

PRELIMINARY UTILITY REPORT

FOR

TERRAIN NORTH BASIN (PHASE 2)
CASTLE ROCK, COLORADO
PROJECT NO. SDP20-0033

Prepared for:

Stratus Terrain, LLC
8480 East Orchard Road, Suite 1100
Greenwood Village, CO 80111
Contact: Richard Dean

Prepared by:



CORE Consultants, Inc.
3473 South Broadway
Englewood, CO 80113
Contact: Technical Contact, PE
Phone: 303-703-4444
CORE Project Number: xx-xxx

February 3, 2023

Engineer's Statement:

The enclosed utility report, and exhibits, were prepared by me, or under my direct supervision, and are correct to the best of my knowledge and belief. Said final utility report has been prepared in accordance with applicable Town of Castle Rock criteria and is in conformance with the master utility plans for the affected area. I accept responsibility, or any liability caused by negligent acts, errors, or omissions on my part in preparing this report.

Andrew Kidder, P.E.
Colorado Professional Engineer
License #38465

Owner/Developer's Statement:

As Owner/Developer of land(s) identified within this report; I agree to proceed, implement, and comply with all recommendations and requirements outlined herein.

Stratus Terrain, LLC

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1. PROJECT LOCATION AND DESCRIPTION

This Preliminary Utility Report analyzes the proposed infrastructure associated with the development of the proposed Terrain North Basin (Phase 2), also known as Terrain Planning Area 8. The overall Terrain Development (Formerly Castle Oaks Estates) is a proposed Planned Development (PD), consisting of single-family homes, multi-family homes, commercial development, community parks and schools' site on approximately 1,180+/- acres in Castle Rock, Colorado.

The portion of the site addressed in the report is currently undeveloped and is approximately 42.47 acres. This portion of the Terrain Development, known as TERRAIN NORTH BASIN (PHASE 2), is composed of 29 single-family detached homes with the associated roadways, open space, and site infrastructure. The development site is bisected by Castle Oaks Drive and McMurdo Gulch lies to the east. TERRAIN NORTH BASIN (PHASE 2) is located in a portion of the East half Section 31 and the Northwest quarter of Section 32, Township 7 South, Range 66 west and a portion of the east half of Section 6, Township 8 South, Range 66 west of the Sixth Principal Meridian, Town of Castle Rock, County of Douglas, State of Colorado. A vicinity map for the site can be found in Appendix F.

The site has naturally occurring slopes ranging from 2 to 33 percent due to a rocky ridgeline that exists on the westerly portion of the site, separating TERRAIN NORTH BASIN (PHASE 2) from the existing Terrain developments to the west, and a downhill slope leading to McMurdo Gulch to the east. The soil is Coni rocky loam and Fondis clay loam and is covered with native vegetation.

Easements and tracts necessary for utilities will be provided during the platting process of the project. The easement and tract sizes and locations will be depicted at the time of final design and construction documents in accordance with Town of Castle Rock Standards.

This report will analyze the proposed water and sanitary sewer systems which will be constructed as part of the development, as well as the connections to the surrounding existing infrastructure. The utility design will conform to the current Town of Castle Rock standards. Easements will be provided for utilities which fall out of the public right-of-way. These will be dedicated on the final plat or at the time of final design/construction documents. The site will not need any additional pump stations, pressure reducing valves, etc. as part of the site development. The proposed water line will be accessible within the site, predominantly within the proposed roadways.

2. CALCULATED WATER DEMANDS

The water demand for TERRAIN NORTH BASIN (PHASE 2) was calculated by using the Single Family Residential/Duplex designation in the Town of Castle Rock Water System Design Criteria Manual, which is 400 gpd/SFE, and a total of 29 dwelling units (29 SFE). Based on this information, an Average Day Demand of 8.06 gallons per minute (gpm) was calculated for the site. A Max Day Factor of 2.5 was used to obtain a Maximum Daily demand of 20.15 gpm. A Peak Hour Factor of 5.5 was used to obtain a Peak Hourly Demand of 44.31 gpm. The total irrigated area was used to calculate an Irrigation Demand of 1.32 gpm, as shown in **Table 2.1**. According to Town of Castle Rock standards the Average Day Irrigation Demand is then added to each Demand scenario seen in **Table 2.1**. The TERRAIN NORTH BASIN (PHASE 2) will be entirely serviced by the Town of Castle Rock Liberty Village Blue pressure zone that is supplied from Tank 14 with a

PRV. Landscape will be provided in Tracts and will utilize an irrigation taps and individual meters throughout the subject site as shown in the table below.

Irrigation water budgets and watering schedule has been provided in Appendix A. Planning Area (PA) 8 will be constructed in Phase 2 and the irrigation tap for PA 8 is located north of Block 2, Lot 1 at the intersection of Westrand Street and Cholla Wood Way.

Tables 1 and 2 below summarize the proposed water and irrigation demands for TERRAIN NORTH BASIN (PHASE 2). Refer to Appendix B for fire flow memorandum, each hydrant will be required to supply 1,500 gpm at 20 psi for two hours.

Table 2.1: TERRAIN NORTH BASIN (PHASE 2) Water Demands

	Average Day Demand (gpm)	Max Day Demand (gpm)	Peak Hour Demand (gpm)
TERRAIN NORTH BASIN (PHASE 2)	8.06	20.15	44.31
*Irrigation Demand	1.32	1.32	1.32
Total Demand	9.37	21.45	45.62

* See Appendix A for Water Demand Calculations. Irrigation demand has been calculated on a Peak Hour basis.

Table 2.2: TERRAIN NORTH BASIN (PHASE 2) Water Demands

	Gallons Per Minute (gpm)	Gallons Per Day (gpd)	Acre-Ft Per Year (AF/YR)
Average Day Demand	9.37	13,495	15.11

3. EXISTING WATER SYSTEM

The existing water system consists of a 16" Liberty Village Blue Zone watermain that is supplied from Tank 14 with an existing pressure reducing valve (PRV) near the intersection of Castle Oaks Drive and Autumn Safe Street, and extends to the North to the Cobblestone (Liberty Village).

Based on the proposed elevations within the site, this site will be serviced off of water mains connected to the Liberty Village Blue Zone. This site will be served by the existing 16" main with hydraulic grade lines (HGL) established by the existing PRV. The Liberty Village Blue Zone has a maximum static HGL of 6508 and a HGL of 6462 for the fire flow condition. Elevations in Terrain North Basin (Phase 2) will vary between 6328 and 6354, with the higher elevation on the northern portion of the site and the lower elevation on the southern portion of the site.

The required storage needed for the TERRAIN NORTH BASIN (PHASE 2) is based on the proposed demand and is calculated as follows:

400gpd/SFE x 29 SFE x 2.5 (Max Day) = 29,000 gallons

Fire Flow @ 1,500 gpm x 2.0 hours = 180,000 gallons

Irrigation Average Daily Demand = 1,901 gallons

Total Storage Volume for TERRAIN NORTH BASIN (PHASE 2) = 210,901 gallons (0.21 MG)

The analysis performed on the water system for the site has shown no adverse effects to the site's adjacent domestic water system infrastructure. Any future development of the existing water infrastructure needs to serve this site is the responsibility of the Developer.

4. PROPOSED WATER SYSTEM

The proposed water system will be looped in the future condition by providing two (2) connections to the existing 16" Liberty Village Blue Zone watermain via a proposed tee near the northerly intersection of Castle Oaks Drive and Autumn Sage Street (south tie-in) and the existing 16" Liberty Village Blue Zone watermain at the northerly intersection of Castle Oaks Drive and Autumn Sage Street (north tie-in). The North tie-in is upstream of an existing PRV and will provide the required looping redundancy for the site. The future Canyons Far South development will provide an additional gravity water feed to the development. A varying diameter (8") main will be routed through the development to provide water service to all lots.

Easements will be provided for utilities which fall out of the public right-of-way. These will be dedicated on the final plat. The site will not need any additional pump stations, pressure reducing valves, etc. as part of the site development. The proposed water line will be accessible within the site, predominantly within the proposed roadways.

Fire Demand Criteria is based upon International Fire Code guidelines. For the purposes of this analysis, a minimum fire flow of 1,500 gpm was used for single-family homes per 2018 International Fire Code. A copy of the Fire Marshal letter is included in Appendix B.

5. PROPOSED WATER SYSTEM ANALYSIS AND MODELING

The Town of Castle Rock criteria requires the water distribution pipe system to deliver Maximum Day plus Fire Flows demand with a minimum dynamic pressure of 20 psi with one critical loop out of service and a maximum velocity of 15 fps, with a critical loop out of service. The Town also requires the system to deliver Peak Hour demands with a minimum residual pressure of 35 psi with one connecting loop out of service, and a maximum velocity of 10 fps under the same conditions. In addition, the minimum static pressure criteria (minimum storage tank level – 20% Full) is 43 psi and the maximum static pressure criteria (maximum storage tank level – 100% Full) is 125 psi.

The water system analysis was performed using version 2015 of the WaterCAD computer program developed by Bentley Systems, Inc. Water lines are sized to transport water during Average Day, Maximum Day, Maximum Day plus Fire Flow, and Peak Hour demand conditions in accordance with the town specifications.

Simulations of different flow models were completed and compared to the corresponding Town criteria. The simulations consisted of: Average Day, Maximum Day plus Fire with one loop out of service, and Peak Hour demands with one loop out of service. Minimum pressure requirements of 20 psi and 35 psi, and maximum velocity criteria of 15 fps and 10 fps were checked against the Maximum Day plus Fire and Peak Hour demands, respectively.

The configuration of the water distribution pipe system meets all Town of Castle Rock criteria based on the proposed development. It delivers Maximum Day plus fire flows demand with a minimum dynamic pressure of 20 psi, and Peak Hour demands with a minimum residual pressure of 35 psi. The full results of all scenarios can be found in Appendix C.

Each simulation contains two outputs: (1) Junction Report, which is used to check the water pressure in the model against the Town's criteria, and (2) Pipe Report, which is used to check velocities and head loss in the model against the Town's criteria.

6. CALCULATED WASTEWATER FLOWS

This report addresses the sanitary sewer system that services TERRAIN NORTH BASIN (PHASE 2), 29 SFE's. The wastewater flows will be conveyed through McMurdo Gulch Interceptor, see the approved "Final Wastewater Utility Report for Terrain – McMurdo Sanitary Sewer Interceptor" by CORE Consultants dated May 5, 2014, last revision date of July 25, 2014, to the existing lift station to the north. No upstream wastewater flows are anticipated to be conveyed through TERRAIN NORTH BASIN (PHASE 2) system.

For the downstream sanitary sewer system analysis of the TERRAIN NORTH BASIN (PHASE 2) development, refer to "Final Wastewater Utility Report for Terrain – McMurdo Sanitary Sewer Interceptor" by CORE Consultants dated May 5, 2014, last revision date of July 25, 2014. There are no Individual Sewage Disposal Systems (ISDS) on the site or proposed as part of this development.

The proposed wastewater flows for TERRAIN NORTH BASIN (PHASE 2) have been calculated for the site using the criteria listed below:

Demand per SFE	200 gal/day/SFE (Single Family Residential/Duplex)
Peak Factor	PF=3.65(ADF-0.168), max=5.0
Infiltration/Inflow	I= 0.10*Average Flow
Peak Design Flow	PDF=(PF*ADF) + (Infiltration/Inflow)

The Average Daily Flows were calculated using 200 gpd/SFE and based on 29 SFE for the design basin. This results in an Average Daily Flow of 4.03 gpm. A peaking factor was calculated using the equation above. This peaking factor was used to determine the Peak Design Flows for the site. This results in a Peak Design Flow of 20.14 gpm for the site. This value includes infiltration/inflow demands. For the complete calculations, see Appendix D.

Table 6.1: TERRAIN NORTH BASIN (PHASE 2) Sanitary Demands

	Gallons Per Minute (gpm)	Gallons Per Day (gpd)	Cubic Feet Per Second (CFS)
Average Daily Flow	4.03	5,800	0.009
Peak Design	20.14	29,000	0.045
Peak Design w/ Infiltration	20.54	29,580	0.046

**A Peaking factor of 5.0 was used for all instances, and infiltration has been applied.*

Terrain is a Master Planned Residential Community and the McMurdo Gulch Interceptor was previously designed and constructed to convey the sewer flows of the overall development to the lift station located to the northeast of the development. Since the construction of the McMurdo Gulch Interceptor, the majority of the Planning Areas within the develop have bene built out and the overall density of the community has not changed. The Planning Areas have developed within the anticipated density ranges, and to get accurate flow calculations for the Interceptor the actual densities (SFE's) were determined for each contributing Planning Area, see Appendix D and F. This provides accurate and current flow information through the Interceptor and demonstrates that the pipes have adequate capacity to convey the additional flows from the North Basin Development.

Utilizing Hydroflow Express (see Appendix E), it was determined that the existing 8-inch sanitary pipe at 0.4% can convey 1,089.80 gpm flowing at 75% full capacity as set forth by the Town of Castle Rock Wastewater Collection System Design Criteria Manual.

Existing Terrain McMurdo Gulch Interceptor Flows (Appendix D):

$$1474 \text{ SFE} = \text{Peak Design Flow (PDF)} = 962.19 \text{ gpm}$$

Proposed TERRAIN NORTH BASIN (PHASE 2) Values (See Appendix D):

$$29 \text{ SFE} = \text{Peak Design Flow (PDF)} = 20.14 \text{ gpm}$$

Total Terrain McMurdo Gulch Interceptor Flows:

$$1503 \text{ SFE} = \text{Peak Design Flow (PDF)} = 982.33 \text{ gpm} < 1,089.80 \text{ capacity}$$

The proposed sanitary sewer system has also been evaluated with the use of Autodesk Storm and Sanitary Analysis 2016, by Autodesk (SSA), a program for the design and analysis of gravity flow and pressure flow through pipe networks. Based on the current SSA modeling for this project, it was determined that four (4) existing 12-inch sanitary pipes slightly exceeded the maximum 75% peak flow capacity set forth by the Town of Castle Rock standards, but were within acceptable general engineering tolerances understanding the variations in sewer modeling software from the original design of the interceptor. In addition, a number of conservative assumptions have been built into the flows including large peaking factors. Finally, all pipe segments will still flow less than 75% deep within the existing pipes. Through our investigations, it was determined that the sewer flows within the McMurdo Gulch Interceptor are in align with the master plan of the development and that the existing sanitary sewer has capacity for the additional proposed units.

Existing Pipes with proposed additional sanitary demand.

Existing Pipe P-4

Design Flow Capacity = 1278.38 GPM
Peak Flow = 996.20 GPM
Flow Capacity = 78%
Depth of Flow = 66%

Existing Pipe P-5

Design Flow Capacity = 1210.46 GPM
Peak Flow = 1029.49 GPM
Flow Capacity = 85%
Depth of Flow = 71%

Existing Pipe – (48)

Design Flow Capacity = 1234.97 GPM
Peak Flow = 996.20 GPM
Flow Capacity = 81%
Depth of Flow = 68%

Existing Pipe – (49)

Design Flow Capacity = 1286.67 GPM
Peak Flow = 996.20 GPM
Flow Capacity = 77%
Depth of Flow = 66%

7. EXISTING WASTEWATER SYSTEM

TERRAIN NORTH BASIN (PHASE 2) will connect to the existing McMurdo Gulch Sanitary Sewer Interceptor which has been approved with the "Final Wastewater Utility Report for Terrain – McMurdo Sanitary Sewer Interceptor" by CORE Consultants dated May 5, 2014, last revision date of July 25, 2014. Existing sanitary flows are conveyed to the north in a gravity main to the existing lift station at the northeast corner of the Terrain development. Flows from the lift station are pumped south in an existing force main to the Town's Wastewater Treatment Facility. This sanitary sewer line is defined within the Town's Wastewater Master Plan, along with the tributary flows to the lift station. Any future development of the existing wastewater infrastructure needed to serve this site is the responsibility of the developer.

The existing adjacent developments have been analyzed to determine the actual buildout and the exact number of SFE's and sewer demands was determined for each junction of the McMurdo Gulch Sewer Interceptor to confirm pipe capacity for the North Basin Development. It was determined that the existing sanitary demand of the adjacent developments is 962.19 gpm, as shown in Appendix D. Thus, the McMurdo Gulch Interceptor is adequately sized to convey the

sanitary flows from the existing and proposed developments, see calculations provide above in Section VI.

8. PROPOSED WASTEWATER SYSTEM

TERRAIN NORTH BASIN (PHASE 2) will connect to the existing sanitary sewer located within McMurdo Gulch just east of the planning areas at four (4) locations. See Appendix F for the calculation verifying the sanitary sewer calculations within the proposed 8" sewer mains. The proposed mains will run within the proposed roadways and connect to various existing manholes.

PA-31

PA-31 has a terminal manhole located at the northerly portion of the planning area. All wastewater flows are conveyed from north to south and into an existing manhole that is a part of the McMurdo Gulch Sanitary Sewer Interceptor.

PA-26

PA-26 has two terminal manholes located at the southerly portion of the planning area. All wastewater flows are conveyed from south to north and into an existing manhole located to the west of Castle Oaks Estates Filing No. 1, Amendment No. 11, also known as Terrain Planning Area 25.

PA-18

PA-18 has a terminal manhole located at the westerly portion of the planning area. All wastewater flows are conveyed from west to north and into the proposed wastewater system located within PA-17.

PA-17

PA-17 takes on wastewater flows from where PA-17 ties into a manhole located at the southerly portion of the planning area. All wastewater flows are conveyed from south to north and into an existing manhole that is a part of the McMurdo Gulch Sanitary Sewer Interceptor.

No lift stations, force mains, etc. are being proposed as part of this development. The existing gravity system has adequate capacity to serve the development. Any sanitary sewer not located within in a public right-of way will be within a dedicated utility easement for access and maintenance. The minimum width of the easement will be 20'. Any future development of the existing wastewater infrastructure needed to serve this site is the responsibility of the developer.

Analyzing the most constrained existing sanitary interceptor with cumulative flows from the existing surrounding areas and including additional proposed wastewater flows yields a total wastewater demand of 1024.48 gpm, which is less than the 1089.8 gpm capacity of the 12-inch pipe discussed above.

9. PROPOSED WASTEWATER SYSTEM ANALYSIS AND MODELING

For the purposes of this report, HydroFlow Express was used to analyze the sanitary pipe capacity for the development, see Appendix D. Design constraints input into the model include:

- 0.4% minimum and 7.5% maximum slopes (8" sewer) at maximum Pipe Capacity (Design Peak Flow) = 75% of full flow capacity
- 0.4% minimum and 7.5% maximum slopes (8" sewer) at calculated Peak Design Demand
- Manning's coefficient 0.011 (PVC)
- Max. Velocity 10 fps
- Min. Velocity 2 fps

Average Day and Peak Design Flow scenarios were performed which analyzed the proposed pipe capacities.

The proposed sanitary sewer system will be evaluated with the use of Hydroflow Express 2018, by Autodesk at the final design of the development. Hydroflow Express is a program for the design and analysis of gravity flow through a pipe or channel.

The minimum velocity requirement of 2 feet per second (ft/sec of fps) at peak design flow, as stated in the Town of Castle Rock Wastewater Collection Systems Design Criteria Manual, Chapter 4, was not met in all pipes, however, within the system. Whenever it was feasible, the slopes on these pipes will be increased to get the largest velocities possible while maintaining adequate bury depths to allow sanitary sewer service to the planning areas discussed herein.

10. POTENTIAL PERMITTING REQUIREMENTS

Permits for the proposed development will be applied for through the Town of Castle Rock and the State of Colorado, where applicable. Permits will be in place prior to the start of construction.

REFERENCES

TOCR (Town of Castle Rock). December 4, 2018. Town of Castle Rock Water System Design Criteria Manual.

TOCR (Town of Castle Rock). December 4, 2018. Town of Castle Rock Wastewater Collection System Design Criteria Manual.

TOCR (Town of Castle Rock). 2016, Town of Castle Rock, 2010 Wastewater Master Plan.

TOCR (Town of Castle Rock). March 2011. Town of Castle Rock, 2010 Water Master Plan Update.

CORE Consultants, Inc., May 2014, Revised July 2014. McMurdo Sanitary Sewer Interceptor Final Wastewater Utility Report.

Computer Modeling Programs:

Bentley Systems, Inc., Version 2018. WaterCAD

Autodesk, Version 2018. Hydroflow Express

Autodesk, Version 2016. Autodesk Storm and Sanitary Analysis

APPENDIX A

WATER DEMANDS

WATER DEMAND CALCULATIONS
IRRIGATION DEMAND CALCULATIONS (BY OTHERS)

Terrain North Basin (Phase 2)
Preliminary Water and Sanitary Sewer
Utility Report

CORE # 14-001
 February 2023
 LMK

Terrain North Basin (Phase 2) Water Demand

PARCEL NO.	USE	DWELLING UNITS	ACRES	EQUIVALENT (SFE/DU)	SFE (DU)	DEMAND		
						AVG DAY (GPD/DU)	AVG DAY (GPM/SFE)	AVG DAY (GPM)
<u>MULTI-FAMILY RESIDENTIAL</u>								
Planning Areas 8	SF	29		1.00	29.0	400	0.28	8.06
USE			IRR AREA	LAND USE RATE	AVG DAY			AVG DAY
			(ACRES)	(GPD/AC)	(GPD)			(GPM)
<u>IRRIGATION</u>								
Irrigation	IRR		0.5	3750		1895		1.32

SFE SUB-TOTAL 29.00 SUB-TOTAL 9.37

PEAKING FACTOR

MAX DAY DEMAND (MDD)	2.5	20.14	GPM
PEAK HOUR (PHD)	5.5	44.31	GPM

RESIDENTIAL & IRRIGATION DAILY DEMAND		GPM	GPD	AF/YR
AVERAGE DAY (ADD)		9.37	13,495	15.11
PEAK DAY (PDD)		21.45	30,895	34.60
RESIDENTIAL & IRRIGATION DEMAND		GPM	GPD	AF/YR
MAX DAY DEMAND (MDD)		21.45	30,895	34.60
PEAK HOUR DEMAND (PHD)		45.62	65,695	73.58

Project Name:		Terrain Borth Basin			
Project Location:		Castle Rock			
Tap Description:		Tap 1			
Date prepared:		27-Jan-23			
Seasonal Water Use and Peak Flow Projections Prepared By HydroSystems-KDI, Inc.					
Description	Irrigated Area (Acre)	Month	Application Rate (in/mo/sqft)	Water Application (gallons)	Peak Season Projected Demand (GPM)
Shrubs & Trees Drip Irrigated	0.51	May	1.67	22,917	5.2
		June	2.22	30,494	
		July	2.40	32,943	
		August	2.09	28,646	
		September	1.62	22,177	
Irrigation Season Totals			10.00	137,177	
				0.42	acre-feet
Site Totals					
Irrigated Area:		22,007 Sq.Ft.		0.51 Acres	
Water Use per Year:		137,177 Gallons		0.42 Acre-feet	
Average Water per Year:		6.23 Gallons/SqFt		10.00 Inches/SqFt	
Peak Season Monthly Water Use:		32,943 Gallons		0.10 Acre-feet	
Average Peak Season Flow:		5 GPM			
Required Tap Size:		3/4 Inches			
Projections are based on a three day per week, eight hour per day, peak season watering schedule.					
Peak season application for Shrubs & Trees is 0.54" per week.					

APPENDIX B

WATER STORAGE DEMANDS

STORAGE CALCULATIONS – DOMESTIC + IRRIGATION DEMANDS

Terrain North Basin (Phase 2)
Preliminary Water and Sanitary Sewer
Utility Report

CORE # 14-001
February 2023
LMK

Terrain North Basin (Phase 2) Water Demand

PARCEL NO.	USE	DWELLING UNITS	ACRES	EQUIVALENT (SFE/DU)	SFE (DU)	DEMAND		
						AVG DAY (GPD/DU)	AVG DAY (GPM/SFE)	AVG DAY (GPM)
<u>MULTI-FAMILY RESIDENTIAL</u>								
Planning Areas 8	SF	29		1.00	29.0	400	0.28	8.06
USE			IRR AREA	LAND USE RATE	AVG DAY			AVG DAY
			(ACRES)	(GPD/AC)	(GPD)			(GPM)
<u>IRRIGATION</u>								
Irrigation	IRR		0.5	3750		1895		1.32

SFE SUB-TOTAL 29.00 SUB-TOTAL 9.37

PEAKING FACTOR

MAX DAY DEMAND (MDD)	2.5	20.14	GPM
PEAK HOUR (PHD)	5.5	44.31	GPM

RESIDENTIAL & IRRIGATION DAILY DEMAND		GPM	GPD	AF/YR
AVERAGE DAY (ADD)		9.37	13,495	15.11
PEAK DAY (PDD)		21.45	30,895	34.60
RESIDENTIAL & IRRIGATION DEMAND		GPM	GPD	AF/YR
MAX DAY DEMAND (MDD)		21.45	30,895	34.60
PEAK HOUR DEMAND (PHD)		45.62	65,695	73.58

APPENDIX C

WATER HYDRAULIC ANALYSIS AND MODELING

STATIC CONDITIONS ANALYSIS

MAX DAY ANALYSIS

PEAK HOUR ANALYSIS

MAX DAY PLUS FIRE FLOW PLUS IRRIGATION ANALYSIS

MAX DAY PLUS FIRE FLOW PLUS IRRIGATION ANALYSIS W/ LOOP CLOSED

STATIC CONDITION

Junction Table - Time: 0.00 hours

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)	Pressure Head (ft)
J-6	6,357.00	0	6,508.00	65	151.00
J-5	6,350.00	0	6,508.00	68	158.00
J-4	6,346.00	0	6,508.00	70	162.00
J-1	6,336.00	0	6,508.00	74	172.00
J-3	6,335.00	0	6,508.00	75	173.00
J-2	6,330.00	0	6,508.00	77	178.00

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	Is Open?	Pressure (Start) (psi)	Pressure (Stop) (psi)
P-1	J-1	J-2	16.0	PVC	120.0	0	0.00	0.00	True	74	77
P-2	J-2	J-3	8.0	PVC	120.0	0	0.00	0.00	True	77	75
P-3	J-3	J-4	8.0	PVC	120.0	0	0.00	0.00	True	75	70
P-4	J-4	J-5	8.0	PVC	120.0	0	0.00	0.00	True	70	68
P-5	J-5	J-1	8.0	PVC	120.0	0	0.00	0.00	True	68	74
P-6	J-5	J-6	8.0	PVC	120.0	0	0.00	0.00	True	68	65
P-7	R-1	J-1	16.0	PVC	120.0	0	0.00	0.00	True	0	74

Reservoir Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Zone	Flow (Out net) (gpm)	Hydraulic Grade (ft)
92	R-1	6,508.00	<None>	0	6,508.00

PEAK HOUR

Junction Table - Time: 0.00 hours

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)	Pressure Head (ft)
J-6	6,357.00	22	6,507.97	65	150.97
J-5	6,350.00	1	6,507.97	68	157.97
J-4	6,346.00	0	6,507.97	70	161.97
J-1	6,336.00	0	6,508.00	74	172.00
J-3	6,335.00	22	6,507.96	75	172.96
J-2	6,330.00	0	6,507.96	77	177.96

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	Is Open?	Pressure (Start) (psi)	Pressure (Stop) (psi)
P-1	J-1	J-2	16.0	PVC	120.0	0	0.00	0.00	False	74	77
P-2	J-2	J-3	8.0	PVC	120.0	0	0.00	0.00	True	77	75
P-3	J-3	J-4	8.0	PVC	120.0	-22	0.14	0.01	True	75	70
P-4	J-4	J-5	8.0	PVC	120.0	-22	0.14	0.00	True	70	68
P-5	J-5	J-1	8.0	PVC	120.0	-46	0.29	0.03	True	68	74
P-6	J-5	J-6	8.0	PVC	120.0	22	0.14	0.01	True	68	65
P-7	R-1	J-1	16.0	PVC	120.0	46	0.07	0.00	True	0	74

Reservoir Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Zone	Flow (Out net) (gpm)	Hydraulic Grade (ft)
92	R-1	6,508.00	<None>	46	6,508.00

CLOSED LOOP @ Px + FF 1500gpm @ J-3

Junction Table - Time: 0.00 hours

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)	Pressure Head (ft)
J-6	6,357.00	10	6,489.05	57	132.05
J-5	6,350.00	1	6,489.05	60	139.05
J-4	6,346.00	0	6,481.69	59	135.69
J-1	6,336.00	0	6,507.61	74	171.61
J-3	6,335.00	1,510	6,459.99	54	124.99
J-2	6,330.00	0	6,459.99	56	129.99

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	Is Open?	Pressure (Start) (psi)	Pressure (Stop) (psi)
P-1	J-1	J-2	16.0	PVC	120.0	0	0.00	0.00	False	74	56
P-2	J-2	J-3	8.0	PVC	120.0	0	0.00	0.00	True	56	54
P-3	J-3	J-4	8.0	PVC	120.0	-1,510	9.64	21.69	True	54	59
P-4	J-4	J-5	8.0	PVC	120.0	-1,510	9.64	7.36	True	59	60
P-5	J-5	J-1	8.0	PVC	120.0	-1,521	9.71	18.56	True	60	74
P-6	J-5	J-6	8.0	PVC	120.0	10	0.06	0.00	True	60	57
P-7	R-1	J-1	16.0	PVC	120.0	1,521	2.43	0.39	True	0	74

Reservoir Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Zone	Flow (Out net) (gpm)	Hydraulic Grade (ft)
92	R-1	6,508.00	<None>	1,521	6,508.00

CLOSED LOOP @ Px + FF 1500gpm @ J-6

Junction Table - Time: 0.00 hours

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)	Pressure Head (ft)
J-6	6,357.00	1,510	6,475.87	51	118.87
J-5	6,350.00	1	6,489.05	60	139.05
J-4	6,346.00	0	6,489.05	62	143.05
J-1	6,336.00	0	6,507.61	74	171.61
J-3	6,335.00	10	6,489.05	67	154.05
J-2	6,330.00	0	6,489.05	69	159.05

Pipe Table - Time: 0.00 hours

Label	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	Is Open?	Pressure (Start) (psi)	Pressure (Stop) (psi)
P-1	J-1	J-2	16.0	PVC	120.0	0	0.00	0.00	False	74	69
P-2	J-2	J-3	8.0	PVC	120.0	0	0.00	0.00	True	69	67
P-3	J-3	J-4	8.0	PVC	120.0	-10	0.06	0.00	True	67	62
P-4	J-4	J-5	8.0	PVC	120.0	-10	0.06	0.00	True	62	60
P-5	J-5	J-1	8.0	PVC	120.0	-1,521	9.71	18.56	True	60	74
P-6	J-5	J-6	8.0	PVC	120.0	1,510	9.64	13.18	True	60	51
P-7	R-1	J-1	16.0	PVC	120.0	1,521	2.43	0.39	True	0	74

Reservoir Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Zone	Flow (Out net) (gpm)	Hydraulic Grade (ft)
92	R-1	6,508.00	<None>	1,521	6,508.00

APPENDIX D

WASTEWATER FLOWS

TERRAIN NORTH BASIN (PHASE I) WASTEWATER DEMAND CALCULATIONS

Terrain North Basin (Phase 2)
Preliminary Water and Sanitary Sewer
Utility Report

CORE # 14-001-071
03/09/2022
CGV

Terrain North Basin (Phase 2) Wastewater Flow

PEAKING FACTOR*
PEAK HOUR (PHD) 5.0

PARCEL	Junction	USE	DWELLING UNITS	EQUIVALENT (SFE/DU)	SFE (DU)	DEMAND				
						AVG DAY (GPD/DU)	AVG DAY (GPD)	AVG DAY (GPM)	PEAK DESIGN (GPM)	PEAK DESIGN (GPD)
RESIDENTIAL										
Planning Areas 8	S-16	SF	29	1.00	29.0	200	5,800	4.03	20.14	29,000
SUB-TOTAL					29.0	SUB-TOTAL	5,800	4.03	20.14	29,000
TOTAL					29	TOTAL	5,800	4.03	20.14	29,000

(I/I=0.1*ADF)

INFILTRATION= 0.40 580

Pg.41 in Manual

TOTALS WITH INFILTRATION= 20.54 29,580

	Gallons Per Minute (GPM)	Gallons Per Day (GPD)	Cubic Feet Per Second (CFS)
Average Daily Flow	4.03	5,800	0.009
Peak Design Flow	20.14	29,000	0.045
Peak Design Flow w/ Infiltration	20.54	29,580	0.046

APPENDIX E

WASTEWATER HYDRAULIC ANALYSIS

HYDROFLOW EXPRESS OUTPUT

Channel Report

8in Sanitary Sewer Peak Hour @ 0.4%

Circular

Diameter (ft) = 0.67

Invert Elev (ft) = 5000.00

Slope (%) = 0.40

N-Value = 0.011

Calculations

Compute by: Known Q

Known Q (cfs) = 0.17

Highlighted

Depth (ft) = 0.20

Q (cfs) = 0.170

Area (sqft) = 0.09

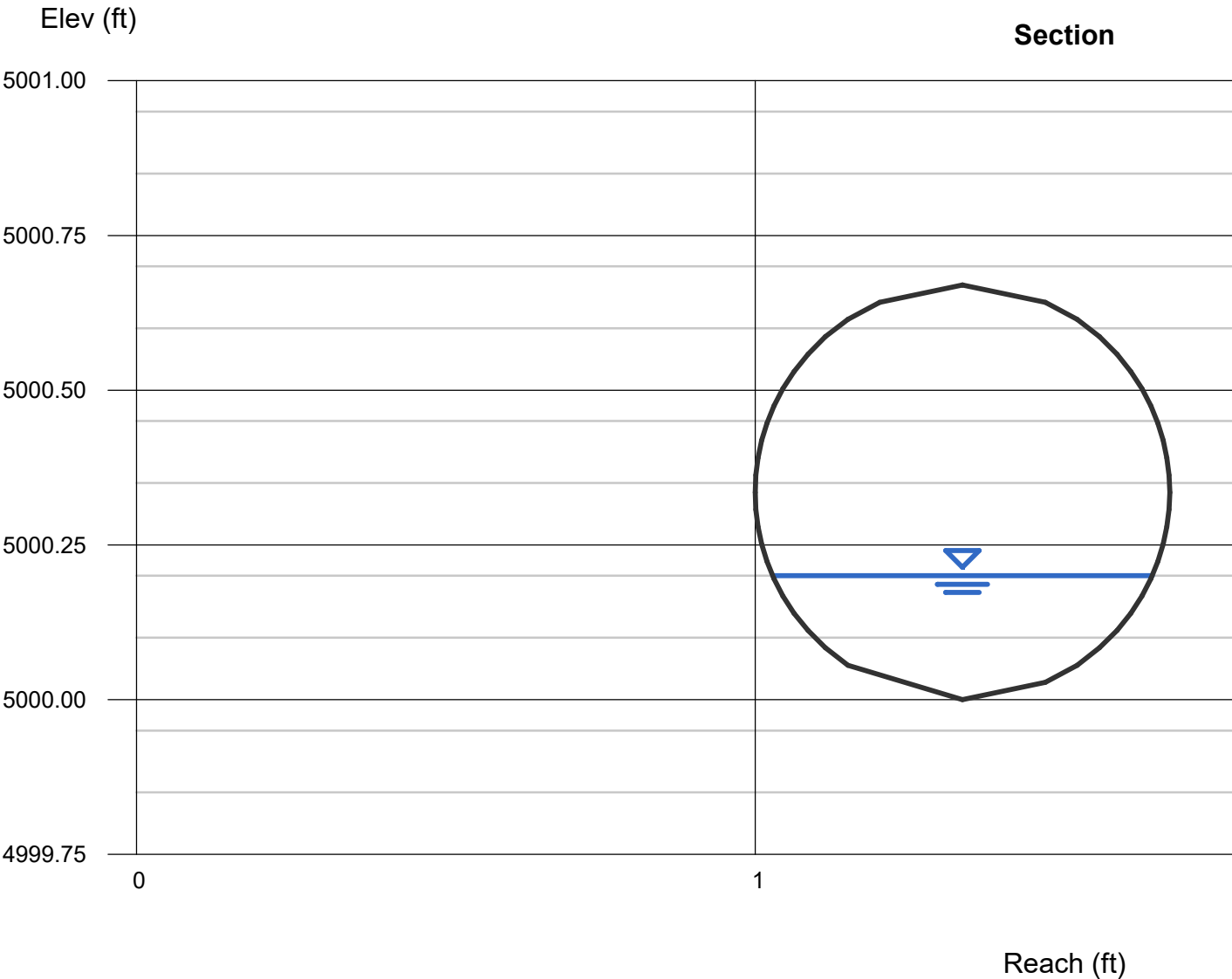
Velocity (ft/s) = 1.91

Wetted Perim (ft) = 0.78

Crit Depth, Yc (ft) = 0.19

Top Width (ft) = 0.61

EGL (ft) = 0.26



Channel Report

8in PVC Pipe @ 0.4%

Circular

Diameter (ft) = 0.67

Invert Elev (ft) = 5000.00

Slope (%) = 0.40

N-Value = 0.011

Calculations

Compute by: Q vs Depth

No. Increments = 4

Highlighted

Depth (ft) = 0.50

Q (cfs) = 0.835

Area (sqft) = 0.28

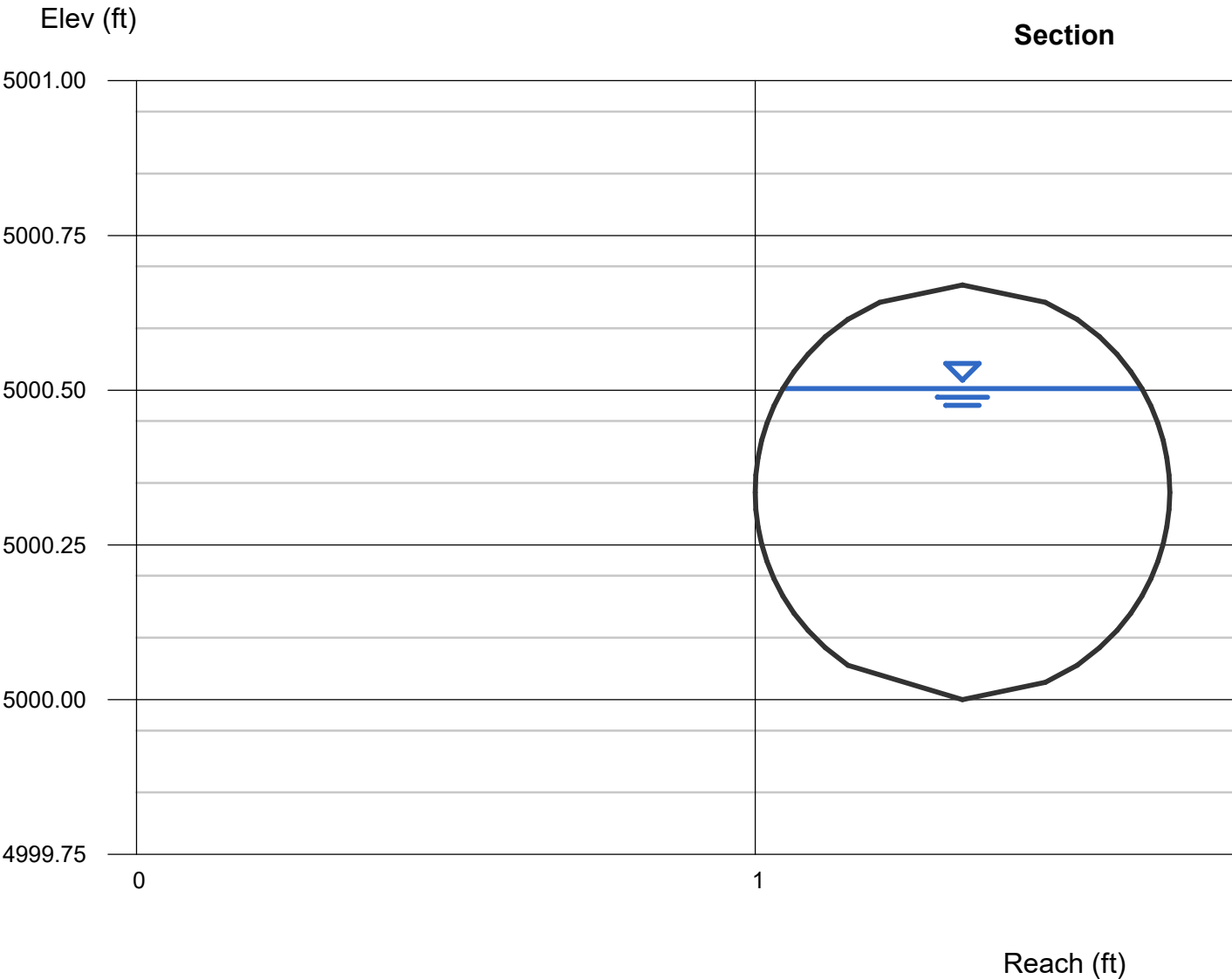
Velocity (ft/s) = 2.94

Wetted Perim (ft) = 1.40

Crit Depth, Yc (ft) = 0.44

Top Width (ft) = 0.58

EGL (ft) = 0.64



Channel Report

8in Sanitary Sewer Peak Hour @ 7.5%

Circular

Diameter (ft) = 0.67

Invert Elev (ft) = 5000.00

Slope (%) = 7.50

N-Value = 0.011

Calculations

Compute by: Known Q

Known Q (cfs) = 0.17

Highlighted

Depth (ft) = 0.10

Q (cfs) = 0.170

Area (sqft) = 0.03

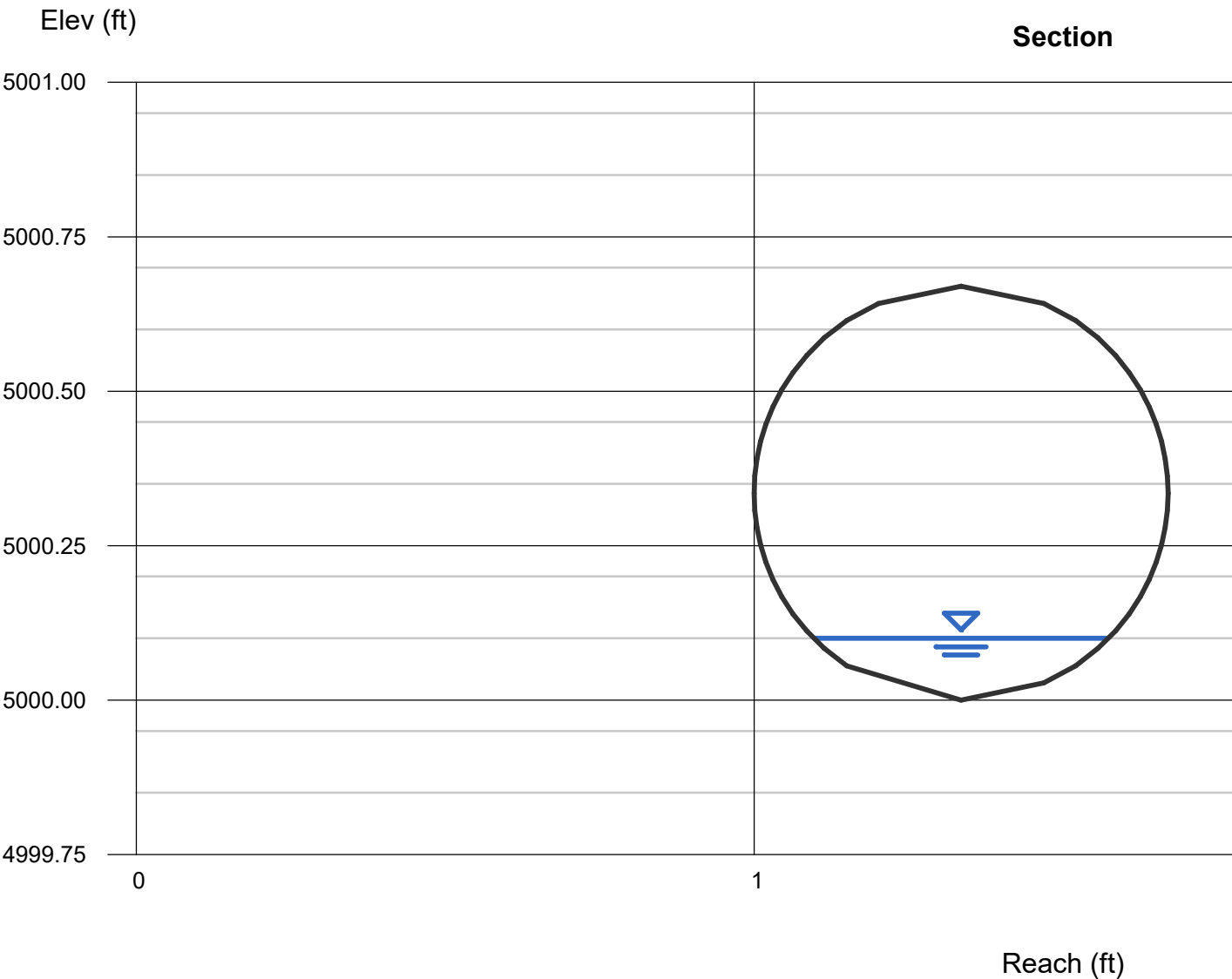
Velocity (ft/s) = 5.13

Wetted Perim (ft) = 0.53

Crit Depth, Yc (ft) = 0.19

Top Width (ft) = 0.48

EGL (ft) = 0.51



Channel Report

8in PVC Pipe @ 7.5%

Circular

Diameter (ft) = 0.67

Invert Elev (ft) = 5000.00

Slope (%) = 7.50

N-Value = 0.011

Calculations

Compute by: Q vs Depth

No. Increments = 4

Highlighted

Depth (ft) = 0.17

Q (cfs) = 0.548

Area (sqft) = 0.07

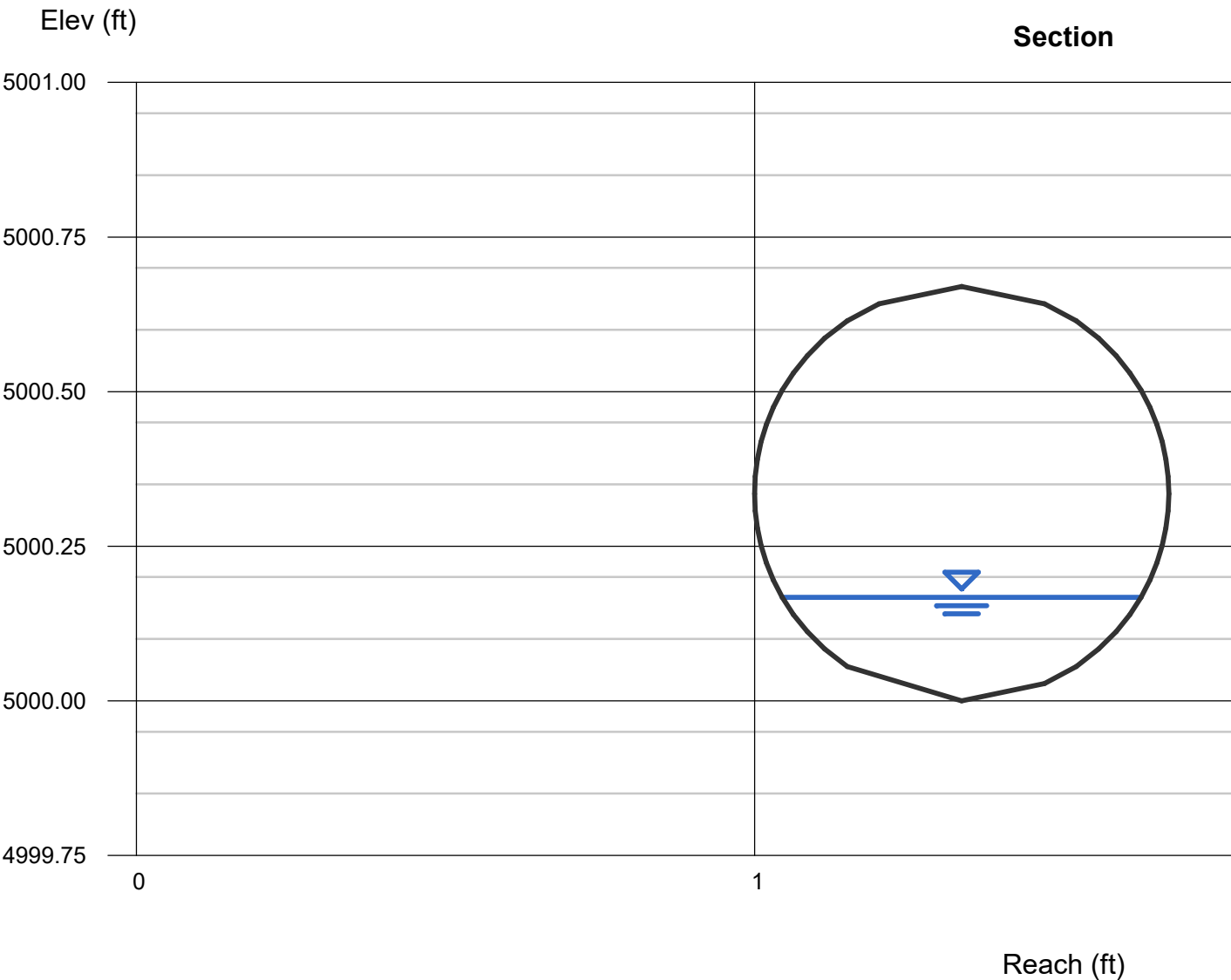
Velocity (ft/s) = 7.89

Wetted Perim (ft) = 0.70

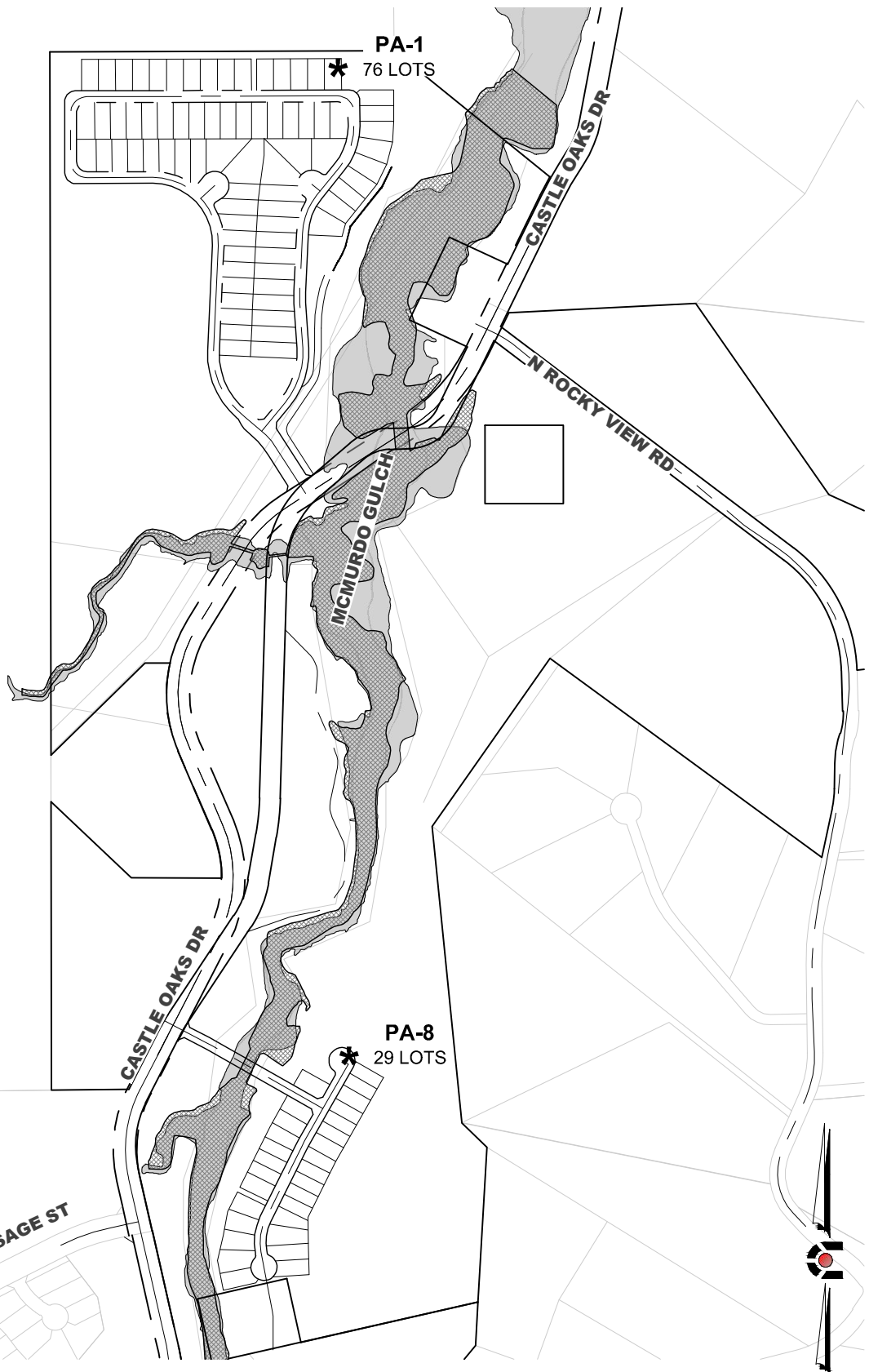
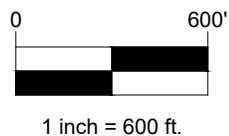
Crit Depth, Yc (ft) = 0.35

Top Width (ft) = 0.58

EGL (ft) = 1.14



7/2/2020 9:37 AM X:\14-001 NORTH BASIN\CAD\PA\NORTH-UTILITY REPORT\NORTH BASIN - VICINITY MAP UTILITY REPORT.DWG

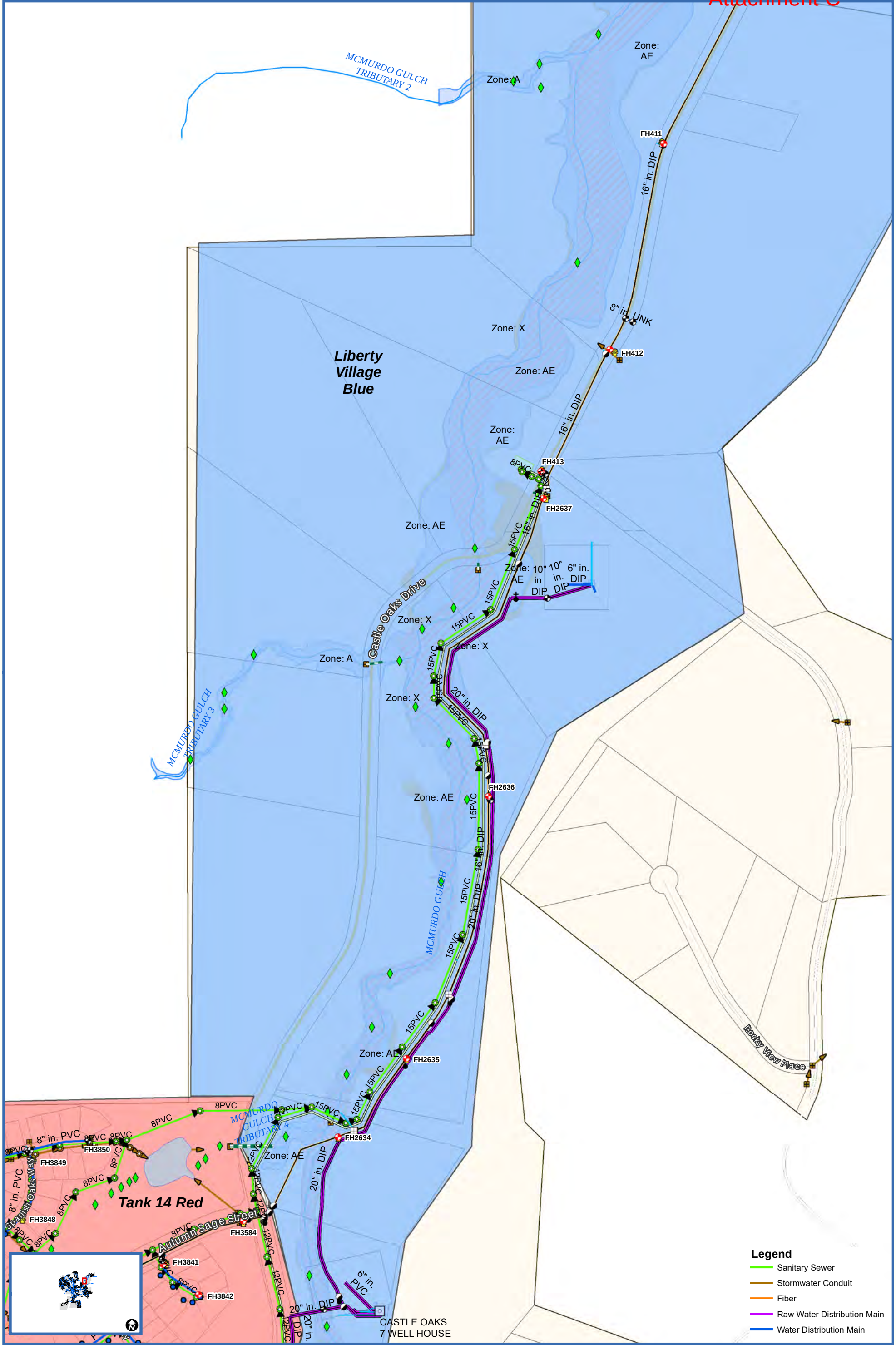


NORTH BASIN CASTLE OAKS DR SOUTH VARIANCE

CREATED BY: MJG

DATE: 07/02/2020

SHEET NUMBER
1
OF 1 SHEETS
JOB NUMBER
14-001



0 205 410 820 1,230 Feet

1 inch = 404 feet



Disclaimer: The data presented has been compiled from various sources, each of which introduces varying degrees of inaccuracies or inconsistencies. Such discrepancies in data are inherent and in supplying this product the Town of Castle Rock assumes no liability for its use or accuracy. Questions or comments regarding the cartographic composition of this map including, but not limited to, errors, omissions, corrections, and/or updates, should be directed to the Utilities Department, Town of Castle Rock, (720) 733-6087. Copyright 2019, Town of Castle Rock Utilities Mapping.

**CASTLE ROCK
UTILITIES MAP
(INTERNAL USE ONLY)**



Preliminary Utility Report Checklist

The Preliminary Utility Report must be in conformance with the latest Town of Castle Rock Water and Wastewater System Design Criteria Manuals, available on the Town's website.

For the Preliminary Utility Report, information contained in the Concept Utility Letter shall be updated to reflect the latest projections for land use and densities. Hydraulic modeling shall only be required for the site proposed in the Site Development Plan (SDP). This modeling may be waived on a case-by-case basis at the discretion of the Utilities Department if it is adequately demonstrated that the SDP is already consistent with the Town's Water/Wastewater Master Plans and that the existing adjacent water/wastewater infrastructure is adequate to support the development without modifications or if the SDP is for a commercial structure on a single lot. The modeling shall accurately reflect the sizes and locations of all proposed water mains associated with the SDP layout. In addition to providing updated land use and density information, the following items shall be specifically addressed:

- Further analysis of any concerns raised in the Concept Utility Letter regarding the Town's ability to serve the development.
- Updated discussion of appurtenant water/wastewater facilities other than distribution mains that will be necessary to serve the development, and the principal design parameters that will be utilized in the final design of such facilities.
- Status of any variances that have been obtained, or will be pursued.
- Updated discussion of maintenance access and any associated concerns.
- Updated status of permitting requirements.
- Updated appendices.

The following outline sets forth the **required minimum** content to be provided in the Preliminary Utility Report that shall be submitted with the SDP. This report must be prepared by, or the report preparation supervised by a registered Professional Engineer licensed in Colorado. A copy of this checklist must be submitted with the Preliminary Utility Report.

Please check off the following items to assure your report is complete. Appropriate notations shall be provided with the checklist. For example, if a specific item is not addressed or not applicable, an explanation needs to be provided.

Included	N/A	
		TITLE SHEET
✓		A. Name of Project, including legal name of development
✓		B. Address
✓		C. Owner
✓		D. Developer
✓		E. Engineer
✓		F. Submittal date and revision dates as applicable

Preliminary Utility Report – Formatting Checklist

Included	N/A	
✓		APPROVAL BLOCK SHEET (Available on Town's website)
✓		TABLE OF CONTENTS
		PROJECT LOCATION AND DESCRIPTION
✓		A. Site Location
✓		B. Description of Property and Land Use
		CALCULATED WATER DEMANDS
✓		A. Average Day Demands (ADD)
✓		B. Max Day Demands (MDD)
✓		C. Peak Hour Demands (PHD)
		EXISTING WATER SYSTEM
✓		A. Existing Distribution System
✓		B. Existing Supply Facilities
		PROPOSED WATER SYSTEM
✓		A. Proposed Distribution System
	✓	B. Proposed Supply Facilities
✓		C. Land Dedication Requirements
		PROPOSED WATER SYSTEM ANALYSIS AND MODELING
✓		A. Hydraulic Models
✓		B. Hydraulic Modeling Scenarios
✓		C. Hydraulic Modeling Output and Required Schematics
		CALCULATED WASTEWATER FLOWS
✓		A. Average Day Wastewater Flows (ADF)
✓		B. Peaking Factor
✓		C. Peak Design Flows (PDF)
		EXISTING WASTEWATER SYSTEM
✓		A. Existing Collection System
		PROPOSED WASTEWATER SYSTEM
✓		A. Proposed Collection System
	✓	B. Proposed Wastewater Facilities
✓		C. Land Dedication Requirements
		PROPOSED WASTEWATER SYSTEM ANALYSIS AND MODELING
✓		A. Hydraulic Models
✓		B. Hydraulic Modeling Scenarios
✓		C. Hydraulic Modeling Output and Required Schematics

Preliminary Utility Report – Formatting Checklist

Included	N/A	
✓		POTENTIAL PERMITTING REQUIREMENTS
✓		REFERENCES
		APPENDICES
✓		Appendix A — Water Demands
✓		Appendix B — Water Storage
✓		Appendix C — Water Hydraulic Analysis and Modeling
✓		Appendix D — Wastewater Flows
✓		Appendix E — Wastewater Hydraulic Modeling
✓		Appendix F — Maps and Plans
✓		A. Vicinity Map
✓		B. Utility Map(s) provided by the Utilities Department
✓		C. Site Development Plan
✓		D. Water/Wastewater Utility Plan(s)

Notes/Comments:

APPENDIX F

MAPS AND PLANS

VICINITY MAP
TOWN OF CASTLE ROCK UTILITY MAP
FINAL UTILITY PLAN CHECKLIST
REFERENCES
WATERCAD MAPS

EXCERPTS FROM
CASTLE OAKS FILING NO. 1
FINAL WATER
& SANITARY SEWER
SYSTEM ANALYSIS REPORT

For

Castle Oaks Estates, LLC

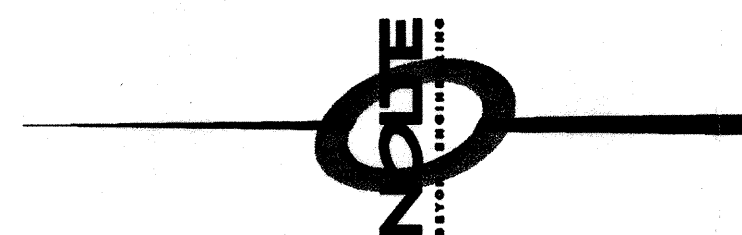
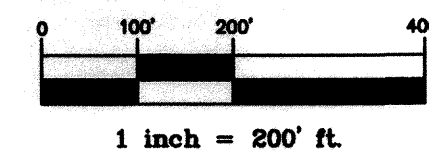
2 North Cascade Avenue
Colorado Springs, CO 80903

By

Nolte Associates, Inc.
7000 S. Yosemite Street, Suite 200
Englewood, Colorado 80112
(303) 220-1001

April 2002
Revised September 2002
Revised January 2003
Revised April 2003

EXCERPTS FROM CASTLE
OAKS FILING NO. 1 FINAL
WATER & SANITARY
SEWER SYSTEM ANALYSIS



SEE SHEET IV

SEE SHEET IV

CASTLE OAKS FILING NO. 1
EXHIBIT IV
SANITARY SEWER ANALYSIS

NOLTE

BEYOND ENGINEERING

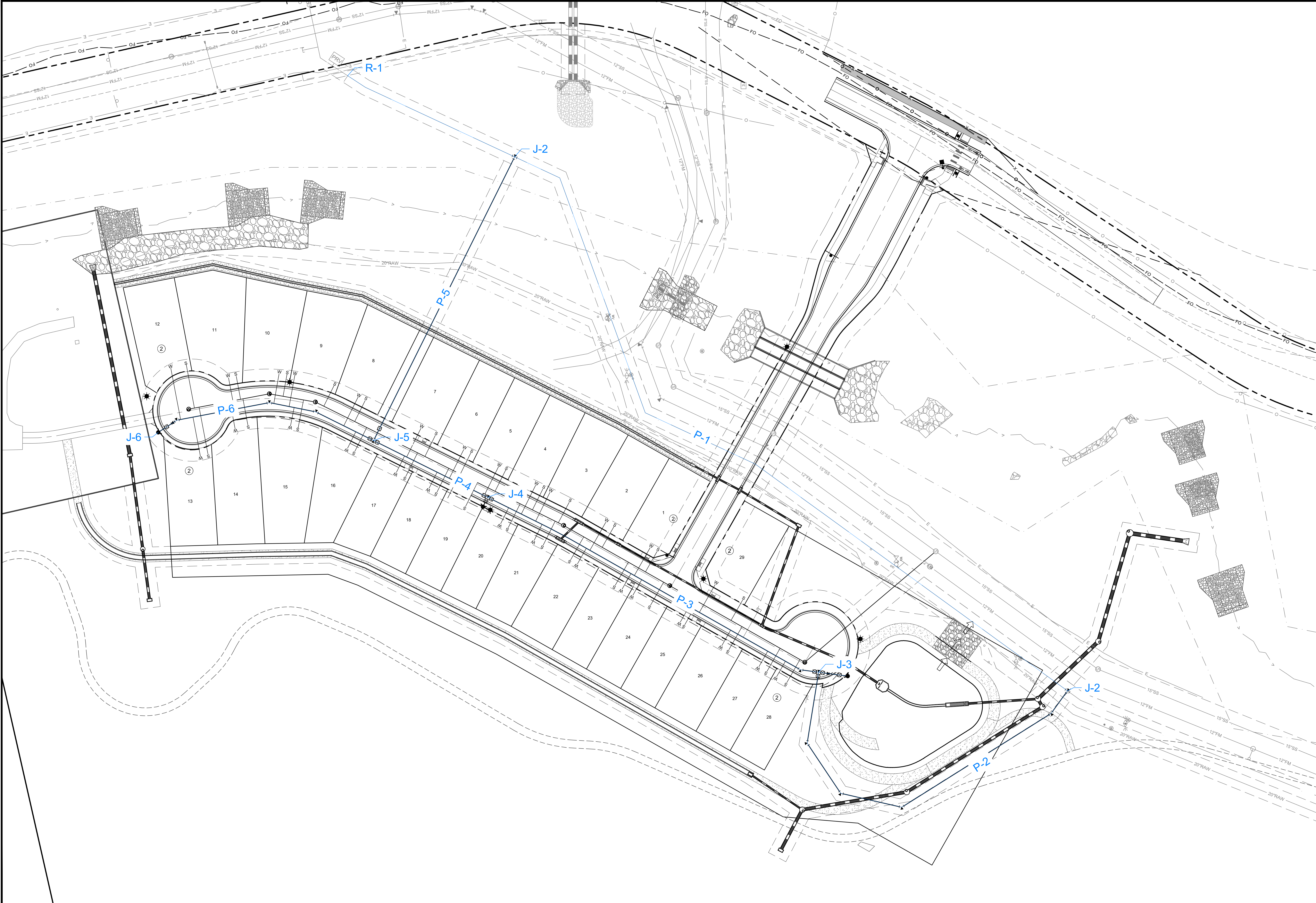
7000 SOUTH YOSEMITE ST., SUITE 200,
ENGLEWOOD, CO. 80150
303.220.1001 TEL 303.220.9001 FAX
WWW.NOLTE.CO

SHEET NUMBER	
V	
OF	SHEETS
V	
SCALE	
VERTICAL: 1" = N/A	
HORIZONTAL: 1" = 200	
JOB NUMBER	
DV1383	

for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.

DATE SUBMITTED: 04/02

PREPARED FOR: CASTLE OAKS ESTATES, LLC



DATE: 2/3/2023

CREATED BY: LK

JOB NO.
14-001

SHEET
1

TERRAIN NORTH BASIN
(PHASE 2)

WATER CAD MAP

CORE

CORE CONSULTANTS, INC.
3472 S. BROADWAY
DENVER, CO 80113
303.703.4444
LIVE@OURCORE.COM

LAND DEVELOPMENT
ENERGY
PUBLIC INFRASTRUCTURE

0

50'

1 inch = 50 ft.