

**Master Utility Report
For
The Opal Master Plan**

Prepared for:

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

July 2024

Engineer's Certification

I hereby certify that this Master Utility Report for The Opal Master Plan was prepared by me (or under my direct supervision) in accordance with the provisions of the City of Aurora Standard Specifications regarding Water and Sanitary Infrastructure.

Robert D. Hansen, P.E, CFM
State of Colorado No. 50417
For and on Behalf of JR Engineering

Date

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I. GENERAL LOCATION AND DESCRIPTION

A. Location

The Opal Master Plan development, hereby referred to as “the site”, is located at 26464 E. Jewell Ave. The site is bounded to the north by East Jewell Avenue, South Powhatan Mile Road to the east, future filing of Foundry to the south, and Foundry Filing No. 1 to the west. Coal Creek lies northeast of the site, running under East Jewell Avenue. The proposed development is approximately 18 acres.

The site is a parcel of land located in the NE ¼ of Section 29, Township 4 South, Range 65 West of the 6th Principal Meridian within the City of Aurora, Arapahoe County, Colorado.



B. Proposed Development

The site is currently undeveloped, covered with native grass, and sparsely distributed brush. There was previously a farmhouse on the site just west of the jog in the existing S Powhatan Mile Rd. The proposed site will consist of proposed roads, commercial development, multi-family development, lawn areas, open space and tracts with a proposed detention pond.

II. WATER

A. Existing Infrastructure

Domestic water is currently available along the north side of the property. A 36-inch water line is located within the right of way of E. Jewell Avenue. The property lies within City of Aurora pressure Zone 4. The static pressure ranges are shown in the table below.

Zone	Hydraulic Grade Line (ft.)	Site Elevation Range (ft.)	Site Static Pressure Range (psi)
4	5850	5620 - 5646	88 - 100

B. Proposed Infrastructure

The site is proposing to extend a network of 8-inch PVC water mains throughout the site for the development. Only conceptual roads are shown at this time, so only those lines are analyzed in this report. This network will connect to the existing 36-inch steel water main in E. Jewell Ave. See Appendix A for the preliminary water distribution map, which shows the existing and proposed improvements.

No connection to Foundry is proposed to the south since our proposed site is in pressure zone 4 while Foundry is in pressure zone 5.

Individual Pressure Reducing Valves (PRVs) will be need as the static pressure at the site is over 80psi.

C. Design Criteria & Anticipated Demand

The *Water, Sanitary Sewer and Storm Drainage Infrastructure Manual*, City of Aurora, CO, updated May 30, 2024, Section 5.02 was referenced for all design criteria. The proposed water demands are broken down in Appendix B and taken from Section 5.02.3 Domestic Water Demand per Zoning Classification, City of Aurora Standards and Specifications. The scenarios modeled include: maximum day, maximum hour, and maximum day plus fire flow demands.

The average day demands were calculated using 1,500 gpd/acre for commercial areas as well as 1,800 gpd/acre for park areas. Average day demands for multi-family land use were calculated using 101 gpd per person and assuming 2.77 people per unit.

Fire flow demands were based on Use Classifications in Section 5.02.2. Commercial and multi-family areas were calculated at 2,500 gpm. Residual pressures and velocities conform to the requirements within Section 5.02 of the City of Aurora Standards and Specifications. See Appendix B for preliminary water demands and model reporting.

III. SANITARY SEWER

A. Existing Infrastructure

The site has two possible connection points. The first is the 30-inch Senac Interceptor, which crosses through the northeast quadrant of the site and is under construction. The second is the 15-inch sanitary sewer line proposed by Foundry Filing 1 (RSN 1792107) which is currently in the civil construction plan review and approval process.

The Senac Interceptor has enough capacity for the sanitary flow produced by the proposed site.

Pipe capacity calculations are provided to demonstrate the Foundry Filing 1 15-inch sanitary sewer also has adequate capacity.

The final connection point(s) are to be finalized during Site Plan and Construction Document processes.

See Appendix A for the preliminary sanitary map, which shows the existing and proposed improvements as well as the two options for the outfall connections described above.

B. Proposed Infrastructure

The development will be broken up into one (1) basin, Basin A, connecting to the sanitary main (30-inch Senac Interceptor and/or 15-inch line by Foundry.) described above via an 8-inch sanitary sewer main.

Basin A encompasses the entire proposed site, which includes commercial and multi-family and encompasses planning areas 1, 2, 4A, 4B, 4C, 4E, 4F, 4G, and 4H. The park/open space areas have been excluded from the sanitary calculations. All sanitary flows will be routed north and connect to either the 30-inch Senac Interceptor and/or the 15-inch sanitary sewer by Foundry.

No sanitary sewer extension to the Foundry Master Plan is required, sanitary sewer service is planned to go around The Opal Master Plan per the Foundry approved MUS.

C. Design Criteria

The *Water, Sanitary Sewer and Storm Drainage Infrastructure Manual*, City of Aurora, CO, updated May 30, 2024, Section 5.02 was referenced for all design criteria. Preliminary sanitary average and peak demands, design slopes, pipe sizes, and pipe capacities have been provided within Appendix C.

Per Aurora Criteria, a maximum peaking factor of 4 and a minimum of 1.7 were used. The minimum velocity in the pipes is 2 fps and the maximum is 10 fps. Minimum

design slope used was 0.40% and a manning's roughness coefficient of 0.011 was used for PVC pipe. The depth of flow in the 8" pipes was kept below 75% full and 80% full in the pipes larger than 12".

The recommended sewer loading rates from Aurora Criteria Section 5.03.9 were used. For residential (multi-family) zoning, the assumed loading rate is 68 gpcd using an assumed 2.77 people per unit. For commercial zoning, the average day loading rate is 1,500 gpd/acre with an equivalent population per acre of 22.

IV. CONCLUSION

A. Conclusions

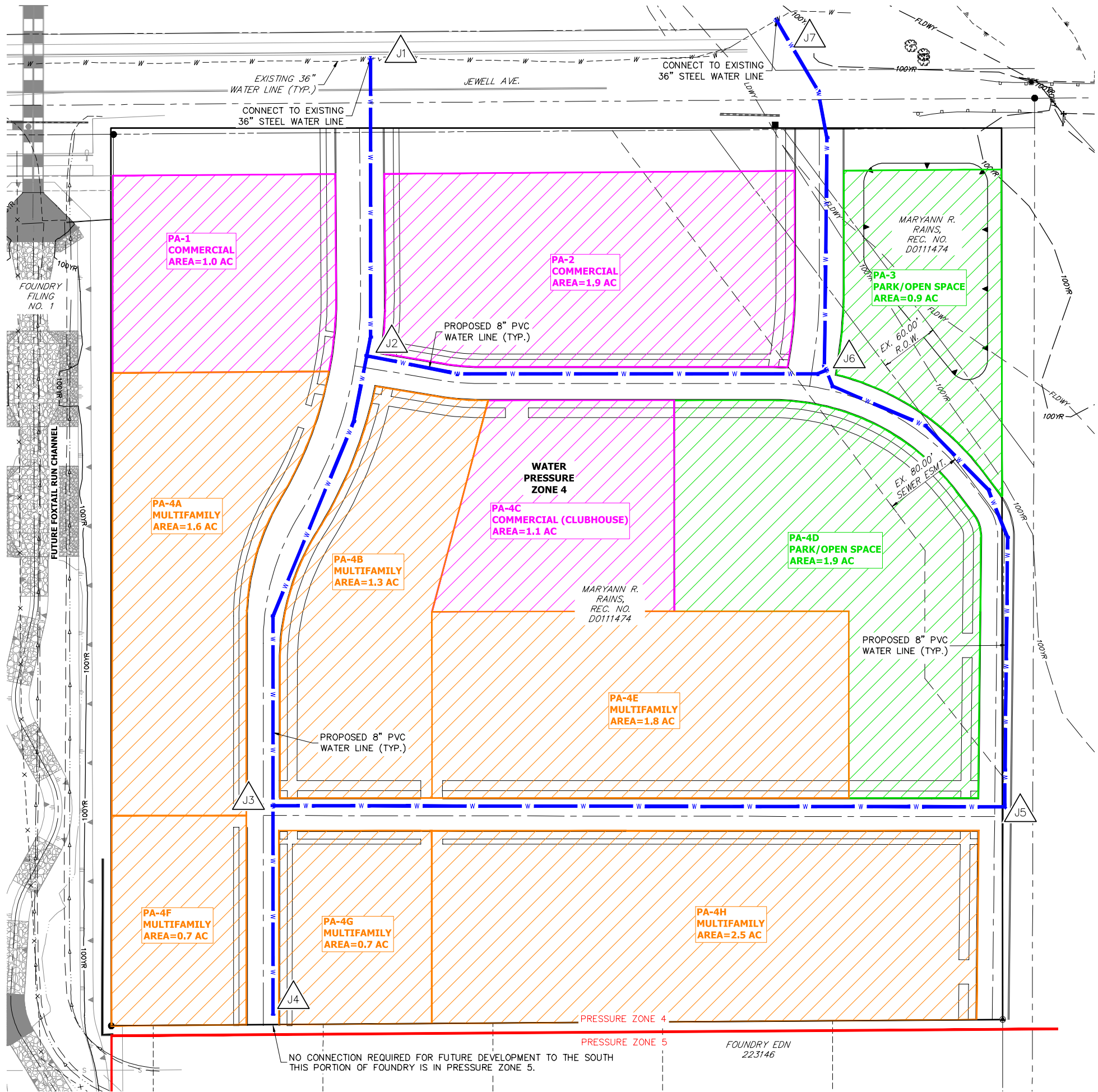
As described above, there will be adequate infrastructure to provide utility services for the The Opal Master Plan development per the City of Aurora criteria.

V. LIST OF REFERENCES

1. *Water, Sanitary Sewer and Storm Drainage Infrastructure Manual*, City of Aurora, updated May 30, 2024.
2. *Foundry Master Utility Report*, by Ware Malcomb, Approved June 13, 2023 (EDN 223146)

APPENDIX A



Water and Sewer Master Plans



NOTES

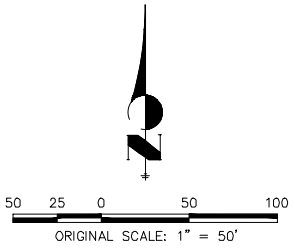
- SANITARY SEWER AND WATER LAYOUTS SHOWN HEREON ARE CONCEPTUAL ONLY. ACTUAL LAYOUTS WILL BE ALIGNED ACCORDING TO THE FINAL LAYOUT OF THE DEVELOPMENT.
- REFER TO MASTER DRAINAGE REPORT FOR STORM SEWER INFORMATION.

LEGEND

EXISTING WATER LINE 
8" PVC WATER LINE 



Know what's below.
Call before you dig.



Approved For One Year From This Date

Water Department Date

THE OPAL MASTER PLAN

MASTER WATER DISTRIBUTION PLAN

SHEET 1 OF 1

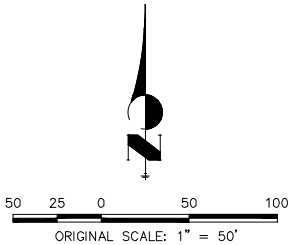
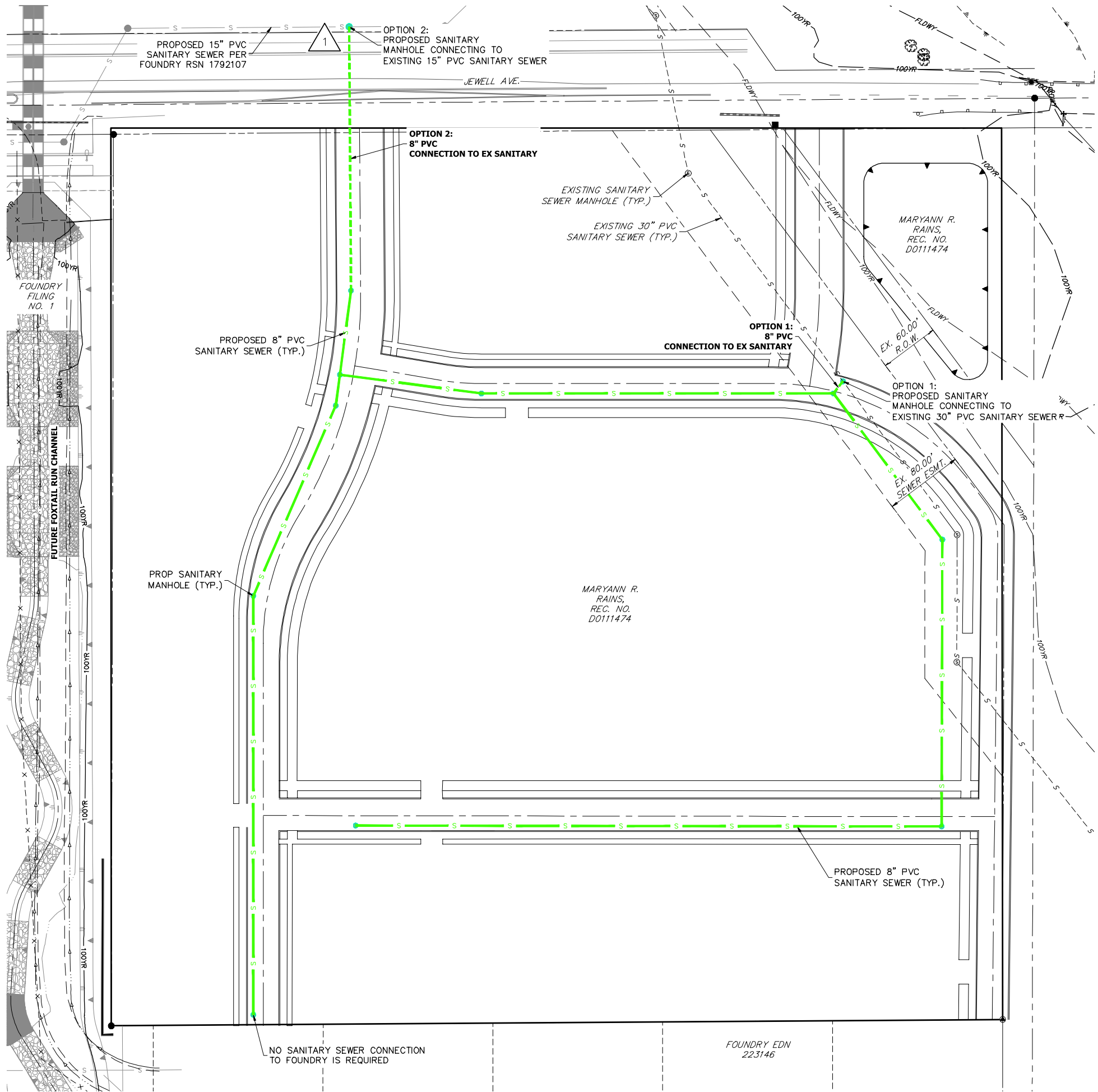
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APPROPRIATE REVIEWING
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ONLY FOR THE PURPOSES
DESIGNATED BY WRITTEN
AUTHORIZATION.



- NOTES**
- SANITARY SEWER AND WATER LAYOUTS SHOWN HEREON ARE CONCEPTUAL ONLY. ACTUAL LAYOUTS WILL BE ALIGNED ACCORDING TO THE FINAL LAYOUT OF THE DEVELOPMENT.
 - REFER TO MASTER DRAINAGE REPORT FOR STORM SEWER INFORMATION.

- LEGEND**
- EXISTING SANITARY SEWER
- 8" PVC SANITARY SEWER

Approved For One Year From This Date

Water Department Date

THE OPAL MASTER PLAN

MASTER SANITARY SEWER PLAN

SHEET 1 OF 1

JOB NO. 16193.00

H-SCALE		V-SCALE		DATE		DESIGNED BY		DRAWN BY		CHECKED BY	
1"=50'		N/A		07/15/24		GAG		AHC			
No.	REVISION										

APPENDIX B

Preliminary Water Demand Calculations

THE OPAL MASTER PLAN
WATER DEMAND CALCULATIONS
PROJ. NO. 16193.00
7/12/2024



AURORA WATER CRITERIA

Domestic Water Demand

Persons/Unit = 2.77 (Residential Units)
Residential Average Day Demand = 101 gpdpp
Commercial Average Day Demand = 1,500 gpd/acre
Parks Average Day Demand = 1,800 gpd/acre

Max Day to Average Day Ratios

Max Daily Demand = 2.8 x Average Day Demand
Max Hourly Demand = 4.5 x Average Day Demand

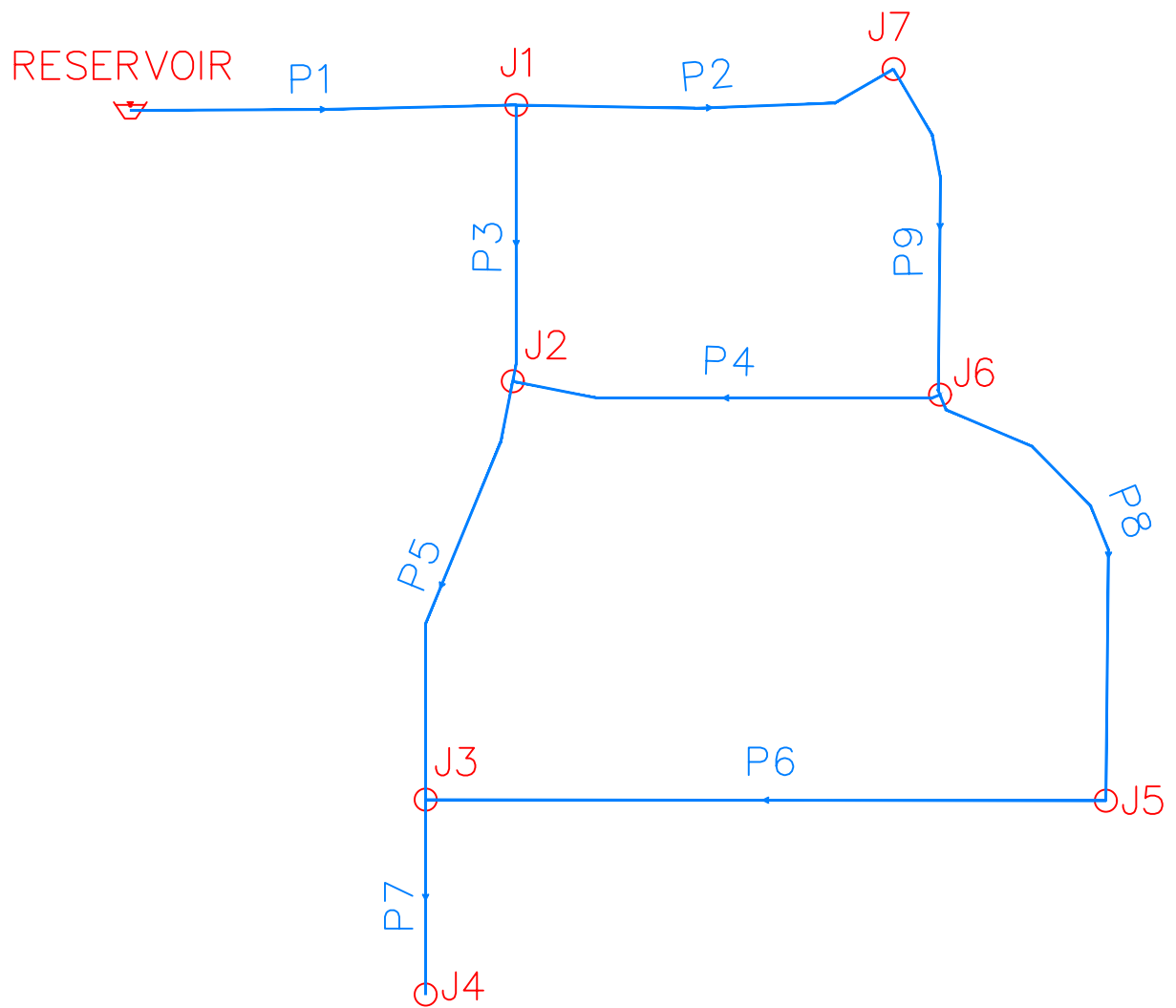
Fire Flow Demands

Commercial /Multifamily Fire Demand = 2,500 gpm

WATER DEMAND CALCULATIONS

PLANNING AREA	WATERCAD NODE	AREA (AC)	ZONING/LAND USE	UNITS	PEOPLE/ UNIT	AVERAGE DAY FACTOR	AVERAGE DAY DEMAND (GPD)	AVERAGE DAY DEMAND (GPM)	MAX DAY FACTOR	MAX DAY DEMAND (GPD)	MAX DAY DEMAND (GPM)	MAX HOUR FACTOR	MAX HOUR DEMAND (GPD)	MAX HOUR DEMAND (GPM)	MAX DAY + FIRE FLOW DEMAND (GPM)
PA-1	J2	1.0	COMMERCIAL	-	-	1,500	1,500.0	1.0	2.8	4,200.0	2.9	4.5	6,750.0	4.7	2,502.9
PA-2	J2	1.9	COMMERCIAL	-	-	1,500	2,850.0	2.0	2.8	7,980.0	5.5	4.5	12,825.0	8.9	2,505.5
PA-3	J6	0.9	PARK/OPEN SPACE	-	-	1,800	1,620.0	1.1	2.8	4,536.0	3.2	4.5	7,290.0	5.1	-
PA-4A	J3	1.6	MULTI-FAMILY	48	2.77	101	13,429.0	9.3	2.8	37,601.1	26.1	4.5	60,430.3	42.0	2,526.1
PA-4B	J3	1.3	MULTI-FAMILY	48	2.77	101	13,429.0	9.3	2.8	37,601.1	26.1	4.5	60,430.3	42.0	2,526.1
PA-4C	J6	1.1	COMMERCIAL (CLUBHOUSE)	-	-	1,500	1,650.0	1.1	2.8	4,620.0	3.2	4.5	7,425.0	5.2	2,503.2
PA-4D	J6	1.9	PARK/OPEN SPACE	-	-	1,800	3,420.0	2.4	2.8	9,576.0	6.7	4.5	15,390.0	10.7	-
PA-4E	J5	1.8	MULTI-FAMILY	48	2.77	101	13,429.0	9.3	2.8	37,601.1	26.1	4.5	60,430.3	42.0	2,526.1
PA-4F	J4	0.7	MULTI-FAMILY	24	2.77	101	6,714.5	4.7	2.8	18,800.5	13.1	4.5	30,215.2	21.0	2,513.1
PA-4G	J4	0.7	MULTI-FAMILY	24	2.77	101	6,714.5	4.7	2.8	18,800.5	13.1	4.5	30,215.2	21.0	2,513.1
PA-4H	J5	2.5	MULTI-FAMILY	72	2.77	101	20,143.4	14.0	2.8	56,401.6	39.2	4.5	90,645.5	62.9	2,539.2
TOTALS		15.4	-	264	-	-	84,899.3	59.0	-	237,718.0	165.1	-	382,046.8	265.3	-
WATERCAD NODE TOTAL DEMANDS	J2	2.9	COMMERCIAL	-	-	3,000	4,350.0	3.02	5.6	12,180.0	8.5	9.0	19,575.0	13.6	2,508.5
	J3	2.9	MULTI-FAMILY	96	5.54	202	26,857.9	18.7	5.6	75,202.2	52.2	9.0	120,860.6	83.9	2,552.2
	J4	1.4	MULTI-FAMILY	48	5.54	202	13,429.0	9.33	5.6	37,601.1	26.1	9.0	60,430.3	42.0	2,526.1
	J5	4.3	MULTI-FAMILY	120	5.54	202	33,572.4	23.3	5.6	94,002.7	65.3	9.0	151,075.8	104.9	2,565.3
	J6	3.9	PARK/OPEN SPACE & COMMERCIAL (CLUBHOUSE)	-	-	5,100	6,690.0	4.6	8.4	18,732.0	13.0	13.5	30,105.0	20.9	2,513.0

Note: The cells highlighted grey represent all of the possible worst-case-scenarios during a fire. Applying the fire flow of 2,500 gpm at node J4 results in the lowest overall pressures throughout the site



ORIGINAL SCALE: 1" = 200'

WATERCAD SCHEMATIC
THE OPAL MASTER PLAN
JOB NO. 16193.00
7/12/2024
SHEET 1 OF 1



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Scenario: Max Day
Current Time Step: 0.000 h
FlexTable: Junction Table

Label	Elevation (ft)	Zone	Demand Collection	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J1	5,626.00	Zone - 4	<Collection: 0 items>	0	5,850.00	97
J2	5,631.00	Zone - 4	<Collection: 1 item>	9	5,849.95	95
J3	5,643.00	Zone - 4	<Collection: 1 item>	52	5,849.90	90
J4	5,645.00	Zone - 4	<Collection: 1 item>	26	5,849.90	89
J5	5,626.00	Zone - 4	<Collection: 1 item>	65	5,849.90	97
J6	5,625.00	Zone - 4	<Collection: 1 item>	13	5,849.95	97
J7	5,619.00	Zone - 4	<Collection: 0 items>	0	5,850.00	100

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Scenario: Max Day
Current Time Step: 0.000 h
FlexTable: Pipe Table

Label	Length (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen- Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	Headloss Gradient (ft/ft)
P1	421	RESERVOIR	J1	36.0	Ductile Iron	130.0	165	0.05	0.00	0.000
P2	421	J1	J7	36.0	Ductile Iron	130.0	78	0.02	0.00	0.000
P3	302	J1	J2	8.0	PVC	150.0	87	0.55	0.05	0.000
P4	468	J2	J6	8.0	PVC	150.0	4	0.03	0.00	0.000
P5	474	J2	J3	8.0	PVC	150.0	74	0.47	0.05	0.000
P6	742	J3	J5	8.0	PVC	150.0	-4	0.02	0.00	0.000
P7	213	J3	J4	8.0	PVC	150.0	26	0.17	0.00	0.000
P8	536	J5	J6	8.0	PVC	150.0	-69	0.44	0.05	0.000
P9	368	J6	J7	8.0	PVC	150.0	-78	0.50	0.05	0.000

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Scenario: Max Day
Current Time Step: 0.000 h
FlexTable: Reservoir Table

ID	Label	Elevation (ft)	Zone	Flow (Out net) (gpm)	Hydraulic Grade (ft)
55	RESERVOIR	5,850.00	Zone - 4	165	5,850.00

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Scenario: Max Hour
Current Time Step: 0.000 h
FlexTable: Junction Table

Label	Elevation (ft)	Zone	Demand Collection	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J1	5,626.00	Zone - 4	<Collection: 0 items>	0	5,850.00	97
J2	5,631.00	Zone - 4	<Collection: 1 item>	14	5,849.89	95
J3	5,643.00	Zone - 4	<Collection: 1 item>	84	5,849.76	89
J4	5,645.00	Zone - 4	<Collection: 1 item>	42	5,849.75	89
J5	5,626.00	Zone - 4	<Collection: 1 item>	105	5,849.76	97
J6	5,625.00	Zone - 4	<Collection: 1 item>	21	5,849.89	97
J7	5,619.00	Zone - 4	<Collection: 0 items>	0	5,850.00	100

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Scenario: Max Hour
Current Time Step: 0.000 h
FlexTable: Pipe Table

Label	Length (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen- Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	Headloss Gradient (ft/ft)
P1	421	RESERVOIR	J1	36.0	Ductile Iron	130.0	265	0.08	0.00	0.000
P2	421	J1	J7	36.0	Ductile Iron	130.0	126	0.04	0.00	0.000
P3	302	J1	J2	8.0	PVC	150.0	140	0.89	0.11	0.000
P4	468	J2	J6	8.0	PVC	150.0	6	0.04	0.00	0.000
P5	474	J2	J3	8.0	PVC	150.0	120	0.76	0.13	0.000
P6	742	J3	J5	8.0	PVC	150.0	-6	0.04	0.00	0.000
P7	213	J3	J4	8.0	PVC	150.0	42	0.27	0.01	0.000
P8	536	J5	J6	8.0	PVC	150.0	-111	0.71	0.13	0.000
P9	368	J6	J7	8.0	PVC	150.0	-126	0.80	0.11	0.000

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Scenario: Max Hour
Current Time Step: 0.000 h
FlexTable: Reservoir Table

ID	Label	Elevation (ft)	Zone	Flow (Out net) (gpm)	Hydraulic Grade (ft)
55	RESERVOIR	5,850.00	Zone - 4	265	5,850.00

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Scenario: Max Day + Fire Flow
Current Time Step: 0.000 h
FlexTable: Junction Table

Label	Elevation (ft)	Zone	Demand Collection	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J1	5,626.00	Zone - 4	<Collection: 0 items>	0	5,849.97	97
J2	5,631.00	Zone - 4	<Collection: 1 item>	9	5,841.85	91
J3	5,643.00	Zone - 4	<Collection: 1 item>	52	5,825.33	79
J4	5,645.00	Zone - 4	<Collection: 1 item>	2,526	5,808.77	71
J5	5,626.00	Zone - 4	<Collection: 1 item>	65	5,834.64	90
J6	5,625.00	Zone - 4	<Collection: 1 item>	13	5,842.26	94
J7	5,619.00	Zone - 4	<Collection: 0 items>	0	5,849.96	100

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Scenario: Max Day + Fire Flow
Current Time Step: 0.000 h
FlexTable: Pipe Table

Label	Length (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen- Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	Headloss Gradient (ft/ft)
P1	421	RESERVOIR	J1	36.0	Ductile Iron	130.0	2,665	0.84	0.03	0.000
P2	421	J1	J7	36.0	Ductile Iron	130.0	1,243	0.39	0.01	0.000
P3	302	J1	J2	8.0	PVC	150.0	1,422	9.08	8.12	0.027
P4	468	J2	J6	8.0	PVC	150.0	-222	1.42	0.40	0.001
P5	474	J2	J3	8.0	PVC	150.0	1,636	10.44	16.52	0.035
P6	742	J3	J5	8.0	PVC	150.0	-942	6.01	9.31	0.013
P7	213	J3	J4	8.0	PVC	150.0	2,526	16.12	16.57	0.078
P8	536	J5	J6	8.0	PVC	150.0	-1,008	6.43	7.61	0.014
P9	368	J6	J7	8.0	PVC	150.0	-1,243	7.93	7.70	0.021

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Scenario: Max Day + Fire Flow
Current Time Step: 0.000 h
FlexTable: Reservoir Table

ID	Label	Elevation (ft)	Zone	Flow (Out net) (gpm)	Hydraulic Grade (ft)
55	RESERVOIR	5,850.00	Zone - 4	2,665	5,850.00

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APPENDIX C

Preliminary Sanitary Demand Calculations

THE OPAL MASTER PLAN
SANITARY SEWER LOADING CALCULATIONS
PROJ. NO. 16193.00
7/15/2024



SANITARY SEWER LOADING CALCULATIONS

BASIN	DESIGN POINT	PLANNING AREA	LAND USE	AVG. DAY FLOW (GPD)	DENSITY (PEOPLE/UNIT)	TOTAL AREA (AC or UNITS)	EQUIVALENT TOTAL POPULATION (P)	LOCAL AVG. FLOW (GPD)	LOCAL PEAK FACTOR (MIN PF=1.7) (MAX PF=4.0)	LOCAL PEAK FLOW (GPD)	LOCAL PEAK FLOW (CFS)	I/I (GPD)	TOTAL LOCAL AVG. FLOW (GPD)	CFS	TOTAL LOCAL PEAK FLOW (GPD)	CFS
A	1	PA-1	COMMERCIAL	1,500	22	2.9	64	4,350	4.0	17,400	0.03	435	4,785	0.01	17,835	0.03
		PA-2														
		PA-4C	COMMERCIAL (CLUBHOUSE)	1,500	22	1.1	24	1,650	4.0	6,600	0.01	165	1,815	0.003	6,765	0.01
		PA-4A	MULTI-FAMILY	68	2.77	264	731	49,727	4.0	198,908	0.31	4,973	54,700	0.08	203,881	0.32
		PA-4B														
		PA-4E														
		PA-4F														
		PA-4G														
		PA-4H														
TOTALS				-	-	-	819	55,727	4.0	222,908	0.34	5,573	61,300	0.09	228,481	0.35

AURORA SANITARY CRITERIA

$$\text{Avg Flow} = \text{Area (AC)} \times \text{Avg Day Flow} \left(\frac{\text{GPD}}{\text{AC}} \right)$$

$$\text{Peak Flow} = \text{Peak Factor} \times \text{Avg Flow}$$

$$I/I = \text{Avg Flow} \times 0.1$$

$$\text{Peak Factor (PF)} = \frac{5}{P^{0.167}}$$

(where P = population in thousands), (Max = 4, Min = 1.7)

$$\text{Total Avg Flow} = \text{Avg Flow} + (\text{Avg Flow} \times 0.1)$$

$$\text{Total Peak Flow} = \text{Peak Flow} + (\text{Avg Flow} \times 0.1)$$

USE	AVERAGE DAY	EQUIVALENT POPULATION PER ACRE
COMMERCIAL	1,500 GPD/ACRE	22
PEOPLE PER UNIT	2.77	-
LOADING RATE (GPCD)	68	-

THE OPAL MASTER PLAN
SANITARY SEWER PIPE CALCULATIONS
PROJ. NO. 16193.00
7/15/2024



SANITARY SEWER PIPE CALCULATIONS

BASIN	DESIGN POINT	AVG. DAY FLOW (GPD)	POPULATION	PEAKING FACTOR	PEAK FLOW (GPD)	I+I (GPD)	PEAK FLOW + I/I (GPD)	PEAK FLOW, q (CFS)	PIPE SIZE (IN)	MIN. PIPE SLOPE (%)	Q _{FULL} (CFS)	FULL FLOW CAPACITY (%)	Q _{CAP} (CFS)	q/Q _{FULL} (%)	V _{PEAK} (FPS)
A	1	55,727	819	4	222,908	5,573	228,481	0.35	8	0.4	0.9	75	0.675	39.3	2.4
CHECK: COMBINED FLOWS AT THE TIE-IN WITH THE 15" PIPE AT DESIGN POINT 11 FROM FOUNDRY MUR BY WARE MALCOMB (APPROVED 6/13/2023)															
-	11	442,707	6,516	3.7	1,618,653	44,271	1,662,924	2.57	15	0.4	4.83	80	3.86	53.3	4
-	1	498,434	7,335	4	1,841,561	49,844	1,891,405	2.92	15	0.4	4.83	80	3.86	60.5	4.1

AURORA SANITARY CRITERIA

USE	AVERAGE DAY	EQUIVALENT POPULATION PER ACRE
COMMERCIAL	1,500 GPD/ACRE	22
PEOPLE PER UNIT	2.77	-
LOADING RATE (GPCD)	68	-

Worksheet for DP 1: 8-Inch PVC (On-Site)

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.011
Channel Slope	0.400 %
Diameter	8.0 in
Discharge	0.35 cfs
Results	
Normal Depth	3.5 in
Flow Area	0.1 ft ²
Wetted Perimeter	1.0 ft
Hydraulic Radius	1.8 in
Top Width	0.66 ft
Critical Depth	3.3 in
Percent Full	43.2 %
Critical Slope	0.473 %
Velocity	2.42 ft/s
Velocity Head	0.09 ft
Specific Energy	0.38 ft
Froude Number	0.914
Maximum Discharge	0.97 cfs
Discharge Full	0.90 cfs
Slope Full	0.060 %
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	3.5 in
Critical Depth	3.3 in
Channel Slope	0.400 %
Critical Slope	0.473 %

Worksheet for DP 1: 15-Inch PVC Tie-In Check

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.011
Channel Slope	0.400 %
Diameter	15.0 in
Discharge	2.92 cfs
Results	
Normal Depth	8.4 in
Flow Area	0.7 ft ²
Wetted Perimeter	2.1 ft
Hydraulic Radius	4.0 in
Top Width	1.24 ft
Critical Depth	8.2 in
Percent Full	56.1 %
Critical Slope	0.428 %
Velocity	4.12 ft/s
Velocity Head	0.26 ft
Specific Energy	0.97 ft
Froude Number	0.961
Maximum Discharge	5.19 cfs
Discharge Full	4.83 cfs
Slope Full	0.146 %
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	8.4 in
Critical Depth	8.2 in
Channel Slope	0.400 %
Critical Slope	0.428 %

APPENDIX D

Reference Information

WARE MALCOMB

ARCHITECTURE | PLANNING | INTERIORS
BRANDING | CIVIL ENGINEERING

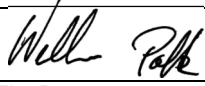

MASTER UTILITY REPORT A PART OF SECTION 29, TOWNSHIP 4 SOUTH, RANGE 65 WEST OF THE SIXTH PRINCIPAL MERIDIAN COUNTY OF ARAPAHOE, STATE OF COLORADO

Foundry

Prepared: April 6, 2022
Revised: October 24, 2022
Revised: January 20, 2023
Revised: March 9, 2023
Revised: April 11, 2023
Revised: May 22, 2023
WM: DCS21-9005

Prepared for:
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Prepared by:
Ware Malcomb
900 South Broadway Suite 320
Denver, CO 80209
P: 303.561.3333

Approved for one year from this date 06/13/2023	
	06/13/2023
Fire Department	Date
	06/09/2023
Water Department	Date

Jason Mann, PE No. 42735

CERTIFICATION

I hereby certify that this Master Utility Report for Foundry was prepared by me (or under my direct supervision) in accordance with the provisions of the City of Aurora Standard Specifications regarding Water and Sanitary Infrastructure.

FACSIMILE

This electronic plan is a facsimile of the
signed and sealed pdf set



05/26/2023

Signature

Date

Jason Mann
State of Colorado Registration No. 42735
Ware Malcomb

Date

Average day demands for the Single-Family Residential areas were calculated using 2.77 people/unit with a per capita flow of 101 gpd.

Fire flow demands were based on Use Classifications in Section 5.02.3. Residential areas were calculated at 1,500 gpm while Commercial and Multi-Family areas were calculated at 2,500 gpm. The proposed school was calculated at 3,500 gpm. Residual pressures and velocities conform to the requirements within Section 5.02 of the City of Aurora Standards and Specifications. See Appendix B for water demands and model reporting.

III. SANITARY SEWER

A. Adjacent Infrastructure

This site is expected to connect to the Senac interceptor. Property ownership groups are in discussions with the City regarding the timing of when this line will be installed. It is anticipated that it will be constructed prior to the development of the Foundry site.

A small portion of the site will drain to the southwest and connect to a stub provided by the Harvest Crossing development to the west (EDN 221354). This stub is anticipated to be 8" PVC and located in the right of way of E. Kewaunee Street. Coordination efforts are underway to ensure this main will have sufficient depth and capacity to service this portion of the development. Refer to the communication provided in Appendix E regarding the capacity of this line.

B. Proposed Infrastructure

The Foundry development was broken up into four basins connecting to the sanitary mains described above. A series of 8", 10", 12" and 15" mains will be extended throughout the development to service each Planning Area.

BASIN A

Basin A encompasses the northwest portion of the site which includes Planning Areas 1-6, 9, and 14. This basin includes a school, a rec center, and a single-family residential area. Sanitary flows from Basins B, C, and D will combine at the north end of this basin and connect to the Senac interceptor.

BASIN B

Basin B encompasses a portion of the southwest corner of the site which includes Planning Areas 15, 16, 18, 19, 20, 21, 22 and portions of Planning Areas 17, 23 & 24. This basin includes a single-family residential area. Sanitary flows from this basin will be routed north to combine with flows from basins A, C, and D and outfall at the north end of the site.

BASIN C

Basin C encompasses the northeast portion of the site which includes Planning Areas 7, 8, 10, 11, 12, and 13. This basin includes a multi-family residential area and two single-family

residential areas. Sanitary flows from this basin will be routed north to combine with flows from Basins A, B and D, and outfall at the north end of the site.

BASIN D

Basin D encompasses the southeast portion of the site which includes Planning Areas 25-30, 32, and a portion of Planning Area 31. This basin includes a single-family residential area. Sanitary flows from this basin will be routed north to combine with Basin C before out-falling at the north end of the site with Basins A and B.

BASIN E

Basin E encompasses the southwest corner of the site which includes Planning Area 23, and portions of Planning Areas 17, 24 and 31. The basin includes a single-family residential area. The sanitary design is being coordinated with the adjacent developments to the west. Sanitary flows from this basin will be routed west and connect to a sanitary stub provided near the Yale and Kewaunee intersection provided by the Harvest Crossing development. This line will connect to the system that routes through the Murphy Creek development designed with the Murphy Creek Master Utility Report (EDN 220132). Per discussions with those developments, the system as currently designed has capacity to convey flows from 75 lots on the Foundry site. It is anticipated that this line will be installed by the time the Planning Areas in Basin B (Neighborhood/Phase 2) are developed.

C. Design Standards

The *Water, Sanitary Sewer and Storm Drainage Infrastructure Manual*, City of Aurora, CO, effective January 2022 Section 5.03 was referenced for all design criteria. Sanitary average and peak demands, design slopes, pipe sizes, and pipe capacities have been provided within Appendix C.

IV. CONCLUSION

A. Conclusions

As described above, there will be adequate infrastructure to provide utility services for the Foundry development per the City of Aurora criteria.

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FOR AND ON BEHALF
OF WARE MALCOMB

FOUNDRY
AURORA COLORADO
CONCEPT WATER PLAN

REMARKS

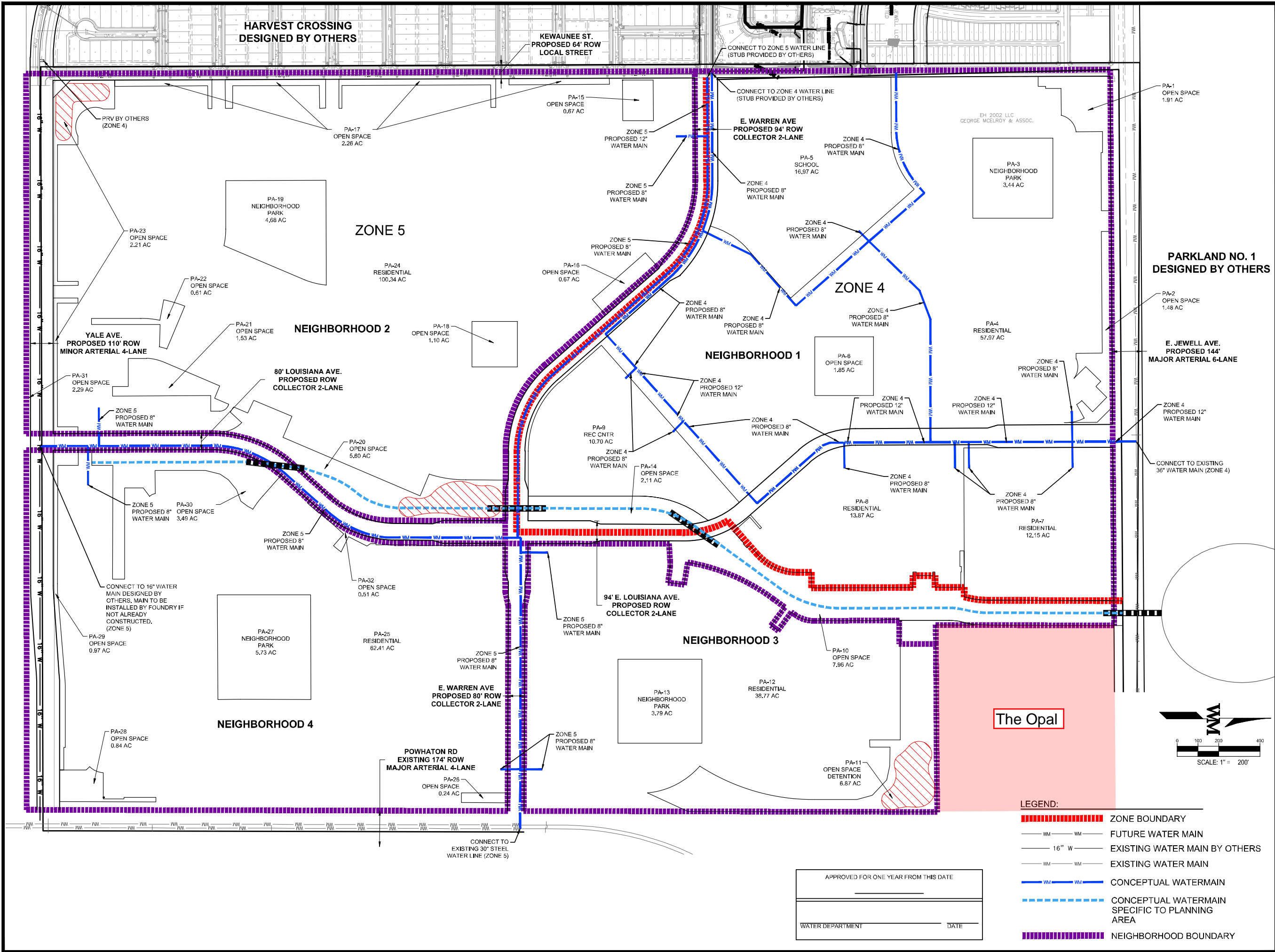
NO. DATE

JOB NO.:	DCS21-9005
PA / PM:	J. MANN
DESIGNED:	X. XXXXX
DATE:	05/22/2023
PLOT DATE:	---

SHEET
WA-1

Sheet 1 of 1

NOT FOR CONSTRUCTION





Sanitary Calculations for Foundry

City of Aurora Standards		
City of Aurora residential density:	2.77	people/unit
Residential average loading:	68	gal/person/day
Commercial loading:	1,500 gpd/acre	22 people/acre
Industrial (School) loading	1,200 gpd/acre	18 people/acre

Design Point	Basins	Average Daily Flow (gpd)	Population	Used Peaking Factor	Peak Flow (gpd)	I + I (gpd)	Peak Flow + (I+I) (gpd)	Peak flow (q) (cfs)	Pipe Size (in)	Minimum Pipe Slope (%)	Q _{full} (cfs)	Full Flow Capacity (%)	Q _{cap.} (cfs)	q/Q _{full} (%)	V _{peak} (fps)
1	D	88,529	1,302	4.0	354,117	8,853	362,970	0.56	8	0.50%	1.01	75%	0.76	55.6%	2.97
2	B	99,266	1,460	4.0	397,063	9,927	406,989	0.63	8	0.40%	0.90	75%	0.68	69.7%	2.80
3	B + D	187,795	2,762	4.0	751,180	18,779	769,959	1.19	10	0.50%	1.83	75%	1.37	65.1%	3.57
4	A3	16,050	235	4.0	64,200	1,605	65,805	0.10	8	0.63%	1.13	75%	0.85	9.0%	2.00
5	A3 + B + D	203,845	2,997	4.0	815,380	20,384	835,764	1.29	12	0.40%	2.66	75%	2.00	48.6%	3.37
6	A2	20,364	305	4.0	81,456	2,036	83,492	0.13	8	0.51%	1.02	75%	0.76	12.7%	2.00
7	A1 + A2	100,417	1,483	4.0	401,668	10,042	411,710	0.64	10	0.40%	1.64	75%	1.23	38.9%	2.82
8	C1	53,494	787	4.0	213,977	5,349	219,326	0.34	8	0.40%	0.90	75%	0.68	37.6%	2.41
9	C1 + C3	84,197	1,238	4.0	336,788	8,420	345,207	0.53	10	0.40%	1.64	75%	1.23	32.6%	2.68
10	C1 + C2 + C3	138,445	2,036	4.0	553,778	13,844	567,623	0.88	10	0.40%	1.64	75%	1.23	53.6%	3.06
11	A + B + C + D	442,707	6,516	3.7	1,618,653	44,271	1,662,924	2.57	15	0.40%	4.83	80%	3.86	53.3%	4.00
12	E	14,127	208	4.0	56,508	1,413	57,921	0.09	8	0.68%	1.18	75%	0.88	7.6%	2.00

Worksheet for DP 11: Basin A+B+C+D - 15"

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.011
Channel Slope	0.40 %
Diameter	15.0 in
Discharge	2.57 cfs
Results	
Normal Depth	7.8 in
Flow Area	0.6 ft ²
Wetted Perimeter	2.0 ft
Hydraulic Radius	3.8 in
Top Width	1.25 ft
Critical Depth	7.7 in
Percent Full	51.9 %
Critical Slope	0.41 %
Velocity	4.00 ft/s
Velocity Head	0.25 ft
Specific Energy	0.90 ft
Froude Number	0.982
Maximum Discharge	5.19 cfs
Discharge Full	4.83 cfs
Slope Full	0.11 %
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	34.7 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	7.8 in
Critical Depth	7.7 in
Channel Slope	0.40 %
Critical Slope	0.41 %