PER ALLOWABLE CAPACITY	14.5	28.0	11.1	11.1

Sanitary Loading Combinations			
Combo	Contributing Basins	Demand (MGD)	Outfall Pipe Diameter
1	C1, OFFSITE-1	1.921	15"
2	A2, A3	0.294	8"
3	A2, A3, C1, OFFSITE-1	2.214	15"
4	A1, A2, A3, C1, OFFSITE-1	2.278	15"
5	C3, OFFSITE-3	0.367	12"
6	C2, C3, OFFSITE-3	0.541	12"
7	C2, C3, OFFSITE-2, OFFSITE-3	0.684	12"
8	25% OF B3, 30% OF B5	0.060	8"
9	70% OF B5, B6	0.185	8"
10	B4, 70% OF B5, B6	0.234	12"
11	75% OF B3, B4, 70% OF B5, B6	0.276	12"
12	B2, 75% OF B3, B4, 70% OF B5, B6	0.297	12"
13	B1, B2, B3, B4, B5, B6	0.376	12"
Design Point 1	TOTAL SANITARY BASIN	3.319	21"

APPENDIX B

Nodal Diagram & Water Hydraulic Computations

Aurora Metro Center Nodal Diagram



Scenario: Base
Current Time Step: 0.000 h
FlexTable: Pipe Table

ID	Label	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Minor Loss Coefficient (Local)	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Length (ft)
43	P-1	R-1	J-1	12.0	PVC	120.0	0.000	0	0.00	0.000	36
75	P-2	J-1	J-2	12.0	PVC	120.0	0.000	0	0.00	0.000	242
77	P-3	R-2	J-2	12.0	PVC	120.0	0.000	0	0.00	0.000	534
105	P-4	J-2	J-8	12.0	PVC	120.0	0.000	0	0.00	0.000	677
137	P-5	J-8	J-3	12.0	PVC	120.0	0.000	0	0.00	0.000	576
135	P-6	J-3	J-10	12.0	PVC	120.0	0.000	0	0.00	0.000	341
136	P-7	J-10	J-9	12.0	PVC	120.0	0.000	0	0.00	0.000	378
109	P-8	J-4	J-9	12.0	PVC	120.0	0.000	0	0.00	0.000	350
63	P-9	J-4	R-3	12.0	PVC	120.0	0.000	0	0.00	0.000	276
86	P-10	R-3	J-5	12.0	PVC	120.0	0.000	0	0.00	0.000	476
87	P-11	J-5	R-4	12.0	PVC	120.0	0.000	0	0.00	0.000	476
69	P-12	J-4	J-6	12.0	PVC	120.0	0.000	0	0.00	0.000	612
70	P-13	J-6	R-5	12.0	PVC	120.0	0.000	0	0.00	0.000	540
72	P-14	J-6	R-6	12.0	PVC	120.0	0.000	0	0.00	0.000	383
100	P-15	R-7	J-7	12.0	PVC	120.0	0.000	0	0.00	0.000	155
101	P-16	J-7	R-8	12.0	PVC	120.0	0.000	0	0.00	0.000	99
128	P-17	R-10	J-8	12.0	PVC	120.0	0.000	0	0.00	0.000	482
111	P-18	J-8	J-9	12.0	PVC	120.0	0.000	0	0.00	0.000	885
112	P-19	J-9	R-9	12.0	PVC	120.0	0.000	0	0.00	0.000	300

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Scenario: Base
Current Time Step: 0.000 h
FlexTable: Junction Table

Label	Elevation (ft)	GIS-IDs	ID	Demand Collection	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	5,453.93	<Collection: 0 items>	42	<Collection: 0 items>	0	5,720.00	115
J-2	5,461.99	<Collection: 0 items>	74	<Collection: 0 items>	0	5,720.00	112
J-3	5,517.90	<Collection: 0 items>	50	<Collection: 0 items>	0	5,720.00	87
J-4	5,500.21	<Collection: 0 items>	60	<Collection: 0 items>	0	5,720.00	95
J-5	5,491.43	<Collection: 0 items>	85	<Collection: 0 items>	0	5,720.00	99
J-6	5,491.50	<Collection: 0 items>	68	<Collection: 0 items>	0	5,720.00	99
J-7	5,460.34	<Collection: 0 items>	99	<Collection: 0 items>	0	5,720.00	112
J-8	5,490.36	<Collection: 0 items>	104	<Collection: 0 items>	0	5,720.00	99
J-9	5,507.36	<Collection: 0 items>	108	<Collection: 0 items>	0	5,720.00	92
J-10	5,512.20	<Collection: 0 items>	134	<Collection: 0 items>	0	5,720.00	90

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Scenario: Base
Current Time Step: 0.000 h
FlexTable: Reservoir Table

ID	Label	Elevation (ft)	Zone	Flow (Out net) (gpm)	Hydraulic Grade (ft)
78	R-1	5,720.00	<None>	0	5,720.00
79	R-2	5,720.00	<None>	0	5,720.00
80	R-3	5,720.00	<None>	0	5,720.00
81	R-4	5,720.00	<None>	0	5,720.00
82	R-5	5,720.00	<None>	0	5,720.00
83	R-6	5,720.00	<None>	0	5,720.00
95	R-7	5,720.00	<None>	0	5,720.00
98	R-8	5,720.00	<None>	0	5,720.00
102	R-10	5,720.00	<None>	0	5,720.00
103	R-9	5,720.00	<None>	0	5,720.00

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Scenario: ADD
Current Time Step: 0.000 h
FlexTable: Pipe Table

ID	Label	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Minor Loss Coefficient (Local)	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Length (ft)
43	P-1	R-1	J-1	12.0	PVC	120.0	0.000	51	0.14	0.000	36
75	P-2	J-1	J-2	12.0	PVC	120.0	0.000	51	0.14	0.000	242
77	P-3	R-2	J-2	12.0	PVC	120.0	0.000	36	0.10	0.000	534
105	P-4	J-2	J-8	12.0	PVC	120.0	0.000	18	0.05	0.000	677
137	P-5	J-8	J-3	12.0	PVC	120.0	0.000	69	0.19	0.000	576
135	P-6	J-3	J-10	12.0	PVC	120.0	0.000	1	0.00	0.000	341
136	P-7	J-10	J-9	12.0	PVC	120.0	0.000	-87	0.25	0.000	378
109	P-8	J-4	J-9	12.0	PVC	120.0	0.000	37	0.11	0.000	350
63	P-9	J-4	R-3	12.0	PVC	120.0	0.000	-38	0.11	0.000	276
86	P-10	R-3	J-5	12.0	PVC	120.0	0.000	16	0.05	0.000	476
87	P-11	J-5	R-4	12.0	PVC	120.0	0.000	-16	0.05	0.000	476
69	P-12	J-4	J-6	12.0	PVC	120.0	0.000	0	0.00	0.000	612
70	P-13	J-6	R-5	12.0	PVC	120.0	0.000	-26	0.07	0.000	540
72	P-14	J-6	R-6	12.0	PVC	120.0	0.000	-32	0.09	0.000	383
100	P-15	R-7	J-7	12.0	PVC	120.0	0.000	4	0.01	0.000	155
101	P-16	J-7	R-8	12.0	PVC	120.0	0.000	-5	0.01	0.000	99
128	P-17	R-10	J-8	12.0	PVC	120.0	0.000	44	0.13	0.000	482
111	P-18	J-8	J-9	12.0	PVC	120.0	0.000	-6	0.02	0.000	885
112	P-19	J-9	R-9	12.0	PVC	120.0	0.000	-56	0.16	0.000	300

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Scenario: ADD
Current Time Step: 0.000 h
FlexTable: Junction Table

Label	Elevation (ft)	GIS-IDs	ID	Demand Collection	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	5,453.93	<Collection: 0 items>	42	<Collection: 0 items>	0	5,720.00	115
J-2	5,461.99	<Collection: 0 items>	74	<Collection: 2 items>	69	5,720.00	112
J-3	5,517.90	<Collection: 0 items>	50	<Collection: 1 item>	68	5,719.98	87
J-4	5,500.21	<Collection: 0 items>	60	<Collection: 0 items>	0	5,720.00	95
J-5	5,491.43	<Collection: 0 items>	85	<Collection: 4 items>	33	5,720.00	99
J-6	5,491.50	<Collection: 0 items>	68	<Collection: 2 items>	58	5,720.00	99
J-7	5,460.34	<Collection: 0 items>	99	<Collection: 1 item>	8	5,720.00	112
J-8	5,490.36	<Collection: 0 items>	104	<Collection: 0 items>	0	5,720.00	99
J-9	5,507.36	<Collection: 0 items>	108	<Collection: 0 items>	0	5,720.00	92
J-10	5,512.20	<Collection: 0 items>	134	<Collection: 2 items>	87	5,719.98	90

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Scenario: ADD
Current Time Step: 0.000 h
FlexTable: Reservoir Table

ID	Label	Elevation (ft)	Zone	Flow (Out net) (gpm)	Hydraulic Grade (ft)
78	R-1	5,720.00	<None>	51	5,720.00
79	R-2	5,720.00	<None>	36	5,720.00
80	R-3	5,720.00	<None>	54	5,720.00
81	R-4	5,720.00	<None>	16	5,720.00
82	R-5	5,720.00	<None>	26	5,720.00
83	R-6	5,720.00	<None>	32	5,720.00
95	R-7	5,720.00	<None>	4	5,720.00
98	R-8	5,720.00	<None>	5	5,720.00
102	R-10	5,720.00	<None>	44	5,720.00
103	R-9	5,720.00	<None>	56	5,720.00

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Scenario: MDD+FF@J-3
Current Time Step: 0.000 h
FlexTable: Pipe Table

ID	Label	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Minor Loss Coefficient (Local)	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Length (ft)
43	P-1	R-1	J-1	12.0	PVC	120.0	0.000	439	1.25	0.001	36
75	P-2	J-1	J-2	12.0	PVC	120.0	0.000	439	1.25	0.001	242
77	P-3	R-2	J-2	12.0	PVC	120.0	0.000	309	0.88	0.000	534
105	P-4	J-2	J-8	12.0	PVC	120.0	0.000	556	1.58	0.001	677
137	P-5	J-8	J-3	12.0	PVC	120.0	0.000	1,486	4.21	0.006	576
135	P-6	J-3	J-10	12.0	PVC	120.0	0.000	-1,205	3.42	0.004	341
136	P-7	J-10	J-9	12.0	PVC	120.0	0.000	-1,449	4.11	0.006	378
109	P-8	J-4	J-9	12.0	PVC	120.0	0.000	707	2.00	0.002	350
63	P-9	J-4	R-3	12.0	PVC	120.0	0.000	-477	1.35	0.001	276
86	P-10	R-3	J-5	12.0	PVC	120.0	0.000	46	0.13	0.000	476
87	P-11	J-5	R-4	12.0	PVC	120.0	0.000	-46	0.13	0.000	476
69	P-12	J-4	J-6	12.0	PVC	120.0	0.000	-229	0.65	0.000	612
70	P-13	J-6	R-5	12.0	PVC	120.0	0.000	-211	0.60	0.000	540
72	P-14	J-6	R-6	12.0	PVC	120.0	0.000	-254	0.72	0.000	383
100	P-15	R-7	J-7	12.0	PVC	120.0	0.000	10	0.03	0.000	155
101	P-16	J-7	R-8	12.0	PVC	120.0	0.000	-13	0.04	0.000	99
128	P-17	R-10	J-8	12.0	PVC	120.0	0.000	758	2.15	0.002	482
111	P-18	J-8	J-9	12.0	PVC	120.0	0.000	-172	0.49	0.000	885
112	P-19	J-9	R-9	12.0	PVC	120.0	0.000	-915	2.60	0.002	300

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Scenario: MDD+FF @J-3
Current Time Step: 0.000 h
FlexTable: Junction Table

Label	Elevation (ft)	GIS-IDs	ID	Demand Collection	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	5,453.93	<Collection: 0 items>	42	<Collection: 0 items>	0	5,719.98	115
J-2	5,461.99	<Collection: 0 items>	74	<Collection: 2 items>	192	5,719.82	112
J-3	5,517.90	<Collection: 0 items>	50	<Collection: 2 items>	2,690	5,715.63	86
J-4	5,500.21	<Collection: 0 items>	60	<Collection: 0 items>	0	5,719.79	95
J-5	5,491.43	<Collection: 0 items>	85	<Collection: 4 items>	92	5,720.00	99
J-6	5,491.50	<Collection: 0 items>	68	<Collection: 2 items>	235	5,719.91	99
J-7	5,460.34	<Collection: 0 items>	99	<Collection: 1 item>	23	5,720.00	112
J-8	5,490.36	<Collection: 0 items>	104	<Collection: 0 items>	0	5,719.15	99
J-9	5,507.36	<Collection: 0 items>	108	<Collection: 0 items>	0	5,719.25	92
J-10	5,512.20	<Collection: 0 items>	134	<Collection: 2 items>	245	5,717.04	89

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Scenario: MDD+FF @J-3
Current Time Step: 0.000 h
FlexTable: Reservoir Table

ID	Label	Elevation (ft)	Zone	Flow (Out net) (gpm)	Hydraulic Grade (ft)
78	R-1	5,720.00	<None>	439	5,720.00
79	R-2	5,720.00	<None>	309	5,720.00
80	R-3	5,720.00	<None>	523	5,720.00
81	R-4	5,720.00	<None>	46	5,720.00
82	R-5	5,720.00	<None>	211	5,720.00
83	R-6	5,720.00	<None>	254	5,720.00
95	R-7	5,720.00	<None>	10	5,720.00
98	R-8	5,720.00	<None>	13	5,720.00
102	R-10	5,720.00	<None>	758	5,720.00
103	R-9	5,720.00	<None>	915	5,720.00

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Scenario: PHD
Current Time Step: 0.000 h
FlexTable: Pipe Table

ID	Label	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Minor Loss Coefficient (Local)	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Length (ft)
43	P-1	R-1	J-1	12.0	PVC	120.0	0.000	229	0.65	0.000	36
75	P-2	J-1	J-2	12.0	PVC	120.0	0.000	229	0.65	0.000	242
77	P-3	R-2	J-2	12.0	PVC	120.0	0.000	161	0.46	0.000	534
105	P-4	J-2	J-8	12.0	PVC	120.0	0.000	80	0.23	0.000	677
137	P-5	J-8	J-3	12.0	PVC	120.0	0.000	308	0.87	0.000	576
135	P-6	J-3	J-10	12.0	PVC	120.0	0.000	2	0.01	0.000	341
136	P-7	J-10	J-9	12.0	PVC	120.0	0.000	-391	1.11	0.001	378
109	P-8	J-4	J-9	12.0	PVC	120.0	0.000	168	0.48	0.000	350
63	P-9	J-4	R-3	12.0	PVC	120.0	0.000	-170	0.48	0.000	276
86	P-10	R-3	J-5	12.0	PVC	120.0	0.000	74	0.21	0.000	476
87	P-11	J-5	R-4	12.0	PVC	120.0	0.000	-74	0.21	0.000	476
69	P-12	J-4	J-6	12.0	PVC	120.0	0.000	2	0.01	0.000	612
70	P-13	J-6	R-5	12.0	PVC	120.0	0.000	-118	0.34	0.000	540
72	P-14	J-6	R-6	12.0	PVC	120.0	0.000	-142	0.40	0.000	383
100	P-15	R-7	J-7	12.0	PVC	120.0	0.000	16	0.05	0.000	155
101	P-16	J-7	R-8	12.0	PVC	120.0	0.000	-20	0.06	0.000	99
128	P-17	R-10	J-8	12.0	PVC	120.0	0.000	200	0.57	0.000	482
111	P-18	J-8	J-9	12.0	PVC	120.0	0.000	-28	0.08	0.000	885
112	P-19	J-9	R-9	12.0	PVC	120.0	0.000	-251	0.71	0.000	300

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Scenario: PHD
Current Time Step: 0.000 h
FlexTable: Junction Table

Label	Elevation (ft)	GIS-IDs	ID	Demand Collection	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	5,453.93	<Collection: 0 items>	42	<Collection: 0 items>	0	5,719.99	115
J-2	5,461.99	<Collection: 0 items>	74	<Collection: 2 items>	309	5,719.95	112
J-3	5,517.90	<Collection: 0 items>	50	<Collection: 1 item>	306	5,719.74	87
J-4	5,500.21	<Collection: 0 items>	60	<Collection: 0 items>	0	5,719.97	95
J-5	5,491.43	<Collection: 0 items>	85	<Collection: 4 items>	148	5,719.99	99
J-6	5,491.50	<Collection: 0 items>	68	<Collection: 2 items>	262	5,719.97	99
J-7	5,460.34	<Collection: 0 items>	99	<Collection: 1 item>	36	5,720.00	112
J-8	5,490.36	<Collection: 0 items>	104	<Collection: 0 items>	0	5,719.93	99
J-9	5,507.36	<Collection: 0 items>	108	<Collection: 0 items>	0	5,719.93	92
J-10	5,512.20	<Collection: 0 items>	134	<Collection: 2 items>	393	5,719.74	90

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Scenario: PHD
Current Time Step: 0.000 h
FlexTable: Reservoir Table

ID	Label	Elevation (ft)	Zone	Flow (Out net) (gpm)	Hydraulic Grade (ft)
78	R-1	5,720.00	<None>	229	5,720.00
79	R-2	5,720.00	<None>	161	5,720.00
80	R-3	5,720.00	<None>	244	5,720.00
81	R-4	5,720.00	<None>	74	5,720.00
82	R-5	5,720.00	<None>	118	5,720.00
83	R-6	5,720.00	<None>	142	5,720.00
95	R-7	5,720.00	<None>	16	5,720.00
98	R-8	5,720.00	<None>	20	5,720.00
102	R-10	5,720.00	<None>	200	5,720.00
103	R-9	5,720.00	<None>	251	5,720.00

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APPENDIX C

Sanitary Hydraulic Computations

Ex. 8" Pipe - Flow Capacity

Project Description	
Friction Method	Manning Formula
Solve For	Discharge
Input Data	
Roughness Coefficient	0.011
Channel Slope	0.400 %
Normal Depth	6.0 in
Diameter	8.0 in
Results	
Discharge	0.532 MGD
Flow Area	0.3 ft ²
Wetted Perimeter	1.4 ft
Hydraulic Radius	2.4 in
Top Width	0.58 ft
Critical Depth	5.2 in
Percent Full	75.0 %
Critical Slope	0.596 %
Velocity	2.93 ft/s
Velocity Head	0.13 ft
Specific Energy	0.63 ft
Froude Number	0.741
Maximum Discharge	0.628 MGD
Discharge Full	0.584 MGD
Slope Full	0.333 %
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	0.0 %
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	6.0 in
Critical Depth	5.2 in
Channel Slope	0.400 %
Critical Slope	0.596 %

Ex. 10" Pipe - Flow Capacity

Project Description	
Friction Method	Manning Formula
Solve For	Discharge
Input Data	
Roughness Coefficient	0.011
Channel Slope	0.400 %
Normal Depth	7.5 in
Diameter	10.0 in
Results	
Discharge	0.965 MGD
Flow Area	0.4 ft ²
Wetted Perimeter	1.7 ft
Hydraulic Radius	3.0 in
Top Width	0.72 ft
Critical Depth	6.6 in
Percent Full	75.0 %
Critical Slope	0.564 %
Velocity	3.40 ft/s
Velocity Head	0.18 ft
Specific Energy	0.80 ft
Froude Number	0.769
Maximum Discharge	1.139 MGD
Discharge Full	1.058 MGD
Slope Full	0.333 %
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	0.0 %
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	7.5 in
Critical Depth	6.6 in
Channel Slope	0.400 %
Critical Slope	0.564 %

Ex. 12" Pipe - Flow Capacity

Project Description	
Friction Method	Manning Formula
Solve For	Discharge
Input Data	
Roughness Coefficient	0.011
Channel Slope	0.400 %
Normal Depth	9.0 in
Diameter	12.0 in
Results	
Discharge	1.569 MGD
Flow Area	0.6 ft ²
Wetted Perimeter	2.1 ft
Hydraulic Radius	3.6 in
Top Width	0.87 ft
Critical Depth	8.0 in
Percent Full	75.0 %
Critical Slope	0.539 %
Velocity	3.84 ft/s
Velocity Head	0.23 ft
Specific Energy	0.98 ft
Froude Number	0.793
Maximum Discharge	1.851 MGD
Discharge Full	1.721 MGD
Slope Full	0.333 %
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	0.0 %
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	9.0 in
Critical Depth	8.0 in
Channel Slope	0.400 %
Critical Slope	0.539 %

Ex. 15" Pipe - Flow Capacity

Project Description	
Friction Method	Manning Formula
Solve For	Discharge
Input Data	
Roughness Coefficient	0.011
Channel Slope	0.400 %
Normal Depth	12.0 in
Diameter	15.0 in
Results	
Discharge	3.050 MGD
Flow Area	1.1 ft ²
Wetted Perimeter	2.8 ft
Hydraulic Radius	4.6 in
Top Width	1.00 ft
Critical Depth	10.6 in
Percent Full	80.0 %
Critical Slope	0.536 %
Velocity	4.48 ft/s
Velocity Head	0.31 ft
Specific Energy	1.31 ft
Froude Number	0.771
Maximum Discharge	3.357 MGD
Discharge Full	3.120 MGD
Slope Full	0.382 %
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	0.0 %
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	12.0 in
Critical Depth	10.6 in
Channel Slope	0.400 %
Critical Slope	0.536 %

Ex. 21" Pipe - Flow Capacity

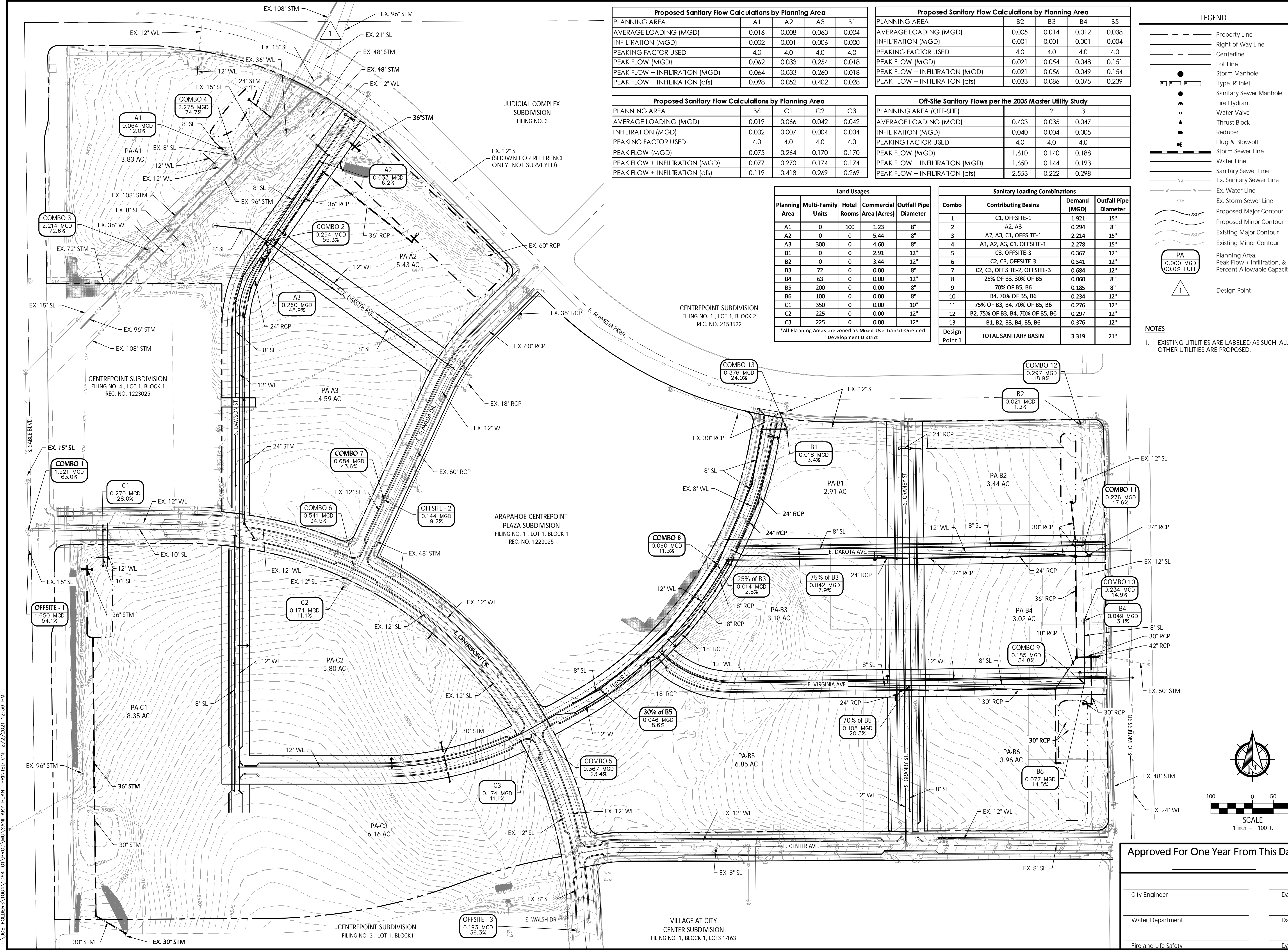
Project Description	
Friction Method	Manning
Solve For	Formula Discharge
Input Data	
Roughness Coefficient	0.011
Channel Slope	0.400 %
Normal Depth	16.8 in
Diameter	21.0 in
Results	
Discharge	7.482 MGD
Flow Area	2.1 ft ²
Wetted Perimeter	3.9 ft
Hydraulic Radius	6.4 in
Top Width	1.40 ft
Critical Depth	15.2 in
Percent Full	80.0 %
Critical Slope	0.499 %
Velocity	5.61 ft/s
Velocity Head	0.49 ft
Specific Energy	1.89 ft
Froude Number	0.815
Maximum Discharge	8.234 MGD
Discharge Full	7.654 MGD
Slope Full	0.382 %
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	42.9 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	16.8 in
Critical Depth	15.2 in
Channel Slope	0.400 %
Critical Slope	0.499 %

APPENDIX D

Utility Maps

Sanitary Routing Map
Water Distribution Map

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Proposed Sanitary Flow Calculations by Planning Area				
PLANNING AREA	A1	A2	A3	B1
AVERAGE LOADING (MGD)	0.016	0.008	0.063	0.004
INFILTRATION (MGD)	0.002	0.001	0.006	0.000
PEAKING FACTOR USED	4.0	4.0	4.0	4.0
PEAK FLOW (MGD)	0.062	0.033	0.254	0.018
PEAK FLOW + INFILTRATION (MGD)	0.064	0.033	0.260	0.018
PEAK FLOW + INFILTRATION (cfs)	0.098	0.052	0.402	0.028

Proposed Sanitary Flow Calculations by Planning Area				
PLANNING AREA	B6	C1	C2	C3
AVERAGE LOADING (MGD)	0.019	0.066	0.042	0.042
INFILTRATION (MGD)	0.002	0.007	0.004	0.004
PEAKING FACTOR USED	4.0	4.0	4.0	4.0
PEAK FLOW (MGD)	0.075	0.264	0.170	0.170
PEAK FLOW + INFILTRATION (MGD)	0.077	0.270	0.174	0.174
PEAK FLOW + INFILTRATION (cfs)	0.119	0.418	0.269	0.269

Proposed Sanitary Flow Calculations by Planning Area				
PLANNING AREA	B2	B3	B4	B5
AVERAGE LOADING (MGD)	0.005	0.014	0.012	0.038
INFILTRATION (MGD)	0.001	0.001	0.001	0.004
PEAKING FACTOR USED	4.0	4.0	4.0	4.0
PEAK FLOW (MGD)	0.021	0.054	0.048	0.151
PEAK FLOW + INFILTRATION (MGD)	0.021	0.056	0.049	0.154
PEAK FLOW + INFILTRATION (cfs)	0.033	0.086	0.075	0.239

Off-Site Sanitary Flows per the 2005 Master Utility Study			
PLANNING AREA (OFF-SITE)	1	2	3
AVERAGE LOADING (MGD)	0.403	0.035	0.047
INFILTRATION (MGD)	0.040	0.004	0.005
PEAKING FACTOR USED	4.0	4.0	4.0
PEAK FLOW (MGD)	1.610	0.140	0.188
PEAK FLOW + INFILTRATION (MGD)	1.650	0.144	0.193
PEAK FLOW + INFILTRATION (cfs)	2.553	0.222	0.298

Land Usages				
Planning Area	Multi-Family Units	Hotel Rooms	Commercial Area (Acres)	Outfall Pipe Diameter
A1	0	100	1.23	8"
A2	0	0	5.44	8"
A3	300	0	4.60	8"
B1	0	0	2.91	12"
B2	0	0	3.44	12"
B3	72	0	0.00	8"
B4	63	0	0.00	12"
B5	200	0	0.00	8"
B6	100	0	0.00	8"
C1	350	0	0.00	10"
C2	225	0	0.00	12"
C3	225	0	0.00	12"

*All Planning Areas are zoned as Mixed-Use Transit-Oriented Development District

Sanitary Loading Combinations			
Combo	Contributing Basins	Demand (MGD)	Outfall Pipe Diameter
1	C1, OFFSITE-1	1.921	15"
2	A2, A3	0.294	8"
3	A2, A3, C1, OFFSITE-1	2.214	15"
4	A1, A2, A3, C1, OFFSITE-1	2.278	15"
5	C3, OFFSITE-3	0.367	12"
6	C2, C3, OFFSITE-3	0.541	12"
7	C2, C3, OFFSITE-2, OFFSITE-3	0.684	12"
8	25% OF B3, 30% OF B5	0.060	8"
9	70% OF B5, B6	0.185	8"
10	B4, 70% OF B5, B6	0.234	12"
11	75% OF B3, B4, 70% OF B5, B6	0.276	12"
12	B2, 75% OF B3, B4, 70% OF B5, B6	0.297	12"
13	B1, B2, B3, B4, B5, B6	0.376	12"
Design Point 1	TOTAL SANITARY BASIN	3.319	21"

LEGEND

- Property Line
- Right of Way Line
- Centerline
- Lot Line
- Storm Manhole
- Type 'R' Inlet
- Sanitary Sewer Manhole
- Fire Hydrant
- Water Valve
- Thrust Block
- Reducer
- Plug & Blow-off
- Storm Sewer Line
- Water Line
- Sanitary Sewer Line
- Ex. Sanitary Sewer Line
- Ex. Water Line
- Ex. Storm Sewer Line
- Proposed Major Contour
- Proposed Minor Contour
- Existing Major Contour
- Existing Minor Contour
- Planning Area, Peak Flow + Infiltration, & Percent Allowable Capacity
- Design Point

NOTES

1. EXISTING UTILITIES ARE LABELED AS SUCH. ALL OTHER UTILITIES ARE PROPOSED.

12071 Tejon Street, Suite 470
Westminster, CO 80234
303.421.4224
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Revision Type:

No.	Rev.	Date:
1		
2		
3		
4		
5		
6		

Proj. Name: Aurora Metro Center
Location: Aurora, Colorado
Plan Set: Master Utility Report
Sheet Name: Sanitary Routing Map

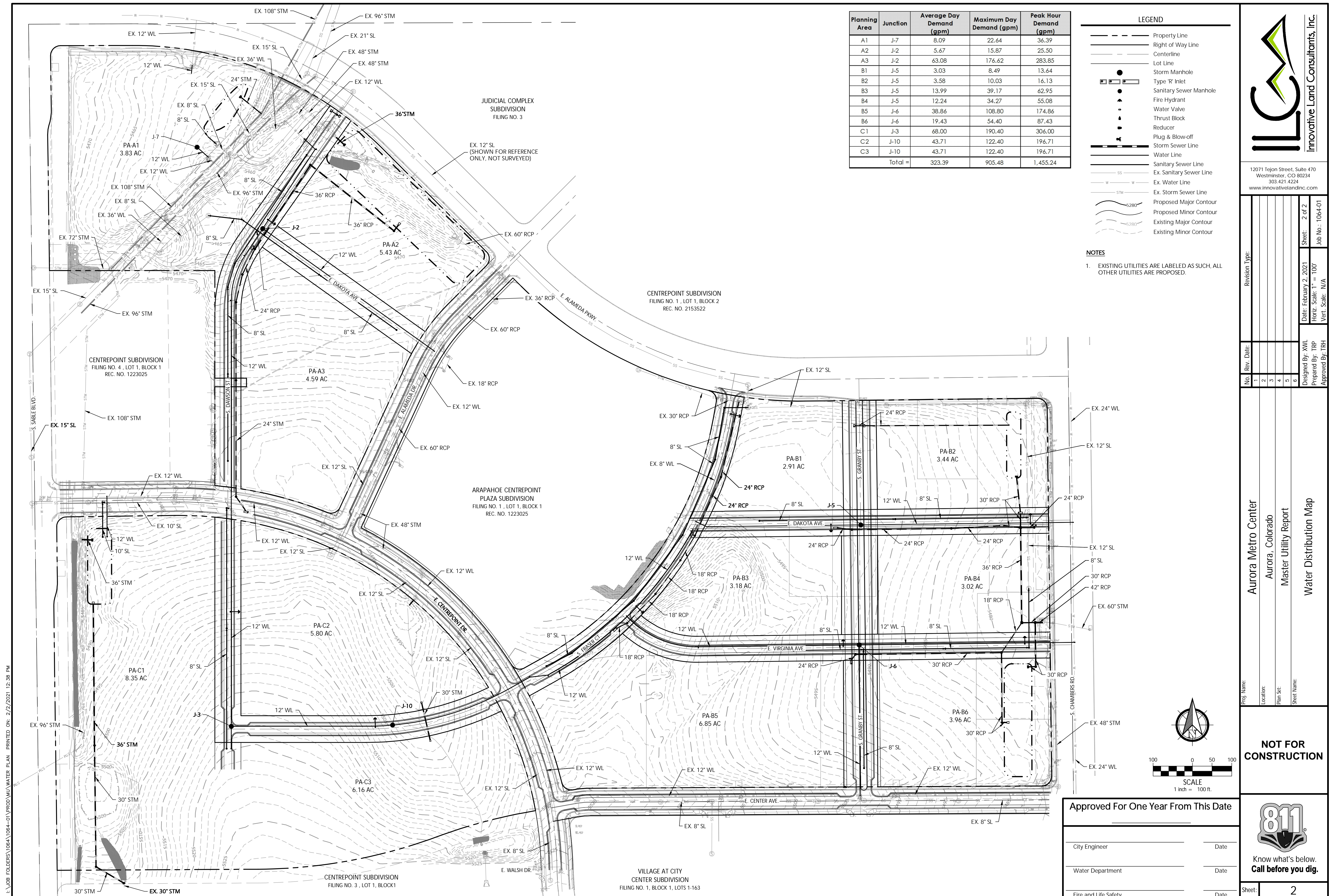
Approved For One Year From This Date

City Engineer	Date
Water Department	Date
Fire and Life Safety	Date

NOT FOR CONSTRUCTION

811 Know what's below. Call before you dig.

Sheet: 1 of 2
Date: February 2, 2021
Prepared By: TRP
Horiz. Scale: 1" = 100'
Job No.: 1064-01
Ver. Scale: N/A
Approved By: TRH



APPENDIX E

References

205115
94

PRINCIPAL-IN-CHARGE: BILL WILLIS, P.E.
PROJECT ENGINEER: PATSY SULLIVAN, P.E.

Centrepoint Development
4.13.05
Master Utility - Sanitary Sewer
TABLE S-1

Parcel	Resturant - Floor Area (SF)	Commercial (Retail) - Floor Area (SF)	Office - Floor Area (SF)	Residential Floor Area (SF)	Known Flows Ave. Day (GPD)	Total (S.F.)	Ave Day GPD ⁽²⁾
1A	101,640	101,640		101,640		304,920	114,655
1B	68,607	68,607	68,607	68,607		274,428	84,253
1C	15,246	15,246	15,246	15,246		60,984	18,723
1D	38,115	38,115	38,115	38,115		152,460	46,807
1E	43,560	43,560		43,560		130,680	49,138
2A	31,944	31,944		31,944		95,832	36,035
2B	200,376	200,376				400,752	210,395
2C		174,240				174,240	8,712
2D	31,944	31,944		31,944		95,832	36,035
4A	204,732	204,732		204,732		614,196	230,949
4B	103,092	103,092		103,092		309,276	116,293
Arap Cnty ⁽⁴⁾			302,400	55,500		357,900	34,572
EX Kaiser			155,400			155,400	46,620
EX Mall		2,173,000				2,173,000	108,650
EX Library					17,500		17,500
EX Offsite					402,500		402,500

Notes:

1. Floor area based on FAR = 1.00 for all parcels and land useage shown on Fig. 1.

2. Per City Criteria:

*Ave Day GPD/S.F. =

$(1 * \text{Resturant}) + (0.05 * \text{Commercial}) + (0.1 * \text{Office}) + ((\text{Residential} / 43560) * (25 \text{ units/AC}) * (1.7 \text{ People/Unit}) * (80 \text{ GPD/Cap})) + (0.3 * \text{Hospital})$

3. Offsite/known flows from City model 3/29/05

4. Arapahoe County parcel includes existing and proposed structures. Existing office building is 162,400 sq ft and proposed office is 140,000 sq ft.

Centrepont Development
4.13.05
Master Utility - Sanitary Sewer
TABLE S-2

Parcel Number	Land Use	Building Area (S.F.)	Ave. Day Flow (GPD)	Max. Peak Flow (GPD) PF=4 ⁽¹⁾	Min. Peak Flow (GPD) PF=1.7 ⁽¹⁾	Infiltration 10% of Ave. (GPD) ⁽¹⁾	Max. Peak + Infiltration (GPD)	Min. Peak + Infiltration (GPD)
1A	Multi-Use	304,920	114,655	458,621	194,914	11,466	470,087	206,380
1B	Multi-Use	274,428	84,253	337,012	143,230	8,425	345,438	151,655
1C	Multi-Use	60,984	18,723	74,892	31,829	1,872	76,764	33,701
1D	Multi-Use	152,460	46,807	187,229	79,572	4,681	191,910	84,253
1E	Multi-Use	130,680	49,138	196,552	83,535	4,914	201,466	88,448
2A	Multi-Use	95,832	36,035	144,138	61,259	3,603	147,742	64,862
2B	Multi-Use	400,752	210,395	841,579	357,671	21,039	862,619	378,711
2C	Retail	174,240	8,712	34,848	14,810	871	35,719	15,682
2D	Multi-Use	95,832	36,035	144,138	61,259	3,603	147,742	64,862
4A	Multi-Use	614,196	230,949	923,794	392,613	23,095	946,889	415,707
4B	Multi-Use	309,276	116,293	465,173	197,699	11,629	476,802	209,328
Arap Cnty ⁽³⁾	Multi-Use	357,900	34,572	138,288	58,772	3,457	141,745	62,230
EX Kaiser	Hospital	155,400	46,620	186,480	79,254	4,662	191,142	83,916
EX Mall	Mall	2,173,000	108,650	434,600	184,705	10,865	445,465	195,570
EX Library	Library	0	17,500	70,000	29,750	1,750	71,750	31,500
EX Offsite	Multi-Use	0	402,500	1,610,000	684,250	40,250	1,650,250	724,500
TOTAL		5,299,900	1,561,836	6,247,345	2,655,122	156,184	6,403,529	2,811,805

Notes:

1. Per City Criteria
2. Offsite flows from City model 3/29/05
3. Arapahoe County parcel includes existing and proposed structures. Existing office building is 162,400 sq ft and proposed office is 140,000 sq ft.

Centrepont Development
4.13.05
Master Utility - Sanitary Sewer
Table S-3

Pipe # Design Point (1)	Existing / Proposed	Diameter (IN)	Slope (%)	Estimated Pipe Capacity (2)			Tributary Peak Flow (GPD) ⁽³⁾	Excess Peak Flow (GPD) 75% Capacity	Excess Peak Flow (GPD) 50% Capacity	Proposed Flow % Capacity
				100% (GPD)	75% (GPD)	50% (GPD)				
1	E	21	0.84	9,405,799	7,054,349	4,702,899	6,403,534	0	1,700,635	68
2	P	18	2.00	9,621,577	7,216,183	4,810,789	5,958,069	0	1,147,280	62
3	P	15	1.50	5,124,210	3,843,157	2,562,105	3,336,556	0	774,451	65
4	P	15	1.50	5,124,210	3,843,157	2,562,105	3,101,512	0	539,407	61
5	E	15	1.50	5,124,210	3,843,157	2,562,105	3,101,512	0	539,407	61
6	E	15	1.46	5,055,426	3,791,569	2,527,713	3,101,512	0	573,799	61
7	E	15	1.46	5,055,426	3,791,569	2,527,713	1,650,250	0	0	33
8	E	15	1.46	5,055,426	3,791,569	2,527,713	1,650,250	0	0	33
9	E	10	1.84	1,924,924	1,443,693	962,462	1,451,262	7,569	488,800	75
10	P	15	0.40	2,646,131	1,984,598	1,323,065	1,105,824	0	0	42
11	P	15	0.40	2,646,131	1,984,598	1,323,065	1,105,824	0	0	42
12	P	12	0.40	1,459,434	1,094,576	729,717	632,379	0	0	43
13	P	12	0.40	1,459,434	1,094,576	729,717	632,379	0	0	43
14	P	10	0.40	897,500	673,125	448,750	473,445	0	24,695	53
15	E	8	4.90	1,732,511	1,299,383	866,255	445,465	0	0	26
16	E	8	1.00	782,669	587,001	391,334	445,465	0	54,131	57
17	P	8	0.40	495,003	371,252	247,502	235,044	0	0	47
18	P	8	0.40	495,003	371,252	247,502	235,044	0	0	47
19	P	15	1.50	5,124,210	3,843,157	2,562,105	3,571,600	0	1,009,495	70
19A	P	18	1.50	8,332,530	6,249,398	4,166,265	4,041,740	0	0	49
20	P	8	0.40	495,003	371,252	247,502	268,674	0	21,172	54
21	P	8	0.40	495,003	371,252	247,502	268,674	0	21,172	54
22	P	8	0.40	495,003	371,252	247,502	268,674	0	21,172	54
23	P	8	0.40	495,003	371,252	247,502	201,466	0	0	41
24	E	12	2.00	3,263,395	2,447,546	1,631,697	1,916,329	0	284,632	59
25	E	12	1.50	2,826,183	2,119,637	1,413,091	1,916,329	0	503,238	68
26	E	12	1.00	2,307,568	1,730,676	1,153,784	1,260,408	0	106,624	55
27	E	12	1.00	2,307,568	1,730,676	1,153,784	1,193,824	0	40,040	52
28	E	12	2.00	3,263,395	2,447,546	1,631,697	1,193,824	0	0	37
29*	E	12	0.30	1,365,020	1,023,765	682,510	1,193,824	170,059	511,314	87
30	E	12	0.30	1,263,907	947,930	631,954	467,030	0	0	37
31	E	12	0.30	1,263,907	947,930	631,954	467,030	0	0	37
32	E	12	0.30	1,263,907	947,930	631,954	467,030	0	0	37
33	E	12	0.30	1,263,907	947,930	631,954	467,030	0	0	37
34	P	8	0.40	495,003	371,252	247,502	17,860	0	0	4
35	P	8	0.40	495,003	371,252	247,502	17,860	0	0	4
36	P	12	0.40	1,459,434	1,094,576	729,717	726,794	0	0	50
37	P	8	0.40	495,003	371,252	247,502	73,871	0	0	15
38	P	8	0.40	495,003	371,252	247,502	73,871	0	0	15
39	E	12	1.82	3,113,080	2,334,810	1,556,540	584,171	0	0	19
40	E	12	3.79	4,492,356	3,369,267	2,246,178	584,171	0	0	13
41	E	12	3.82	4,510,101	3,382,576	2,255,050	584,171	0	0	13
42	P	12	1.80	3,095,928	2,321,946	1,547,964	584,171	0	0	19
43	P	12	0.80	2,063,952	1,547,964	1,031,976	526,771	0	0	26
44	P	12	0.80	2,063,952	1,547,964	1,031,976	526,771	0	0	26
45	P	12	0.80	2,063,952	1,547,964	1,031,976	191,142	0	0	9

Notes:

1. Refer to Drawing SS1 for locations of pipes/design points and input locations for tributary parcel flows.
2. Estimated pipe capacities based on Manning's relationship $n=0.013$ for PVC
3. Tributary Peak Flow includes offsite flow. Refer to Table S-2 and Drawing SS1.

TABLE W-1

Parcel	Area (acres)	FAR	Type	Bldg Area (Sq ft)	Sq ft per Person	Estimated Demand		
						Avg. Day (GPD) ⁽¹⁾	Max Day (GPM) ⁽³⁾	Max Hour (GPM) ⁽⁴⁾
1A	7.0	1.00	Retail	101,640	1200	12,282	21	34
			Restaurant	101,640	250	58,951	102	164
			Residential	101,640	850	17,339	30	48
				304,920		88,571	154	246
1B	6.3	1.00	Office	68,607	1600	6,218	11	17
			Retail	68,607	1200	8,290	14	23
			Restaurant	68,607	250	39,792	69	111
			Residential	68,607	850	11,704	20	33
				274,428		66,003	115	183
1C	1.4	1.00	Mixed Use	60,984	700	12,632	22	35
				60,984		12,632	22	35
1D	3.5	1.00	Office	38,115	1600	3,454	6	10
			Retail	38,115	1200	4,606	8	13
			Restaurant	38,115	250	22,107	38	61
			Residential	38,115	850	6,502	11	18
				152,460		36,668	64	102
1E	3.0	1.00	Retail	43,560	1200	5,264	9	15
			Restaurant	43,560	250	25,265	44	70
			Residential	43,560	850	7,431	13	21
				130,680		37,959	66	105
4A	14.1	1.00	Retail	204,732	1200	24,738	43	69
			Restaurant	204,732	250	118,745	206	330
			Residential	204,732	850	34,925	61	97
				614,196		178,408	310	496
4B	7.1	1.00	Retail	103,092	1200	12,457	22	35
			Restaurant	103,092	250	59,793	104	166
			Residential	103,092	850	17,586	31	49
				309,276		89,837	156	250
2A	2.2	1.00	Retail	31,944	1200	3,860	7	11
			Restaurant	31,944	250	18,528	32	51
			Residential	31,944	850	5,449	9	15
				95,832		27,837	48	77
2B	9.2	1.00	Retail	200,376	1200	24,212	42	67
			Restaurant	200,376	250	116,218	202	323
				400,752		140,430	244	390

Parcel	Area (acres)	FAR	Type	Bldg Area (Sq ft)	Sq ft per Person	Estimated Demand		
						Avg. Day (GPD) ⁽¹⁾	Max Day (GPM) ⁽³⁾	Max Hour (GPM) ⁽⁴⁾
2C			Retail	174,240	1200	21,054	37	58
	4.0	1.00		174,240		21,054	37	58
2D			Retail	31,944	1200	3,860	7	11
			Restaurant	31,944	250	18,528	32	51
			Residential	31,944	850	5,449	9	15
	5.0	1.00		217,800		27,837	48	77
Arap Cty	12.5		Exist (Office)	162,400	1600	14,718	26	41
			Future (Office)	140,000	1600	12,688	22	35
			Residential	55,500	850	9,468	16	26
Other	17.1	1.00 ⁽²⁾	Exist Villages (Resid)	744,876	850	127,067	221	353
	3.6		Exist Kaiser (Office)	155,400	1600	14,083	24	39
	92.4		TOTAL			905,259	1,572	2,515

Notes:

- (1) Average day demand is based on 145 gpcd.
- (2) FAR value for existing Villages development is an assumed value.
- (3) Max day factor = 2.5 x average day.
- (4) Max hour factor = 4.0 x average day.
- (5) Empirical water demand data for Metro Denver area includes:

Building type	gpd/sq ft
Restaurant	0.57
Retail	0.12
Office	0.09
Mixed Use	0.20
Resid	0.17



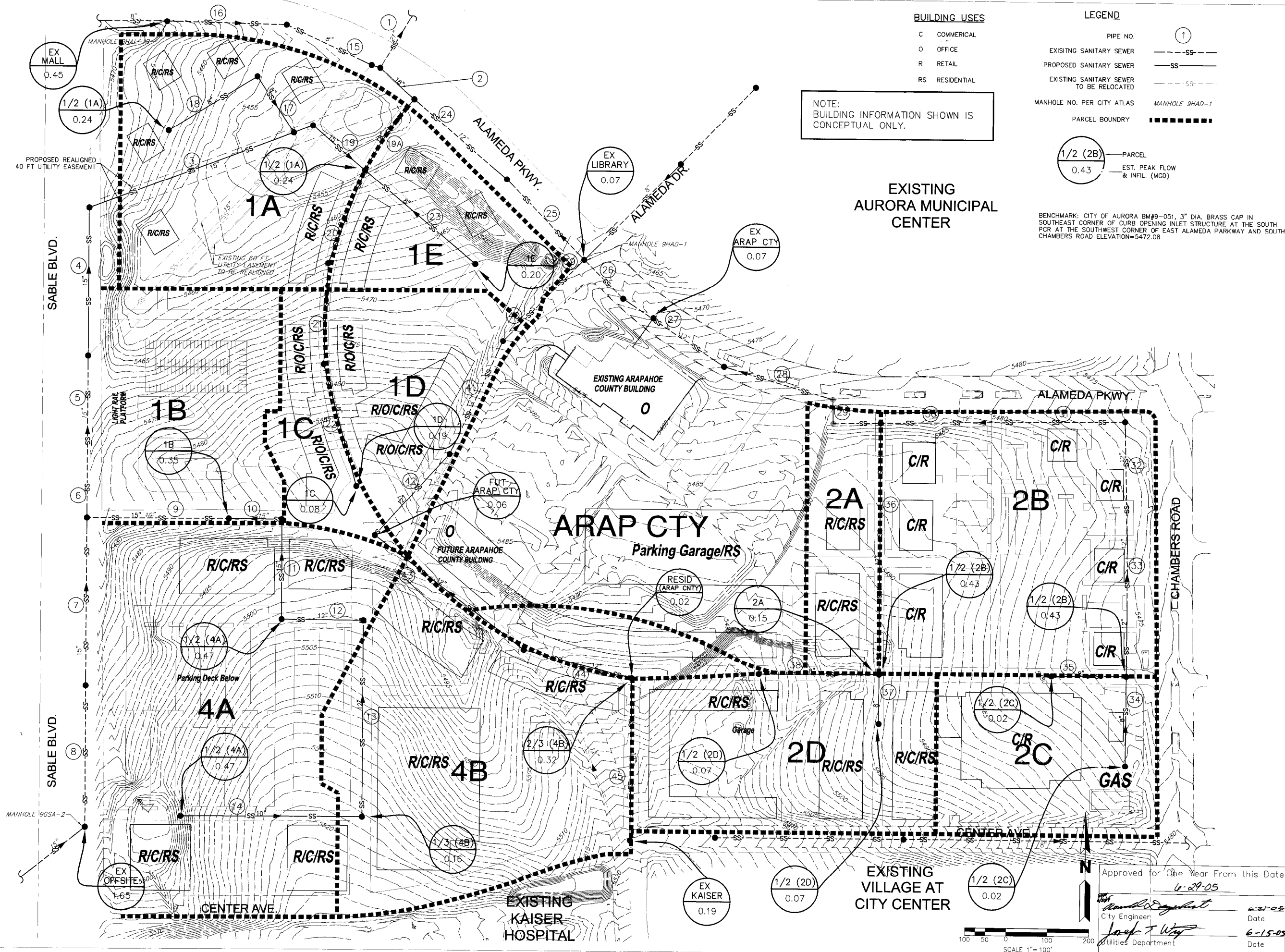
CENTREPOINT

MASTER UTILITY REPORT WATER LAYOUT

FEBRUARY 25, 2005		No.	Description of Revisions	Date	Name
Date:		1	CITY COMMENTS	4/14/05	P.S.
Job Number:	17443.C.01	2	CITY COMMENTS	5/28/05	P.S.
Design By:	B. EVANS				
Drawn By:	K. HARRISON				
Checked By:	B. WILLIS				

Plot view:
PLOT_____

Dwg. Name:
Sanitary.dwg

[illegible]