



Preliminary Utility Report

**QuikTrip 4267
Lot 2, Plum Creek Commons
Unit Two
Castle Rock, Colorado**

Prepared for:

**QuikTrip Corporation
4705 South 129th East Ave
Tulsa, OK 74134
(918) 615-7273
Contact: Tushar Patel**

Prepared by:

**Kimley-Horn and Associates, Inc.
2 N Nevada Avenue, Suite 900
Colorado Springs, CO 80903
(719) 453-0180
Contact: Jessica McCallum**



Project #: 096888068
Prepared: May 8, 2026
Revised:



UTILITY REPORT APPROVAL BLOCKS

Engineer's Statement:

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

Signature: _____

Registered Professional Engineer State Of Colorado No. _____

(Affix Seal)

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.

Name of Developer

Authorized Signature

TABLE OF CONTENTS

PROJECT LOCATION AND DESCRIPTION	4
SITE LOCATION	4
DESCRIPTION OF PROPERTY AND LAND USE	4
EXISTING WATER SYSTEM.....	5
EXISTING DISTRIBUTION SYSTEM	5
EXISTING SUPPLY FACILITIES	6
CALCULATED WATER SYSTEM DEMANDS	6
AVERAGE DAY DEMANDS (ADD)	6
MAX DAY DEMANDS (MDD)	7
PEAK HOUR DEMANDS (PHD).....	8
PROPOSED WATER SYSTEM	9
PROPOSED WATER SYSTEM ANALYSIS AND MODELING	9
STATIC DEVELOPMENT SCENARIO	9
MAX DAY DEMAND PLUS FIRE FLOW SCENARIO	9
PEAK HOUR DEMAND SCENARIO	10
EXISTING WASTEWATER SYSTEM	10
EXISTING COLLECTION SYSTEM	10
CALCULATED WASTEWATER FLOWS	10
AVERAGE DAILY WASTEWATER FLOWS (ADF)	10
PEAKING FACTOR	11
PEAK DESIGN FLOWS	12
PROPOSED WASTEWATER SYSTEM.....	12
PROPOSED WASTEWATER SYSTEM ANALYSIS AND MODELING	12
CONCLUSION	13
COMPLIANCE WITH STANDARDS.....	13
REFERENCES	14

APPENDIX LIST

APPENDIX A – WATER DEMANDS

APPENDIX B – WASTEWATER FLOWS

APPENDIX C – WATER STORAGE

APPENDIX D – WATER SYSTEM HYDRAULIC ANALYSIS AND MODELING

APPENDIX E – SANITARY SEWER SYSTEM HYDRAULIC MODELING

APPENDIX F – MAPS AND PLANS

PROJECT LOCATION AND DESCRIPTION

The purpose of this report is to outline the utility design of the proposed QuikTrip Store No. 4267 and Bubble Bath Car Wash project ("the Project") located at 405 S. Wilcox Street in Castle Rock, Colorado.

SITE LOCATION

The Site is located in southwest of the E. Plum Creek Parkway and S. Wilcox Street intersection at 405 S. Wilcox Street in Castle Rock, Colorado. More specifically the site is Lot 2 of Plum Creek Commons Unit Two in the Southwest ¼ Section 11, Township 8 South, Range 67 West of the 6th Prime Meridian in the City of Castle Rock, County of Douglas, State of Colorado. The Site is bounded by a commercial building to the north and south, S. Wilcox Street to the east, and East Plum Creek to the west. The Site is located adjacent to Lot 1 of Plum Creek Commons Unit One. The Site is within a Straight Zoned Area and is Zoning Type B per Town of Castle Rock Municipal Code Title 17.

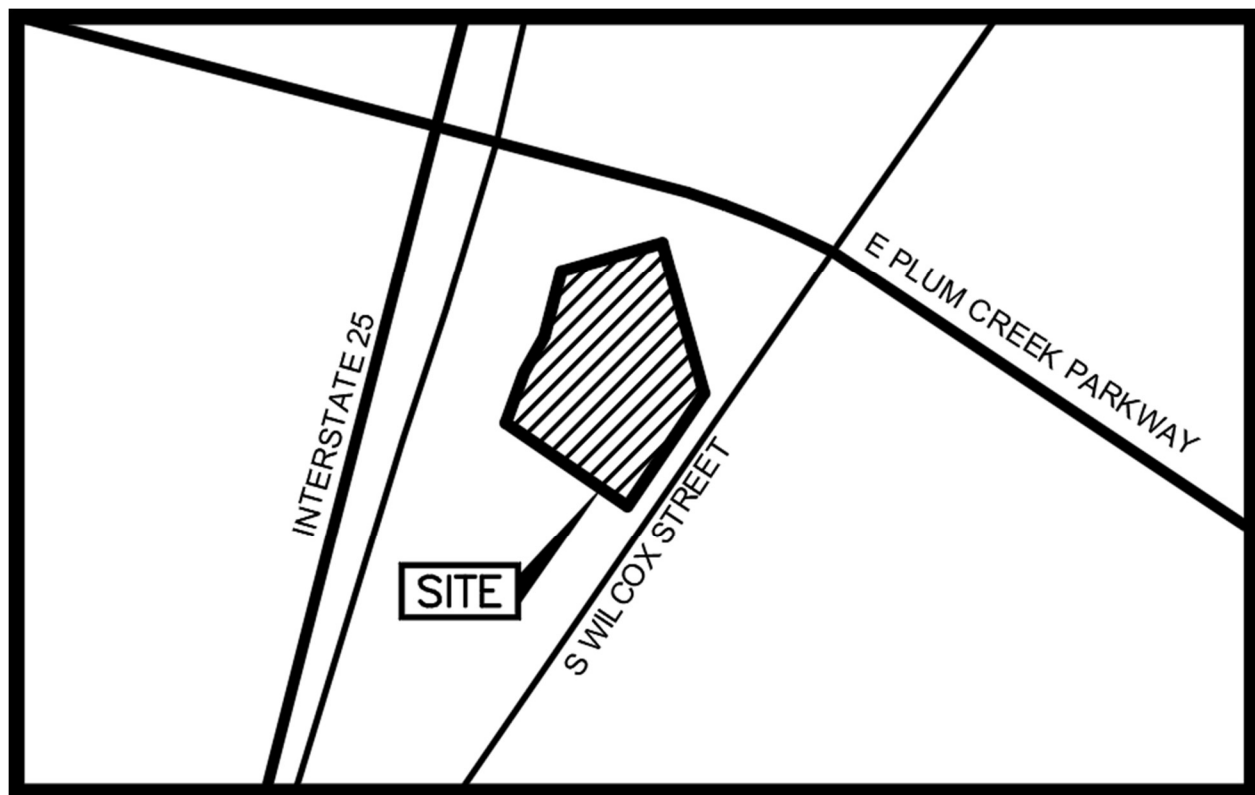


Figure 1: Site Vicinity Map

DESCRIPTION OF PROPERTY AND LAND USE

The Site totals approximately 3.113 acres with an existing vacant commercial building with parking and associated utilities, all on Lot 2 of the Plum Creek Commons subdivision. The Project is anticipated to consist of a 6,445 square foot single story QuikTrip Convenience Store and a 4,326 square foot Bubble Bath Car Wash. The QuikTrip Convenience Store will be accompanied by detached fuel pumps, an air station, drive aisles and parking looping the building, landscaping, and associated utility improvements. The Bubble Bath Car Wash will have drive aisles and parking, landscaping, and associated utility improvements. It is anticipated that 0.83 acres of land within the Site will be landscaped and irrigated. The

existing access roads off East Plum Creek Parkway and South Wilcox Street will be utilized for site access.

Per the Town of Castle Rock Water and Wastewater Criteria Manuals (2018), the single-family equivalents (SFEs) for the development were calculated, as shown in **Table 1**.

The Bubble Bath Car Wash SFE calculations were done using the Car Washes Criteria outlined in Section 4.4.1 of the Water Design Criteria Manual and Section 4.4.1.1 of the Wastewater Design Criteria Manual.

The QuikTrip Convenience Store SFE calculations were done using the Retail/Offices Criteria outlined in Section 4.4.1 of the Water Design Criteria Manual and Section 4.4.1.1 of the Wastewater Design Criteria Manual.

The irrigated land SFE calculations were done using the Irrigated Land Criteria outlined in Section 4.4.1 of the Water Design Criteria Manual and Section 4.4.1.1 of the Wastewater Design Criteria Manual. Note that all landscaped areas within the Site were taking into account, including those adjacent to the QuikTrip Convenience store. Demand calculations for Retail/Offices are inclusive of demands for irrigated land, however, Car Wash demand criteria are not. As both facilities are on the same site, to ensure all demand from irrigated land was considered and to get a more conservative estimate, demand for all irrigated land within the site was calculated separately.

Table 1: Calculated SFEs for Development

	Bubble Bath Car Wash	QuikTrip Convenience Store	Irrigated Land
Water SFEs	12.5	3.2	7.7
Wastewater SFEs	2.48	3.2	0.0

There are a number of existing easements located within and immediately adjacent to the site, including multiple utility and access easements. Final easements or tracts necessary for utilities are not known at this time but will be provided at either at time of platting or at time of final design and construction documents in accordance with Town of Castle Rock standards regarding location and size of easements and tracts.

There are no navigable waterways on the Project Site, however, some of the Eastern portions of the site cross into the East Plum Creek 100-year regulatory floodplain.

EXISTING WATER SYSTEM

The existing water system at the Project Site is shown in the utility map provided by Castle Rock Water, **Appendix F**.

EXISTING DISTRIBUTION SYSTEM

There is an existing looped water line providing water to the existing infrastructure on the Project Site. The existing water line is a 6” cast iron pipe with one existing fire hydrant located in the existing parking lot on site. Existing infrastructure is shown in the utility map in **Appendix F**.

The proposed utilities for the Project will connect to the existing 6” cast iron pipe within South Wilcox Street to the southeast of the Project site. The existing Town of Castle Rock pressure zone at the proposed connection points to the existing water system is the Tank 5 Yellow Pressure Zone per the Town of Castle Rock Water Master Plan (2023).

There are two existing buildings immediately adjacent to the Site, consisting of one building to the Northeast and one building to the South. Both existing buildings adjacent to the Site connect to the existing 6” cast iron pipe running through the existing parking lot.

EXISTING SUPPLY FACILITIES

The 2023 Town of Castle Rock Water Master Plan provides mapping of the existing water mains, pressure zones, and nearby tanks and PRVs. The Project Site is located adjacent to existing water distribution mains as shown in the utility map in **Appendix F**.

The Project Site is located within the Tank 5 Yellow Pressure Zone per the Town of Castle Rock Water Master Plan (2023). The hydraulic grade line for the Site ranges from 6334’ to 6352’. The Site is serviced by Tanks 12A and 12B and the Meadows Water Treatment Plant and Plum Creek Water Purification Facility. The capacities and fire volumes in each tank are shown in **Table 2**, below:

Table 2: Existing Tank Volumes		
	Capacity (MG)	Fire Flow Volume in Tank (MG)
Tank 12A	3.94	0.72
Tank 12B	6.13	0.72

CALCULATED WATER SYSTEM DEMANDS

Water system demands were calculated using Chapter 4 of the Town of Castle Rock Water Criteria Manual (2018) and the 2024 International Fire Code (IFC). Full water demand calculations are included in **Appendix A**.

AVERAGE DAY DEMANDS (ADD)

Chapter 4 of the Town of Castle Rock Water Criteria Manual provides typical average day demand (ADD) for different land usage types. The water design criteria utilized to calculate the ADD for the Project were as follows:

- Retail/Office Typical ADD/Unit = 0.2 gpd/SF, including irrigation demands
- Car Washes Typical ADD/Unit = 5,000 gpd/facility, not including irrigation demands
- Irrigated Land (Sports Fields and School Sites Excluded) = 3,750 gpd/irrigated acre

Subtotaled demands categorized by land use type are shown in **Table 3**. Note that the Bubble Bath Car Wash and QuikTrip Convenience Store are located on the same site and that the demand calculation for the Retail/Offices land use is inclusive of irrigation demand while the demand calculations for Car Washes are not. In an effort to provide a conservative estimate, the demand from irrigation for all irrigated areas within the Project Site was calculated, regardless of proximity to the Bubble Bath Car Wash or the QuikTrip Convenience Store.

Table 3: Projected Water Average Day Demands

	Land Use	ADD (gpd)	ADD (gpm)	Average Annual Supply (AF/YR)
QuikTrip Convenience Store	Retail/Offices	1,289	0.895	1.444
Bubble Bath Car Wash	Car Washes	5,000	3.472	5.601
Irrigated Land	Irrigated Land (Sports Fields and School Sites Excluded)	3,098	2.151	3.470

Water use data provided by the MEP Engineer for the Bubble Bath Car Wash from a comparable location with similar traffic showed a higher average day demand of 14,329 gpd (10.0 gpm) when compared to the City's planning demand generation factors. These demands provided by the MEP engineer assume that 550 cars would be utilizing the car wash each day during its 12 hours of operation. The calculations used by the MEP Engineer to reach the average day demand value are based on the equipment present in the car wash. The 14,329 gpd average day demand calculated by the MEP Engineer represents the amount of water consumed from the city each day but is not representative of the total amount of water used for daily operations. The remaining water needed for each car wash will be taken from the Project's on-site reclaimed water storage tank. A comparison of the calculated demand for the Bubble Bath using Town Criteria versus the provided MEP demands for the Bubble Bath are shown in **Table 4**, below.

Table 4: Comparison of Car Wash Calculated Water System Average Day Demands

	ADD (gpd)	ADD (gpm)	Average Annual supply (AF/YR)
Bubble Bath Car Wash – Calculated from Town Criteria	5,000	3.472	5.601
Bubble Bath Car Wash – Demands provided by MEP	14,329	9.951	16.050

The demands provided by the MEP Engineer for the Bubble Bath Car Wash give a more conservative estimate of water usage at the proposed Bubble Bath Car Wash. The demands from MEP were used for further calculations and modeling to get a more conservative estimate of demands on the existing system.

MAX DAY DEMANDS (MDD)

Chapter 4 of the Town of Castle Rock Water Criteria Manual provides the following peaking factor for maximum day demand (MDD):

$$\text{Maximum Day Demand/Average Day Demand (MDD/ADD)} = 2.5$$

$$\text{MDD} = \text{Domestic ADD} \times \text{Maximum Day Factor} + \text{Irrigation ADD}$$

The tabulated MDDs, subtotaled by land use, are shown in **Table 5**. Note that the MDD calculated for the Bubble Bath Car Wash was based on the ADD provided by the MEP Engineer to get a more conservative estimate and that irrigation demands are included in the Car Wash land use subtotal.

Table 5: Projected Water System Maximum Day Demands

	Land Use	MDD (gpd)	MDD (gpm)
QuikTrip Convenience Store	Retail/Offices	3,223	2.238
Bubble Bath Car Wash	Car Washes	38,921	27.028

Fire flow demands were determined per 2024 International Fire Code (IFC). For the purpose of the fire flow calculations, because construction type was unknown, it was assumed that the construction type for both the QuikTrip Convenience Store and the Bubble Bath Car Wash would be Type V-B. Type V-B construction yields the most conservative fire flow demands under IFC. The square footage of both the QuikTrip Convenience Store and the Bubble Bath Car Wash were used to estimate fire flows using Tables B105.1 and B105.1(2) from the 2024 IFC. Fire flows necessary for each building are shown in **Table 6**, below.

Table 6: Fire Flows per IFC (2024)

	Fire Flow (gpm)	Duration (hours)
QuikTrip Convenience Store	2,250	2
Bubble Bath Car Wash	1,750	2

For the purpose of future calculations and modeling using fire flow, the largest determined required fire flow, 2,250 gpm, was used.

The tabulated MDDs and fire flow demands were used to calculate the required storage volumes necessary to serve the development, as specified in the Town of Castle Rock Water Design Criteria Manual and shown below:

$$\text{Storage (MG)} = \text{Maximum Day Demand (MG)} + \text{Fire Flow (MG)}$$

The storage volume necessary for the QuikTrip Convenience Store and The Bubble Bath Car Wash is 50,143 gallons (0.050 MG). Full fire flow and required storage volume calculations are shown in **Appendix C**.

PEAK HOUR DEMANDS (PHD)

Chapter 4 of the Town of Castle Rock Water Criteria Manual provides the following peaking factor for peak hour demand (PHD):

$$\text{Peak Hour Demand/Average Day Demand (PHD/ADD)} = 5.5$$

$$\text{PHD} = \text{Domestic ADD} \times \text{Peak Hour Factor} + \text{Irrigation ADD}$$

The tabulated PHDs, subtotaled by land use, are shown in **Table 7**, below. Note that the Bubble Bath Car Wash PHD shown below was calculated using the demand from the MEP Engineer and is inclusive of the irrigation demand for the entire Site.

Table 7: Projected Water System Peak Hour Demands

	Land Use	PHD (gpd)	PHD (gpm)
QuikTrip Convenience Store	Retail/Offices	7,090	4.923
Bubble Bath Car Wash	Car Washes	81,908	56.880

PROPOSED WATER SYSTEM

The proposed water system will be looped through the development by tapping the existing 8" main in South Wilcox Street and utilizing part of the existing 6" line entering the north side of the site off of E Plum Creek Parkway. The tapping mechanisms will be per the Town of Castle Rock Water System Design Criteria Manual. Proposed easements are shown on the Utility Plan in **Appendix F**. Calculations for the proposed water system are included in **Appendix A**. The domestic meter size will be based on water supply fixture units at the time of building permit.

A portion of the existing 6" looped water line on site will be demolished. A new 8" looped water main will be installed on site to provide service to the Project and to the existing buildings located immediately adjacent to the Site. Existing services to buildings adjacent to the Site will be impacted during construction as the existing loop is removed and new pipe is installed. Both services will be disconnected from the existing 6" cast iron pipe and reconnected to the new pipe segments installed as part of the Project. The building to the south of the Site will be connected to a new 8" water main following the same general alignment to S Wilcox St. The building to the northeast of the Site will be connected to a new 6" water main. Services to these buildings will be restored in the final condition, as shown in the plans included in **Appendix F**.

PROPOSED WATER SYSTEM ANALYSIS AND MODELING

The proposed water system has been modeled with WaterCAD. Anticipated distribution lines and connections to the existing system are represented within the model as shown in **Appendix D**. Nodes modeled within the distribution system were set at anticipated design pipe elevations with a minimum depth of cover of 5 feet. All pipes within the model were calculated using Hazen-Williams coefficients of 120. The section below discusses all modeled scenarios and results compared to the required hydraulic design criteria set forth in Chapter 4 of the Town of Castle Rock Water System Design Criteria.

STATIC DEVELOPMENT SCENARIO

Static development pressures with zero demands with the supplying storage tanks at 20% and 100% full are included within this report in **Appendix D**. The tank level HGLs (Hydraulic Grade Line) for the Town of Castle Rock Water Yellow Pressure Zone utilized for these scenarios were 6334' for the 20% full static condition and 6352' for the tank 100% full static condition. The 20% full static condition is referred to as the low HGL scenario and the 100% full static condition is represented by the high HGL scenario. Hydraulic Modeling results are included in **Appendix D**.

As seen in **Appendix D**, the static pressure throughout the system is between 50 and 90 pounds per square inch (psi) during both tank stages, satisfying Town of Castle Rock Water Design Criteria. The HGL of 6334' for the tank 20% stage was further utilized to evaluate all remaining scenarios in the dynamic conditions.

MAX DAY DEMAND PLUS FIRE FLOW SCENARIO

In the MDD scenario and all MDD plus Fire Flow Scenarios tested, all calculated demands can be provided with the proposed pipes throughout the development distribution system connecting to the existing system. Pipe sizes for both the proposed and existing system are shown in **Appendix D**.

As seen in **Appendix D**, in the MDD scenario, all pressures are within the required range of 43-125 psi and velocities within pipes do not exceed 5 ft/s (feet per second) compliant with Town of Castle Rock Water Design Criteria. Two MDD plus Fire Flow scenarios were run, applying all fire flow demands to each of the hydrants on site. In both of the MDD plus Fire Flow scenarios modeled, each hydrant within the Site was able to provide 2,250 gpm of available fire flow at 20 psi residual pressure per the 2024 International Fire Code. Fire Flow results tables are included in **Appendix D**. Fire Flow confirmation from Castle Rock Fire and Rescue will be obtained to verify fire flow results during construction document review.

PEAK HOUR DEMAND SCENARIO

In PHD scenario, all calculated demands can be provided with 8" pipes. Additionally, all pressures within the distribution system are within 43-125 psi and velocities within pipes do not exceed 10 ft/s, compliant with Town of Castle Rock Water Design Criteria. Model results for this scenario are included in **Appendix D**.

EXISTING WASTEWATER SYSTEM

The existing wastewater system at the Project Site is shown in the utility map provided by Castle Rock Water, **Appendix F**.

EXISTING COLLECTION SYSTEM

There is an existing 8" vitrified clay pipe running through the current site on the eastern side. This pipe runs from the southeast corner of the site north into East Plum Creek Parkway where it joins a 15" PVC line which runs through East Plum Creek Parkway to the north of the Site. Additionally, there is an existing 10" vitrified clay pipe following the alignment of South Wilcox Street to the west of the site.

Existing piping on site flows into the downtown portion of the Town of Castle Rock gravity sanitary sewer system.

CALCULATED WASTEWATER FLOWS

Wastewater system demands were calculated using Chapter 4 of the Town of Castle Rock Wastewater Criteria Manual (2018). Full wastewater demand calculations are included in **Appendix B**.

AVERAGE DAILY WASTEWATER FLOWS (ADF)

Chapter 4 of the Town of Castle Rock Wastewater Criteria Manual provides wastewater system average daily flows (ADFs) for different land usage types. The following wastewater design criteria were utilized to calculate system demands:

- Retail/Offices Typical ADF/Unit = 0.1 gpd/SF
- Car Washes Typical ADF/Unit = 5,000 gpd/acre
- Irrigated Land Typical ADF/Unit = 0 gpd/acre

Projected ADFs for the Project, subtotaled by land usage type, are shown in **Table 8**.

Table 8: Projected Sanitary Sewer Average Daily Flows

	Land Use	ADF (gpd)	ADF (gpm)	ADF (cfs)
QuikTrip Convenience Store	Retail/Offices	644.5	0.448	0.0010
Bubble Bath Car Wash	Car Washes	496.6	0.345	0.0008
Irrigated Land	Irrigated Land	0.0	0.000	0.0000

Demand data provided by the MEP Engineer for the Bubble Bath Car Wash from a comparable location with similar traffic shows an ADF of 423 gpd, slightly below the calculated demand using Town of Castle Rock criteria. Demands provided by the MEP Engineer assume that 550 cars would be utilizing the car wash each day during its 12 hours of operation and are based upon the equipment present in the car wash. The ADF provided from the MEP Engineer is not representative of the flows that will be captured by the on-site reclaimed water tanks and represents only the flows being returned to the existing sanitary sewer system. A comparison of the calculated ADF using Town Criteria and the ADF provided by the MEP Engineer are shown in **Table 9**, below.

Table 9: Comparison of Car Wash Sanitary Sewer Average Daily Flows

	ADF (gpd)	ADF (gpm)	ADF (cfs)
Bubble Bath Car Wash – Calculated from Town Criteria	496.6	0.345	0.0008
Bubble Bath Car Wash – Demands provided by MEP	423.0	0.294	0.0007

The ADF calculated using Town Criteria is more conservative than the value provided by the MEP Engineer and was used in all further calculations and models to provide a more conservative estimate of system impacts.

PEAKING FACTOR

The Peaking Factor (PF) was calculated using the Town of Castle Rock Wastewater Design Criteria Manual criteria below:

$$PF = 3.65 \times [(ADF)^{-0.168}]$$

$$\text{Maximum PF} = 5.0$$

The tabulated PFs by land usage type are shown in **Table 10**, below. Note that peaking factor for the Bubble Bath Car Wash was calculated using the ADF as determined using the Town of Castle Rock Wastewater Design Criteria as it provides a more conservative estimate than the ADF provided by the MEP Engineer.

Table 10: Sanitary Sewer Peaking Factor

	Land Use	ADF (MGD)	Calculated PF	PF Used
QuikTrip Convenience Store	Retail/Offices	0.000645	12.5	5.0
Bubble Bath Car Wash	Car Washes	0.000497	13.1	5.0
Irrigated Land	Irrigated Land	0.000000	0.0	0.0

PEAK DESIGN FLOWS

Peak Design Flows (PDFs) were calculated using the following Town of Castle Rock Wastewater Design Criteria:

$$\text{PDF} = \text{Peak Base Flow} + \text{I/I Allowance} = (\text{ADF} \times \text{PF}) + (0.1 \times \text{ADF})$$

The tabulated PDFs by land usage type are shown in **Table 11**, below. Note that the ADF used to tabulate the PDF for the Bubble Bath Car Wash was determined using Town of Castle Rock Wastewater Design Criteria as it is more conservative than the ADF provided by the MEP Engineer.

Table 11: Projected Sanitary Sewer Peak Design Flows

	Land Use	PDF (gpd)	PDF (gpm)	PDF (cfs)
QuikTrip Convenience Store	Retail/Offices	3,287	2.28	0.00611
Bubble Bath Car Wash	Car Washes	2,532	1.76	0.00471
Irrigated Land	Irrigated Land	0	0.00	0.00000

PROPOSED WASTEWATER SYSTEM

The proposed sanitary sewer system will collect flows from the existing veterinary building to the southeast of the Site by installing a manhole on the existing 8" VCP line running along the western side of the Site. Approximately 350 linear feet of the existing 8" VCP sanitary sewer line on site will be removed and manholes will be installed to collect flow from the existing buildings adjacent to the Project Site. Service will be maintained to the existing buildings adjacent to the site by installing a manhole at each end of the demolished section of pipe. Flows from the proposed QuikTrip Convenience Store and Bubble Bath Car Wash would be collected by a proposed 8" PVC sanitary sewer line connecting to the existing 10" VCP sanitary sewer line in South Wilcox Street. Proposed system modifications are reflected in the plans included in **Appendix F**.

PROPOSED WASTEWATER SYSTEM ANALYSIS AND MODELING

The proposed wastewater system has been evaluated using FlowMaster. Anticipated collection lines and connections to the existing system are represented within the model as shown in **Appendix E**. Pipe segments modeled within the collection system utilized a Manning's coefficient value of $n = 0.011$ for PVC as specified in Chapter 4 of the Town of Castle Rock Wastewater System Design Criteria.

The proposed wastewater system will convey flows from the existing veterinary services building located southwest of the Project Site, the proposed Bubble Bath Car Wash, and the proposed QuikTrip Convenience Store to the outfall manhole located in E Wilcox St. The flows from the existing veterinary services building are unknown and were omitted for the purpose of this analysis. There are five segments of pipe proposed by the Project, as shown in **Appendix E**. Segment P-1 conveys flows from the existing veterinary services building only. Segments P-2, P-3, and P-4 convey flows from the existing veterinary services building and the proposed Bubble Bath Car Wash. Segment P-5 conveys flows from the existing veterinary services building, the proposed Bubble Bath Car Wash, and the proposed QuikTrip Convenience store. Flows through pipe segments P-2 and P-5 were modeled under peak flow conditions to determine if the proposed pipe has the capacity to convey the projected flows.

In order to successfully convey flows between the existing manhole collecting flows on site and the proposed connection manhole, a preliminary vertical analysis was done. This analysis revealed that, with the proposed sanitary sewer layout and standard 0.1' drops at each sanitary sewer manhole, the maximum possible slope for the proposed sanitary sewer line would be 0.44%.

Table 12: Sanitary Sewer Pipe Segments and Contributing Flows

	Contributing Buildings	PDF (cfs)
P-1	Existing Veterinary Services Building	Unknown
P-2	Existing Veterinary Services Building, Bubble Bath Car Wash	0.00471
P-3	Existing Veterinary Services Building, Bubble Bath Car Wash	0.00471
P-4	Existing Veterinary Services Building, Bubble Bath Car Wash	0.00471
P-5	Existing Veterinary Services Building, Bubble Bath Car Wash, QuikTrip Convenience Store	0.01082

The estimated peak flow for the Bubble Bath Car Wash is 0.00471 cfs, as calculated in previous sections of this report. To meet a 2.00 fps self-cleansing velocity as required by Town of Castle Rock Criteria, the slope of the proposed 8" sanitary sewer line would have to be 8.7% in pipe segments P-2, P-3, and P-4 as shown in **Appendix E**. The minimum slope to meet Town requirements for velocity exceeds both the maximum possible slope determined by the preliminary vertical analysis and the maximum slope for 8" sanitary sewer lines as specified in Town Criteria.

The estimated peak flow for the QuikTrip Convenience Store is 0.00611 cfs, as calculated in previous sections of this report. To meet a 2.00 fps self-cleansing velocity as required by Town of Castle Rock Criteria, the slope of the proposed 8" sanitary sewer line would have to be 4.25% in pipe segment P-5 as shown in **Appendix E**. The minimum slope necessary to meet Town requirements for velocity exceed the maximum possible slope between the two existing manholes as determined by the preliminary vertical analysis.

Due to site constraints, the gravity sanitary sewer system is not anticipated to meet Town Criteria for minimum velocities.

CONCLUSION

COMPLIANCE WITH STANDARDS

Proposed water system designs associated with the Project have been designed in substantial accordance with applicable Town of Castle Rock Criteria and are not anticipated to adversely affect the existing facilities to which they connect.

Proposed sanitary sewer system designs associated with the Project do not comply with the velocity requirements outlined in Town Criteria due to site constraints. Further coordination and evaluation of the sanitary sewer system is needed to determine how to proceed.

REFERENCES

Town of Castle Rock, Water System Design 2018 Criteria Manual, Town of Castle Rock; December 2018

Town of Castle Rock, Wastewater Collection Design 2018 Criteria Manual, Town of Castle Rock; December 2018

Castle Rock, Colorado Municipal Code, Title 17 – ZONING, Chapter 17.28 – Business/Commercial/Industrial Districts

Town of Castle Rock Zoning Map

Town of Castle Rock Water Master Plan 2023, Castle Rock Water; 2023

2024 International Fire Code, International Code Council, 2023

Flowmaster, Version V8i, Software licensed by Bentley Systems, Incorporated.

WaterCAD, Version V8i, Software licensed by Bentley Systems, Incorporated.

APPENDIX A – WATER DEMANDS

Town of Castle Rock Water System Design Criteria		
Land Use	Typical ADD/Unit	Typical SFEs/Unit
Retail/Offices	0.2 gpd/SF	0.0005/SF
Car Washes	5,000 gpd/facility	12.5/facility
Irrigated Land (Sports Fields and School Sites Excluded)	3,750 gpd/irrigated acre	9.38/acre

Peaking Factors from Town of Castle Rock Water System Design Criteria:

Maximum Day Demand/Average Day Demand (MDD/ADD) = 2.5

Peak Hour Demand/Average Day Demand (PHD/ADD) = 5.5

Design Demand Calculations - ADD						
Facility	Land Use	Square Footage	SFEs	ADD (gpd)	ADD (gpm)	Average Annual supply (AF/YR)
QuikTrip Convenience Store	Retail/Offices	6,445	3.2	1289	0.895	1.444
Bubble Bath Car Wash	Car Washes	4,326	12.5	5000	3.472	5.601
	Irrigated Land (Sports Fields and School Sites Excluded)					
Irrigated land around car wash		35,987	7.7	3098	2.151	3.470

Design Demand Calculations - MDD					
Facility	Land Use	ADD (gpd)	Peaking Factor*	MDD (gpd)	MDD (gpm)
QuikTrip Convenience Store	Retail/Offices	1289	2.5	3223	2.238
Bubble Bath Car Wash	Car Washes	14329	2.5	38921	27.028

*From Town of Castle Rock Water System Design Criteria, MDD/ADD = 2.5

Design Demand Calculations - PHD					
Facility	Land Use	ADD (gpd)	Peaking Factor**	PHD (gpd)	PHD (gpm)
QuikTrip Convenience Store	Retail/Offices	1289	5.5	7090	4.923
Bubble Bath Car Wash	Car Washes	14329	5.5	81908	56.880

**From Town of Castle Rock Water System Design Criteria, PHD/ADD = 5.5

Design Demand Calculations – QuikTrip Convenience Store

SFEs = 0.0005 SFE/SF x 6,445 SF = 3.2 SFEs

Average Day Demand = 0.2 gpd/SF x 6,445 SF = 1,289 gpd = 0.895 gpm = 1.444 af/yr

Max Day Demand = 1,289 gpd x 2.5 = 3,223 gpd = 2.238 gpm

Peak Hour Demand = 14,329 gpd x 5.5 = 7,090 gpd = 4.923 gpm

Design Demand Calculations – Irrigated land around car wash

SFEs = 9.38 SFEs/acre x 0.0826 acre = 7.7 SFEs

Average Day Demand = 3,750 gpd/irrigated acre x 0.0826 = 3,098 gpd = 2.151 gpm = 3.470 af/yr

Design Demand Calculations – Bubble Bath Car Wash

SFEs = 12.5 SFEs/facility x 1 facility = 12.5 SFEs

Average Day Demand = 5,000 gpd/facility x 1 facility = 5,000 gpd = 3.472 gpm = 5.601 af/yr per Town Criteria; 14,329 gpd = 9.95 gpm = 16.05 af/yr demand provided by MEP Engineer

Max Day Demand = 14,329 gpd x 2.5 + Irrigated Land ADD (3,098 gpd) = 38,921 gpd = 27.028 gpm

Peak Hour Demand = 14,329 gpd x 5.5 + Irrigated Land ADD (3,098 gpd) = 81,908 gpd = 56.880 gpm

APPENDIX B – WASTEWATER FLOWS

Town of Castle Rock Wastewater System Design Criteria		
Land Use	Typical ADD/Unit	Typical SFEs/Unit
Retail/Offices	0.1 gpd/SF	0.0005/SF
Car Washes	5,000 gpd/acre	25.0/acre
Irrigated Land	0 gpd/acre	0.0/acre

Design Demand Calculations - ADF						
Facility	Land Use	Square Footage	SFEs	ADF (gpd)	ADF (gpm)	ADF (cfs)
QuikTrip Convenience Store	Retail/Offices	6445	3.2	644.5	0.448	0.0010
Bubble Bath Car Wash	Car Washes	4326	2.5	496.6	0.345	0.0008

Design Demand Calculations - Peaking Factor					
Facility	Land Use	ADF (MGD)	Calculated PF	Maximum PF*	PF Used
QuikTrip Convenience Store	Retail/Offices	0.000645	12.5	5.0	5.0
Bubble Bath Car Wash	Car Washes	0.000497	13.1	5.0	5.0

*Maximum PF specified in the Town of Castle Rock Wastewater Design Criteria is 5.0

Design Demand Calculations - PDF									
Facility	Land Use	ADF (MGD)	PF	I/I		PDF (MGD)	PDF (gpd)	PDF (gpm)	PDF (cfs)
				Peak Base Flow (MGD)	Allowance (MGD)**				
QuikTrip Convenience Store	Retail/Offices	0.000645	5.0	0.00322	0.000064	0.0033	3,287	2.28	0.00611
Bubble Bath Car Wash	Car Washes	0.000497	5.0	0.00248	0.000050	0.0025	2,532	1.76	0.00471

**Town of Castle Rock Wastewater Design Criteria specifies an I/I allowance equal to ten percent of the ADF

Design Demand Calculations – QuikTrip Convenience Store:

$SFEs = 0.0005 \text{ SFE/SF} \times 6,445 \text{ SF} = 3.2 \text{ SFEs}$

$\text{Average Daily Flow} = 0.1 \text{ gpd/SF} \times 6,445 \text{ SF} = 644.5 \text{ gpd} = 0.448 \text{ gpm} = 0.0010 \text{ cfs} = 0.000645 \text{ MGD}$

$\text{Peaking Factor} = 3.65 \times (0.000645 \text{ MGD})^{(-0.168)} = 12.5 \text{ calculated PF; } 5.0 \text{ maximum used}$

$I/I \text{ Allowance} = 10\% \times 0.000645 \text{ MGD} = 0.0000645 \text{ MGD}$

$\text{Peak Base Flow} = 0.000645 \times 5.0 = 0.00322 \text{ MGD}$

$\text{Peak Daily Flow} = 0.00322 \text{ MGD} + 0.0000645 \text{ MGD} = 0.0033 \text{ MGD} = 3,287 \text{ gpd} = 2.28 \text{ gpm} = 0.00611 \text{ cfs}$

Design Demand Calculations – Bubble Bath Car Wash:

$SFEs = 25.0/\text{acre} \times 0.0993 \text{ acre} = 2.5 \text{ SFEs}$

$\text{Average Daily Flow} = 5,000 \text{ gpd/acre} \times 0.0993 \text{ acre} = 496.6 \text{ gpd} = 0.345 \text{ gpm} = 0.0008 \text{ cfs} = 0.000497 \text{ MGD}$

$\text{Peaking Factor} = 3.65 \times (0.000497 \text{ MGD})^{-0.168} = 13.1 \text{ calculated PF; } 5.0 \text{ maximum used}$

$I/I \text{ Allowance} = 10\% \times 0.000497 \text{ MGD} = 0.000050 \text{ MGD}$

$\text{Peak Base Flow} = 0.000497 \text{ MGD} \times 5.0 = 0.00248 \text{ MGD}$

$\text{Peak Daily Flow} = 0.00248 \text{ MGD} + 0.000050 \text{ MGD} = 0.0025 \text{ MGD} = 2,532 \text{ gpd} = 1.76 \text{ gpm} = 0.00471 \text{ cfs}$

APPENDIX C – WATER STORAGE

Storage Requirement Calculation				
Facility	MDD (MG)	Fire Flow (MG)	Fire Flow Duration (hr)	Storage Volume (MG)
QuikTrip Convenience Store	0.0032225	0.27	2	0.273225
Bubble Bath Car Wash	0.038920554	0.21	2	0.25

Storage Requirement Calculation – QuikTrip Convenience Store:

Max Day Demand (calculated in Appendix A) = 0.0032225 MGD

Fire Flow per Table B105.1 of 2024 International Fire Code for 6,445 square feet construction type V-B = 2250 gpm for 2 hours

Storage needed for fire flow = 2250 gal/min x 60 min/hr x 2 hr = 270,000 gallons = 0.27 million gallons

Required Storage Volume (MG) = 0.0032225 MG + 0.27 MG = 0.2732 MG

Storage Requirement Calculation – Bubble Bath Car Wash:

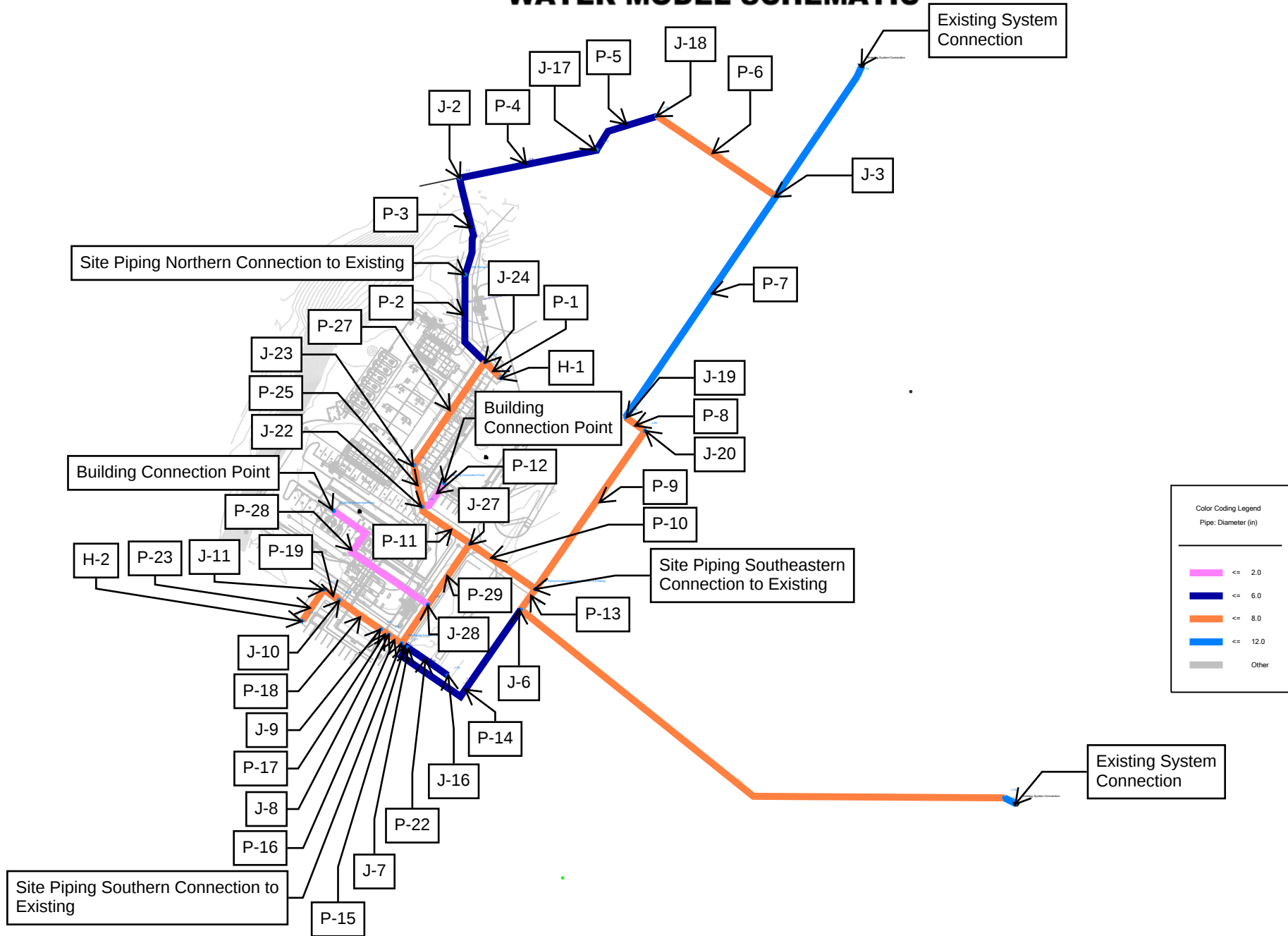
Max Day Demand (calculated in Appendix A) = 0.038920554 MG

Fire Flow per Table B105.1 of 2024 International Fire Code for 4,326 square feet of construction type V-B= 1750 gpm for 2 hours

Storage needed for fire flow = 1750 gal/min x 60 min/hr x 2 hr = 210,000 gallons = 0.21 MG

Required Storage Volume (MG) = 0.038920554 MG + 0.21 MG = 0.2489 MG

WATER MODEL SCHEMATIC



QT & BB Castle Rock Hydraulic Modeling Outputs

QT & BB Castle Rock - Static Scenario: Low HGL

Reservoir Table - Time: 0.00 hours

Label	Elevation (ft)	Flow (Out net) (gpm)	Hydraulic Grade (ft)
Existing System Connection	6,334.00	0.00	6,334.00
Existing System Connection	6,334.00	0.00	6,334.00

Junction Table - Time: 0.00 hours

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Velocity of Maximum Pipe (ft/s)	Flow (Total Available) (gpm)
Building Connection Point	6,216.54	0.00	51	(N/A)	(N/A)
J-16	6,218.00	0.00	50	(N/A)	(N/A)
J-7	6,217.30	0.00	50	(N/A)	(N/A)
Building Connection Point	6,217.00	0.00	51	(N/A)	(N/A)
J-6	6,217.00	0.00	51	(N/A)	(N/A)
J-22	6,216.85	0.00	51	(N/A)	(N/A)
Site Piping Southern Connection To Existing	6,216.75	0.00	51	(N/A)	(N/A)
J-28	6,216.64	0.00	51	(N/A)	(N/A)
J-27	6,216.54	0.00	51	(N/A)	(N/A)
J-9	6,216.40	0.00	51	(N/A)	(N/A)
J-8	6,216.32	0.00	51	(N/A)	(N/A)
J-24	6,216.15	0.00	51	(N/A)	(N/A)
J-10	6,215.99	0.00	51	(N/A)	(N/A)
Site Piping Southeastern Connection To Existing	6,216.00	0.00	51	(N/A)	(N/A)
J-11	6,215.68	0.00	51	(N/A)	(N/A)
J-20	6,213.00	0.00	52	(N/A)	(N/A)
J-19	6,213.00	0.00	52	(N/A)	(N/A)
Site Piping Northern Connection To Existing	6,209.80	0.00	54	(N/A)	(N/A)
J-3	6,205.00	0.00	56	(N/A)	(N/A)
J-17	6,203.00	0.00	57	(N/A)	(N/A)
J-18	6,203.00	0.00	57	(N/A)	(N/A)
J-2	6,199.00	0.00	58	(N/A)	(N/A)
J-23	6,127.00	0.00	90	(N/A)	(N/A)

QT & BB Castle Rock - Static Scenario: Low HGL

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	H-1	J-24	8.0	Ductile Iron	120.0	29	0.00	0.00	0.00
P-2	J-24	Site Piping Northern Connection To Existing	6.0	Ductile Iron	120.0	129	0.00	0.00	0.00
P-3	Site Piping Northern Connection To Existing	J-2	6.0	Cast iron	120.0	134	0.00	0.00	0.00
P-4	J-2	J-17	6.0	Ductile Iron	120.0	189	0.00	0.00	0.00
P-5	J-17	J-18	6.0	PVC	120.0	99	0.00	0.00	0.00
P-6	J-18	J-3	8.0	PVC	120.0	193	0.00	0.00	0.00
P-7	J-3	J-19	12.0	Ductile Iron	120.0	359	0.00	0.00	0.00
P-8	J-19	J-20	8.0	Ductile Iron	120.0	32	0.00	0.00	0.00
P-9	J-20	Site Piping Southeastern Connection To Existing	8.0	Cast iron	120.0	258	0.00	0.00	0.00
P-10	Site Piping Southeastern Connection To Existing	J-27	8.0	Ductile Iron	120.0	107	0.00	0.00	0.00
P-11	J-27	J-22	8.0	Ductile Iron	120.0	83	0.00	0.00	0.00
P-12	J-22	Building Connection Point	2.0	Ductile Iron	120.0	46	0.00	0.00	0.00
P-13	Site Piping Southeastern Connection To Existing	J-6	8.0	Cast iron	120.0	34	0.00	0.00	0.00
P-14	J-6	J-7	6.0	Cast iron	120.0	252	0.00	0.00	0.00
P-15	J-7	Site Piping Southern Connection To Existing	6.0	Cast iron	120.0	10	0.00	0.00	0.00
P-16	Site Piping Southern Connection To Existing	J-8	8.0	Cast iron	120.0	21	0.00	0.00	0.00
P-17	J-8	J-9	8.0	Cast iron	120.0	13	0.00	0.00	0.00
P-18	J-9	J-10	8.0	Cast iron	120.0	68	0.00	0.00	0.00
P-19	J-10	J-11	8.0	Cast iron	120.0	25	0.00	0.00	0.00
P-22	J-7	J-16	6.0	Cast iron	120.0	66	0.00	0.00	0.00
P-23	J-11	H-2	8.0	Ductile Iron	120.0	51	0.00	0.00	0.00
P-25	J-22	J-23	8.0	Ductile Iron	120.0	57	0.00	0.00	0.00
P-27	J-23	J-24	8.0	Ductile Iron	120.0	168	0.00	0.00	0.00
P-28	Site Piping Southern Connection To Existing	J-28	8.0	Ductile Iron	120.0	63	0.00	0.00	0.00
P-28	J-28	Building Connection Point	2.0	Ductile Iron	120.0	207	0.00	0.00	0.00
P-29	J-28	J-27	8.0	Ductile Iron	120.0	100	0.00	0.00	0.00

QT & BB Castle Rock - Static Scenario: Low HGL

Hydrant Table - Time: 0.00 hours

Label	Length (Hydrant Lateral) (ft)	Elevation (ft)	Demand (gpm)	Pressure (psi)	Velocity of Maximum Pipe (ft/s)	Flow (Total Available) (gpm)
H-1	20	6,217.86	0.00	50	(N/A)	(N/A)
H-2	20	6,221.00	0.00	49	(N/A)	(N/A)

QT & BB Castle Rock Hydraulic Modeling Outputs

QT & BB Castle Rock - Static Scenario: High HGL

Reservoir Table - Time: 0.00 hours

Label	Elevation (ft)	Flow (Out net) (gpm)	Hydraulic Grade (ft)
Existing System Connection	6,352.00	0.00	6,352.00
Existing System Connection	6,352.00	0.00	6,352.00

Junction Table - Time: 0.00 hours

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Velocity of Maximum Pipe (ft/s)	Flow (Total Available) (gpm)
Building Connection Point	6,216.54	0.00	59	(N/A)	(N/A)
J-16	6,218.00	0.00	58	(N/A)	(N/A)
J-7	6,217.30	0.00	58	(N/A)	(N/A)
Building Connection Point	6,217.00	0.00	58	(N/A)	(N/A)
J-6	6,217.00	0.00	58	(N/A)	(N/A)
J-22	6,216.85	0.00	58	(N/A)	(N/A)
Site Piping Southern Connection To Existing	6,216.75	0.00	59	(N/A)	(N/A)
J-28	6,216.64	0.00	59	(N/A)	(N/A)
J-27	6,216.54	0.00	59	(N/A)	(N/A)
J-9	6,216.40	0.00	59	(N/A)	(N/A)
J-8	6,216.32	0.00	59	(N/A)	(N/A)
J-24	6,216.15	0.00	59	(N/A)	(N/A)
J-10	6,215.99	0.00	59	(N/A)	(N/A)
Site Piping Southeastern Connection To Existing	6,216.00	0.00	59	(N/A)	(N/A)
J-11	6,215.68	0.00	59	(N/A)	(N/A)
J-20	6,213.00	0.00	60	(N/A)	(N/A)
J-19	6,213.00	0.00	60	(N/A)	(N/A)
Site Piping Northern Connection To Existing	6,209.80	0.00	62	(N/A)	(N/A)
J-3	6,205.00	0.00	64	(N/A)	(N/A)
J-17	6,203.00	0.00	64	(N/A)	(N/A)
J-18	6,203.00	0.00	64	(N/A)	(N/A)
J-2	6,199.00	0.00	66	(N/A)	(N/A)
J-23	6,199.00	0.00	66	(N/A)	(N/A)

QT & BB Castle Rock - Static Scenario: High HGL

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	H-1	J-24	8.0	Ductile Iron	120.0	29	0.00	0.00	0.00
P-2	J-24	Site Piping Northern Connection To Existing	6.0	Ductile Iron	120.0	129	0.00	0.00	0.00
P-3	Site Piping Northern Connection To Existing	J-2	6.0	Cast iron	120.0	134	0.00	0.00	0.00
P-4	J-2	J-17	6.0	Ductile Iron	120.0	189	0.00	0.00	0.00
P-5	J-17	J-18	6.0	PVC	120.0	99	0.00	0.00	0.00
P-6	J-18	J-3	8.0	PVC	120.0	193	0.00	0.00	0.00
P-7	J-3	J-19	12.0	Ductile Iron	120.0	359	0.00	0.00	0.00
P-8	J-19	J-20	8.0	Ductile Iron	120.0	32	0.00	0.00	0.00
P-9	J-20	Site Piping Southeastern Connection To Existing	8.0	Cast iron	120.0	258	0.00	0.00	0.00
P-10	Site Piping Southeastern Connection To Existing	J-27	8.0	Ductile Iron	120.0	107	0.00	0.00	0.00
P-11	J-27	J-22	8.0	Ductile Iron	120.0	83	0.00	0.00	0.00
P-12	J-22	Building Connection Point	2.0	Ductile Iron	120.0	46	0.00	0.00	0.00
P-13	Site Piping Southeastern Connection To Existing	J-6	8.0	Cast iron	120.0	34	0.00	0.00	0.00
P-14	J-6	J-7	6.0	Cast iron	120.0	252	0.00	0.00	0.00
P-15	J-7	Site Piping Southern Connection To Existing	6.0	Cast iron	120.0	10	0.00	0.00	0.00
P-16	Site Piping Southern Connection To Existing	J-8	8.0	Cast iron	120.0	21	0.00	0.00	0.00
P-17	J-8	J-9	8.0	Cast iron	120.0	13	0.00	0.00	0.00
P-18	J-9	J-10	8.0	Cast iron	120.0	68	0.00	0.00	0.00
P-19	J-10	J-11	8.0	Cast iron	120.0	25	0.00	0.00	0.00
P-22	J-7	J-16	6.0	Cast iron	120.0	66	0.00	0.00	0.00
P-23	J-11	H-2	8.0	Ductile Iron	120.0	51	0.00	0.00	0.00
P-25	J-22	J-23	8.0	Ductile Iron	120.0	57	0.00	0.00	0.00
P-27	J-23	J-24	8.0	Ductile Iron	120.0	168	0.00	0.00	0.00
P-28	Site Piping Southern Connection To Existing	J-28	8.0	Ductile Iron	120.0	63	0.00	0.00	0.00
P-28	J-28	Building Connection Point	6.0	Ductile Iron	120.0	207	0.00	0.00	0.00
P-29	J-28	J-27	8.0	Ductile Iron	120.0	100	0.00	0.00	0.00

QT & BB Castle Rock - Static Scenario: High HGL

Hydrant Table - Time: 0.00 hours

Label	Length (Hydrant Lateral) (ft)	Elevation (ft)	Demand (gpm)	Pressure (psi)	Velocity of Maximum Pipe (ft/s)	Flow (Total Available) (gpm)
H-1	20	6,217.86	0.00	58	(N/A)	(N/A)
H-2	20	0.00	0.00	2,748	(N/A)	(N/A)

QT & BB Castle Rock Hydraulic Modeling Outputs

QT & BB Castle Rock - Static Scenario: High HGL

Reservoir Table - Time: 0.00 hours

Label	Elevation (ft)	Flow (Out net) (gpm)	Hydraulic Grade (ft)
Existing System Connection	6,334.00	1,011.62	6,334.00
Existing System Connection	6,334.00	517.65	6,334.00

Junction Table - Time: 0.00 hours

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Velocity of Maximum Pipe (ft/s)	Flow (Total Available) (gpm)
Building Connection Point	6,216.54	27.03	45	(N/A)	(N/A)
J-16	6,218.00	0.00	46	(N/A)	(N/A)
J-7	6,217.30	0.00	46	(N/A)	(N/A)
Building Connection Point	6,217.00	2.24	48	(N/A)	(N/A)
J-6	6,217.00	0.00	49	(N/A)	(N/A)
J-22	6,216.85	0.00	48	(N/A)	(N/A)
Site Piping Southern Connection To Existing	6,216.75	0.00	46	(N/A)	(N/A)
J-28	6,216.64	0.00	47	(N/A)	(N/A)
J-27	6,216.54	0.00	48	(N/A)	(N/A)
J-9	6,216.40	0.00	46	(N/A)	(N/A)
J-8	6,216.32	0.00	46	(N/A)	(N/A)
J-24	6,216.15	0.00	49	(N/A)	(N/A)
J-10	6,215.99	0.00	45	(N/A)	(N/A)
Site Piping Southeastern Connection To Existing	6,216.00	0.00	49	(N/A)	(N/A)
J-11	6,215.68	0.00	44	(N/A)	(N/A)
J-20	6,213.00	0.00	52	(N/A)	(N/A)
J-19	6,213.00	0.00	52	(N/A)	(N/A)
Site Piping Northern Connection To Existing	6,209.80	0.00	52	(N/A)	(N/A)
J-3	6,205.00	0.00	56	(N/A)	(N/A)
J-17	6,203.00	0.00	56	(N/A)	(N/A)
J-18	6,203.00	0.00	56	(N/A)	(N/A)
J-2	6,199.00	0.00	57	(N/A)	(N/A)
J-23	6,127.00	0.00	87	(N/A)	(N/A)

QT & BB Castle Rock - Static Scenario: High HGL

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	H-1	J-24	8.0	Ductile Iron	120.0	29	0.00	0.00	0.00
P-2	J-24	Site Piping Northern Connection To Existing	6.0	Ductile Iron	120.0	129	280.35	3.18	1.05
P-3	Site Piping Northern Connection To Existing	J-2	6.0	Cast iron	120.0	134	280.35	3.18	1.09
P-4	J-2	J-17	6.0	Ductile Iron	120.0	189	280.35	3.18	1.54
P-5	J-17	J-18	6.0	PVC	120.0	99	280.35	3.18	0.81
P-6	J-18	J-3	8.0	PVC	120.0	193	280.35	1.79	0.39
P-7	J-3	J-19	12.0	Ductile Iron	120.0	359	731.27	2.07	0.59
P-8	J-19	J-20	8.0	Ductile Iron	120.0	32	731.27	4.67	0.38
P-9	J-20	Site Piping Southeastern Connection To Existing	8.0	Cast iron	120.0	258	731.27	4.67	3.06
P-10	Site Piping Southeastern Connection To Existing	J-27	8.0	Ductile Iron	120.0	107	790.81	5.05	1.47
P-11	J-27	J-22	8.0	Ductile Iron	120.0	83	278.12	1.78	0.16
P-12	J-22	Building Connection Point	2.0	Ductile Iron	120.0	46	2.24	0.23	0.01
P-13	Site Piping Southeastern Connection To Existing	J-6	8.0	Cast iron	120.0	34	59.54	0.38	0.00
P-14	J-6	J-7	6.0	Cast iron	120.0	252	458.11	5.20	5.10
P-15	J-7	Site Piping Southern Connection To Existing	6.0	Cast iron	120.0	10	458.10	5.20	0.20
P-16	Site Piping Southern Connection To Existing	J-8	8.0	Cast iron	120.0	21	1,500.00	9.57	0.93
P-17	J-8	J-9	8.0	Cast iron	120.0	13	1,500.00	9.57	0.58
P-18	J-9	J-10	8.0	Cast iron	120.0	68	1,500.00	9.57	3.07
P-19	J-10	J-11	8.0	Cast iron	120.0	25	1,500.00	9.57	1.12
P-22	J-7	J-16	6.0	Cast iron	120.0	66	0.01	0.00	0.00
P-23	J-11	H-2	8.0	Ductile Iron	120.0	51	1,500.00	9.57	2.29
P-25	J-22	J-23	8.0	Ductile Iron	120.0	57	280.36	1.79	0.11
P-27	J-23	J-24	8.0	Ductile Iron	120.0	168	280.36	1.79	0.34
P-28	Site Piping Southern Connection To Existing	J-28	8.0	Ductile Iron	120.0	63	1,041.90	6.65	1.44
P-28	J-28	Building Connection Point	2.0	Ductile Iron	120.0	207	27.03	2.76	4.68
P-29	J-28	J-27	8.0	Ductile Iron	120.0	100	1,068.93	6.82	2.39

QT & BB Castle Rock - Static Scenario: High HGL

Hydrant Table - Time: 0.00 hours

Label	Length (Hydrant Lateral) (ft)	Elevation (ft)	Demand (gpm)	Pressure (psi)	Velocity of Maximum Pipe (ft/s)	Flow (Total Available) (gpm)
H-1	20	6,217.86	0.00	48	(N/A)	(N/A)
H-2	20	6,221.00	1,500.00	41	(N/A)	(N/A)

QT & BB Castle Rock Hydraulic Modeling Outputs

QT & BB Castle Rock - Active Scenario: Low HGL Max Day + Fire (H1)

Reservoir Table - Time: 0.00 hours

Label	Elevation (ft)	Flow (Out net) (gpm)	Hydraulic Grade (ft)
Existing System Connection	6,334.00	1,603.65	6,334.00
Existing System Connection	6,334.00	675.62	6,334.00

Junction Table - Time: 0.00 hours

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Velocity of Maximum Pipe (ft/s)	Flow (Total Available) (gpm)
Building Connection Point	6,216.54	27.03	44	(N/A)	(N/A)
J-16	6,218.00	0.00	46	(N/A)	(N/A)
J-7	6,217.30	0.00	46	(N/A)	(N/A)
Building Connection Point	6,217.00	2.24	44	(N/A)	(N/A)
J-6	6,217.00	0.00	47	(N/A)	(N/A)
J-22	6,216.85	0.00	44	(N/A)	(N/A)
Site Piping Southern Connection To Existing	6,216.75	0.00	46	(N/A)	(N/A)
J-28	6,216.64	0.00	46	(N/A)	(N/A)
J-27	6,216.54	0.00	46	(N/A)	(N/A)
J-9	6,216.40	0.00	46	(N/A)	(N/A)
J-8	6,216.32	0.00	46	(N/A)	(N/A)
J-24	6,216.15	0.00	40	(N/A)	(N/A)
J-10	6,215.99	0.00	46	(N/A)	(N/A)
Site Piping Southeastern Connection To Existing	6,216.00	0.00	48	(N/A)	(N/A)
J-11	6,215.68	0.00	47	(N/A)	(N/A)
J-20	6,213.00	0.00	51	(N/A)	(N/A)
J-19	6,213.00	0.00	51	(N/A)	(N/A)
Site Piping Northern Connection To Existing	6,209.80	0.00	45	(N/A)	(N/A)
J-3	6,205.00	0.00	55	(N/A)	(N/A)
J-17	6,203.00	0.00	53	(N/A)	(N/A)
J-18	6,203.00	0.00	55	(N/A)	(N/A)
J-2	6,199.00	0.00	52	(N/A)	(N/A)
J-23	6,127.00	0.00	82	(N/A)	(N/A)

QT & BB Castle Rock - Active Scenario: Low HGL Max Day + Fire (H1)

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	H-1	J-24	8.0	Ductile Iron	120.0	29	2,250.00	14.36	2.79
P-2	J-24	Site Piping Northern Connection To Existing	6.0	Ductile Iron	120.0	129	675.26	7.66	5.37
P-3	Site Piping Northern Connection To Existing	J-2	6.0	Cast iron	120.0	134	675.26	7.66	5.56
P-4	J-2	J-17	6.0	Ductile Iron	120.0	189	675.26	7.66	7.84
P-5	J-17	J-18	6.0	PVC	120.0	99	675.26	7.66	4.13
P-6	J-18	J-3	8.0	PVC	120.0	193	675.26	4.31	1.98
P-7	J-3	J-19	12.0	Ductile Iron	120.0	359	928.40	2.63	0.92
P-8	J-19	J-20	8.0	Ductile Iron	120.0	32	928.40	5.93	0.59
P-9	J-20	Site Piping Southeastern Connection To Existing	8.0	Cast iron	120.0	258	928.40	5.93	4.77
P-10	Site Piping Southeastern Connection To Existing	J-27	8.0	Ductile Iron	120.0	107	1,259.45	8.04	3.47
P-11	J-27	J-22	8.0	Ductile Iron	120.0	83	1,576.98	10.07	4.07
P-12	J-22	Building Connection Point	2.0	Ductile Iron	120.0	46	2.24	0.23	0.01
P-13	Site Piping Southeastern Connection To Existing	J-6	8.0	Cast iron	120.0	34	331.06	2.11	0.09
P-14	J-6	J-7	6.0	Cast iron	120.0	252	344.57	3.91	3.01
P-15	J-7	Site Piping Southern Connection To Existing	6.0	Cast iron	120.0	10	344.57	3.91	0.12
P-16	Site Piping Southern Connection To Existing	J-8	8.0	Cast iron	120.0	21	0.01	0.00	0.00
P-17	J-8	J-9	8.0	Cast iron	120.0	13	0.01	0.00	0.00
P-18	J-9	J-10	8.0	Cast iron	120.0	68	0.01	0.00	0.00
P-19	J-10	J-11	8.0	Cast iron	120.0	25	0.01	0.00	0.00
P-22	J-7	J-16	6.0	Cast iron	120.0	66	0.00	0.00	0.00
P-23	J-11	H-2	8.0	Ductile Iron	120.0	51	0.00	0.00	0.00
P-25	J-22	J-23	8.0	Ductile Iron	120.0	57	1,574.74	10.05	2.81
P-27	J-23	J-24	8.0	Ductile Iron	120.0	168	1,574.74	10.05	8.25
P-28	Site Piping Southern Connection To Existing	J-28	8.0	Ductile Iron	120.0	63	344.56	2.20	0.19
P-28	J-28	Building Connection Point	2.0	Ductile Iron	120.0	207	27.03	2.76	4.68
P-29	J-28	J-27	8.0	Ductile Iron	120.0	100	317.53	2.03	0.25

QT & BB Castle Rock - Active Scenario: Low HGL Max Day + Fire (H1)

Hydrant Table - Time: 0.00 hours

Label	Length (Hydrant Lateral) (ft)	Elevation (ft)	Demand (gpm)	Pressure (psi)	Velocity of Maximum Pipe (ft/s)	Flow (Total Available) (gpm)
H-1	20	6,217.86	2,250.00	38	(N/A)	(N/A)
H-2	20	6,221.00	0.00	44	(N/A)	(N/A)

QT & BB Castle Rock Hydraulic Modeling Outputs

QT & BB Castle Rock - Active Scenario: Low HGL Max Day + Fire (H2)

Reservoir Table - Time: 0.00 hours

Label	Elevation (ft)	Flow (Out net) (gpm)	Hydraulic Grade (ft)
Existing System Connection	6,334.00	1,507.70	6,334.00
Existing System Connection	6,334.00	771.57	6,334.00

Junction Table - Time: 0.00 hours

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Velocity of Maximum Pipe (ft/s)	Flow (Total Available) (gpm)
Building Connection Point	6,216.54	27.03	41	(N/A)	(N/A)
J-16	6,218.00	0.00	41	(N/A)	(N/A)
J-7	6,217.30	0.00	42	(N/A)	(N/A)
Building Connection Point	6,217.00	2.24	45	(N/A)	(N/A)
J-6	6,217.00	0.00	46	(N/A)	(N/A)
J-22	6,216.85	0.00	45	(N/A)	(N/A)
Site Piping Southern Connection To Existing	6,216.75	0.00	42	(N/A)	(N/A)
J-28	6,216.64	0.00	43	(N/A)	(N/A)
J-27	6,216.54	0.00	45	(N/A)	(N/A)
J-9	6,216.40	0.00	40	(N/A)	(N/A)
J-8	6,216.32	0.00	41	(N/A)	(N/A)
J-24	6,216.15	0.00	46	(N/A)	(N/A)
J-10	6,215.99	0.00	38	(N/A)	(N/A)
Site Piping Southeastern Connection To Existing	6,216.00	0.00	47	(N/A)	(N/A)
J-11	6,215.68	0.00	37	(N/A)	(N/A)
J-20	6,213.00	0.00	51	(N/A)	(N/A)
J-19	6,213.00	0.00	51	(N/A)	(N/A)
Site Piping Northern Connection To Existing	6,209.80	0.00	50	(N/A)	(N/A)
J-3	6,205.00	0.00	55	(N/A)	(N/A)
J-17	6,203.00	0.00	55	(N/A)	(N/A)
J-18	6,203.00	0.00	56	(N/A)	(N/A)
J-2	6,199.00	0.00	55	(N/A)	(N/A)
J-23	6,127.00	0.00	84	(N/A)	(N/A)

QT & BB Castle Rock - Active Scenario: Low HGL Max Day + Fire (H2)

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	H-1	J-24	8.0	Ductile Iron	120.0	29	0.00	0.00	0.00
P-2	J-24	Site Piping Northern Connection To Existing	6.0	Ductile Iron	120.0	129	417.72	4.74	2.21
P-3	Site Piping Northern Connection To Existing	J-2	6.0	Cast iron	120.0	134	417.72	4.74	2.28
P-4	J-2	J-17	6.0	Ductile Iron	120.0	189	417.72	4.74	3.22
P-5	J-17	J-18	6.0	PVC	120.0	99	417.72	4.74	1.70
P-6	J-18	J-3	8.0	PVC	120.0	193	417.72	2.67	0.81
P-7	J-3	J-19	12.0	Ductile Iron	120.0	359	1,089.98	3.09	1.24
P-8	J-19	J-20	8.0	Ductile Iron	120.0	32	1,089.98	6.96	0.79
P-9	J-20	Site Piping Southeastern Connection To Existing	8.0	Cast iron	120.0	258	1,089.98	6.96	6.42
P-10	Site Piping Southeastern Connection To Existing	J-27	8.0	Ductile Iron	120.0	107	1,177.45	7.52	3.06
P-11	J-27	J-22	8.0	Ductile Iron	120.0	83	415.48	2.65	0.34
P-12	J-22	Building Connection Point	2.0	Ductile Iron	120.0	46	2.24	0.23	0.01
P-13	Site Piping Southeastern Connection To Existing	J-6	8.0	Cast iron	120.0	34	87.47	0.56	0.01
P-14	J-6	J-7	6.0	Cast iron	120.0	252	684.10	7.76	10.71
P-15	J-7	Site Piping Southern Connection To Existing	6.0	Cast iron	120.0	10	684.10	7.76	0.42
P-16	Site Piping Southern Connection To Existing	J-8	8.0	Cast iron	120.0	21	2,250.00	14.36	1.97
P-17	J-8	J-9	8.0	Cast iron	120.0	13	2,250.00	14.36	1.22
P-18	J-9	J-10	8.0	Cast iron	120.0	68	2,250.00	14.36	6.51
P-19	J-10	J-11	8.0	Cast iron	120.0	25	2,250.00	14.36	2.37
P-22	J-7	J-16	6.0	Cast iron	120.0	66	0.00	0.00	0.00
P-23	J-11	H-2	8.0	Ductile Iron	120.0	51	2,250.00	14.36	4.85
P-25	J-22	J-23	8.0	Ductile Iron	120.0	57	417.72	2.67	0.24
P-27	J-23	J-24	8.0	Ductile Iron	120.0	168	417.72	2.67	0.71
P-28	Site Piping Southern Connection To Existing	J-28	8.0	Ductile Iron	120.0	63	1,565.90	9.99	3.06
P-28	J-28	Building Connection Point	2.0	Ductile Iron	120.0	207	27.03	2.76	4.68
P-29	J-28	J-27	8.0	Ductile Iron	120.0	100	1,592.93	10.17	5.00

QT & BB Castle Rock - Active Scenario: Low HGL Max Day + Fire (H2)

Hydrant Table - Time: 0.00 hours

Label	Length (Hydrant Lateral) (ft)	Elevation (ft)	Demand (gpm)	Pressure (psi)	Velocity of Maximum Pipe (ft/s)	Flow (Total Available) (gpm)
H-1	20	6,217.86	0.00	45	(N/A)	(N/A)
H-2	20	6,221.00	2,250.00	33	(N/A)	(N/A)

QT & BB Castle Rock Hydraulic Modeling Outputs
QT & BB Castle Rock - Active Scenario: Peak Hour Demand

Reservoir Table - Time: 0.00 hours

Label	Elevation (ft)	Flow (Out net) (gpm)	Hydraulic Grade (ft)
Existing System Connection	6,334.00	41.04	6,334.00
Existing System Connection	6,334.00	20.78	6,334.00

Junction Table - Time: 0.00 hours

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)	Velocity of Maximum Pipe (ft/s)	Flow (Total Available) (gpm)
Building Connection Point	6,216.54	56.88	43	(N/A)	(N/A)
J-16	6,218.00	0.00	50	(N/A)	(N/A)
J-7	6,217.30	0.00	50	(N/A)	(N/A)
Building Connection Point	6,217.00	4.92	51	(N/A)	(N/A)
J-6	6,217.00	0.00	51	(N/A)	(N/A)
J-22	6,216.85	0.00	51	(N/A)	(N/A)
Site Piping Southern Connection To Existing	6,216.75	0.00	51	(N/A)	(N/A)
J-28	6,216.64	0.00	51	(N/A)	(N/A)
J-27	6,216.54	0.00	51	(N/A)	(N/A)
J-9	6,216.40	0.00	51	(N/A)	(N/A)
J-8	6,216.32	0.00	51	(N/A)	(N/A)
J-24	6,216.15	0.00	51	(N/A)	(N/A)
J-10	6,215.99	0.00	51	(N/A)	(N/A)
Site Piping Southeastern Connection To Existing	6,216.00	0.00	51	(N/A)	(N/A)
J-11	6,215.68	0.00	51	(N/A)	(N/A)
J-20	6,213.00	0.00	52	(N/A)	(N/A)
J-19	6,213.00	0.00	52	(N/A)	(N/A)
Site Piping Northern Connection To Existing	6,209.80	0.00	54	(N/A)	(N/A)
J-3	6,205.00	0.00	56	(N/A)	(N/A)
J-17	6,203.00	0.00	57	(N/A)	(N/A)
J-18	6,203.00	0.00	57	(N/A)	(N/A)
J-2	6,199.00	0.00	58	(N/A)	(N/A)
J-23	6,127.00	0.00	90	(N/A)	(N/A)

QT & BB Castle Rock - Active Scenario: Peak Hour Demand

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	H-1	J-24	8.0	Ductile Iron	120.0	29	0.00	0.00	0.00
P-2	J-24	Site Piping Northern Connection To Existing	6.0	Ductile Iron	120.0	129	11.67	0.13	0.00
P-3	Site Piping Northern Connection To Existing	J-2	6.0	Cast iron	120.0	134	11.67	0.13	0.00
P-4	J-2	J-17	6.0	Ductile Iron	120.0	189	11.67	0.13	0.00
P-5	J-17	J-18	6.0	PVC	120.0	99	11.67	0.13	0.00
P-6	J-18	J-3	8.0	PVC	120.0	193	11.67	0.07	0.00
P-7	J-3	J-19	12.0	Ductile Iron	120.0	359	29.36	0.08	0.00
P-8	J-19	J-20	8.0	Ductile Iron	120.0	32	29.36	0.19	0.00
P-9	J-20	Site Piping Southeastern Connection To Existing	8.0	Cast iron	120.0	258	29.36	0.19	0.01
P-10	Site Piping Southeastern Connection To Existing	J-27	8.0	Ductile Iron	120.0	107	34.81	0.22	0.00
P-11	J-27	J-22	8.0	Ductile Iron	120.0	83	6.75	0.04	0.00
P-12	J-22	Building Connection Point	2.0	Ductile Iron	120.0	46	4.92	0.50	0.04
P-13	Site Piping Southeastern Connection To Existing	J-6	8.0	Cast iron	120.0	34	5.45	0.03	0.00
P-14	J-6	J-7	6.0	Cast iron	120.0	252	15.33	0.17	0.01
P-15	J-7	Site Piping Southern Connection To Existing	6.0	Cast iron	120.0	10	15.33	0.17	0.00
P-16	Site Piping Southern Connection To Existing	J-8	8.0	Cast iron	120.0	21	0.01	0.00	0.00
P-17	J-8	J-9	8.0	Cast iron	120.0	13	0.01	0.00	0.00
P-18	J-9	J-10	8.0	Cast iron	120.0	68	0.00	0.00	0.00
P-19	J-10	J-11	8.0	Cast iron	120.0	25	0.00	0.00	0.00
P-22	J-7	J-16	6.0	Cast iron	120.0	66	0.00	0.00	0.00
P-23	J-11	H-2	8.0	Ductile Iron	120.0	51	0.00	0.00	0.00
P-25	J-22	J-23	8.0	Ductile Iron	120.0	57	11.67	0.07	0.00
P-27	J-23	J-24	8.0	Ductile Iron	120.0	168	11.67	0.07	0.00
P-28	Site Piping Southern Connection To Existing	J-28	8.0	Ductile Iron	120.0	63	15.32	0.10	0.00
P-28	J-28	Building Connection Point	2.0	Ductile Iron	120.0	207	56.88	5.81	18.55
P-29	J-28	J-27	8.0	Ductile Iron	120.0	100	41.56	0.27	0.01

QT & BB Castle Rock - Active Scenario: Peak Hour Demand

Hydrant Table - Time: 0.00 hours

Label	Length (Hydrant Lateral) (ft)	Elevation (ft)	Demand (gpm)	Pressure (psi)	Velocity of Maximum Pipe (ft/s)	Flow (Total Available) (gpm)
H-1	20	6,217.86	0.00	50	(N/A)	(N/A)
H-2	20	6,221.00	0.00	49	(N/A)	(N/A)

APPENDIX E – SANITARY SEWER SYSTEM HYDRAULIC MODELING



UTILITY GENERAL NOTES <u>UTILITY INSTALLATION CONSIDERATIONS</u> PRIOR TO THE CONSTRUCTION OF, OR CONNECTION TO ANY STORM DRAIN, SANITARY SEWER, OR ANY OTHER ELEVATION SENSITIVE UTILITY, THE CONTRACTOR SHALL EXCAVATE, VERIFY AND CALCULATE ALL POINTS OF CONNECTIONS AND ALL UTILITY CROSSINGS. THE CONTRACTOR SHALL INFORM THE ENGINEER AND THE OWNER OF ANY CONFLICT OR REQUIRED DEVIATIONS FROM THE PLAN. THE ENGINEER AND OWNER WILL BE HELD HARMLESS IN THE EVENT THE ENGINEER AND OWNER ARE NOT NOTIFIED OF A DESIGN CONFLICT. AS POSSIBLE, ALL PROPOSED UTILITIES SHALL BE ROUTED THROUGH PERVIOUS AREAS - SPECIFICALLY AVOIDING ON-SITE PAVED AREAS DESIGNATED FOR PARKING, ACCESS, AND VEHICULAR TRAFFIC FLOW. ANY EXISTING LINED SANITARY SEWER MANHOLE THAT WILL BE ADJUSTED SHALL HAVE THEIR LINING REESTABLISHED.

LEGEND

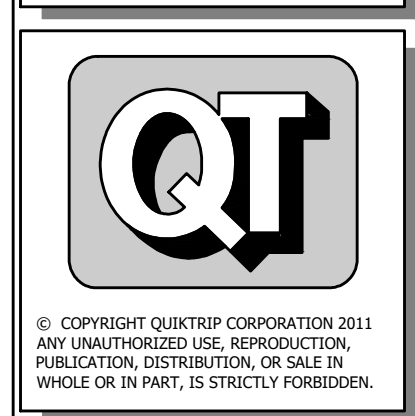
	WTR	WATER LINE
		FIRE HYDRANT
	SS	SANITARY SEWER LINE
		SANITARY SEWER MANHOLE
	UGE	UNDERGROUND ELECTRIC LINE
	UGT	UNDERGROUND TELEPHONE LINE
	ST	STORM PIPE ($\leq 10"$)
		STORM PIPE ($\geq 12"$)
		STORM MANHOLE
		STORM INLET
	wtr	EXISTING WATER LINE
	ss	EXISTING SANITARY LINE
	gas	EXISTING GAS LINE
	uge	EXISTING UNDERGROUND ELECTRIC LINE
	ohe	EXISTING OVERHEAD ELECTRIC LINE
		CONCRETE CURB AND GUTTER
		PROPERTY LINE

PROJECT NO.: 096888068

Kimley»Horn

© 2026 KIMLEY-HORN AND ASSOCIATES, INC.
2 North Nevada Avenue, Suite 900
Colorado Springs, CO 80903 (719) 453-0180

QuikTrip No. 4267



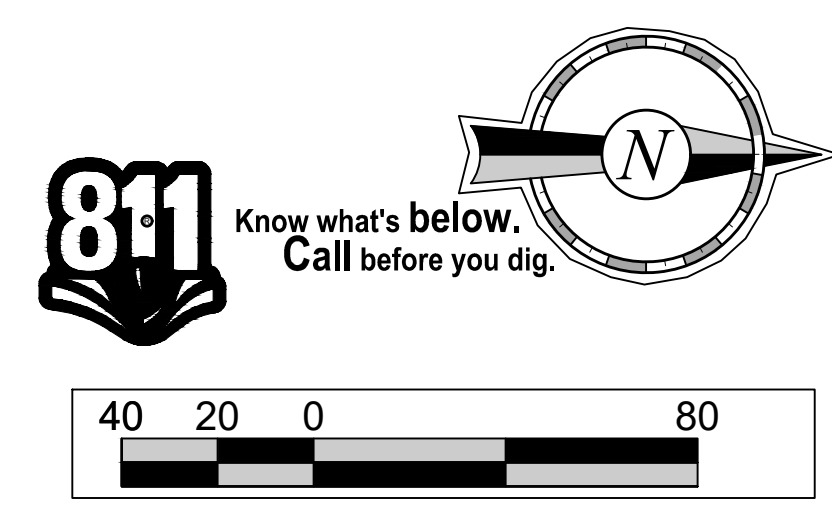
PROTOTYPE: P-125
DIVISION:
VERSION: G4-RE
DESIGNED BY:
DRAWN BY:
REVIEWED BY:

[illegible]

SHEET TITLE:	
GENERAL UTILITY PLAN (C150)	

SHEET NUMBER:

6 OF 16

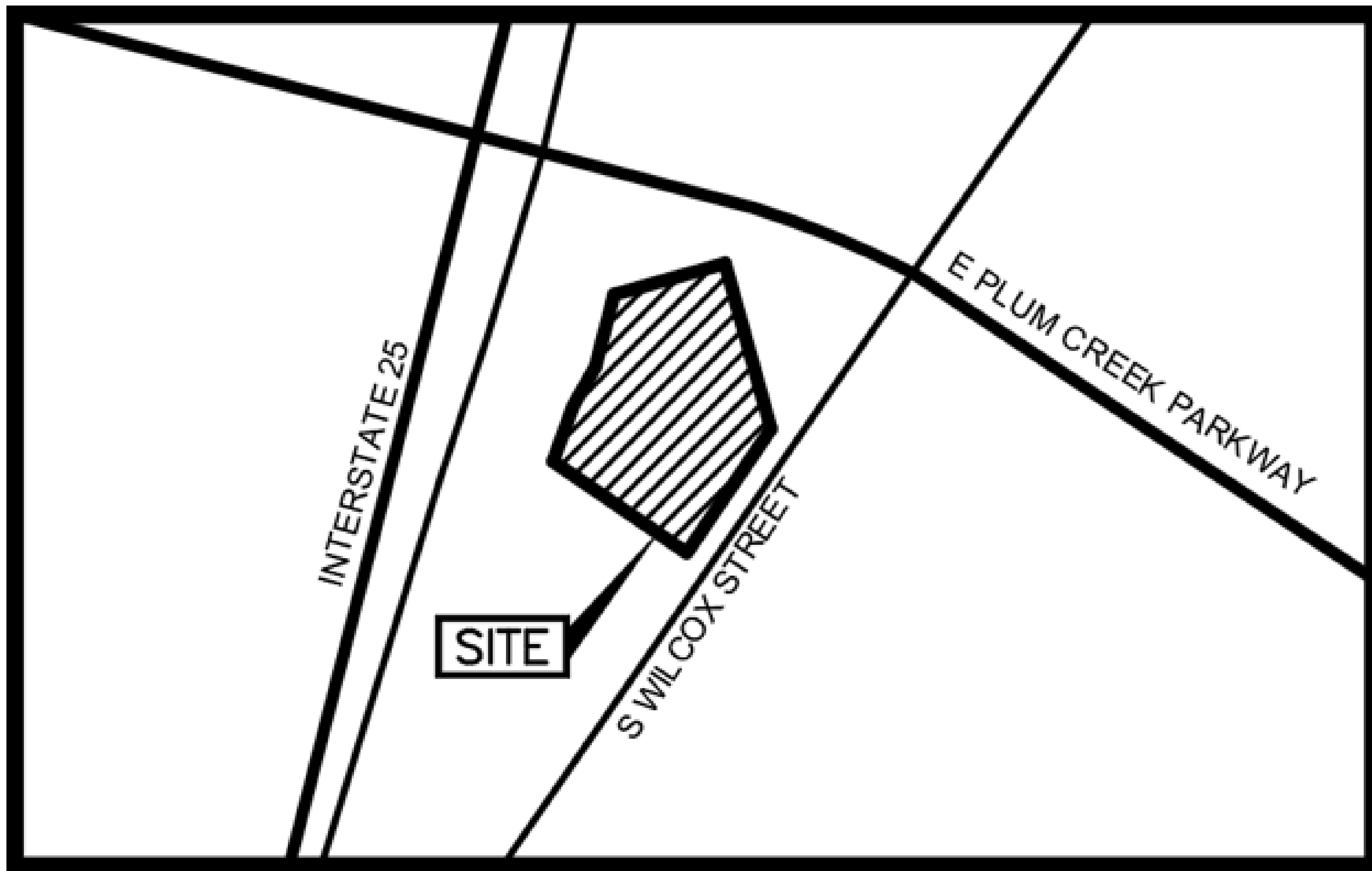


P2 - Bubble Bath Only

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.011
Channel Slope	8.700 %
Diameter	8.0 in
Discharge	0.00471 cfs
Results	
Normal Depth	0.2 in
Flow Area	0.0 ft ²
Wetted Perimeter	0.2 ft
Hydraulic Radius	0.1 in
Top Width	0.21 ft
Critical Depth	0.4 in
Percent Full	2.5 %
Critical Slope	0.648 %
Velocity	2.00 ft/s
Velocity Head	0.06 ft
Specific Energy	0.08 ft
Froude Number	3.328
Maximum Discharge	4.53101 cfs
Discharge Full	4.21213 cfs
Slope Full	0.000 %
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	2.5 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.2 in
Critical Depth	0.4 in
Channel Slope	8.700 %
Critical Slope	0.648 %

P5 - Bubble Bath + QuikTrip

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Roughness Coefficient	0.011
Channel Slope	4.250 %
Diameter	8.0 in
Discharge	0.01081 cfs
Results	
Normal Depth	0.4 in
Flow Area	0.0 ft ²
Wetted Perimeter	0.3 ft
Hydraulic Radius	0.2 in
Top Width	0.27 ft
Critical Depth	0.6 in
Percent Full	4.4 %
Critical Slope	0.604 %
Velocity	2.00 ft/s
Velocity Head	0.06 ft
Specific Energy	0.09 ft
Froude Number	2.515
Maximum Discharge	3.16687 cfs
Discharge Full	2.94399 cfs
Slope Full	0.000 %
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	4.4 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.4 in
Critical Depth	0.6 in
Channel Slope	4.250 %
Critical Slope	0.604 %



INTERSTATE 25

SITE

S WILCOX STREET

E PLUM CREEK PARKWAY



0 62.5 125 250 Feet
Date: 5/1/2026 1:1,528



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 in 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) 733-6000. Copyright 2024, Town of Castle Rock Utilities Mapping.

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

