

Fine Point Business Park
MASTER UTILITY STUDY

Project:

Fine Point Business Park
Aurora, Colorado

Client:

Ambrose Property Group
8888 Keystone Crossing Suite 1150
Indianapolis, IN 46240
Contact: Dan Kmiecik

Prepared By:

Kimley-Horn and Associates, Inc.
6200 S Syracuse Way, Suite 300
Greenwood Village, CO 80111
(303) 974-3625

Prepared: June 16, 2023

APPROVED FOR ONE YEAR FROM THIS DATE	
Water Department	Date
Fire Department	Date

ENGINEER'S CERTIFICATION

This report and plan for the utility design of the Fine Point Business Park was prepared by me (or under my direct supervision) in accordance with the provisions of City of Aurora Water, Sanitary Sewer & Storm Drainage Infrastructure Standards and Specifications and was designed to comply with the provisions thereof.



Bradley Cooney, P.E.
Registered Professional Engineer
State of Colorado No. 54547



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INTRODUCTION

Location

The Site is located a northwest of the intersection of East 56th Avenue and Powhatan Road in Section 08, Township 3 South, Range 65 West of the 6th Principal Meridian, City of Aurora, County of Adams, State of Colorado. The proposed site is bounded by Powhatan Road to the east, the existing Costco site to the north, Jackson Gap Way to the west, the existing Fine Airport Parking site to the northwest, and East 56th Avenue to the south. The 113.5 +/- acre site (109 +/- acre after ROW and channel dedication) is currently sparsely vegetated with native grass, weeds, and brush cover. The parcel is located within the Airport District, Subarea C, Denver International Airport Influence subarea.

Vicinity Map

A vicinity map is provided below for reference:



Proposed Land Use

The proposed Master Plan development (the project) is anticipated to consist of primarily industrial land uses with mixed commercial along Jackson Gap Way. Development of the properties will include the build out of East 58th Avenue, East 56th Avenue, Powhaton Road, and a north-south private drive. The project includes three accesses along Jackson Gap way, three accesses along 56th Avenue, and five accesses along 58th Avenue. The development has been divided into six planning areas, PA-1A, PA-1B, PA-2, PA-3, PA-4, and PA-5. With PA-1A being a regional water quality pond. **Appendix A** summarizes the planning areas for The Project.

The Project will include onsite and offsite water and sanitary sewer infrastructure consisting of water distribution piping and sanitary sewer collection piping. The water and sanitary sewer infrastructure were designed and sized to serve the land uses within each planning area. For the purposes of this analysis, it is assumed the entire site will be developed.

Sanitary Sewer System

Sanitary Sewer Infrastructure

According to the Porteos Master Utility Report revised January 2016 217130, The Fine Point Business Park development (Area OS-1) is included in the sanitary flow calculations of that report. Per that report, there is a sanitary sewer point of connection located at the northeast corner of the Fine Point Property PA-3. PA-3 and the East portion of PA-1B will be tying into this connection on Powhaton Road (tributary to DP 3). The rest of the site, PA-1A, PA-1B West and PA-2 will be draining north to the northern boundary before draining west to an existing sanitary sewer manhole on the east side of Jackson Gap Street (tributary to DP 1). PA-4 and PA-5 will be tying into existing sewer to the southwest of the existing Fine Airport Parking site (tributary to DP 2). PA-1B West and PA-2 will be draining their buildings along a proposed main that runs North around the East side of the existing Fine Airport Parking site, then ties into Jackson Gap Way to the Northwest of the Park Whiz site. After analyzing the pipes for capacity, there is adequate capacity to serve this development based upon our proposed sanitary sewer drainage patterns. The Sewer in Jackson Gap Way will need to be connected to the west into the City of Aurora system in 60th Ave. The development is proposing an 8" connection as that will have adequate capacity to service the site.

Sanitary Sewer Design Criteria

The sanitary sewer system is designed per Section 5.00 Design Criteria and Construction Plans of *Aurora Water 2023 Water, Sewer, and Storm Drainage Infrastructure Standards & Specifications*. The requirements for the sanitary sewer system are as follows:

- Average day unit flow rate for industrial developments is 1,200 GPD/acre. For Commercial, the average day unit flow rate is 1,500 GPD/acre.
- Infiltration and inflow assumed to be 10% of average day flow
- Manning's n for PVC is 0.011
- Minimum pipe velocity is 2 FPS
- Average Day to Peak Flow peaking factor shall range from 1.7 to 4 per the site population. The peaking factor used for this analysis is 4.
- Development is light industrial and is not anticipated to contain industrial strength waste or hazardous waste. Industrial pretreatment will not be required.

Sanitary Sewer Demand and Sizing

The proposed sanitary sewer demand has been calculated based on land use, area, and unit demand per Aurora Water standards, as previously stated. The development has been divided into six planning areas, PA-1A, PA-1B, PA-2, PA-3, PA-4 and PA-5. The flow was determined based on the area of the planning area multiplied by the Aurora City requirements based on site use zoning. For the purpose of this analysis, it was assumed that all planning areas will be developed per the Master Land Use and Utility Plan, see **Appendix A**. See **Table 1** below for a summary of proposed sanitary sewer flow and **Appendix B** for detailed sanitary sewer calculations.

Table 1. Sanitary Sewer Demands Summary

Wastewater System Capacity				
Planning Area	Site Area (Acres)	Average Day Flow (GPD)	Peak Flow (GPD)	Peak Day + Infiltration (GPD)
SEWER SERVICE LINES				
PA-1B East	8.38	10,056	40,224	41,230
PA-1B West	16.52	19,824	79,296	81,278
PA-2	56.77	68,124	272,496	279,308
PA-3	6.24	7,488	29,952	30,701
PA-4	10.84	16,260	65,040	66,666
PA-5	5.40	8,100	32,400	33,210
P-1A (POND)	4.96	N/A	N/A	N/A

The sewer collection piping was sized to convey the peak flow plus infiltration and inflow. The onsite collection piping was conceptually sized at 8". Note that at the junction of DP 3, the existing sanitary sewer infrastructure within Powhaton Road increases to 10". The piping was conceptually designed to understand possible pipe slopes and aid in the sizing process. Sanitary sewer main and building service sizing will be confirmed during detailed design. See **Table 2** below for a summary of the sanitary sewer pipe sizing and **Appendix B** for FlowMaster sizing calculations.

Table 2. Sanitary Sewer Sizing Summary

Planning Area	Peak Day + I&I Flow (GPD)	Channel Slope (%)	Pipe Diameter (in)	Normal Depth (in)	Pipe Velocity (FPS)
SEWER MAINS					
DP 1	635,270	0.6	8"	5.9	3.58
DP 2	99,876	0.5	8"	2.1	2.09
DP 3	986,558	0.5	10"	7	3.76
1. Unit flow is 1,200 GPD/acre per Aurora Water, Sanitary Sewer & Storm Drainage Infrastructure Standards and Specifications.					
2. Infiltration is 10% of average day flow per Aurora Water, Sanitary Sewer & Storm Drainage Infrastructure Standards and Specifications.					
3. Sewer velocity shall not exceed 10 feet/second per Aurora Water, Sanitary Sewer & Storm Drainage Infrastructure Standards and Specifications.					
All snips from Aurora Standards (as of 3/15/2021)					

Water System

Water System Infrastructure

The site is located within Pressure Zone 3 of the existing water system, refer to **Appendix D** for the pressure zone map. The Zone 3 HGL is set at 5,720 FT per conversations with Aurora Water. The Site generally slopes from south to north with the high point being 5,490 FT and the low point being 5,445 FT. The static pressure at the site generally ranges from 107 PSI to 112 PSI. The following sections outline the requirements and methodology used to design the conceptual water system.

Water System Design Criteria

The water system is designed per Section 5.00 Design Criteria and Construction Plans of *Aurora Water 2023 Water, Sewer, and Storm Drainage Infrastructure Standards and Specifications*. The requirements for the water system are as follows:

- Water line material shall be PVC or DIP (C=130 was used for modeling and head loss calculations)
- Average Day unit flow rate for industrial developments is 1,200 GPD/acre
- Average Day unit flow rate for commercial developments is 1,500 GPD/acre
- Water system is designed to meet the Max Hour Demand and Max Day plus Fire Flow
- The peaking factor from Average Day Demand to Max Day Demand is 2.8
- The peaking factor from Average Day Demand to Max Hour Demand is 4.5

- Fire Flow demand and duration for industrial developments is 3,500 GPM for 3 hours
- Fire Flow demand and duration for residential developments is 1,500 GPM for 2 hours
- Fire Flow demand and duration for industrial developments is 2,500 GPM for 2 hours
- Minimum residual pressure during max day plus fire flow is 20 PSI
- Maximum velocity during fire flow is 10 FPS (industry standard)

Water System Demand and Sizing

The Proposed water demand has been calculated based on land use, area, and unit demand per *Aurora Water Standards & Specifications* as outlined above. The development has been divided into 6 planning areas, PA-1A, PA-1B (East and West), PA-2, PA-3, PA-4, and PA-5. The demand calculations were based on the area of the planning area multiplied by the non-residential industrial unit flows per the *Aurora Water 2022 Water, Sewer, and Storm Drainage Infrastructure Standards and Specifications*. Planning area PA-1B is proposed as a detention pond and was not included in the flow calculations. For the purpose of this analysis, it was assumed that all planning areas will be developed per the Master Land Use and Utility Plan, see **Appendix A**. See **Table 3** below for a summary of proposed water demands and **Appendix C** for detailed water demand calculations.

Table 3. Water Demand Summary

Water System Capacity				
Planning Area	Area (Acres)	Average Day Flow (GPD)	Max Day Demand (GPD)	Max Hour Demand (GPD)
PA-1B (East and West)	24.90	29,880	83,664	134,460
PA-2	56.77	68,124	190,747	306,558
PA-3	6.24	7,488	20,966	33,696
PA-4	10.84	16,260	45,528	73,170
PA-5	5.40	8,100	22,680	36,450
P-1A	4.96	N/A	N/A	N/A

Water System Modeling

The Proposed water system was modeled using Bentley WaterCAD Version 8i program to assess the water distribution hydraulics system. The proposed water system is modeled with the assumption of a full build out condition of all planning areas using the Hazen-Williams equation. The water system was evaluated under five scenarios: static, average day, max day, max hour, and max day + fire flow (3,500 GPM fire flow modeled sequentially on each fire flow node).

When building the model, it was important to place demands at locations where pressure or velocities may be lower or higher based on topography. This approach produces the most conservative modeling results. In order to meet velocity requirements during the max day plus fire flow scenario, PA-3 piping will be 8" and all other onsite piping must be 12". Based on modeling results, a PRV will not be required as part of this project. **Appendix C** includes the water model schematic and detailed reports for each modeling scenario. Below is a summary of the maximum and minimum system pressures and maximum velocities for each scenario.

- *Static Condition* – the minimum static pressure is 109 PSI and the maximum is 123 PSI.
- *Average Day Condition* – the minimum system pressure during the average day scenario is 109 PSI and the maximum is 123 PSI. The maximum velocity is 0.28 FPS.
- *Max Day Condition* – the minimum system pressure during the average day scenario is 109 PSI and the maximum is 123 PSI. The maximum velocity is 7.95 FPS.
- *Peak Hour Condition* – the minimum system pressure during the max day scenario is 109 PSI and the maximum is 123 PSI. The maximum velocity is 0.44 FPS.
- *Max Day Plus Fire Flow Condition* – the minimum system pressure during the max day scenario is 107 PSI and the maximum is 122 PSI. The maximum velocity is 0.28 FPS.

CONCLUSIONS

As described in the sections above, the development will consist of +/-109 acres of mixed-use commercial and industrial development. Water service to the project will tie into existing water lines in Jackson Gap Way, E 58th Avenue and Powhaton Road. Sewer service to the site will be completed using an onsite collection system and discharge into existing city systems.

The sanitary sewer system will be composed of onsite collection piping connecting to the existing sewer systems in Powhaton Road and Jackson Gap Way. The onsite system will include 8" sanitary sewer main lines connecting to each building and ultimately as a 8" when connecting into the established city system.

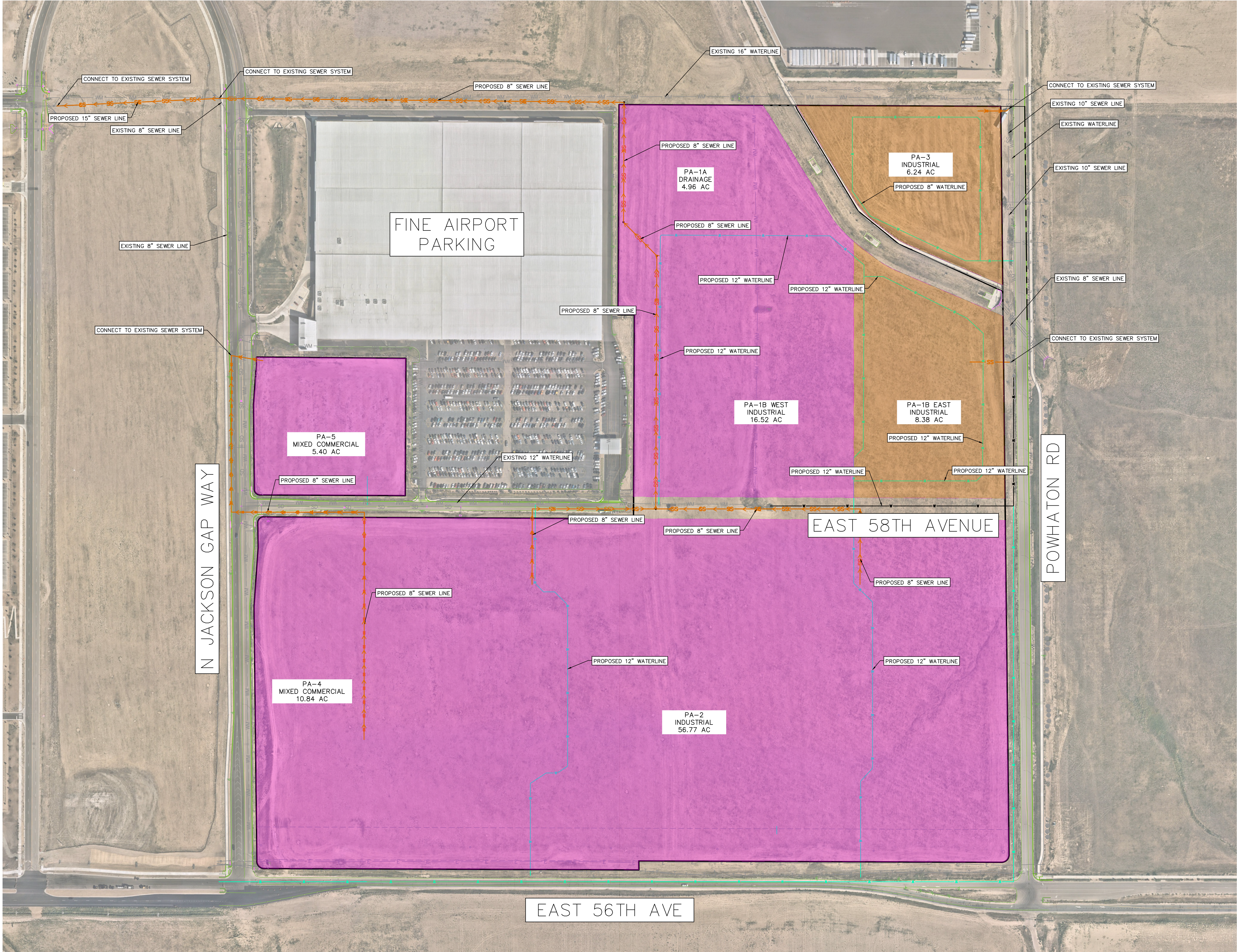
The water system will utilize pressure from Zone 3 and will connect to water lines in N Jackson Gap Way and in Powhaton Road. The onsite water lines will be 8" diameter for PA-3 and 12" diameter for all other onsite piping per conceptual modeling.

REFERENCES

Water, Sanitary Sewer & Storm Drainage Infrastructure Standards and Specifications,
City of Aurora; Revised January 2023.

Appendix A

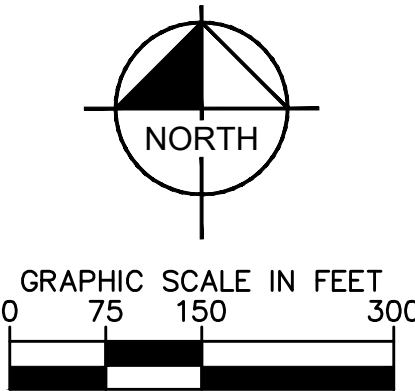
Master Land Use & Utility Plan



PLAN VIEW

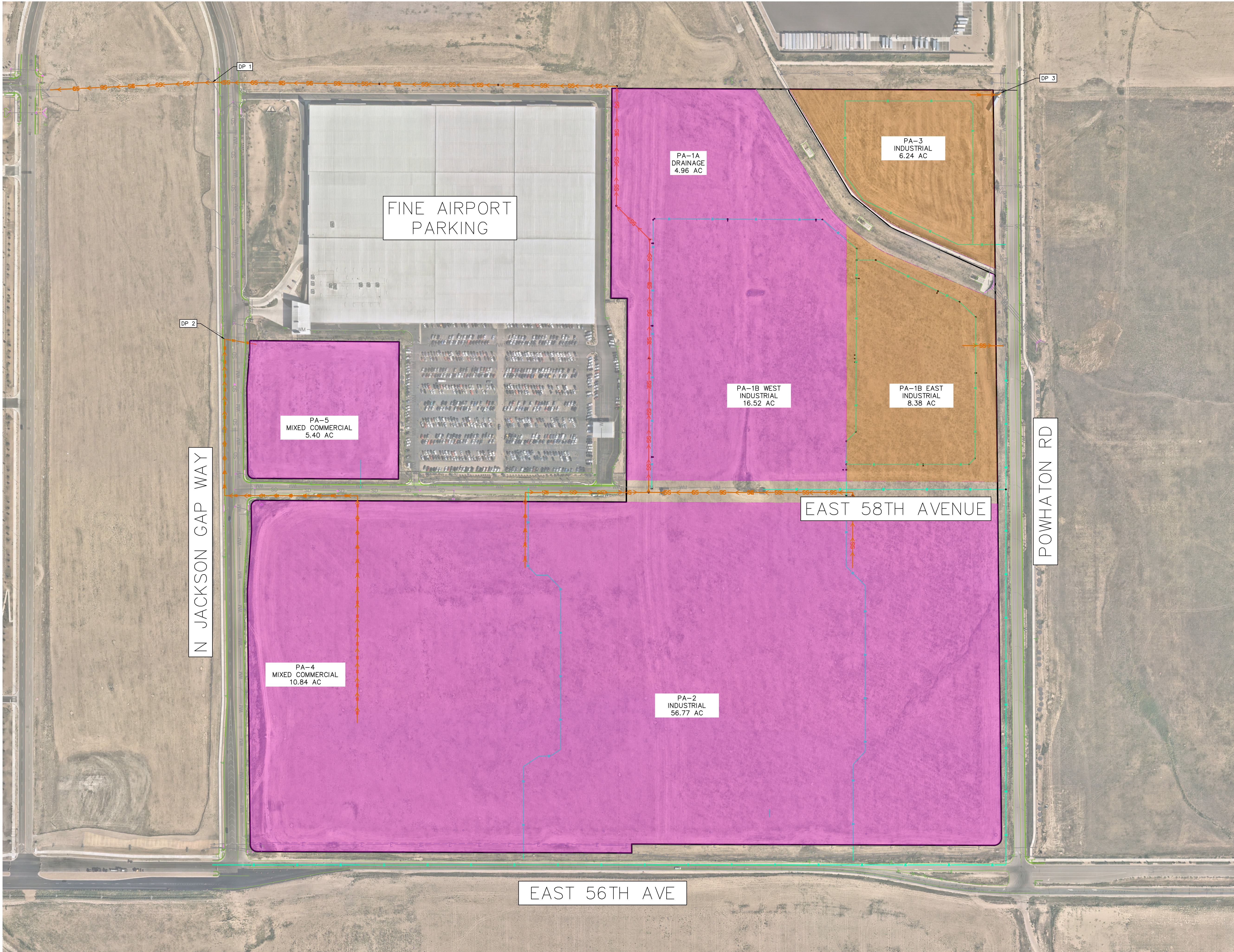
LEGEND

- SSWR DRAINS TO JACKSON GAP WAY
- SSWR DRAINS TO POWHATON ROAD
- PROPOSED WATER LINE
- PROPOSED SEWER LINE



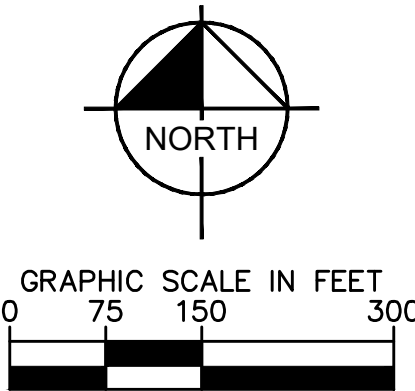
Appendix B

Sanitary Sewer Demands
FlowMaster Reports



LEGEND

	SSWR DRAINS TO JACKSON GAP WAY
	SSWR DRAINS TO POWHATON ROAD
	PROPOSED WATER LINE
	PROPOSED SEWER LINE





Project #: 196617000

Project: Fine Parking Business Park

Location: Aurora, CO

By: SMO

Checked: BJC

Rev. Date: 7/17/2023

Wastewater System Capacity								
Planning Area	Land Use	Site Area (Acres)	Average Unit Flow (GPD/acre)	Average Day Flow (GPD)	Peak Factor	Peak Flow (GPD)	Infiltration (GPD)	Peak Day + Infiltration (GPD)
SEWER SERVICE LINES								
PA-1B East	INDUSTRIAL	8.38	1,200	10,056	4.0	40,224	1,006	41,230
PA-1B West	INDUSTRIAL	16.52	1,200	19,824	4.0	79,296	1,982	81,278
PA-2	INDUSTRIAL	56.77	1,200	68,124	4.0	272,496	6,812	279,308
PA-3	INDUSTRIAL	6.24	1,200	7,488	4.0	29,952	749	30,701
PA-4	MU-COMM	10.84	1,500	16,260	4.0	65,040	1,626	66,666
PA-5	MU-COMM	5.40	1,500	8,100	4.0	32,400	810	33,210
PA-1A	Detention Pond	4.96	N/A	N/A	N/A	N/A	N/A	N/A



Project #: 196617000

Project: Fine Parking Business Park

Location: Aurora, CO

By: SMO

Checked: BJC

Rev. Date: 7/17/2023

SANITARY SEWER ROUTING									
Planning Area	Land Use	Site Area (Acres)	Average Unit Flow (GPD/acre)	Average Day Flow (GPD)	Equivalent Population	Peak Factor	Peak Flow (GPD)	Infiltration (GPD)	Peak Day + Infiltration (GPD)
SEWER SERVICE LINES									
PA-1B West	INDUSTRIAL	16.52	1,200	19,824	297	-	-	-	-
PA-1B East	INDUSTRIAL	8.38	1,200	10,056	151	-	-	-	-
PA-2	INDUSTRIAL	56.77	1,200	68,124	1,022	-	-	-	-
PA-3	INDUSTRIAL	6.24	1,200	7,488	112	-	-	-	-
PA-4	MU-COMM	10.84	1,500	16,260	238	-	-	-	-
PA-5	MU-COMM	5.40	1,500	8,100	119	-	-	-	-
PA-1A	Detention Pond	4.96	N/A	N/A	N/A	-	-	-	-
Porteos PA-12	INDUSTRIAL	185.9	1,200	223,080	3,346	-	-	-	-
FINE POINT PARKING	INDUSTRIAL	35.53	1,200	42,636	640	-	-	-	-

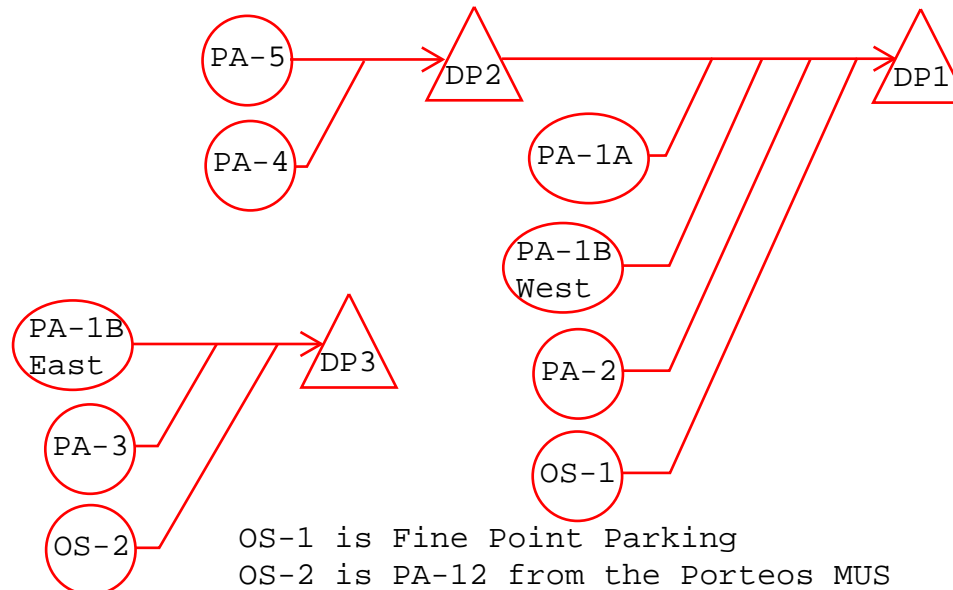
SANITARY SEWER ROUTING									
DP 1	Industrial	130.02	1,200	154,944	1,677	4.0	619,776	15,494	635,270
DP 2	Mixed	16.24	1,200	24,360	357	4.0	97,440	2,436	99,876
DP 3	Industrial	200.52	1,200	240,624	3,459	4.0	962,496	24,062	986,558

1. Unit flow is 1,200 GPD/acre per Aurora Water, Sanitary Sewer & Storm Drainage Infrastructure Standards and Specifications.

2. Infiltration is 10% of average day flow per Aurora Water, Sanitary Sewer & Storm Drainage Infrastructure Standards and Specifications.

3. Sewer velocity shall not exceed 10 feet/second per Aurora Water, Sanitary Sewer & Storm Drainage Infrastructure Standards and Specifications.

4. Equivalent Population is 22 per commercial acre and 18 per industrial acre per Aurora Water, Sanitary Sewer & Storm Drainage Infrastructure Standards and Specifications.



Worksheet for DP 1 - Used Capacity for Proposed E-W Jackson Gap Way - 60th Ave Connector 10" Pipe

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Roughness Coefficient	0.011
Channel Slope	0.006 ft/ft
Diameter	8.0 in
Discharge	441.26 gpm
Results	
Normal Depth	5.9 in
Flow Area	0.3 ft ²
Wetted Perimeter	1.4 ft
Hydraulic Radius	2.4 in
Top Width	0.59 ft
Critical Depth	5.6 in
Percent Full	73.4 %
Critical Slope	0.007 ft/ft
Velocity	3.58 ft/s
Velocity Head	0.20 ft
Specific Energy	0.69 ft
Froude Number	0.925
Maximum Discharge	534.07 gpm
Discharge Full	496.48 gpm
Slope Full	0.005 ft/ft
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	53.6 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	5.9 in
Critical Depth	5.6 in
Channel Slope	0.006 ft/ft
Critical Slope	0.007 ft/ft

Worksheet for DP 2 - Used Capacity for Jackson Gap Way South Tie-In

Project Description	
Friction Method	Manning
Solve For	Formula Normal Depth
Input Data	
Roughness Coefficient	0.011
Channel Slope	0.005 ft/ft
Diameter	8.0 in
Discharge	69.36 gpm
Results	
Normal Depth	2.1 in
Flow Area	0.1 ft ²
Wetted Perimeter	0.7 ft
Hydraulic Radius	1.2 in
Top Width	0.59 ft
Critical Depth	2.2 in
Percent Full	26.4 %
Critical Slope	0.005 ft/ft
Velocity	2.09 ft/s
Velocity Head	0.07 ft
Specific Energy	0.24 ft
Froude Number	1.041
Maximum Discharge	487.53 gpm
Discharge Full	453.22 gpm
Slope Full	0.000 ft/ft
Flow Type	Supercritical
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	26.4 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.1 in
Critical Depth	2.2 in
Channel Slope	0.005 ft/ft
Critical Slope	0.005 ft/ft

Worksheet for DP 3 - Used Capacity For Powhatan Road 10" Tie-In

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.011
Channel Slope	0.014 ft/ft
Diameter	8.0 in
Discharge	685.11 gpm
Results	
Normal Depth	6.0 in
Flow Area	0.3 ft ²
Wetted Perimeter	1.4 ft
Hydraulic Radius	2.4 in
Top Width	0.58 ft
Critical Depth	6.9 in
Percent Full	74.4 %
Critical Slope	0.011 ft/ft
Velocity	5.48 ft/s
Velocity Head	0.47 ft
Specific Energy	0.96 ft
Froude Number	1.396
Maximum Discharge	815.80 gpm
Discharge Full	758.38 gpm
Slope Full	0.011 ft/ft
Flow Type	Supercritical
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	74.4 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	6.0 in
Critical Depth	6.9 in
Channel Slope	0.014 ft/ft
Critical Slope	0.011 ft/ft

Appendix C

Water Demands

WaterCAD Analysis



Project #: 196617000

Project: Fine Parking Business Park

Location: Aurora, CO

By: SMO

Checked: BJC

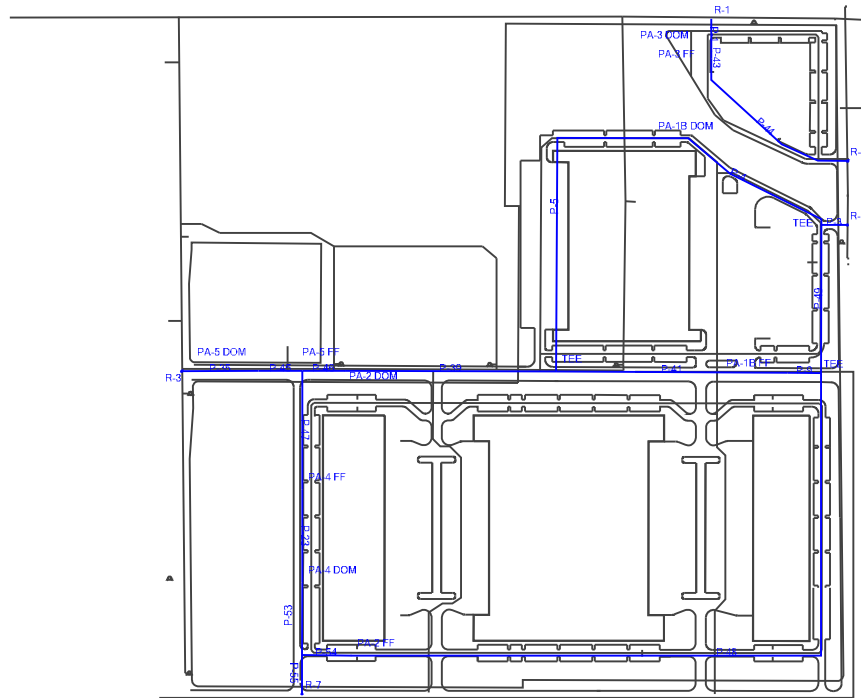
Rev. Date: 6/15/2023

Water System Capacity								
Planning Area	Land Use	Area (Acres)	Average Unit Flow (GPD/acre)	Average Day Flow (GPD)	Max Day Factor	Max Day Demand (GPD)	Max Hour Factor	Max Hour Demand (GPD)
PA-1B	INDUSTRIAL	24.90	1,200	29,880	2.8	83,664	4.5	134,460
PA-2	INDUSTRIAL	56.77	1,200	68,124	2.8	190,747	4.5	306,558
PA-3	INDUSTRIAL	6.24	1,200	7,488	2.8	20,966	4.5	33,696
PA-4	MU-COMM	10.84	1,500	16,260	2.8	45,528	4.5	73,170
PA-5	MU-COMM	5.40	1,500	8,100	2.8	22,680	4.5	36,450
PA-1A	POND	4.96	N/A	N/A	N/A	N/A	N/A	N/A

1. Unit flow is 1,200 GPD/acre per Aurora Water Water, Sanitary Sewer & Storm Drainage Infrastructure Standards and Specifications.

2. Assumed that pipe velocity during max day plus fire flow must be less than 10 ft/s and that velocity guidance per Aurora Standards is based on max day flow only.

Fine Point Overall Layout



Fine Point - Active Scenario: Static
Junction Table - Time: 0.00 hours

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)	Fire Flow (Needed) (gpm)	Velocity (Upper Limit) (ft/s)	Pressure (Residual Lower Limit) (psi)	Flow (Total Available) (gpm)	Velocity of Maximum Pipe (ft/s)
PA-5 DOM	5,447.46	0	5,724.86	120	0	0.00	0	(N/A)	(N/A)
PA-2 DOM	5,450.51	0	5,724.86	119	0	0.00	0	(N/A)	(N/A)
PA-4 DOM	5,469.38	0	5,724.86	111	0	0.00	0	(N/A)	(N/A)
PA-2 FF	5,472.57	0	5,724.86	109	0	0.00	0	(N/A)	(N/A)
TEE	5,454.91	0	5,724.86	117	0	0.00	0	(N/A)	(N/A)
PA-1B FF	5,456.05	0	5,724.86	116	0	0.00	0	(N/A)	(N/A)
TEE	5,456.78	0	5,724.86	116	0	0.00	0	(N/A)	(N/A)
TEE	5,450.65	0	5,724.86	119	0	0.00	0	(N/A)	(N/A)
PA-3 DOM	5,440.37	0	5,724.86	123	0	0.00	0	(N/A)	(N/A)
PA-4 FF	5,467.05	0	5,724.86	112	0	0.00	0	(N/A)	(N/A)
PA-1B DOM	5,446.74	0	5,724.86	120	0	0.00	0	(N/A)	(N/A)
PA-3 FF	5,440.37	0	5,724.86	123	0	0.00	0	(N/A)	(N/A)
PA-5 FF	5,449.14	0	5,724.86	119	0	0.00	0	(N/A)	(N/A)

Fine Point - Active Scenario: Static

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Length (ft)	Flow (Absolute) (gpm)	Velocity (ft/s)	Headloss (ft)
P-1	R-1	PA-3 DOM	12.0	PVC	130.0	125	0	0.00	0.00
P-3	R-6	TEE	12.0	PVC	130.0	101	0	0.00	0.00
P-4	TEE	PA-1B DOM	12.0	PVC	130.0	772	0	0.00	0.00
P-5	PA-1B DOM	TEE	12.0	PVC	130.0	1,274	0	0.00	0.00
P-9	PA-1B FF	TEE	12.0	PVC	130.0	130	0	0.00	0.00
P-23	PA-4 DOM	PA-4 FF	12.0	PVC	130.0	360	0	0.00	0.00
P-35	PA-5 DOM	R-3	12.0	PVC	130.0	298	0	0.00	0.00
P-39	TEE	PA-2 DOM	12.0	PVC	130.0	818	0	0.00	0.00
P-41	TEE	PA-1B FF	12.0	PVC	130.0	899	0	0.00	0.00
P-43	PA-3 DOM	PA-3 FF	12.0	PVC	130.0	27	0	0.00	0.00
P-44	PA-3 FF	R-2	12.0	PVC	130.0	724	0	0.00	0.00
P-45	PA-5 DOM	PA-5 FF	12.0	PVC	130.0	169	0	0.00	0.00
P-46	PA-5 FF	PA-2 DOM	12.0	PVC	130.0	167	0	0.00	0.00
P-47	PA-5 FF	PA-4 FF	12.0	PVC	130.0	461	0	0.00	0.00
P-48	PA-2 FF	TEE	12.0	PVC	130.0	2,919	0	0.00	0.00
P-49	TEE	TEE	12.0	PVC	130.0	573	0	0.00	0.00

Fine Point - Active Scenario: Static

Reservoir Table - Time: 0.00 hours

Label	Elevation (ft)	Flow (Out net) (gpm)	Hydraulic Grade (ft)
R-1	5,724.86	0	5,724.86
R-2	5,724.86	0	5,724.86
R-3	5,724.86	0	5,724.86
R-6	5,724.86	0	5,724.86
R-7	5,724.86	0	5,724.86

Fine Point - Active Scenario: Average Day

Junction Table - Time: 0.00 hours

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)	Fire Flow (Needed) (gpm)	Velocity (Upper Limit) (ft/s)	Pressure (Residual Lower Limit) (psi)	Flow (Total Available) (gpm)	Velocity of Maximum Pipe (ft/s)
PA-5 DOM	5,447.46	6	5,724.86	120	0	0.00	0	(N/A)	(N/A)
PA-2 DOM	5,450.51	47	5,724.86	119	0	0.00	0	(N/A)	(N/A)
PA-4 DOM	5,469.38	11	5,724.86	111	0	0.00	0	(N/A)	(N/A)
PA-2 FF	5,472.57	0	5,724.86	109	0	0.00	0	(N/A)	(N/A)
TEE	5,454.91	0	5,724.86	117	0	0.00	0	(N/A)	(N/A)
PA-1B FF	5,456.05	0	5,724.86	116	0	0.00	0	(N/A)	(N/A)
TEE	5,456.78	0	5,724.86	116	0	0.00	0	(N/A)	(N/A)
TEE	5,450.65	0	5,724.86	119	0	0.00	0	(N/A)	(N/A)
PA-3 DOM	5,440.37	5	5,724.86	123	0	0.00	0	(N/A)	(N/A)
PA-4 FF	5,467.05	0	5,724.86	112	0	0.00	0	(N/A)	(N/A)
PA-1B DOM	5,446.74	21	5,724.86	120	0	0.00	0	(N/A)	(N/A)
PA-3 FF	5,440.37	0	5,724.86	123	0	0.00	0	(N/A)	(N/A)
PA-5 FF	5,449.14	0	5,724.86	119	0	0.00	0	(N/A)	(N/A)

Fine Point - Active Scenario: Average Day

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Length (ft)	Flow (Absolute) (gpm)	Velocity (ft/s)	Headloss (ft)
P-1	R-1	PA-3 DOM	12.0	PVC	130.0	125	4	0.01	0.00
P-3	R-6	TEE	12.0	PVC	130.0	101	28	0.08	0.00
P-4	TEE	PA-1B DOM	12.0	PVC	130.0	772	19	0.05	0.00
P-5	PA-1B DOM	TEE	12.0	PVC	130.0	1,274	2	0.00	0.00
P-9	PA-1B FF	TEE	12.0	PVC	130.0	130	14	0.04	0.00
P-23	PA-4 DOM	PA-4 FF	12.0	PVC	130.0	360	12	0.04	0.00
P-35	PA-5 DOM	R-3	12.0	PVC	130.0	298	28	0.08	0.00
P-39	TEE	PA-2 DOM	12.0	PVC	130.0	818	13	0.04	0.00
P-41	TEE	PA-1B FF	12.0	PVC	130.0	899	14	0.04	0.00
P-43	PA-3 DOM	PA-3 FF	12.0	PVC	130.0	27	2	0.00	0.00
P-44	PA-3 FF	R-2	12.0	PVC	130.0	724	2	0.00	0.00
P-45	PA-5 DOM	PA-5 FF	12.0	PVC	130.0	169	22	0.06	0.00
P-46	PA-5 FF	PA-2 DOM	12.0	PVC	130.0	167	35	0.10	0.00
P-47	PA-5 FF	PA-4 FF	12.0	PVC	130.0	461	12	0.04	0.00
P-48	PA-2 FF	TEE	12.0	PVC	130.0	2,919	5	0.01	0.00
P-49	TEE	TEE	12.0	PVC	130.0	573	9	0.03	0.00

Fine Point - Active Scenario: Average Day

Reservoir Table - Time: 0.00 hours

Label	Elevation (ft)	Flow (Out net) (gpm)	Hydraulic Grade (ft)
R-1	5,724.86	4	5,724.86
R-2	5,724.86	2	5,724.86
R-3	5,724.86	28	5,724.86
R-6	5,724.86	28	5,724.86
R-7	5,724.86	29	5,724.86

Fine Point - Active Scenario: Max Day
Junction Table - Time: 0.00 hours

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)	Fire Flow (Needed) (gpm)	Velocity (Upper Limit) (ft/s)	Pressure (Residual Lower Limit) (psi)	Flow (Total Available) (gpm)	Velocity of Maximum Pipe (ft/s)
PA-5 DOM	5,447.46	16	5,724.85	120	0	0.00	0	(N/A)	(N/A)
PA-2 DOM	5,450.51	132	5,724.84	119	0	0.00	0	(N/A)	(N/A)
PA-4 DOM	5,469.38	32	5,724.85	111	0	0.00	0	(N/A)	(N/A)
PA-2 FF	5,472.57	0	5,724.86	109	0	0.00	0	(N/A)	(N/A)
TEE	5,454.91	0	5,724.85	117	0	0.00	0	(N/A)	(N/A)
PA-1B FF	5,456.05	0	5,724.85	116	0	0.00	0	(N/A)	(N/A)
TEE	5,456.78	0	5,724.85	116	0	0.00	0	(N/A)	(N/A)
TEE	5,450.65	0	5,724.86	119	0	0.00	0	(N/A)	(N/A)
PA-3 DOM	5,440.37	15	5,724.86	123	0	0.00	0	(N/A)	(N/A)
PA-4 FF	5,467.05	0	5,724.85	112	0	0.00	0	(N/A)	(N/A)
PA-1B DOM	5,446.74	58	5,724.85	120	0	0.00	0	(N/A)	(N/A)
PA-3 FF	5,440.37	0	5,724.86	123	0	0.00	0	(N/A)	(N/A)
PA-5 FF	5,449.14	0	5,724.85	119	0	0.00	0	(N/A)	(N/A)

Fine Point - Active Scenario: Max Day

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Length (ft)	Flow (Absolute) (gpm)	Velocity (ft/s)	Headloss (ft)
P-1	R-1	PA-3 DOM	12.0	PVC	130.0	125	10	0.03	0.00
P-3	R-6	TEE	12.0	PVC	130.0	101	78	0.22	0.00
P-4	TEE	PA-1B DOM	12.0	PVC	130.0	772	54	0.15	0.01
P-5	PA-1B DOM	TEE	12.0	PVC	130.0	1,274	5	0.01	0.00
P-9	PA-1B FF	TEE	12.0	PVC	130.0	130	40	0.11	0.00
P-23	PA-4 DOM	PA-4 FF	12.0	PVC	130.0	360	35	0.10	0.00
P-35	PA-5 DOM	R-3	12.0	PVC	130.0	298	78	0.22	0.01
P-39	TEE	PA-2 DOM	12.0	PVC	130.0	818	36	0.10	0.00
P-41	TEE	PA-1B FF	12.0	PVC	130.0	899	40	0.11	0.01
P-43	PA-3 DOM	PA-3 FF	12.0	PVC	130.0	27	4	0.01	0.00
P-44	PA-3 FF	R-2	12.0	PVC	130.0	724	4	0.01	0.00
P-45	PA-5 DOM	PA-5 FF	12.0	PVC	130.0	169	62	0.18	0.00
P-46	PA-5 FF	PA-2 DOM	12.0	PVC	130.0	167	97	0.28	0.01
P-47	PA-5 FF	PA-4 FF	12.0	PVC	130.0	461	35	0.10	0.00
P-48	PA-2 FF	TEE	12.0	PVC	130.0	2,919	15	0.04	0.00
P-49	TEE	TEE	12.0	PVC	130.0	573	25	0.07	0.00

Fine Point - Active Scenario: Max Day

Reservoir Table - Time: 0.00 hours

Label	Elevation (ft)	Flow (Out net) (gpm)	Hydraulic Grade (ft)
R-1	5,724.86	10	5,724.86
R-2	5,724.86	4	5,724.86
R-3	5,724.86	78	5,724.86
R-6	5,724.86	78	5,724.86
R-7	5,724.86	82	5,724.86

Fine Point - Active Scenario: Peak Hour

Junction Table - Time: 0.00 hours

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)	Fire Flow (Needed) (gpm)	Velocity (Upper Limit) (ft/s)	Pressure (Residual Lower Limit) (psi)	Flow (Total Available) (gpm)	Velocity of Maximum Pipe (ft/s)
PA-5 DOM	5,447.46	25	5,724.84	120	0	0.00	0	(N/A)	(N/A)
PA-2 DOM	5,450.51	213	5,724.82	119	0	0.00	0	(N/A)	(N/A)
PA-4 DOM	5,469.38	51	5,724.84	111	0	0.00	0	(N/A)	(N/A)
PA-2 FF	5,472.57	0	5,724.85	109	0	0.00	0	(N/A)	(N/A)
TEE	5,454.91	0	5,724.83	117	0	0.00	0	(N/A)	(N/A)
PA-1B FF	5,456.05	0	5,724.84	116	0	0.00	0	(N/A)	(N/A)
TEE	5,456.78	0	5,724.84	116	0	0.00	0	(N/A)	(N/A)
TEE	5,450.65	0	5,724.85	119	0	0.00	0	(N/A)	(N/A)
PA-3 DOM	5,440.37	23	5,724.86	123	0	0.00	0	(N/A)	(N/A)
PA-4 FF	5,467.05	0	5,724.84	112	0	0.00	0	(N/A)	(N/A)
PA-1B DOM	5,446.74	93	5,724.83	120	0	0.00	0	(N/A)	(N/A)
PA-3 FF	5,440.37	0	5,724.86	123	0	0.00	0	(N/A)	(N/A)
PA-5 FF	5,449.14	0	5,724.83	119	0	0.00	0	(N/A)	(N/A)

Fine Point - Active Scenario: Peak Hour

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Length (ft)	Flow (Absolute) (gpm)	Velocity (ft/s)	Headloss (ft)
P-1	R-1	PA-3 DOM	12.0	PVC	130.0	125	16	0.05	0.00
P-3	R-6	TEE	12.0	PVC	130.0	101	126	0.36	0.01
P-4	TEE	PA-1B DOM	12.0	PVC	130.0	772	86	0.24	0.02
P-5	PA-1B DOM	TEE	12.0	PVC	130.0	1,274	7	0.02	0.00
P-9	PA-1B FF	TEE	12.0	PVC	130.0	130	65	0.18	0.00
P-23	PA-4 DOM	PA-4 FF	12.0	PVC	130.0	360	57	0.16	0.00
P-35	PA-5 DOM	R-3	12.0	PVC	130.0	298	124	0.35	0.02
P-39	TEE	PA-2 DOM	12.0	PVC	130.0	818	57	0.16	0.01
P-41	TEE	PA-1B FF	12.0	PVC	130.0	899	65	0.18	0.01
P-43	PA-3 DOM	PA-3 FF	12.0	PVC	130.0	27	7	0.02	0.00
P-44	PA-3 FF	R-2	12.0	PVC	130.0	724	7	0.02	0.00
P-45	PA-5 DOM	PA-5 FF	12.0	PVC	130.0	169	99	0.28	0.01
P-46	PA-5 FF	PA-2 DOM	12.0	PVC	130.0	167	156	0.44	0.02
P-47	PA-5 FF	PA-4 FF	12.0	PVC	130.0	461	57	0.16	0.01
P-48	PA-2 FF	TEE	12.0	PVC	130.0	2,919	25	0.07	0.01
P-49	TEE	TEE	12.0	PVC	130.0	573	40	0.11	0.00

Fine Point - Active Scenario: Peak Hour

Reservoir Table - Time: 0.00 hours

Label	Elevation (ft)	Flow (Out net) (gpm)	Hydraulic Grade (ft)
R-1	5,724.86	16	5,724.86
R-2	5,724.86	7	5,724.86
R-3	5,724.86	124	5,724.86
R-6	5,724.86	126	5,724.86
R-7	5,724.86	132	5,724.86

Fine Point - Active Scenario: Max Day + Fire Flow
Junction Table - Time: 0.00 hours

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)	Fire Flow (Needed) (gpm)	Velocity (Upper Limit) (ft/s)	Pressure (Residual Lower Limit) (psi)	Flow (Total Available) (gpm)	Velocity of Maximum Pipe (ft/s)
PA-5 DOM	5,447.46	16	5,724.85	120	0	2.50	0	(N/A)	(N/A)
PA-2 DOM	5,450.51	132	5,724.84	119	0	2.00	0	(N/A)	(N/A)
PA-4 DOM	5,469.38	32	5,724.85	111	0	2.50	0	(N/A)	(N/A)
PA-2 FF	5,472.57	0	5,724.86	109	3,500	10.00	20	3,501	8.12
TEE	5,454.91	0	5,724.85	117	0	2.50	0	(N/A)	(N/A)
PA-1B FF	5,456.05	0	5,724.85	116	3,500	10.00	20	3,501	6.10
TEE	5,456.78	0	5,724.85	116	0	2.50	0	(N/A)	(N/A)
TEE	5,450.65	0	5,724.86	119	0	2.50	0	(N/A)	(N/A)
PA-3 DOM	5,440.37	15	5,724.86	123	0	2.50	0	(N/A)	(N/A)
PA-4 FF	5,467.05	0	5,724.85	112	3,500	10.00	20	3,501	5.30
PA-1B DOM	5,446.74	58	5,724.85	120	0	2.50	0	(N/A)	(N/A)
PA-3 FF	5,440.37	0	5,724.86	123	3,500	10.00	20	3,501	6.25
PA-5 FF	5,449.14	0	5,724.85	119	3,500	10.00	20	3,501	4.64

Fine Point - Active Scenario: Max Day + Fire Flow

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Length (ft)	Flow (Absolute) (gpm)	Velocity (ft/s)	Headloss (ft)
P-1	R-1	PA-3 DOM	12.0	PVC	130.0	125	10	0.03	0.00
P-3	R-6	TEE	12.0	PVC	130.0	101	78	0.22	0.00
P-4	TEE	PA-1B DOM	12.0	PVC	130.0	772	54	0.15	0.01
P-5	PA-1B DOM	TEE	12.0	PVC	130.0	1,274	5	0.01	0.00
P-9	PA-1B FF	TEE	12.0	PVC	130.0	130	40	0.11	0.00
P-23	PA-4 DOM	PA-4 FF	12.0	PVC	130.0	360	35	0.10	0.00
P-35	PA-5 DOM	R-3	12.0	PVC	130.0	298	78	0.22	0.01
P-39	TEE	PA-2 DOM	12.0	PVC	130.0	818	36	0.10	0.00
P-41	TEE	PA-1B FF	12.0	PVC	130.0	899	40	0.11	0.01
P-43	PA-3 DOM	PA-3 FF	12.0	PVC	130.0	27	4	0.01	0.00
P-44	PA-3 FF	R-2	12.0	PVC	130.0	724	4	0.01	0.00
P-45	PA-5 DOM	PA-5 FF	12.0	PVC	130.0	169	62	0.18	0.00
P-46	PA-5 FF	PA-2 DOM	12.0	PVC	130.0	167	97	0.28	0.01
P-47	PA-5 FF	PA-4 FF	12.0	PVC	130.0	461	35	0.10	0.00
P-48	PA-2 FF	TEE	12.0	PVC	130.0	2,919	15	0.04	0.00
P-49	TEE	TEE	12.0	PVC	130.0	573	25	0.07	0.00

Fine Point - Active Scenario: Max Day + Fire Flow

Reservoir Table - Time: 0.00 hours

Label	Elevation (ft)	Flow (Out net) (gpm)	Hydraulic Grade (ft)
R-1	5,724.86	10	5,724.86
R-2	5,724.86	4	5,724.86
R-3	5,724.86	78	5,724.86
R-6	5,724.86	78	5,724.86
R-7	5,724.86	82	5,724.86

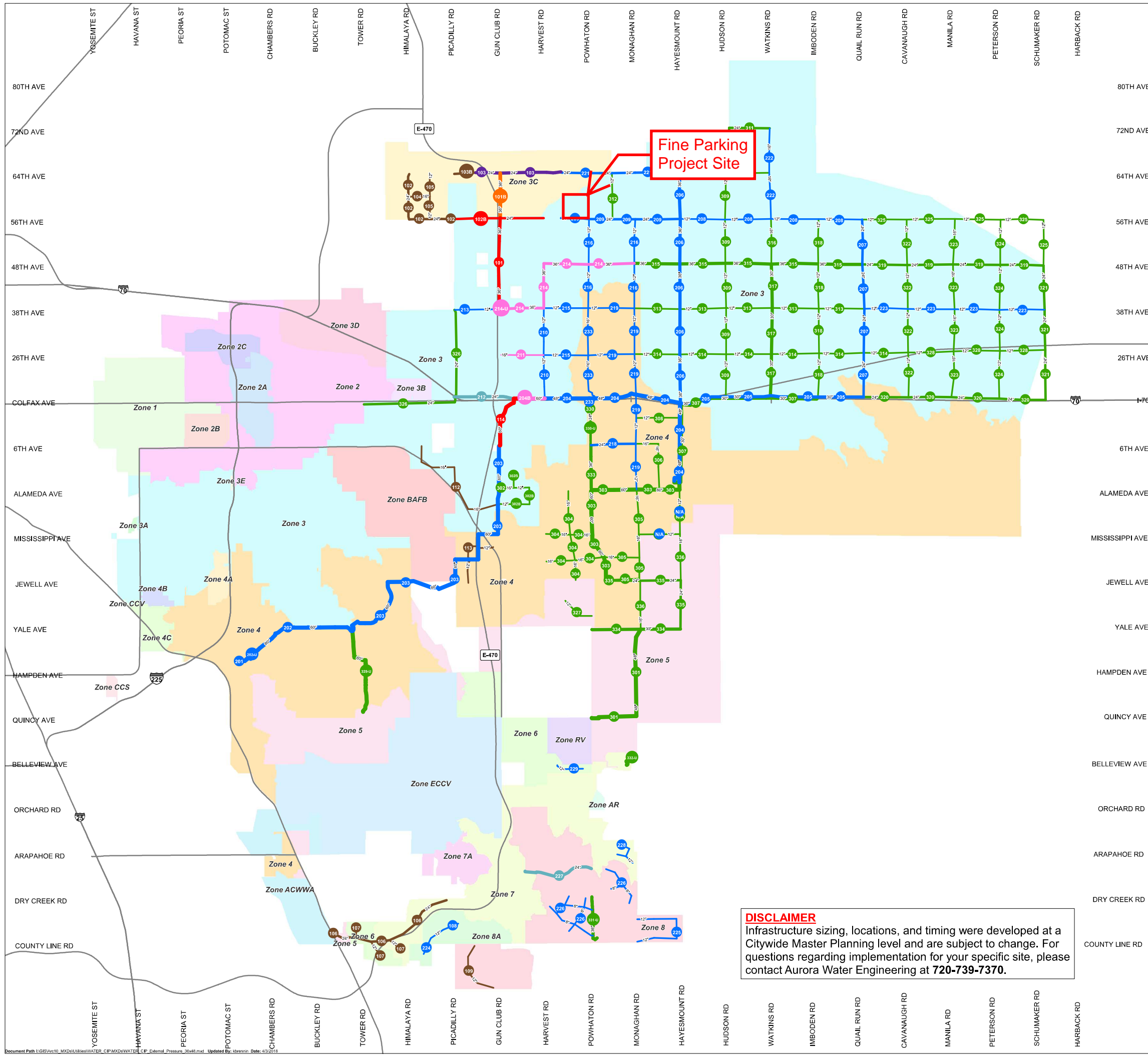
Fine Point - Active Scenario: Max Day + Fire Flow

Fire Flow Results Table - Time: 0.00 hours

Label	Satisfies Fire Flow Constraints ?	Velocity (Upper Limit) (ft/s)	Fire Flow Status	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Velocity of Maximum Pipe (ft/s)	Pipe w/ Maximum Velocity
PA-5 DOM	(N/A)	2.50	(N/A)	0	(N/A)	(N/A)	(N/A)	0	(N/A)	(N/A)	(N/A)
PA-2 DOM	(N/A)	2.00	(N/A)	0	(N/A)	(N/A)	(N/A)	0	(N/A)	(N/A)	(N/A)
PA-4 DOM	(N/A)	2.50	(N/A)	0	(N/A)	(N/A)	(N/A)	0	(N/A)	(N/A)	(N/A)
PA-2 FF	True	10.00	1	3,500	3,501	3,500	3,501	20	107	8.12	P-54
TEE	(N/A)	2.50	(N/A)	0	(N/A)	(N/A)	(N/A)	0	(N/A)	(N/A)	(N/A)
PA-1B FF	True	10.00	1	3,500	3,501	3,500	3,501	20	113	6.10	P-9
TEE	(N/A)	2.50	(N/A)	0	(N/A)	(N/A)	(N/A)	0	(N/A)	(N/A)	(N/A)
TEE	(N/A)	2.50	(N/A)	0	(N/A)	(N/A)	(N/A)	0	(N/A)	(N/A)	(N/A)
PA-3 DOM	(N/A)	2.50	(N/A)	0	(N/A)	(N/A)	(N/A)	0	(N/A)	(N/A)	(N/A)
PA-4 FF	True	10.00	1	3,500	3,501	3,500	3,501	20	109	5.30	P-53
PA-1B DOM	(N/A)	2.50	(N/A)	0	(N/A)	(N/A)	(N/A)	0	(N/A)	(N/A)	(N/A)
PA-3 FF	True	10.00	1	3,500	3,501	3,500	3,501	20	122	6.25	P-1
PA-5 FF	True	10.00	1	3,500	3,501	3,500	3,501	20	118	4.64	P-35

Appendix D

Reference Utility Maps

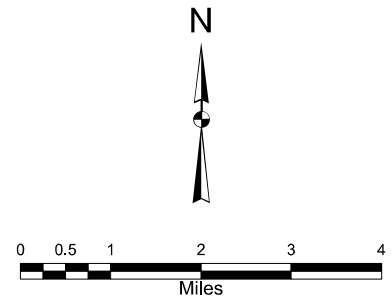


Legend

City Limit

System Improvement Projects by Year

- Year 2018 (Project Number & Diameter)
- Year 2019 (Project Number & Diameter)
- Year 2020 (Project Number & Diameter)
- Year 2021 (Project Number & Diameter)
- Year 2022 (Project Number & Diameter)
- Year 2035 (Project Number & Diameter)
- Build Out (Project Number & Diameter)
- Developer Projects



City of Aurora Aurora Water Capital Improvement Plan

Infrastructure
Improvements

April, 2018

DISCLAIMER
Infrastructure sizing, locations, and timing were developed at a Citywide Master Planning level and are subject to change. For questions regarding implementation for your specific site, please contact Aurora Water Engineering at 720-739-7370.