# FINAL UTILITY REPORT

For:

## OUTLETS AT CASTLE ROCK – PADS B AND C
CD22-0026

## LOT 1, BLOCK 1, OUTLETS AT CASTLE ROCK FILING NO. 1

## 5050 FACTORY SHOPS BOULEVARD, CASTLE ROCK, COLORADO


OWNER/DEVELOPER:
Craig Realty Group
5050 Factory Shops Blvd., Suite 842
Castle Rock, CO 80108
Contact: Patrick Wentland
Phone: 303.468.1684

ENGINEER:
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2009 W. Littleton Blvd.
Suite #300
Littleton, CO 80120
Contact: Jay M. Newell, PE
303.794.4727 x 203


February 2023

## II. 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 Castle 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: 2 / 24 / 23

Registered Professional Engineer
State Of Colorado No. 35219

**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.

Craig Realty Group

Name of Developer

Patrick Wentland

Authorized Signature

TOWN OF CASTLE ROCK COLORADO

DEVELOPMENT SERVICES
**APPROVED**
By jkirkpatrick
on 04/23/2025
APPROVED-CD22-0026 Final Util Rpt.pdf
**Record Document on File**

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# IV. PROJECT LOCATION AND DESCRIPTION

## A. Site Location

1. A vicinity map is included in the Appendices of this report for reference.

2. The proposed site, at 5050 Factory Shops Boulevard, is situated in the north half of Section 27, Township 7 South, Range 67 West of the 6th Principal Meridian, Town of Castle Rock, County of Douglas, State of Colorado.

3. Factory Shops Boulevard lies generally west of the site; the Outlet Access road intersecting with Factory Shops Boulevard lies generally north of the site; the Outlets at Castle Rock retail development lies generally east of the site; and parking for the Outlets at Castle Rock retail development lies generally south of the site.

4. Castle Pines Commerical Filing 10A lies generally west across Factory Shops Boulevard from the site. This development includes the Lowe's home improvement store and various commercially developed outlots. The Promenade at Castle Rock development lies generally north and west of the site including Sam's Club to the north, King Sooper's to the northwest, and various other commercial developments and vacant lots. The Outlets at Castle Rock lies east of the site. Existing commercial development, including the Outlets at Castle Rock's west parking area, lies south of the site on Lot 3, Block 1, Castle Rock Factory Shops; and additional commercial development lies further south of the site across New Memphis Court, including various restaurants and retailers.

## B. Description of Property and Land Use

1. The subject site is approximately 9.0 acres. Portions of the subject site are intended to be developed by the owner as a pad lot, generally within the existing parking field west of the overall outlet development. Final development of the pad sites, including building construction, is to be accomplished by future tenants. The portions of the subject site to be developed as a pad lot is approximately 6.3 acres, and the portions to be developed as pad sites are approximately 1.8 acres within this pad lot.

2. As described herein, the pad lot will be constructed by the property owner including construction of site and utility infrastructure. The pad sites, including buildings, site improvements immediately adjacent to the buildings, and building utility service extensions from provided stubs will be constructed by future tenants. Final water meter sizes will be determined at the time of building permitting based on the required demand of the total building water supply fixture units and any additional water usage, as shown on the commercial fixture unit worksheet to be provided to the Town of Castle Rock. Other phasing is not applicable to the proposed development described in this report.

3. A breakdown of SFEs for the proposed development of the subject site (94 total) is included in the Appendices of this report for reference.

4. Areas and land uses are described above and herein, and are included in the Site Map and calculations included in the Appendices of this report for reference. Pad Site B is anticipated to be developed as retail and possible restaurant; while Pad Site C is anticipated to be developed as a restaurant.

5. Irrigated open space and park areas other than landscaping typical of commercial development is not applicable to the proposed development. As indicated by Section 4.4.1.1 – Waster System Average Daily Demands (ADD) within the *Town of Castle Rock, Water System Design, 2018 Criteria Manual* (a.k.a. WATER MANUAL; see appendices), "…All tabulated ADD rates include irrigation demands with the exception of multi-family residential, car washes, gyms/fitness centers, and schools…" Regardless, the site is served by several separate, existing irrigation taps which will be re-used to irrigate existing and proposed common landscape areas. In addition, a proposed irrigation tap and stub for extension by the future tenant will be installed to provide service to Pad Site C. No tap or stub is proposed for Pad Site B. The future tenant(s) are anticipated to install their own tap and service off the proposed main bisecting the pad site.

6. Anticipated commercial building size is reported in the calculations included in the Appendices of this report for reference.

7. Neither Navigable Waterways nor major or minor drainageways and floodplains appear to be applicable to the development described in this report.

8. Existing irrigation canals and ditches do not appear to be applicable to the development described in this report.

9. Significant geologic features and topography do not appear to be applicable to the development described in this report.

10. Existing On-Site Wastewater Treatment Systems (OWTS) do not appear to be applicable to the development described in this report.

11. Existing water wells do not appear to be applicable to the development described in this report.

## V. CALCULATED WATER DEMANDS

### A. Average Daily Demands (ADD)

1. ADDs (37,515 gpd total) are tabulated in the Appendices of this report for reference. Initial and full build-out are considered the same for the purposes of this report.

B. Max Day Demands (MDD)

1. MDDs (93,788 gpd total) are tabulated in the Appendices of this report for reference. Initial and full build-out are considered the same for the purposes of this report.

2. The largest potential commercial fire flow required for the size and type of the proposed buildings is reported in the Appendices of this report for reference (1,500 gpm for each of the proposed uses of Pad B and/or of Pad C). The proposed buildings are assumed to be sprinklered.

3. Residential fire flow is not applicable to the development described in this report.

4. MDDs associated with open space, parks, fields, and common area landscaping are not applicable to the development described in this report.

5. Required storage volume (0.239 MG) and fire flow (1,500 gpm for the Restaurant of Pad C) are reported in the Appendices of this report for reference.

C. Peak Hour Demands (PHD)

1. PHDs (206,333 gpd total) are tabulated in the Appendices of this report for reference. Initial and full build-out are considered the same for the purposes of this report.

2. PHDs associated with open space, parks, fields, and common area landscaping is not applicable to the development described in this report.

D. Irrigation Demands

1. As described herein, separate irrigation demands are not applicable to the development described in this report. Regardless, irrigation demand forms are included in the Appendices of this report for reference. Zones C33 and C34 combined (designed to run simultaneously) represent the highest irrigation demand at 48 gpm.

## VI. EXISTING WATER SYSTEM

A. Existing Distribution System

1. Town, *Castle Rock Utility Maps* (a.k.a. ToCR MAP 1 and ToCR MAP 2; see appendices) indicate a 12" DIP waterline exists in the drive immediately west of the Outlets at Castle Rock's buildings, east of the proposed pad lots. The same *Castle Rock Utility Maps* indicate this waterline is a part of the overall system serving the subject site, the Outlets at Castle Rock, and the surrounding development.

2. No known or anticipated shortcomings or bottlenecks are associated with this specific portion of the existing system.

3. Pump station capacities do not appear to be applicable to the development described in this report.

4. Based on the calculations and as shown in the Site Map included in the Appendices of this report for reference, static pressure at the proposed connection points to the existing system is 94.6 psi at Connection Point #1 and 94.9 psi at Connection Point #2.

B. Existing Supply Facilities

1. The proposed development lies within Parcel Number 10/11 of the *1st Amendment to the Final Water and Sanitary Sewer System Study for Castle Pines Commercial PD*, prepared by TST Inc. of Denver, Consulting Engineers, dated revised September 9, 2006 (a.k.a. STUDY; see appendices). The STUDY indicates that a "…previous report entitled Water and Sanitary Sewer System Study, dated November, 1994, was prepared for the overall Castle Pines Commercial PD…[and that the STUDY]…updates the previous reports…" The STUDY includes the subject site within the Town of Castle Rock's Yellow Pressure Zone. The *Town of Castle Rock Water Master Plan 2017* (a.k.a. WATER MASTER PLAN; see appendices) corroborates inclusion of the subject site within the Yellow Pressure Zone and indicates said zone is supplied by Tanks 12A and 12B.

2. The highest and lowest elevations of the subject site and subsequent anticipated maximum and minimum static water pressures are reported in the calculations in the Appendices of this report for reference.

3. Tanks 12A and 12B serving the subject site are located to the southwest, near the intersection of Meadows Parkway and Coachline Road. Their volumes, as reported in the WATER MASTER PLAN are 3.94 MG and 6.13 MG respectively. Required storage for the subject site is included in the Appendices of this report for reference and is less than the total storage provided by Tank 12A and Tank 12B. The WATER MASTER PLAN also indicates that, "…Tank 18 (yellow zone) in Cobblestone Ranch is planned to be constructed in the 2019-2020 planning horizon…and will add an additional 2.2 MG of storage." The WATER MASTER PLAN continues, "…The Cobblestone Ranch subdivision (formerly known as Liberty Village) currently is served through a long transmission main that crosses three pressure zones. A 2 MG water storage tank is planned to provide dedicated storage for maximum day demand plus fire flow in this area…" It is unclear from the WATER MASTER PLAN how the subject site's storage requirements might impact the existing and planned storage.

# VII. PROPOSED WATER SYSTEM

## A. Proposed Distribution System

1. The proposed water facilities consist of the installation of a water main loop extending to and through the subject site as shown in the Site Map included in the Appendices of this report for reference. Proposed main lines are 12" diameter. Two proposed fire hydrants are anticipated. Any future development of the existing water infrastructure needed to serve the subject site is the responsibility of the developer.

2. Looping in addition to that described herein is not anticipated.

3. Proposed SFEs associated with the subject site are included in the Appendices of this report for reference. The WATER MASTER PLAN's Figures 4.4a and 4.4b indicate that the subject site is a part of their Planned Development Zoning number10 and that this PD along with PD numbers 8, 9, 43, and 91 were zoned for a maximum of 1008 SFEs (0 SF + 1550 MF), platted and SDP approved for 690 SFEs (0 SF + 1062 MF) and re-entitled for 662 SFEs (0 SF + 1018 MF). It is unclear from the WATER MASTER PLAN how the subject site's SFE requirements might impact the WATER MASTER PLAN's modeling.

4. There do not appear to be assumptions specific to the subject site within the WATER MASTER PLAN. Therefore, any re-evaluation appears inapplicable, unless determined applicable by the Town of Castle Rock.

## B. Proposed Supply Facilities

1. No additional pump stations, wells, PRVs, storage reservoirs, or purification facilities are anticipated to be necessary to adequately serve the subject site.

## C. Required Fire Flow

1. Required fire flows and durations are included in the Appendices of this report for reference. A "Confirmation Memo for Required Fire Flow" provided by the Castle Rock Fire and Rescue Department is also included in the Appendices of this report for reference.

## D. Land Dedication Requirements

1. All portions of the proposed water system are planned to be located outside the public right-of-way, and will therefore require the dedication of utility easements to the town.

2. No portions of the proposed water system are anticipated to be difficult for the town to access or maintain.

## VIII. PROPOSED WATER SYSTEM ANALYSIS AND MODELING

### A. Hydraulic Models

1. Hydraulic modeling included with this report was performed with the assistance of the U.S. Environmental Protection Agency, National Risk Management Research Laboratory, Water Supply and Water Resources Division software application, EPANET.

2. Anticipated primary distribution lines and connection to the existing system are represented in the model included in the Appendices of this report for reference.

3. Elevations of modeled nodes are at the design pipe elevations as indicated in the project construction documents; generally between 5 and 7 feet below finished grade.

### B. Hydraulic Modeling Scenarios

1. Static development pressures (zero demands) with the supplying storage tank at twenty percent and one hundred percent full are included in the calculations in the Appendices of this report for reference.

2. All dynamic water modeling included in this report has been performed at a minimum (twenty percent) tank stage.

3. MDD plus fire flow (re: Section IV.B.5 and Section V.D.1 herein regarding irrigation) calculations are included in the calculations and results in the Appendices of this report for reference. Initial and full build-out are considered the same for the purposes of this report. Closed pipes and fire flow node IDs are clearly stated and shown. The demand scenario analyzed is described in the Demand Table below. The scenario was analyzed with at least one critical distribution loop out of service (i.e. closed pipes) in accordance with Section 4.4.3 of the WATER MANUAL. Demand from the overall surrounding development was modeled at Junctions P and Q by equally dividing the STUDY's total MDD of 1,199 gpm (STUDY Planning Areas 1 through 16). The scenario was modeled with only the fire flow calculated for the largest building(s), in accordance with the Town of Castle Rock's direction.

   Demand Table

| Junct. | M | N | E | G | H | A | P | Q |
|---|---|---|---|---|---|---|---|---|
| | (gpm) | (gpm) | (gpm) | (gpm) | (gpm) | (gpm) | (gpm) | (gpm) |
| Scenario | | | | | | | | |
| F2 | 1500 | 0 | 41 | 3 | 22 | 0 | 599.5 | 599.5 |

4. PHD (re: Section IV.B.5 and Section V.D.1 herein regarding irrigation) calculations are included in the calculations and results in the Appendices of this report for reference. Initial and full build-out are considered the same for the purposes of this

report. Closed pipes are clearly stated and shown. The demand scenario analyzed is described in the Demand Table below. It was analyzed with at least one critical distribution loop out of service (i.e. closed pipes) in accordance with Section 4.4.3 of the WATER MANUAL. Demand from the overall surrounding development was modeled at Junctions P and Q by equally dividing the STUDY's total PHD of 2,037 gpm (STUDY Planning Areas 1 through 16).

Demand Table

| Junction | M | N | E | G | H | A | P | Q |
|---|---|---|---|---|---|---|---|---|
| | (gpm) | (gpm) | (gpm) | (gpm) | (gpm) | (gpm) | (gpm) | (gpm) |
| Scenario | | | | | | | | |
| X | 0 | 0 | 89 | 6 | 48 | 0 | 1018.5 | 1018.5 |

5. A water quality aging analysis is not included in this report.

C. Hydraulic Modeling Output and Required Schematics

1. Junction reports that identify junction ID, demand, and residual pressure are included in the Appendices of this report for reference.

2. Total demand supplied by the model for each scenario is included in the Appendices of this report for reference.

3. Pipe reports that identify pipe ID, pipe length, pipe size, pipe material, Hazen-Williams "C" factor, computed velocity, and flow for each scenario are included in the Appendices of this report for reference.

4. Schematics that depict the modeled network with pipe and junction IDs and easily correlated to the Site Map(s) are included in the Appendices of this report for reference. Analysis results clearly indicate which pipes are open and closed.

5. Proposed pipes within all scenarios modeled meet the pressure and velocity criteria set forth in the WATER MANUAL with the following exceptions:

   Velocity of the proposed 6" fire hydrant lateral modeled (Pipe 14) exceeds velocity criteria (17 ft/s > 15 ft/s) as typically expected when fire demands are placed on such fire hydrant laterals and junctions.

D. Fire Flow Test Results

1. Fire Flow Test Results from the STUDY are included in the Appendices of this report for reference as are Fire Flow Test Results coordinated more recently with the Town.

## IX. CALCULATED WASTEWATER FLOWS

A. Average Daily Wastewater Flows (ADF)

1. ADFs (18,758 gpd total) are tabulated in the Appendices of this report for reference. Initial and full build-out are considered the same for the purposes of this report.

B. Peaking Factor (PF)

1. PFs (5.0 max for design) are tabulated in the Appendices of this report for reference.

C. Peak Design Flows (PDF)

1. PDFs (95,663 gpd total) are tabulated in the Appendices of this report for reference. Initial and full build-out are considered the same for the purposes of this report.

## X. EXISTING WASTEWATER SYSTEM

A. Existing Collection System

1. Town, *Castle Rock Utility Maps* (a.k.a. ToCR MAP 1 and ToCR MAP 2; see appendices) included in the Appendices of this report for reference indicate an 8" PVC sanitary sewer line exists in the existing 90' Water, Storm and Sanitary Sewer Easement (Rec. No. 9664761) paralleling the abandoned Factory Shops Boulevard alignment northwest of the subject site and continues south into the Factory Shops Boulevard R.O.W. west of the subject site. The same *Castle Rock Utility Maps* indicate this sanitary sewer line is a part of the overall system serving the subject site, the Outlets at Castle Rock, and the surrounding development.

2. The proposed development lies within Parcel Number 10/11 of the *1st Amendment to the Final Water and Sanitary Sewer System Study for Castle Pines Commercial PD*, prepared by TST Inc. of Denver, Consulting Engineers, dated revised September 9, 2006 (a.k.a. STUDY; see appendices). The STUDY indicates that a "…previous report entitled Water and Sanitary Sewer System Study, dated November, 1994, was prepared for the overall Castle Pines Commercial PD…[and that the STUDY]…updates the previous reports…" The *Town of Castle Rock Wastewater Master Plan 2016* (a.k.a. WASTEWATER MASTER PLAN) does not appear to include a breakdown of specific wastewater collection subbasin(s).

3. The STUDY accounts for flows from the subject site by inclusion of its area within Parcel Number 10/11's reported 63.0 acres tributary to the STUDY's Line A-7. The STUDY indicates that Line A-7 conveys flows to Line A-5, A-3, and A-1 respectively before discharging to an "…existing 27" interceptor running parallel to State Highway 85…" (a.k.a. the "East Plum Creek Interceptor") at location "A-1."

4. The STUDY includes a discussion concerning "…Off-site wastewater flows from Silver Heights [which] are routed through the sanitary sewer lines in the PD via Line 'A-8', east of the existing Castle Rock Factory Shops…" and further that "…Capacity for up to 600 dwelling units has been included in the calculations for this flow." The STUDY suggests that its analysis "…determined that the flows from Silver Heights in the Town's existing line exceed the line capacity based on calculation methods required by the Town of Castle Rock…" and recommends that "…this area be further evaluated by the Town…"

## XI. PROPOSED WASTEWATER SYSTEM

### A. Proposed Collection System

1. The proposed wastewater facilities consist of the installation of a wastewater main extension into and through the subject site as shown in the Site Map included in the Appendices of this report for reference. The proposed main line is 8" diameter. One proposed commercial service tap off this proposed main extension is anticipated at this time (for service to Pad C). Any future development of the existing wastewater infrastructure needed to serve the subject site is the responsibility of the developer including the installation of any grease interceptors which must be in accordance with the Plum Creek Water Reclamation Authority Code of Rules and Regulations. At such time as pad site tenant(s) apply for Commercial Building Permit(s), said tenants will be required to submit a Grease Interceptor Requirement form. In addition, and in conjunction with the submittal of the Grease Interceptor Requirement form, a Plum Creek Water Reclamation Authority, Industry Information Questionnaire must be complete and submit by the tenant(s).

2. Proposed SFEs associated with the subject site are included in the Appendices of this report for reference and in the Pipe Table herein. The WASTEWATER MASTER PLAN does not appear to include a breakdown of SFEs used in the town's hydraulic modeling. Therefore comparison is not possible.

   The STUDY does, however, include SFEs used in its analysis. The STUDY's Parcel Number 10/11 is split; ¾ of its area (47.25 ac.; 142 SFE) being conveyed by the STUDY's Line A-7, and ¼ of its area (15.75 ac.; 47 SFE) being conveyed by Line A-6. The subject site is within the STUDY's Parcel Number 10/11 ¾ portion and therefore tributary to Line A-7.

   Notwithstanding, for more applicable analysis the proposed demands associated with the subject site included in the Appendices of this report for reference are based on proposed building square footage and more specific use ("Restaurants" and "Retail/Offices" from the *Town of Castle Rock, Wastewater Collection Design, 2018 Criteria Manual* [a.k.a. WASTEWATER MANUAL] Table 4.4.1.1; see appendices) than the STUDY's parcel acreage and generic "Other Commercial" use found in

Table 4.4.1.1. Further, the STUDY reports cumulative demand and downstream capacity in gpd, not SFE; therefore comparison of demand herein is in gpd.

Other factors impact the subject comparison. The existing development does not appear to have followed all of the STUDY's assumptions. In particular, the STUDY appears to have accounted for Parcel Number 5 in its analysis for both Line A-9 (tributary to Line A-7 of interest as noted above) and Line B-7. The *Concept Utility Letter for Promenade at Castle Rock PD*, prepared by Bowman/VISION LAND, dated revised December 10, 2014 (a.k.a. PROMENADE REPORT; see appendices) appears to confirm that wastewater from the STUDY's Parcel Number 5 is intended to be conveyed by Line B-7 rather than by Line A-9. ToCR MAP 1 and ToCR MAP 2 further substantiate this rendering of the wastewater system. In addition, development of another pad lot within the Outlets at Castle Rock retail development property tributary to Line A-7 is proposed to occur. The *Utility Report For Outlets at Castle Rock – Pad D*, prepared by Sterling Design Associates, llc, dated April 2020 (a.k.a. PAD D REPORT) approved by the Town of Castle Rock, indicates ADF and PDF wastewater flows of 6,000 gpd and 30,600 gpd respectively for this proposed development.

Without the STUDY's Parcel Number 5 wastewater contribution to Line A-7; Line A-7's assumed cumulative average and peak flows are reduced from 161,616 gpd and 773,122 gpd to 148,350 gpd and 706,792 gpd respectively. Although these reduced acreage based demands may still include the subject site's proposed contributions, the more conservative approach of adding the proposed demands from the development described in this report (ADF = 18,758 gpd; PDF=96,663 gpd) along with the proposed demands from the development described in the PAD D REPORT (ADF = 6,000 gpd; PDF = 30,600 gpd) suggests a total proposed flow (ADF = 173,108 gpd / 0.27 cfs; PDF=834,055 gpd / 1.29 cfs) approximately 6.6% in excess of the STUDY's reported and approved Line Capacity (782,771 gpd / 1.21 cfs) for Line A-7 serving the subject site and upstream properties.

The *Castle Rock Factory Shops Construction Plans – As-Built*, prepared by Rocky Mountain Consultants, Inc., dated December 6, 1993 (a.k.a. SOUTH ASBUILT; see appendices) indicates Line A-7's critical section to be 8" PVC at 0.72 % and Line A-1, A-3, and A-5's critical section to be 10"PVC at 1.93%. Calculations included in the Appendices of this report for reference determining flow characteristics of the various demands within these pipe sections are summarized in the Capacity Table below:

Capacity Table

| Pipe Section | Capy. (cfs) | Approved Demand (cfs) | % of Capy. (%) | Proposed Demand (cfs) | % of Capy. (%) |
|---|---|---|---|---|---|
| A-7 (8"PVC @ 0.72%) | 1.32 | 1.21 | 91.7 | 1.29 | 97.7 |
| A-1, A-3, A-5 (10"PVC @ 1.93%) | 3.87 | 1.21 | 31.3 | 1.29 | 33.3 |

(% of Capy. = Demand / Capy.)

3. There do not appear to be assumptions specific to the subject site within the WASTEWATER MASTER PLAN. Therefore, any re-evaluation appears inapplicable, unless determined applicable by the Town of Castle Rock.

B. Proposed Wastewater Facilities

1. No additional lift stations, force mains, or pretreatment facilities are anticipated to be necessary to adequately serve the subject site.

C. Land Dedication Requirements

1. All portions of the proposed wastewater system are planned to be located outside the public right-of-way, and will therefore require the dedication of utility easements to the town.

2. No portions of the proposed wastewater system are anticipated to be difficult for the town to access or maintain.

## XII. PROPOSED WASTEWATER SYSTEM ANALYSIS AND MODELING

A. Hydraulic Models

1. Hydraulic modeling included with this report was performed with the assistance of Bentley Systems Incorporated's software application, FlowMaster.

2. Anticipated primary collection lines and connection to the existing system are represented in the model included in the Appendices of this report for reference.

B. Hydraulic Modeling Scenarios

1. ADF calculations for the proposed system are included in the calculations and results in the Appendices of this report for reference. Initial and full build-out are considered the same for the purposes of this report. Calculations are included for both minimum and maximum allowable slopes per the WASTEWATER MANUAL.

2. PDF calculations for the proposed system are included in the calculations and results in the Appendices of this report for reference. Initial and full build-out are considered the same for the purposes of this report. Calculations are included for both minimum and maximum allowable slopes per the WASTEWATER MANUAL. In addition, calculations determining the minimum required slope to achieve the minimum required velocity are included.

C. Hydraulic Modeling Output and Required Schematics

1. Pipe reports that identify Manning's "n" coefficient for proposed PVC pipe, pipe size, design slope, and computed velocities are included in the Appendices of this report for reference.

2. Tabulations identifying ADF, Peaking Factor, and PDF are included in the Appendices of this report for reference. The Pipe Table below includes SFE, full pipe flow, maximum capacity, and the ratio of PDF divided by maximum capacity.

Pipe Table

| Design Point | Use | SFE | Full Flow/PDF (cfs) | Max. Capy. (cfs) | PDF/Max. Capy. (%) |
|---|---|---|---|---|---|
| | Restaurant (Pad B) | 31.5 | 0.0497 | 1.19* | 4.18 |
| | Retail (Pad B) | 3.8 | 0.0059 | | |
| 1 | | 35.3 | 0.0556 | 1.19* | 4.67 |
| | Restaurant (Pad C) | 58.5 | 0.0924 | | |
| 2 | | 93.8 | 0.1480 | 1.19* | 12.44 |
| | | | | 1.69† | 8.76 |

(Max. Capy. = 75% of flow at depth equal to the pipe dia. [8"PVC] at 1.2%* and 2.42%† design slopes)

3. Schematics that depict the modeled network with pipe and junction Design Points, are included only as indicated on the Site Map included in the Appendices of this report for reference.

4. Minimum allowable slopes (0.40%) do not result in required PDF minimum velocities (2.0 ft/s). Minimum slopes for Pad B, Design Point 1 and Design Point 2 of 1.13%, 1.03% and 0.46% respectively, are required to meet PDF minimum velocities as shown in the calculations included in the Appendices of this report for reference.

Maximum allowable slopes (7.50%) do not result in velocities which exceed allowable PDF maximums (10 ft/s).

Design, accommodating the existing and proposed site constraints, includes a slope of 1.2% for the majority of the proposed system with a run of 2.42% at the system's

downstream end just prior to connection with the existing system. Calculations included in the Appendices of this report for reference indicate system characteristics resulting from the design which include velocities between 2.04 ft/s and 3.61 ft/s.

## XIII. POTENTIAL PERMITTING REQUIREMENTS

There are no forseeable Federal, State, or County permitting requirements associated with this project. Permits typical for the construction of waterline within the Town of Castle Rock are anticipated.

## XIV. REFERENCES

1. *Town of Castle Rock, Water System Design, 2018 Criteria Manual*, current edition; Town of Castle Rock.

2. *1st Amendment to the Final Water and Sanitary Sewer System Study for Castle Pines Commercial PD*, revised September 9, 2006; TST Inc. of Denver, Consulting Engineers.

3. *Town of Castle Rock Water Master Plan 2017*, current edition; Town of Castle Rock.

4. *Town of Castle Rock Wastewater Master Plan 2016*, current edition; Town of Castle Rock.

5. *Town of Castle Rock, Wastewater Collection Design, 2018 Criteria Manual*, current edition; Town of Castle Rock.

6. *Concept Utility Letter for Promenade at Castle Rock PD*, revised December 10, 2014; Bowman/VISION LAND.

# XV. APPENDICES

# APPENDIX A – GENERAL MAPS AND PLANS

VICINITY MAP
L1 & L2, BLOCK 1, CASTLE PINES COMMERCIAL FIL. NO. 5; L3, BLOCK 1, CASTLE ROCK FACTORY SHOPS
SCALE: 1" = 1,000'
DATE: 12/06/2019

NORTH

Sterling Design Associates, llc
CIVIL ENGINEERS - LANDSCAPE ARCHITECTS
2009 W. Littleton Blvd. #300
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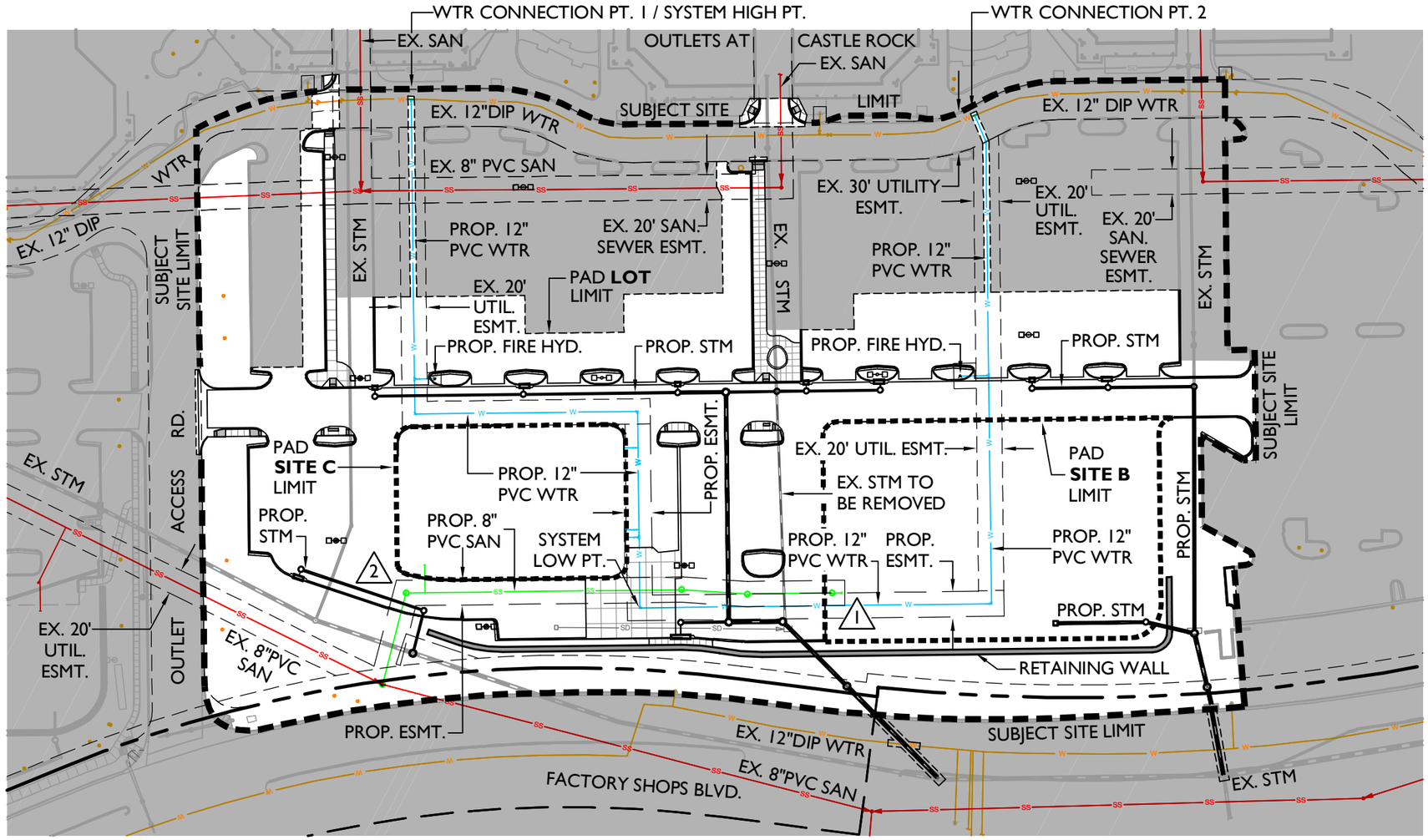
www.SterlingDesignAssociates.com




RE: UTILITY LETTER APPENDIX D - WATER HYDRAULIC ANALYSIS AND MODELING
AND APPENDIX G - WASTEWATER HYDRAULIC ANALYSIS AND MODELING
FOR ADDITIONAL INFORMATION

**LEGEND**

- PROPERTY LINE / R.O.W.
- EXIST. CURB & GUTTER
- EXIST. CURB & GUTTER TO BE REMOVED
- PROP. CURB & GUTTER
- PROP. TEMPORARY CURB & GUTTER
- PROP. RETAINING WALL
- DESIGN POINT
- SUBJECT SITE LIMIT
- PAD **LOT** LIMIT
- PAD **SITE** LIMIT
- EXIST. SANITARY SEWER
- PROP. SANITARY SEWER
- EXIST. WATERLINE
- PROP. WATERLINE

NORTH

**UTILITY SITE MAP**
LOT 1, BLOCK 1, OUTLETS AT CASTLE ROCK FILING NO. 1

SCALE: 1" = 100'
DATE: 8/22/2022

Sterling Design Associates, llc
CIVIL ENGINEERS - LANDSCAPE ARCHITECTS
2009 W. Littleton Blvd. #300
Littleton, CO 80120
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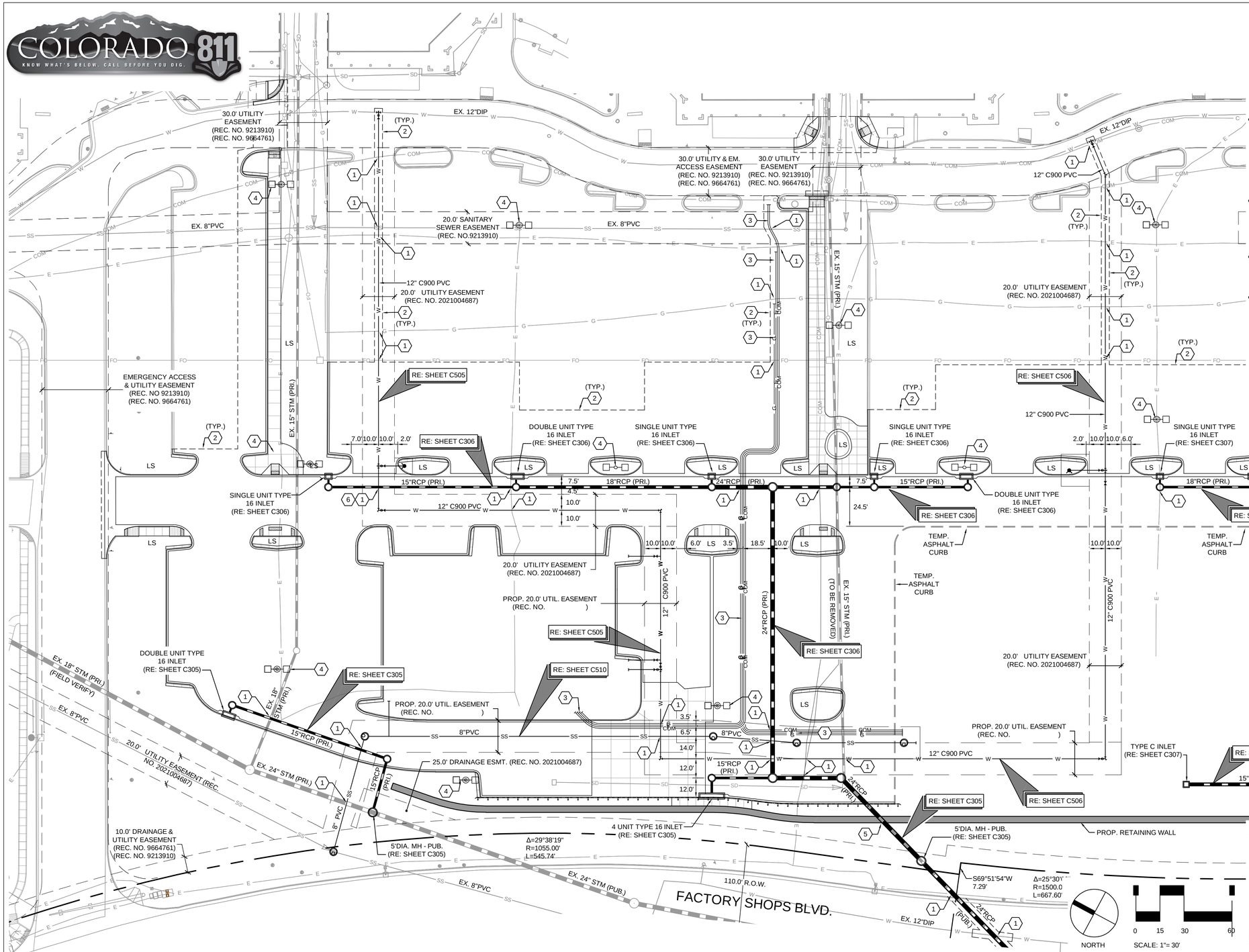


## CONSTRUCTION NOTES

1. CAUTION - UTILITY CROSSING! CONTRACTOR SHALL VERIFY HORIZONTAL AND VERTICAL LOCATION OF CROSSING UTILITIES PRIOR TO CONSTRUCTION AND PROVIDE ADEQUATE CLEARANCES BETWEEN EXISTING/PROPOSED UTILITY INSTALLATIONS. CONTRACTOR TO CONFIRM INVERTS, UTILITY PROVIDER ALLOWABLE CLEARANCES, AND DEMOLITION/RELOCATION INTENT PER PLAN(S) PRIOR TO CONSTRUCTION.
2. SAWCUT AND REMOVE EXISTING PAVEMENT, CURB, GUTTER, RAMP(S), CONCRETE, DRIVE AND/OR WALK TO NEAREST JOINT, 2-FEET MINIMUM OFF PROPOSED LIP OF GUTTER OR EDGE OF CONCRETE, OR TO LIMITS AS SHOWN. RE: SITE & GRADING SHEETS FOR ADDITIONAL INFORMATION.
3. APPROXIMATE ALIGNMENT AND CONNECTION POINTS FOR PROPOSED GAS, COMM., PRIMARY ELEC., AND TELEPHONE SERVICE. SEE DRY UTILITY NOTE, THIS SHEET.
4. CONTRACTOR TO PROVIDE AND INSTALL CONDUITS, PULL BOXES, AND WIRING FOR SITE LIGHTING; TYPICAL. REFERENCE SITE ELECTRIC PLANS FOR SIZING, RUN TERMINUS, AND OTHER WIRING REQUIREMENTS. ADJUST EXISTING POWER SUPPLY ROUTING AS NECESSARY TO MAINTAIN POWER TO FIXTURES TO REMAIN. RE: SHEET C201 FOR POLES TO REMAIN AND POLES AND/OR FIXTURES TO REPLACE; AND GENERAL LIGHTING PLAN FOR ADDITIONAL INFORMATION.
5. CAUTION - UTILITY CROSSING! CONTRACTOR SHALL COORDINATE ALL WORK WITH RETAINING WALL DESIGN PRIOR TO GRADING AND/OR CONSTRUCTION OF UTILITIES OR WALL. CONTRACTOR SHALL VERIFY HORIZONTAL AND VERTICAL LOCATION OF CROSSING UTILITY AND WALL PRIOR TO CONSTRUCTION OF ANY IMPROVEMENTS AND PROVIDE ADEQUATE CLEARANCES BETWEEN EXISTING/PROPOSED UTILITY INSTALLATIONS AND WALL. CONTRACTOR TO CONFIRM INVERTS, AND UTILITY PROVIDER/WALL DESIGN ALLOWABLE CLEARANCES PRIOR TO CONSTRUCTION.
6. CONSTRUCT WATERLINE LOWERING. RE: SHEET C505.


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THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE TO EXISTING IMPROVEMENTS AND UTILITIES AND SHALL REPAIR ANY DAMAGE AT HIS EXPENSE.

## DRY UTILITY NOTE

PRIOR TO CONSTRUCTION - CONTRACTOR TO VERIFY THE EXACT SIZE, ALIGNMENT, AND CONNECTION POINTS WITH THE DRY UTILITY PROVIDERS. THE CONTRACTOR IS RESPONSIBLE FOR ALL PROVISION AND INSTALLATIONS REQUIRED OF ALL DRY UTILITY APPURTENANCES (INCLUDING, BUT NOT LIMITED TO, TRENCHING, CONDUITS, PULL BOXES, ETC.) REQUIRED FOR SERVICE CONNECTION THAT ARE NOT INCLUDED IN THE UTILITY PROVIDER'S SCOPE.

## GENERAL NOTES

1. CONTRACTOR SHALL PROVIDE A MINIMUM SEVENTY TWO (72) HOURS' NOTICE TO THE ON-SITE TCR CONSTRUCTION INSPECTOR, (720) 733-2200, PRIOR TO MAKING ANY CONNECTIONS OR TIE-INS TO EXISTING WATER, SANITARY SEWER, AND/OR STORM SEWER SYSTEMS PROVIDED THAT THE UTILITY TIE-IN DOES NOT DISRUPT SERVICE TO EXISTING CR WATER CUSTOMERS. IF THE TIE-IN WILL DISRUPT UTILITY SERVICE, THEN CONTRACTOR SHALL PROVIDE A MINIMUM OF THREE (3) WEEKS' NOTICE TO THE TCR CONSTRUCTION INSPECTOR TO ALLOW TIME FOR CR WATER TO PROVIDE WRITTEN NOTIFICATION TO EXISTING CUSTOMERS AFFECTED BY THE TIE-IN. ALL TOWN UTILITY TIE-INS MUST BE APPROVED BY CR WATER PRIOR TO COMMENCING WORK.
2. CONTRACTOR SHALL NOTIFY CASTLE ROCK WATER OF ANY WORK THAT REQUIRES SHUTDOWN OR INTERRUPTION OF SERVICE OF EXISTING WATER MAINS THREE WEEKS PRIOR TO THE PROPOSED SHUTDOWN OR INTERRUPTION UNLESS OTHERWISE APPROVED BY CASTLE ROCK WATER.
3. REFER TO SHEETS C101 THROUGH C103 FOR GENERAL NOTES.
4. DIMENSIONS ARE FROM FLOWLINE AND CENTERLINE OF UTILITY UNLESS OTHERWISE NOTED.

## TOWN APPROVAL BLOCK

**TOWN OF CASTLE ROCK APPROVAL**
**PLANS ARE HEREBY APPROVED FOR ONE YEAR FROM DATE OF DEVELOPMENT SERVICES APPROVAL**

APPROVED BY:

DEVELOPMENT SERVICES DATE

## PROF. ENGINEER CERTIFICATION

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COLORADO REGISTERED JAY M. NEWELL 35219 PROFESSIONAL ENGINEER

JAY M. NEWELL, CO PE #35219 2 / 24 / 23

STERLING DESIGN ASSOCIATES, LLC

ISSUES & REVISIONS

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| DRAWN BY: JN | DRAWING FILE: - |

PROJECT:

**OUTLETS AT CASTLE ROCK**
**PADS B & C**
**5050 FACTORY SHOPS BLVD.**
**CASTLE ROCK, CO 80108**

CLIENT:

CRAIG REALTY GROUP
4100 MACARTHUR BLVD., SUITE 100
NEWPORT BEACH, CA 92660

TEL: (714) 299-7578

SHEET TITLE:

**OVERALL UTILITY PLAN**

SHEET NUMBER:

**C501** **18 OF 36**

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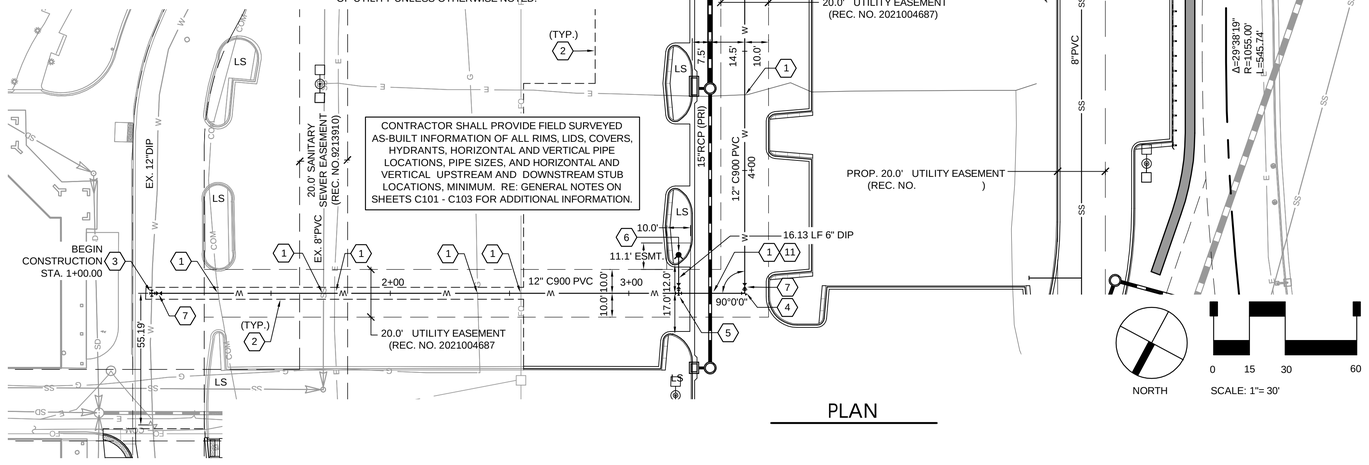
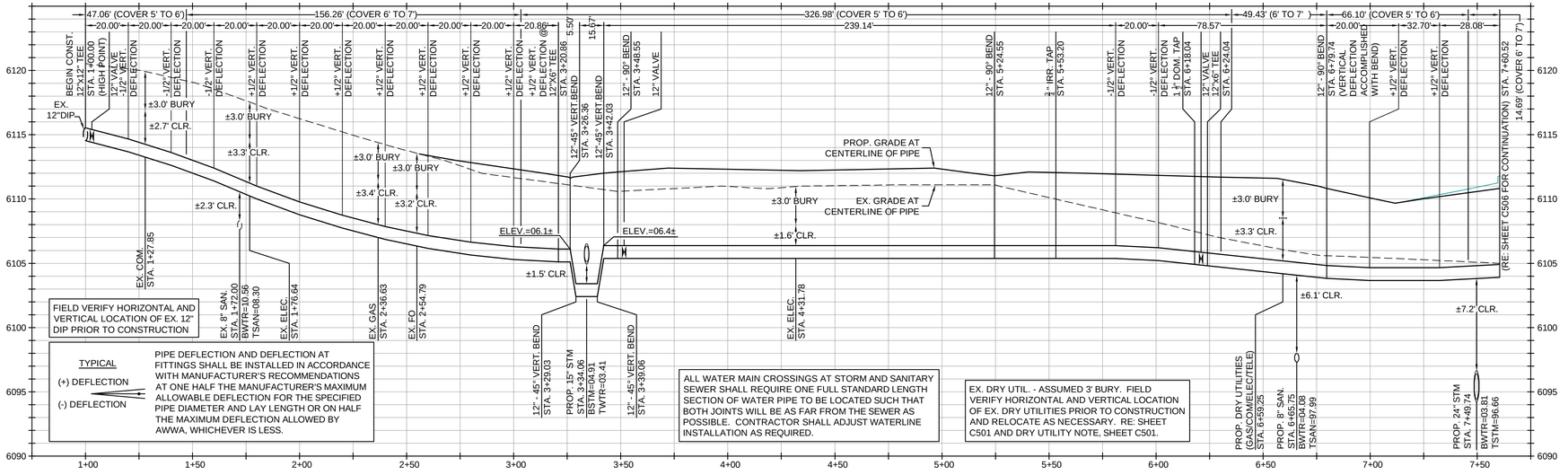
## GENERAL NOTES

1. REFER TO SHEETS C101 THROUGH C103 FOR GENERAL NOTES.
2. SYSTEM IS WITHIN TOWN OF CASTLE ROCK YELLOW PRESSURE ZONE.
3. REFER TO STORMWATER PLAN & PROFILE AND SANITARY SEWER SYSTEM PLAN & PROFILE FOR ADDITIONAL UTILITY CROSSING INFORMATION.
4. CONTRACTOR SHALL PROVIDE A MINIMUM OF SEVENTY TWO (72) HOURS NOTICE TO THE ON-SITE TCR CONSTRUCTION INSPECTOR, (720) 733-2200, PRIOR TO MAKING ANY CONNECTIONS OR TIE-INS TO EXISTING WATER, SANITARY SEWER, AND/OR STORM SEWER SYSTEMS PROVIDED THAT THE UTILITY TIE-IN DOES NOT DISRUPT SERVICE TO EXISTING CR WATER CUSTOMERS. IF THE TIE-IN WILL DISRUPT UTILITY SERVICE, THEN CONTRACTOR SHALL PROVIDE A MINIMUM OF THREE (3) WEEKS NOTICE TO THE TCR CONSTRUCTION INSPECTOR TO ALLOW TIME FOR CR WATER TO PROVIDE WRITTEN NOTIFICATION TO EXISTING CUSTOMERS AFFECTED BY THE TIE-IN. ALL TOWN UTILITY TIE-INS MUST BE APPROVED BY CR WATER PRIOR TO COMMENCING WORK.
5. CONTRACTOR SHALL NOTIFY CASTLE ROCK WATER OF ANY WORK THAT REQUIRES SHUTDOWN OR INTERRUPTION OF SERVICE OF EXISTING WATER MAINS THREE WEEKS PRIOR TO THE PROPOSED SHUTDOWN OR INTERRUPTION UNLESS OTHERWISE APPROVED BY CASTLE ROCK WATER.
6. DIMENSIONS ARE FROM FLOWLINE AND CENTERLINE OF UTILITY UNLESS OTHERWISE NOTED.




PLAN

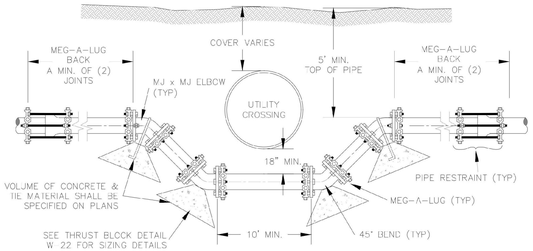



PROFILE

HORIZONTAL SCALE 1" = 30'
VERTICAL SCALE 1" = 5'

NOTES:

1. WHERE WATER LINE COVER EXCEEDS 7'-6" AT THE LOW POINT OF THE CONDUIT CROSSING, VERTICAL BENDS ARE REQUIRED. WHEN COVER IS LESS THAN 7'-6", PIPE JOINTS MAY BE DEFLECTED 1/2 THE MANUFACTURER'S RECOMMENDED DEFLECTION IN LIEU OF VERTICAL BENDS. THE LIMITS OF THE DEPRESSED AREA SHALL BE DOCUMENTED ON THE "AS-BUILT" DRAWINGS.
2. IF UTILITY CROSSING IS SANITARY SEWER & IS OVER A RAW OR POTABLE WATER LINE, ALL UTILITY CROSSING JOINTS WITHIN 10' SHALL BE ENCASED 1' BOTH SIDES OF THE JOINT W/ CONCRETE. SEE ENCASEMENT DETAIL W-20.
3. MULTIPLE JOINTS BETWEEN MEG-A-LUG FITTINGS SHALL BE RESTRAINED.
4. SEE PIPE RESTRAINT TABLE (DETAIL W-18) FOR SPECIFICATIONS.
5. NO TEES, SERVICE CONNECTIONS, VALVES, OR FIRE HYDRANT CONNECTIONS ARE ALLOWED IN LOWERING.
6. PIPE MATERIAL IN LOWERED SECTION SHALL MATCH THE MAIN LINE.




| Sheet Revisions | | Town of Castle Rock | WATERLINE LOWERING | DETAIL PLAN NO. |
|---|---|---|---|---|
| Date | Comments | 100 N. Wilcox St. | | W-17 |
| 3/16 | REVISED PER STAFF COMMENTS | Castle Rock, CO 80104 | | |
| 5/26 | REVISED PER STAFF COMMENTS | Phone: (720) 733-2230 | | Sheet 1 of 1 |
| | | Fax: (720) 733-2217 | | |
| | | Development Services | Issued By: Town of Castle Rock, Development Services January 1, 2023 | |

## CONSTRUCTION NOTES

1. CAUTION - UTILITY CROSSING! CONTRACTOR SHALL VERIFY HORIZONTAL AND VERTICAL LOCATION OF CROSSING UTILITIES PRIOR TO CONSTRUCTION AND PROVIDE ADEQUATE CLEARANCES BETWEEN EXISTING/PROPOSED UTILITY INSTALLATIONS. CONTRACTOR TO CONFIRM INVERTS, UTILITY PROVIDER ALLOWABLE CLEARANCES, AND DEMOLITION/RELOCATION INTENT PER PLAN(S) PRIOR TO CONSTRUCTION.
2. SAWCUT AND REMOVE EXISTING PAVEMENT, CURB, GUTTER, RAMP(S), CONCRETE, DRIVE AND/OR WALK TO NEAREST JOINT, 2-FEET MINIMUM OFF PROPOSED LIP OF GUTTER OR EDGE OF CONCRETE, OR TO LIMITS AS SHOWN. RE: SITE & GRADING SHEETS FOR ADDITIONAL INFORMATION.
3. INSTALL 12"x12" CUT-IN TEE WITH THRUST RESTRAINT. RE: SHEET C591, ToCR, DEVELOPMENT SERVICES, DETAIL PLAN NO. W-18 AND W-22.
4. INSTALL12" - 90° BEND WITH THRUST RESTRAINT. RE: SHEET C591, ToCR, DEVELOPMENT SERVICES, DETAIL PLAN NO. W-18 AND W-22.
5. INSTALL 12"x6" TEE WITH THRUST RESTRAINT. RE: SHEETS C591, ToCR, DEVELOPMENT SERVICES, DETAIL PLAN NO. W-18 AND W-22.
6. INSTALL FIRE HYDRANT INCL. LINE, VALVE AND RISER. RE: SHEETS C591 & C592, ToCR, DEVELOPMENT SERVICES, DETAIL PLAN NO. W-11 / W-11A AND W-37 AS REQUIRED.
7. INSTALL 12" GATE VALVE. RE: SHEETS C591 & C592, ToCR, DEVELOPMENT SERVICES, DETAIL PLAN NO. W-10 AND W-37 AS REQUIRED.
8. INSTALL 1 ½" DOMESTIC WATER TAP WITH CURB STOP VALVE, ± 20 LF 1 ½" TYPE K COPPER LINE, AND CORP. STOP. METER AND VAULT BY OTHERS. PLUG AND MARK FOR FUTURE CONNECTION. RE: SHEETS C590 & C592, ToCR, DEVELOPMENT SERVICES, DETAIL PLAN NO. W-3 AND W-23.
9. INSTALL 12"x6" TEE WITH THRUST RESTRAINT AND ±20 LF 6" DUCTILE IRON LINE. PLUG AND MARK FOR FUTURE CONNECTION. RE: SHEETS C591 & C592, ToCR, DEVELOPMENT SERVICES, DETAIL PLAN NO. W-18, W-22, AND W-23. CONTRACTOR SHALL COORDINATE INSTALLATION WITH TOWN INSPECTOR TO ENSURE ACCEPTANCE.
10. INSTALL 6" VALVE. RE: SHEETS C591 & C592, ToCR, DEVELOPMENT SERVICES, DETAIL PLAN NO. W-10 AND W-37 AS REQUIRED.
11. CONSTRUCT WATERLINE LOWERING. RE: TOCR, DEVELOPMENT SERVICES, DETAIL PLAN NO. W-17, THIS SHEET.
12. INSTALL ¾ " IRRIGATION WATER TAP WITH CURB STOP VALVE, ± 20 LF ¾ " TYPE K COPPER LINE, AND CORP. STOP. METER AND VAULT BY OTHERS. PLUG AND MARK FOR FUTURE CONNECTION. RE: SHEETS C590 & C592, ToCR, DEVELOPMENT SERVICES, DETAIL PLAN NO. W-4A AND W-23.

## TOWN APPROVAL BLOCK

**TOWN OF CASTLE ROCK APPROVAL**
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APPROVED BY:

DEVELOPMENT SERVICES DATE

## PROF. ENGINEER CERTIFICATION

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COLORADO REGISTERED JAY M. NEWELL 35219 PROFESSIONAL ENGINEER

2 / 24 / 23

JAY M. NEWELL, CO PE #35219


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STERLING DESIGN ASSOCIATES, LLC

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DATE: 02/24/2023
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DRAWN BY: JN
DRAWING FILE: -

PROJECT:

**OUTLETS AT CASTLE ROCK**
**PADS B & C**
**5050 FACTORY SHOPS BLVD.**
**CASTLE ROCK, CO 80108**

CLIENT:

CRAIG REALTY GROUP
4100 MACARTHUR BLVD., SUITE 100
NEWPORT BEACH, CA 92660

TEL: (714) 299-7578

SHEET TITLE:

**WATER SYSTEM PLAN & PROFILE**

SHEET NUMBER:

**C505** **19 OF 36**

## CAUTION - NOTICE TO CONTRACTOR

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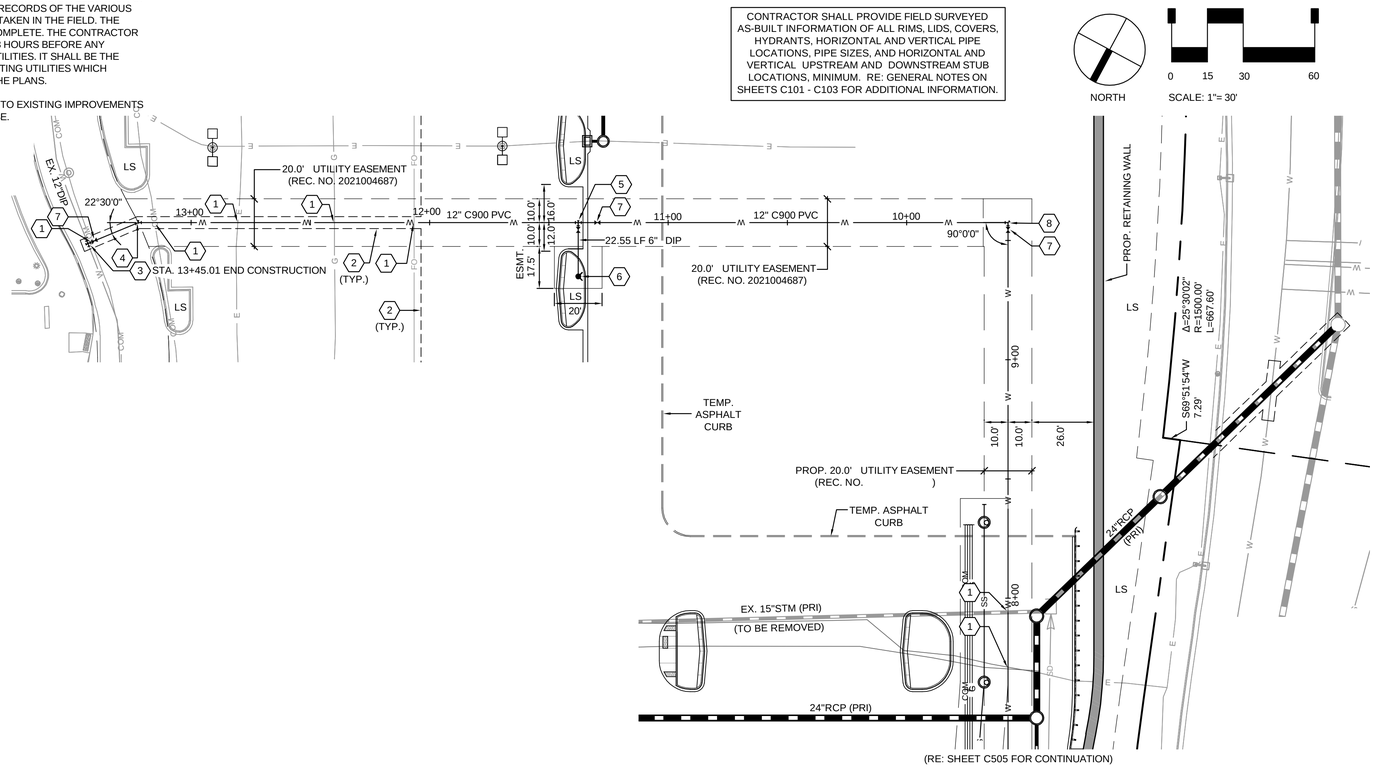
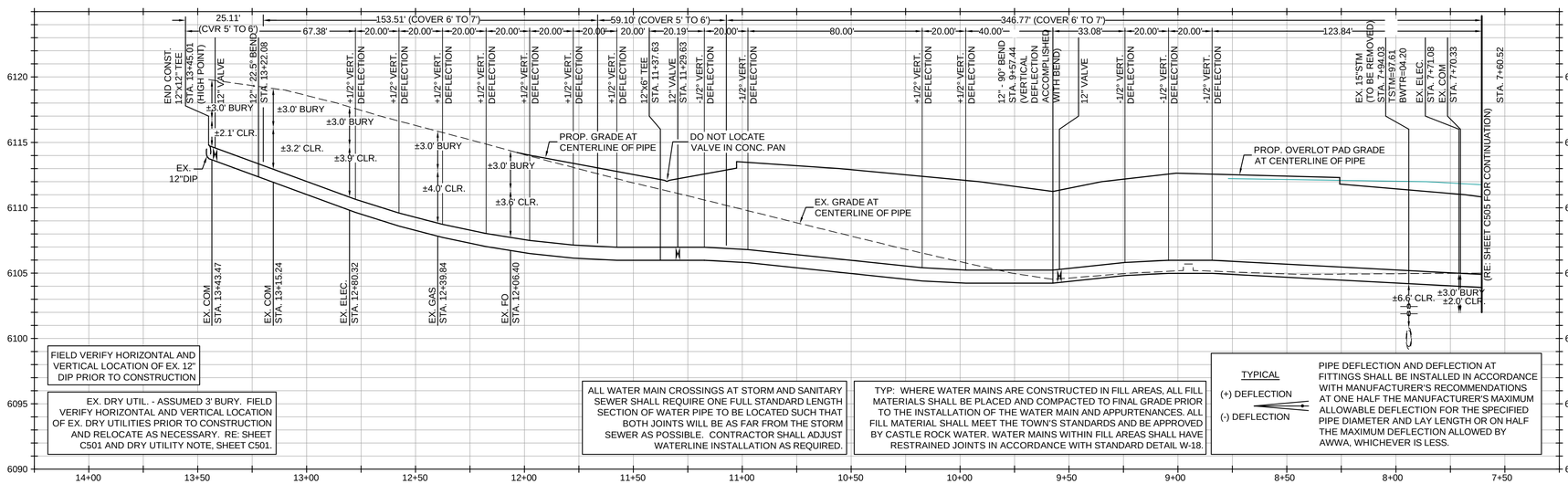
THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE TO EXISTING IMPROVEMENTS AND UTILITIES AND SHALL REPAIR ANY DAMAGE AT HIS EXPENSE.

CONTRACTOR SHALL PROVIDE FIELD SURVEYED AS-BUILT INFORMATION OF ALL RIMS, LIDS, COVERS, HYDRANTS, HORIZONTAL AND VERTICAL PIPE LOCATIONS, PIPE SIZES, AND HORIZONTAL AND VERTICAL UPSTREAM AND DOWNSTREAM STUB LOCATIONS, MINIMUM. RE: GENERAL NOTES ON SHEETS C101 - C103 FOR ADDITIONAL INFORMATION.




## PLAN




FIELD VERIFY HORIZONTAL AND VERTICAL LOCATION OF EX. 12" DIP PRIOR TO CONSTRUCTION

EX. DRY UTIL. - ASSUMED 3' BURY. FIELD VERIFY HORIZONTAL AND VERTICAL LOCATION OF EX. DRY UTILITIES PRIOR TO CONSTRUCTION AND RELOCATE AS NECESSARY. RE: SHEET C501 AND DRY UTILITY NOTE, SHEET C501.

ALL WATER MAIN CROSSINGS AT STORM AND SANITARY SEWER SHALL REQUIRE ONE FULL STANDARD LENGTH SECTION OF WATER PIPE TO BE LOCATED SUCH THAT BOTH JOINTS WILL BE AS FAR FROM THE STORM SEWER AS POSSIBLE. CONTRACTOR SHALL ADJUST WATERLINE INSTALLATION AS REQUIRED.

TYP: WHERE WATER MAINS ARE CONSTRUCTED IN FILL AREAS, ALL FILL MATERIALS SHALL BE PLACED AND COMPACTED TO FINAL GRADE PRIOR TO THE INSTALLATION OF THE WATER MAIN AND APPURTENANCES. ALL FILL MATERIAL SHALL MEET THE TOWN'S STANDARDS AND BE APPROVED BY CASTLE ROCK WATER. WATER MAINS WITHIN FILL AREAS SHALL HAVE RESTRAINED JOINTS IN ACCORDANCE WITH STANDARD DETAIL W-18.

TYPICAL
(+) DEFLECTION
(-) DEFLECTION

PIPE DEFLECTION AND DEFLECTION AT FITTINGS SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AT ONE HALF THE MANUFACTURER'S MAXIMUM ALLOWABLE DEFLECTION FOR THE SPECIFIED PIPE DIAMETER AND LAY LENGTH OR ON HALF THE MAXIMUM DEFLECTION ALLOWED BY AWWA, WHICHEVER IS LESS.

## PROFILE

HORIZONTAL SCALE 1" = 30'
VERTICAL SCALE 1" = 5'

## GENERAL NOTES

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3. INSTALL 12"x12" CUT-IN TEE WITH THRUST RESTRAINT. RE: SHEET C591, ToCR, DEVELOPMENT SERVICES, DETAIL PLAN NO. W-18 AND W-22.
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8. INSTALL12" - 90° BEND WITH THRUST RESTRAINT. RE: SHEET C591, ToCR, DEVELOPMENT SERVICES, DETAIL PLAN NO. W-18 AND W-22.

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DESCRIPTION: -

DATE: 02/24/2023
SCALE: 1" = 30'
PROJECT MANAGER: JS
PROJECT NO.: -
DRAWN BY: JN
DRAWING FILE: -

PROJECT:

**OUTLETS AT CASTLE ROCK**
**PADS B & C**
**5050 FACTORY SHOPS BLVD.**
**CASTLE ROCK, CO 80108**

CLIENT:

CRAIG REALTY GROUP
4100 MACARTHUR BLVD., SUITE 100
NEWPORT BEACH, CA 92660

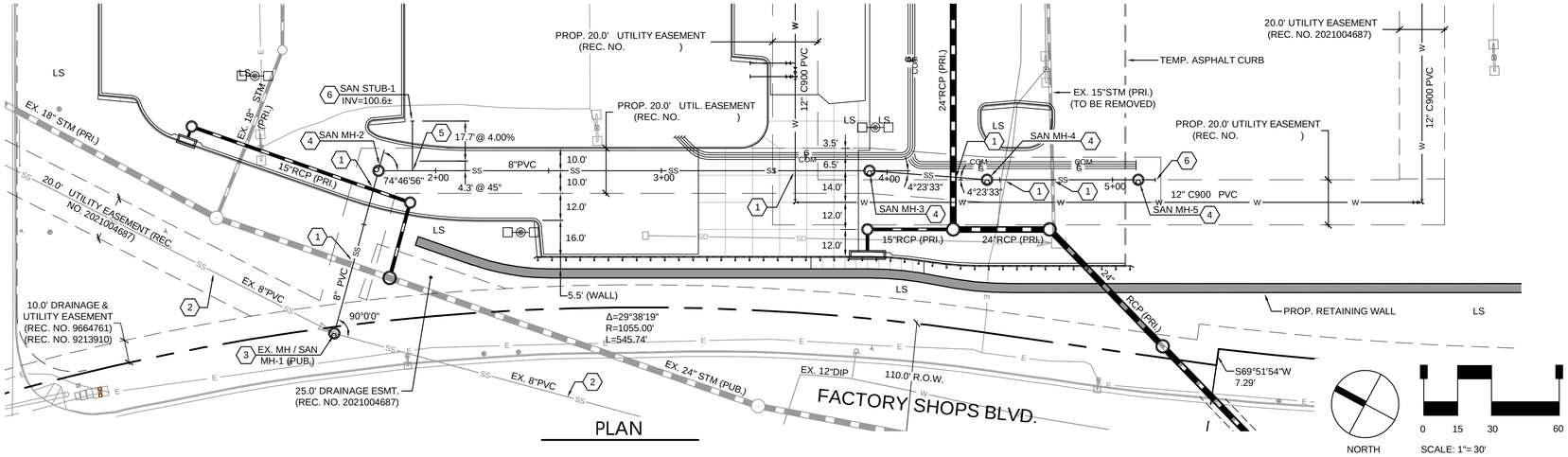
TEL: (714) 299-7578

SHEET TITLE:

**WATER SYSTEM PLAN & PROFILE**

SHEET NUMBER:

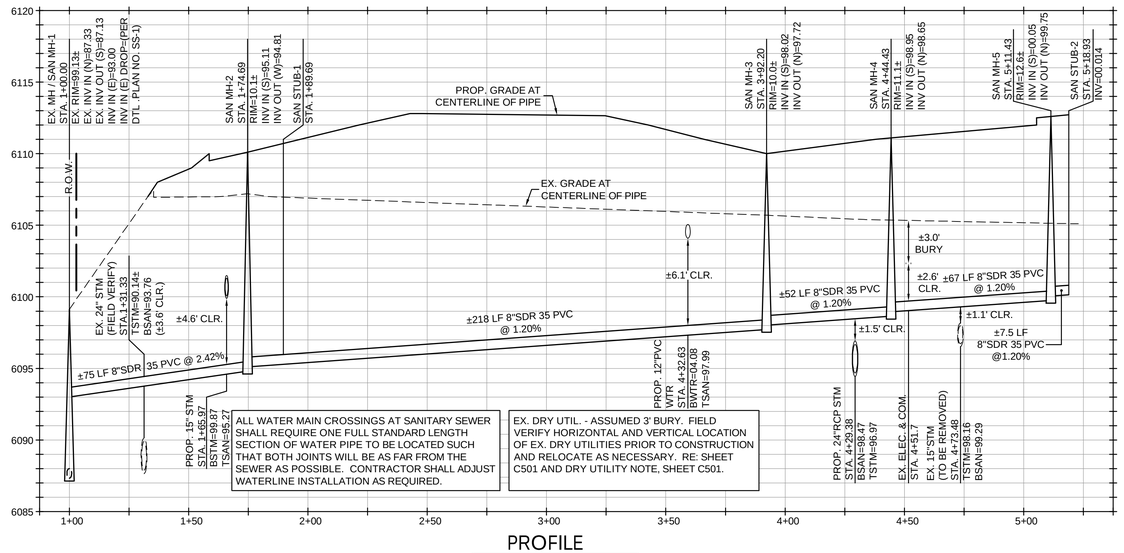
**C506** **20 OF 36**




PLAN

NORTH SCALE: 1"= 30'

0 15 30 60




PROFILE

HORIZONTAL SCALE 1" = 30'
VERTICAL SCALE 1" = 5'

CONTRACTOR SHALL PROVIDE FIELD SURVEYED AS-BUILT INFORMATION OF ALL RIMS, LIDS, COVERS, SEWER PIPE INVERTS, PIPE LOCATIONS, PIPE SIZES, AND HORIZONTAL AND VERTICAL UPSTREAM, DOWNSTREAM AND VERTICAL BEND STUB LOCATIONS, MINIMUM. RE: GENERAL NOTES ON SHEETS C101 - C103 FOR ADDITIONAL INFORMATION.

## GENERAL NOTES

1. REFER TO SHEETS C101 THROUGH C103 FOR GENERAL NOTES.
2. CONTRACTOR SHALL PROVIDE A MINIMUM OF SEVENTY TWO (72) HOURS NOTICE TO THE ON-SITE TCR CONSTRUCTION INSPECTOR, (720) 733-2200, PRIOR TO MAKING ANY CONNECTIONS OR TIE-INS TO EXISTING WATER, SANITARY SEWER, AND/OR STORM SEWER SYSTEMS PROVIDED THAT THE UTILITY TIE-IN DOES NOT DISRUPT SERVICE TO EXISTING CR WATER CUSTOMERS. IF THE TIE-IN WILL DISRUPT UTILITY SERVICE, THEN CONTRACTOR SHALL PROVIDE A MINIMUM OF THREE (3) WEEKS NOTICE TO THE TCR CONSTRUCTION INSPECTOR TO ALLOW TIME FOR CR WATER TO PROVIDE WRITTEN NOTIFICATION TO EXISTING CUSTOMERS AFFECTED BY THE TIE-IN. ALL TOWN UTILITY TIE-INS MUST BE APPROVED BY CR WATER PRIOR TO COMMENCING WORK.
3. DIMENSIONS ARE FROM FLOWLINE AND CENTERLINE OF UTILITY UNLESS OTHERWISE NOTED.

## CONSTRUCTION NOTES

1. CAUTION - UTILITY CROSSING! CONTRACTOR SHALL VERIFY HORIZONTAL AND VERTICAL LOCATION OF CROSSING UTILITIES PRIOR TO CONSTRUCTION AND PROVIDE ADEQUATE CLEARANCES BETWEEN EXISTING/PROPOSED UTILITY INSTALLATIONS. CONTRACTOR TO CONFIRM INVERTS, UTILITY PROVIDER ALLOWABLE CLEARANCES, AND DEMOLITION/RELOCATION INTENT PER PLAN(S) PRIOR TO CONSTRUCTION.
2. EXISTING UTILITY LINE AND/OR STRUCTURE TO REMAIN AND BE PROTECTED THROUGHOUT CONSTRUCTION.
3. REMOVE EXISTING MANHOLE. CONSTRUCT 4' DIA. SANITARY OUTSIDE DROP MANHOLE OVER EXISTING SEWER PIPE(S). RE: SHEET C592, TOWN OF CASTLE ROCK, DEVELOPMENT SERVICES, DETAIL PLAN NO. SS-1.
4. CONSTRUCT 4' DIA. SANITARY MANHOLE. RE: SHEET C592, TOWN OF CASTLE ROCK, DEVELOPMENT SERVICES, DETAIL PLAN NO. SS-3 AND SS-4.
5. CONSTRUCT 6" SANITARY SEWER SERVICE TAP AND TYPE "B" STUB. RE: SHEET C590, TOWN OF CASTLE ROCK, DEVELOPMENT SERVICES, DETAIL PLAN NO. SS-2.
6. PLUG AND MARK FOR FUTURE CONNECTION. RE: SHEET C590, TOWN OF CASTLE ROCK, DEVELOPMENT SERVICES, DETAIL PLAN NO. SS-2.


Sterling Design Associates, llc
CIVIL ENGINEERS - LANDSCAPE ARCHITECTS
2009 W. Littleton Blvd. #300
Littleton, CO 80120
303.794.4727 ph
www.SterlingDesignAssociates.com


STERLING DESIGN ASSOCIATES, LLC

ISSUES & REVISIONS

| | | |
|---|---|---|
| NO.: 1 | DATE: | BY: |
| DESCRIPTION: | | |
| NO.: 2 | DATE: - | BY: - |
| DESCRIPTION: - | | |
| NO.: 3 | DATE: - | BY: - |
| DESCRIPTION: - | | |
| NO.: 4 | DATE: - | BY: - |
| DESCRIPTION: - | | |
| NO.: 5 | DATE: - | BY: - |
| DESCRIPTION: - | | |
| NO.: 6 | DATE: - | BY: - |
| DESCRIPTION: - | | |

| | |
|---|---|
| DATE: **02/24/2023** | SCALE: **1" = 30'** |
| PROJECT MANAGER: **JS** | PROJECT NO.: **-** |
| DRAWN BY: **JN** | DRAWING FILE: **-** |

PROJECT:

## TOWN APPROVAL BLOCK

**TOWN OF CASTLE ROCK APPROVAL**
**PLANS ARE HEREBY APPROVED FOR ONE YEAR FROM DATE OF DEVELOPMENT SERVICES APPROVAL**

APPROVED BY:

DEVELOPMENT SERVICES DATE

## PROF. ENGINEER CERTIFICATION

I HEREBY AFFIRM THAT THESE FINAL CONSTRUCTION PLANS WERE PREPARED UNDER MY DIRECT SUPERVISION, IN ACCORDANCE WITH ALL APPLICABLE TOWN OF CASTLE ROCK AND STATE OF COLORADO STANDARDS AND STATUTES, RESPECTIVELY; AND THAT I AM FULLY RESPONSIBLE FOR ALL DESIGN AND REVISIONS RELATIVE TO SAID PLANS.

COLORADO REGISTERED JAY M. NEWELL 35219 PROFESSIONAL ENGINEER

2 / 24 / 23

JAY M. NEWELL, CO PE #35219

**OUTLETS AT CASTLE ROCK**
**PADS B & C**
**5050 FACTORY SHOPS BLVD.**
**CASTLE ROCK, CO 80108**

CLIENT:

CRAIG REALTY GROUP
4100 MACARTHUR BLVD., SUITE 100
NEWPORT BEACH, CA 92660

TEL: (714) 299-7578

SHEET TITLE:

**SANITARY SEWER SYSTEM PLAN & PROFILE**

SHEET NUMBER:

**C510** **21 OF 36**

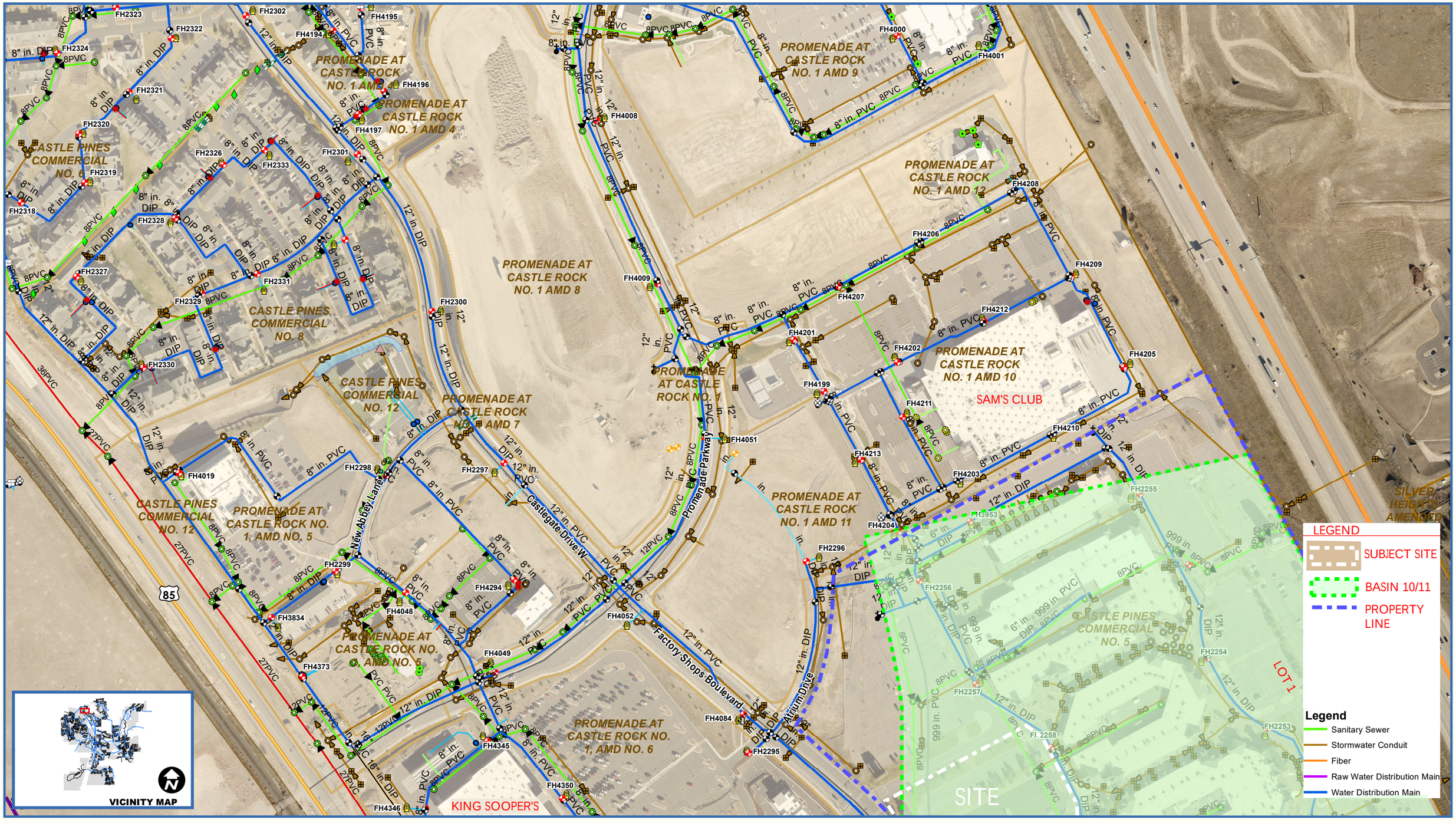
COLORADO 811 KNOW WHAT'S BELOW. CALL BEFORE YOU DIG.

## CAUTION - NOTICE TO CONTRACTOR

THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES AND, WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CALL THE LOCAL UTILITY LOCATION CENTER AT LEAST 48 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATIONS OF THE UTILITIES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE TO EXISTING IMPROVEMENTS AND UTILITIES AND SHALL REPAIR ANY DAMAGE AT HIS EXPENSE.

# Town of Castle Rock - Map 1




0 125 250 500 750 Feet

1 inch = 251 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 it's use or accuracy. Questions or omments 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 2017, Town of Castle Rock Utilities Mapping.

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

Date: 7/15/2019

Document Path: \\CRSAN1\UTUsers\tclose\Desktop\11x17 LndScp.mxd

# Town of Castle Rock - Map 2

CASTLE ROCK Qwater
Securing our future drop by drop

0 90 180 360 540 Feet

1 inch = 186 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 it's 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 2017, Town of Castle Rock Utilities Mapping.

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

Date: 9/6/2019

Document Path: \\CRSAN1\UTUsers\tclose\Desktop\11x17 LndScp.mxd

# APPENDIX B – WATER DEMANDS

STERLING
DESIGN ASSOCIATES
Civil Engineers | Landscape Architects

# Water Analysis

Job Name: CROM Pad - Castle Rock, Colorado

Date: 8/23/22

By: JMN

## CALCULATED DEMANDS

| Use | [1]Typical ADD/Unit (gpd/sf) | [1]SFEs/Unit (SFE/sf) | Bldg. Area (sf) | ADD (gpd) | ADD (gpm) | ADD (acft/yr) | [2]MDD (gpd) | MDD (gpm) | [2]PHD (gpd) | PHD (gpm) | SFE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Restaurant (Pad C) | 3.00 | 0.0075 | 7,805 | 23,415 | 16 | 26 | 58,538 | 41 | 128,783 | 89 | 59 |
| Retail/Offices (Pad B) | 0.20 | 0.0005 | 7,500 | 1,500 | 1 | 2 | 3,750 | 3 | 8,250 | 6 | 4 |
| Restaurant (Pad B) | 3.00 | 0.0075 | 4,200 | 12,600 | 9 | 14 | 31,500 | 22 | 69,300 | 48 | 32 |
| Total | | | 19,505 | 37,515 | 26 | 42 | 93,788 | 65 | 206,333 | 143 | 94 |

[1]*Town of Castle Rock, Water System Design, 2018 Criteria Manual* ; Section 4.4.1 - Design Demands

[2]*Town of Castle Rock, Water System Design, 2018 Criteria Manual* ; Section 4.4.1.2 - Demand Factors; MDD/ADD = 2.5; PHD/ADD = 5.5

## PROPOSED WATER SYSTEM

| Use | [3]Construction Type | Bldg. Area (sf) | [4]Fire Demand (gpm) | (gpd) |
|---|---|---|---|---|
| Restaurant (Pad C) | V-B | 7,805 | 1,500 | 2,160,000 |
| Retail/Offices (Pad B) | V-B | 7,500 | 1,500 | 2,160,000 |
| Restaurant (Pad B) | V-B | 4,200 | 1,500 | 2,160,000 |
| Total | | 19,505 | 4,500 | 6,480,000 |

[3]Assumed

[4]*IFC* (2012; 2018), Appendix B, Table B105.1 and B105.1(2) (respectively); 2 hr duration, 50% sprinkler reduction

STERLING
DESIGN ASSOCIATES
Civil Engineers | Landscape Architects

# Water Analysis

Job Name: CROM Pad - Castle Rock, Colorado

Date: 5/5/22

By: JMN

## PROPOSED WATER SYSTEM ANALYSIS & MODELING

[1,3]Tank Conditions

| | |
|---|---|
| ToCR Pressure Zone = | Yellow |
| ToCR Max. HGL Elevation = | 6352.00 ft |
| ToCR Tank = | Tank 12 A ( Dia = 172.0 ft ; Ht = 22.8 ft; Vol=3.94 MG ) |
| ToCR Tank = | Tank 12 B ( Dia = 172.0 ft ; Ht = 22.8 ft; Vol=6.13 MG ) |
| ToCR 20% HGL Elevation = | 6333.76 ft |

Existing System Connection Conditions

| Junction | | Elevation (ft) | [2]Static Pressure (psi) |
|---|---|---|---|
| A | (Pt. # 1) | 6115.5 | 94.6 |
| L | (Pt. # 2) | 6114.8 | 94.9 |

Proposed System Elevation Conditions

| Junction | Elevation (ft) | Static Pressure (psi) | Description | Demand | Tank Stage | Criteria (psi) |
|---|---|---|---|---|---|---|
| A | 6115.5 | 95 | Max. Elev./Min. Pressure | 0 | 20% | > 43 |
| F | 6104.8 | 107 | Min. Elev./Max. Pressure | 0 | 100% | < 125 |

[1]*Town of Castle Rock Water Master Plan 2017*

[2]Based on Pressure Zone Max. HGL Elevation

[3]*Town of Castle Rock Water Demand Design 2018 Criteria Manual*

TABLE B105.1

MINIMUM REQUIRED FIRE-FLOW AND FLOW DURATION FOR BUILDINGS

| FIRE-FLOW CALCULATION AREA (square feet) | | | | | FIRE-FLOW (gallons per minute)[b] | FLOW DURATION (hours) |
|---|---|---|---|---|---|---|
| Type IA and IB[a] | Type IIA and IIIA[a] | Type IV and V-A[a] | Type IIB and IIIB[a] | Type V-B[a] | | |
| 0-22,700 | 0-12,700 | 0-8,200 | 0-5,900 | 0-3,600 | 1,500 | 2 |
| 22,701-30,200 | 12,701-17,000 | 8,201-10,900 | 5,901-7,900 | 3,601-4,800 | 1,750 | |
| 30,201-38,700 | 17,001-21,800 | 10,901-12,900 | 7,901-9,800 | 4,801-6,200 | 2,000 | |
| 38,701-48,300 | 21,801-24,200 | 12,901-17,400 | 9,801-12,600 | 6,201-7,700 | 2,250 | |
| 48,301-59,000 | 24,201-33,200 | 17,401-21,300 | 12,601-15,400 | 7,701-9,400 | 2,500 | |
| 59,001-70,900 | 33,201-39,700 | 21,301-25,500 | 15,401-18,400 | 9,401-11,300 | 2,750 | |
| 70,901-83,700 | 39,701-47,100 | 25,501-30,100 | 18,401-21,800 | 11,301-13,400 | 3,000 | 3 |
| 83,701-97,700 | 47,101-54,900 | 30,101-35,200 | 21,801-25,900 | 13,401-15,600 | 3,250 | |
| 97,701-112,700 | 54,901-63,400 | 35,201-40,600 | 25,901-29,300 | 15,601-18,000 | 3,500 | |
| 112,701-128,700 | 63,401-72,400 | 40,601-46,400 | 29,301-33,500 | 18,001-20,600 | 3,750 | |

TABLE B105.1(2)

REFERENCE TABLE FOR TABLES B105.1(1) AND B105.2

| FIRE-FLOW CALCULATION AREA (square feet) | | | | | FIRE FLOW (gallons per minute)[b] | FLOW DURATION (hours) |
|---|---|---|---|---|---|---|
| Type IA and IB[a] | Type IIA and IIIA[a] | Type IV and V-A[a] | Type IIB and IIIB[a] | Type V-B[a] | | |
| 0-22,700 | 0-12,700 | 0-8,200 | 0-5,900 | 0-3,600 | 1,500 | 2 |
| 22,701-30,200 | 12,701-17,000 | 8,201-10,900 | 5,901-7,900 | 3,601-4,800 | 1,750 | |
| 30,201-38,700 | 17,001-21,800 | 10,901-12,900 | 7,901-9,800 | 4,801-6,200 | 2,000 | |
| 38,701-48,300 | 21,801-24,200 | 12,901-17,400 | 9,801-12,600 | 6,201-7,700 | 2,250 | |
| 48,301-59,000 | 24,201-33,200 | 17,401-21,300 | 12,601-15,400 | 7,701-9,400 | 2,500 | |
| 59,001-70,900 | 33,201-39,700 | 21,301-25,500 | 15,401-18,400 | 9,401-11,300 | 2,750 | |
| 70,901-83,700 | 39,701-47,100 | 25,501-30,100 | 18,401-21,800 | 11,301-13,400 | 3,000 | 3 |
| 83,701-97,700 | 47,101-54,900 | 30,101-35,200 | 21,801-25,900 | 13,401-15,600 | 3,250 | |
| 97,701-112,700 | 54,901-63,400 | 35,201-40,600 | 25,901-29,300 | 15,601-18,000 | 3,500 | |
| 112,701-128,700 | 63,401-72,400 | 40,601-46,400 | 29,301-33,500 | 18,001-20,600 | 3,750 | |

PLAN REVIEW # 13052

# *Castle Rock Fire and Rescue Department*

*300 Perry Street - Castle Rock, CO 80104*
*(303) 660-1066*

## PLAN REVIEW

| PROJECT LOCATION | PROJECT # |
|---|---|
| Outlet Mall New Pad SIte - 5050 Factory Shops - NEW PAD SITES - | 3592 |
| **PROJECT DESCRIPTION** | **OCCUPANCY ID** |
| Outlet Mall New Pad SIte - 5050 Factory Shops - NEW PAD SITES - | |
| **AREA INVOLVED IN ENTIRE PROJECT** | **ALTERNATE ID** |
| Outlet Mall New Pad SIte - 5050 Factory Shops - NEW PAD SITES - | |

| PERMIT # | PERMIT DESCRIPTION | | |
|---|---|---|---|
| 13052 | Fire Flow Evaluation | | |
| **AREA AFFECTED BY THIS PERMIT** | | **SQUARE FEET** | **VALUE OF WORK** |
| SDP20-0004 - Outlet Mall New Pad SIte - 5050 Factory Shops - FIREFLOW ] | | | |
| **CONTACT NAME** | **NOTIFY BY** | **NOTIFY AT** | |
| | | | |
| **REASON FOR SUBMITTAL** | **PLAN REVIEWER** | **SUBMITTED** | **COMPLETED** |
| Review Only | ssullivan | 07/08/2022 | 07/08/2022 |

| CONTRACTOR | BUSINESS PHONE | FAX NUMBER |
|---|---|---|
| N/A (ID 3373) | | |
| **STREET ADDRESS** | **CITY, STATE, ZIP** | |
| | | |
| **E-MAIL ADDRESS** | **STATE LICENSE NUMBER** | |
| | | |

## *CASTLE ROCK FIRE AND RESCUE DEPARTMENT*

**** PLAN REVIEW LETTER ****

**<< PLEASE READ THE FOLLOWING CAREFULLY >>**

On 07-08-2022 a review was conducted on the submitted FIRE FLOW requirements for the Factory Shops Pads B&C, located on 5050 Factory Shops Blvd. The following comments pertain to the project:

**CODE USED IN REVIEW:**

The submitted plans have been reviewed for compliance to the 2018 edition of the International Fire Code (IFC).

**REVIEW COMMENTS:**

INFORMATION ON THE PROJECT:

The project consists of a new medical office building that will be fully sprinkler protected . From the information currently known to the fire department the following comments pertain to the required fire flows:

The largest proposed building is a 1-Story, 11,900 square foot building, constructed of Type V-B construction, with a full NFPA 13 Fire Sprinkler system. The base required fire flow as noted in the 2018 IFC - Table B105.1, would be: 3000 gpm, the code provides an allowance for sprinkler systems, and based on the knowledge of this building the fire department will allow a 50% reduction bringing the required fire flow to: 1500 gpm for a duration of 2-Hours

**FINAL FIRE FLOW REQUIRED:**

2018 International Fire Code (IFC), Appendix B, as amended by the Town of Castle Rock requires a MINIMUM fire flow requirement of 1500 gpm @ 20 psi for a duration of 2-hours. This

fire flow shall be from 1 fire hydrants within 100 feet of the structure's FDC.

**BUILDING INFORMATION:**

Type of Construction: The proposed project is shown as being located in a building of EXACT TYPE UNKNOWN AT THIS TIME.

Occupancy Classification: The proposed occupancy classification for this project has been reviewed for compliance with the 2018 IFC and IBC. The occupancy classification of the project is shown as being a EXACT TYPE UNKNOWN AT THIS TIME.

.

**ACTION TAKEN BY THE FIRE DEPARTMENT:**

Approval of the above fire flow is based on the information known to the fire department as of the date of this review, as the result of additional information or inspections if the fire flow changes, corrective action may be required.

Should you have any questions please feel free to contact me.

Kevin Sullivan - Fire Prevention Officer - Ksullivan@crgov.com

| DATE RECEIVED | BY: | | |
|---|---|---|---|
| DATE FEE PAID | PLAN REVIEW FEE | CHECK # | RECEIPT # |
| 07/08/2022 | 0.00 | | |

| PICKED UP BY | COMPANY | DATE |
|---|---|---|
| | | |

Sterling Design Associates, llc
CIVIL ENGINEERS - LANDSCAPE ARCHITECTS

# Memo

Date: July 8, 2022

To: Castle Rock Fire and Rescue
300 Perry St.
Castle Rock, CO 80104

From: Jay Newell, PE

RE: Lot 1, Block 1, Outlets at Castle Rock Filing No. 1 – Pads B & C
Confirmation Memo for Required Fire Flow

A portion of Lot 1 is intended to be developed as pad lots, generally within the existing parking field on the west side of the overall Outlets at Castle Rock development. Improvements to the existing parking field include parking island reconfiguration, re-grading, re-paving, and utility construction. Leased pad sites, to be developed by future tenants including buildings and utility services will generally be within the limits of these pad lot improvements.

The anticipated commercial use(s) consist of approximately 7,500 square feet of retail/office on Pad B; approximately 4,200 square feet of restaurant on Pad B and approximately 7,805 square feet of restaurant on Pad C. Type V-B construction and building sprinkler systems are assumed.

Castle Rock Fire and Rescue:

Required Fire Flow 1500 GPM

Required Duration 2- Hours

This letter shall be null and void if any buildings referenced are NOT sprinklered.

Castle Rock Fire and Rescue

FIRE REVIEW 13052

**Castle Rock Fire & Rescue Department**

These plans have been reviewed and accepted subject to any/all corrections in compliance with the International Fire Code as amended and adopted by the Town of Castle Rock.

Comments and Corrections will be in the attached plan review letter and/or marked on the plans.

All projects are subject to changes in the field in accordance with the current codes and ordinances.

Completed by:

Kevin Sullivan
ICC FIRE INSPECTOR II : 9533547
COLORADO FIRE INSPECTOR III: 216312661

Jay M. Newell, PE
Wayne T. Sterling, RLA, LEED AP

2009 W. Littleton Blvd. #300
Littleton, CO 80120

303.794.4727
www.SterlingDesignAssociates.com

## Irrigation System Hydraulic - ZONE VALVES C33 & C34 (WORST CASE)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Project Name:** | **Outlets at Castle Rock - Pads B & C** | | | | | | **Date:** | | April 20, 2023 |
| **Project Location:** | **5050 Factory Shops Blvd - W side of property** | | | | | | | | |
| **Prepared by:** | **Sterling Design Associates - Mike Haaf** | | | | | **Current TOCR Registration #** | | | 15-1105 |
| **Tap Size** | | **3.00** | " | Water Meter Acct. 00004595-02 | | **Source of Pressure** | Dawn Tiffany Castle Rock Water - Hydrant 2257 | | |
| **Static Water Pressure:** | | **95** | psi | | | | | | |
| **Hydraulic Grade At Zone:** | **C33 & C34** | | | | | **Company** | | | |
| | Ft. of Copper | | | Pipe Size (") | | K Copper | Friction Loss (from chart) | Flow-GPM | Loss/Gain |
| Service Line (tap to meter): | 15 | LF | | 3.00 | | K Copper | 2.30 /100 FT | 48 | 0.35 |
| Water Meter: | | | | 3.00 | | | 0.50 | 48 | 0.50 |
| Service Line (meter to backflow): | 5 | LF | | 3.00 | | K Copper | 2.30 /100 FT | 48 | 0.12 |
| Backflow: | | | | 3.00 | | | 12 | 48 | 12.00 |
| Master Valve: | | | | 3 | | | 0 | 48 | 0.00 |
| Pressure Required at Head: | | | | | | | | | 40 |
| Lateral Allowance: | | | | | | | | | 3.00 |
| Control Valve Allowance: | | | | | | | | | 4.00 |
| Mainline Allowances: | | | | | | | | | |
| Length of Mainline | Pipe Material | | Size | | Gals. | | | | |
| Assumed Existing 175 | LF CL200BE | | 3.000 | "@ | 48 | GPM | 0.21 /100 FT | | 0.37 |
| Proposed 1200 | LF CL200BE | | 2.500 | "@ | 48 | GPM-Looped | 0.57 /100 FT | | 6.84 |
| Elevation: | | | | | | | | | |
| | Tap elevation | | 6,121 | | | | High/Low: 6,101 | | -8.66 |
| *Green shading indicates required information you must provide* | | | | | | | | | |
| **Total System requirements (PSI)** | | | | | | | | | ***58.51*** |
| **Available System Pressure (PSI)** | | | | | | | | | ***95.00*** |

*Town of Castle Rock provides a minimum of 43 psi*

*permanent*

***Total irrigated area for tap #*** C ***is*** 90,565 ***sq. ft.***

## CLWUR WORKSHEET - OVERALL LANDSCAPE AREA

| CLWUR Chart for the Town of Castle Rock | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Irrig. Zone | Plant Type | App Rate (inches/month) | Zone (VL, L, Mod, HW) | % of Total Area | IA (Irrigated area in sf for each zone) | LWUR (Landscape Water Use Rating) | TA (Total Area of all irrigated landscape Zones)* | CLWUR (LWUR x IA/TA) |
| A | Drip Irrigated Shrubs, Trees & Perennials | 2.4 | Low | 40.37 | 36,557 sf | 2.00 | 90,565 sf | 2.0 x 36,557/90,565 = .81 |
| B | Existing Spray Irrigated Turf | 3.0 | Mod | 7.51 | 6,797 sf | 3.00 | 90,565 sf | 3.0 x 6,797/90,565 = .23 |
| C | Overseeded Established Spray Irrigated Turf | 2.4 | Low | 36.60 | 33,151 sf | 2.00 | 90,565 sf | 2.0 x 33,151/90,565 = .73 |
| D | Low Water Use Spray Irrigated Turf | 2.4 | Low | 15.52 | 14,060 sf | 2.00 | 90,565 sf | 2.0 x 14,060/90,565 = 0.31 |
| | | | | | | | | Total of the CLWUR = 2.08 |

*Area includes right-of-way landscaping.

# IRRIGATION CHART

Registered Professional: Michael Haaf  Registration #: 15-1105  Date: 4/20/2023
Company Name: Sterling Design Associates  Address: 2009 W Littleton Blvd, Littleton, CO 80120
Phone: (303) 794-4727 x210  Email: mike@sterlingdesignassociates.com  Clock Make: Hunter  Model: ICC2 - Programmable up to 54 Stations

_____ Circle  _____ Diamond  _____ Square

| Program | Zone | Hydrozone (Very Low <5" Low 5-10" Medium 10-15" High >15") | Plant Type (Turf, Native, Shrubs, Perennials, Trees, Annuals, etc.) | Head Type (Rotors, Sprays, Bubblers, Drip, SDI, etc.) | Nozzle (Nozzle/ Emitter size) | App. Rate (Inches/hour) | GPM (Per Zone) | Inches/ Month (Average May - September) | Run Time (Minutes/ Month) | Run Time (Minutes Every Third Day) | Water Usage (Gallons per month) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ex: 1 | High | Blue Grass | RB 1806 SAM PRS | 15" | 1.83 | 15 | 6 | 197 | 20 | 2951 |
| EXISTING | C1 | Very Low-Med | Shrubs, Trees &/or Perennials - Ex. | Drip- Point Source | .5 - 1.0 gph | 1.25 | 1 | 2.4 | 115 | 12 | 58 |
| run simultaneously A | C2 | Very Low-Med | Shrubs, Trees &/or Perennials - Ex. | Drip- Point Source | .5 - 1.0 gph | 1.25 | 1 | 2.4 | 115 | 12 | 58 |
| run simultaneously B | C3 | Very Low-Med | Shrubs, Trees &/or Perennials - Ex. | Drip- Point Source | .5 - 1.0 gph | 1.25 | 1 | 2.4 | 115 | 12 | 58 |
| run simultaneously A | C4 | Very Low-Med | Shrubs, Trees &/or Perennials - Ex. | Drip- Point Source | .5 - 1.0 gph | 1.25 | 1 | 2.4 | 115 | 12 | 58 |
| run simultaneously B | C5 | Very Low-Med | Shrubs, Trees &/or Perennials - Ex. | Drip- Point Source | .5 - 1.0 gph | 1.25 | 1 | 2.4 | 115 | 12 | 58 |
| A | C6 | Very Low-Med | Shrubs, Trees &/or Perennials - Ex. | Drip- Point Source | .5 - 1.0 gph | 1.25 | 1 | 2.4 | 115 | 12 | 58 |
| | C7 | Very Low-Med | Shrubs, Trees &/or Perennials - Ex. | Drip- Point Source | .5 - 1.0 gph | 1.25 | 1 | 2.4 | 115 | 12 | 58 |
| | C8 | | VACANT | | | | | | | | |
| run simultaneously A | C9 | Very Low-Med | Shrubs, Trees &/or Perennials | Drip- Point Source | .5 - 1.0 gph | 1.25 | 1 | 2.4 | 115 | 12 | 80 |
| B | C10 | Very Low-Med | Shrubs, Trees &/or Perennials | Drip- Point Source | .5 - 1.0 gph | 1.25 | 2 | 2.4 | 115 | 12 | 184 |
| run simultaneously A | C11 | Very Low-Med | Shrubs, Trees &/or Perennials | Drip- Point Source | .5 - 1.0 gph | 1.25 | 1 | 2.4 | 115 | 12 | 115 |
| B | C12 | Very Low-Med | Shrubs, Trees &/or Perennials | Drip- Point Source | .5 - 1.0 gph | 1.25 | 1 | 2.4 | 115 | 12 | 150 |
| run simultaneously A | C13 | Very Low-Med | Shrubs, Trees &/or Perennials | Drip- Point Source | .5 - 1.0 gph | 1.25 | 2 | 2.4 | 115 | 12 | 207 |
| B | C14 | Very Low-Med | Shrubs, Trees &/or Perennials | Drip- Point Source | .5 - 1.0 gph | 1.25 | 3 | 2.4 | 115 | 12 | 369 |
| run simultaneously A | C15 | Very Low-Med | Shrubs, Trees &/or Perennials | Drip- Point Source | .5 - 1.0 gph | 1.25 | 3 | 2.4 | 115 | 12 | 334 |
| B | C16 | Very Low-Med | Shrubs, Trees &/or Perennials | Drip- Point Source | .5 - 1.0 gph | 1.25 | 2 | 2.4 | 115 | 12 | 196 |
| run simultaneously A | C17 | Very Low-Med | Shrubs, Trees &/or Perennials | Drip- Point Source | .5 - 1.0 gph | 1.25 | 3 | 2.4 | 115 | 12 | 311 |
| B | C18 | Very Low-Med | Shrubs, Trees &/or Perennials | Drip- Point Source | .5 - 1.0 gph | 1.25 | 2 | 2.4 | 115 | 12 | 184 |
| run simultaneously A | C19 | Very Low-Med | Shrubs, Trees &/or Perennials | Drip- Point Source | .5 - 1.0 gph | 1.25 | 2 | 2.4 | 115 | 12 | 242 |
| B | C20 | Very Low-Med | Shrubs, Trees &/or Perennials | Drip- Point Source | .5 - 1.0 gph | 1.25 | 2 | 2.4 | 115 | 12 | 184 |
| run simultaneously A | C21 | Very Low-Med | Shrubs, Trees &/or Perennials | Drip- Point Source | .5 - 1.0 gph | 1.25 | 2 | 2.4 | 115 | 12 | 265 |
| B | C22 | Very Low-Med | Shrubs, Trees &/or Perennials | Drip- Point Source | .5 - 1.0 gph | 1.25 | 1 | 2.4 | 115 | 12 | 81 |
| run simultaneously A | C23 | Very Low-Med | Shrubs, Trees &/or Perennials | Drip- Point Source | .5 - 1.0 gph | 1.25 | 1 | 2.4 | 115 | 12 | 115 |
| B | C24 | Med | Nature's Prairie Sod/Ex. Turf | Hunter MP 3000 | 30' radius | 0.39 | 23 | 3 | 462 | 46 | 10523 |
| A | C25 | Low | Overseeded Turf | I-20-06-SS | 40' radius | 0.74 | 44 | 2.4 | 195 | 19 | 8582 |
| A | C26 | Low | Nature's Prairie Sod/Fescue Seed | Hunter MP 3000 | 30' radius | 0.45 | 36 | 2.4 | 320 | 32 | 12160 |
| A | C27 | Low | Nature's Prairie Sod/Fescue Seed | I-20-06-SS | 40' radius | 0.74 | 30 | 2.4 | 195 | 19 | 5838 |
| run simultaneously B | C28 | Low | Nature's Prairie Sod/Fescue Seed | I-20-06-SS | 40' radius | 0.74 | 16 | 2.4 | 195 | 19 | 3114 |
| A | C29 | Low | Nature's Prairie Sod/Fescue Seed | I-20-06-SS | 40' radius | 0.74 | 28 | 2.4 | 195 | 19 | 5449 |
| run simultaneously B | C30 | Low | Nature's Prairie Sod/Fescue Seed | Hunter MP 3500 | 35' radius | 0.52 | 4 | 2.4 | 277 | 28 | 1163 |
| A | C31 | Low | Nature's Prairie Sod/Fescue Seed | Hunter MP 2000 & MP 3000 | 20'-30' radius | 0.45 | 24 | 2.4 | 320 | 32 | 7706 |
| run simultaneously B | C32 | Low | Nature's Prairie Sod/Fescue Seed | Hunter MP 2000 & MP 3000 | 20'-30' radius | 0.45 | 17 | 2.4 | 320 | 32 | 5504 |
| A | C33 | Low | Nature's Prairie Sod/Fescue Seed | Hunter MP 3000 | 30' radius | 0.45 | 28 | 2.4 | 320 | 32 | 9024 |
| run simultaneously B | C34 | Low | Fescue Turf Seed Mix | Hunter MP 3500 | 35' radius | 0.52 | 20 | 2.4 | 277 | 28 | 5594 |
| A | C35 | Low | Fescue Turf Seed Mix | Hunter MP 2000 & MP 3000 | 20'-30' radius | 0.45 | 20 | 2.4 | 320 | 32 | 6366 |
| run simultaneously B | C36 | Low | Nature's Prairie Sod/Fescue Seed | Hunter MP 2000 & MP 3000 | 20'-30' radius | 0.45 | 20 | 2.4 | 320 | 32 | 6432 |
| A | C37 | Low | Nature's Prairie Sod | Hunter MP 3000 | 30' radius | 0.45 | 15 | 2.4 | 320 | 32 | 4672 |
| run simultaneously B | C38 | Low | Nature's Prairie Sod | Hunter MP 3500 | 35' radius | 0.45 | 19 | 2.4 | 320 | 32 | 6048 |
| A | C39 | Med | Nature's Prairie Sod/Ex. Turf | Hunter MP 3000 | 30' radius | 0.39 | 23 | 3 | 462 | 46 | 10615 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | Total | | | | | | | | Min/ Month | Min/cycle | Gallons/Month |
| | | | | | | | | | ~~7356~~ | ~~736~~ | 112198 |
| | | | | | | | | | 4,456 | 450 | |

*Projections are based on irrigating an established landscape within a three-day-a-week, eight hour per day watering schedule (Mon/Wed/Fri, 12am-8am).*

*System has been designed to operate up to two zones simultaneously up to 50 gpm.*

*Projected application rates will need to be adjusted due to seasonal changes and weather conditions above and below the average values utilized.*

*Peak season applications for Nature's Prairie Sod is 0.75" per week.*

*Peak season application for Shrubs, Trees or Perennials is 0.59" per week.*

Run time figures reduced due to zones running simultaneously

# APPENDIX C – WATER STORAGE

STERLING
DESIGN ASSOCIATES
Civil Engineers | Landscape Architects

# Water Analysis

Job Name: CROM Pad - Castle Rock, Colorado

Date: 8/23/22

By: JMN

STORAGE VOLUME

| Use | MDD (gpm) | Fire Flow (gpm) | [5]Storage (MG) | |
|---|---|---|---|---|
| Restaurant (Pad C) | 41 | 1,500 | 0.239 | |
| Retail/Offices (Pad B) | 3 | 1,500 | 0.184 | |
| Restaurant (Pad B) | 22 | 1,500 | 0.212 | |
| Total | 65 | 4,500 | 0.634 | |
| (Max Design) | ( | 1,500 | 0.239 | ) (per ToCR comment) |

[5]*Town of Castle Rock, Water System Design, 2018 Criteria Manual* ; Section 4.4.2 - Storage Requirements (MDD*60 min/hr*24 hrs + Fire Flow*60 min/hr*2 hr)

# TOWN OF CASTLE ROCK
# FIRE FLOW TEST FORM

**6/9/2020**

F **F11-2020**

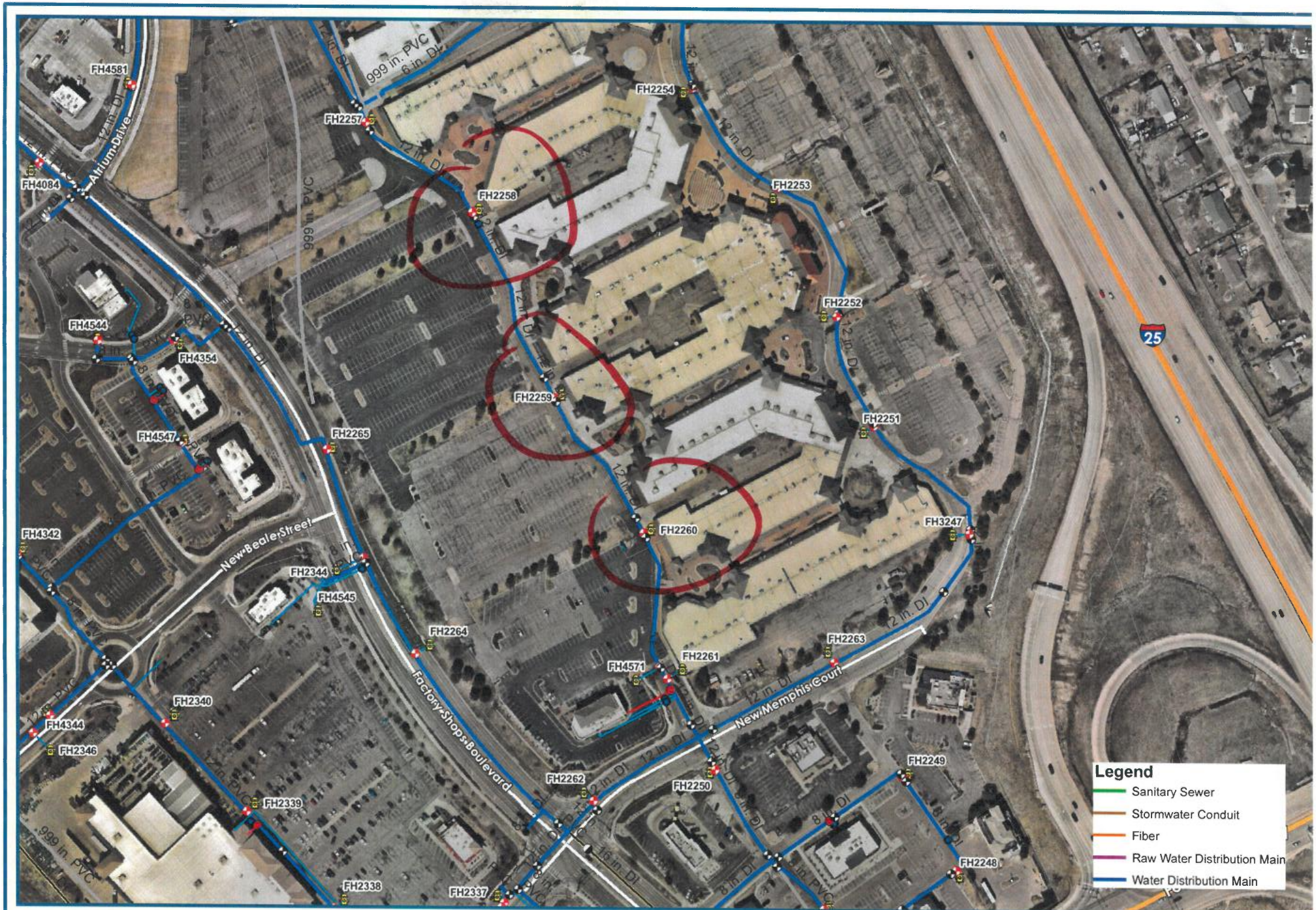
P

Jon Spenser
Sterling Design Associates
303-505-3655
jon@sterlingdesignassociates.com

**Test Conducted By:** JC, AW
**Date:** 06/10/2020
**Start Time** 8:15 A.M
**End Time** 9:20

| | | | |
|---|---|---|---|
| **Pressure Hydrant** | | | |
| Hydrant ID | FH | 2259 | |
| Pre-test Static Pressure (Ps1) | | 98 PSi | |
| Residual Pressure (Pr) | | 86 PSi | psi |
| Post-test Static Pressure (Ps2) | | 98 PSi | psi |
| | | | psi |
| **Flowing Hydrant** | | | |
| | | | |
| Hydrant ID | FH | 2258 | |
| Orifice Side (D) | | 4 1/2 inch | |
| Main Size (Dp) | | 12 ~~6~~ inch | in |
| | | | in |
| Calculated Flowrate (Qr) | | | |
| Estimated Volume Discharged (Q) | | | gpm |
| | | 12,500 | gallons |

Notes: Please see map attached




CASTLE ROCK Qwater
Securing our future drop by drop

VICINITY MAP

0 110 220 440 660 Feet

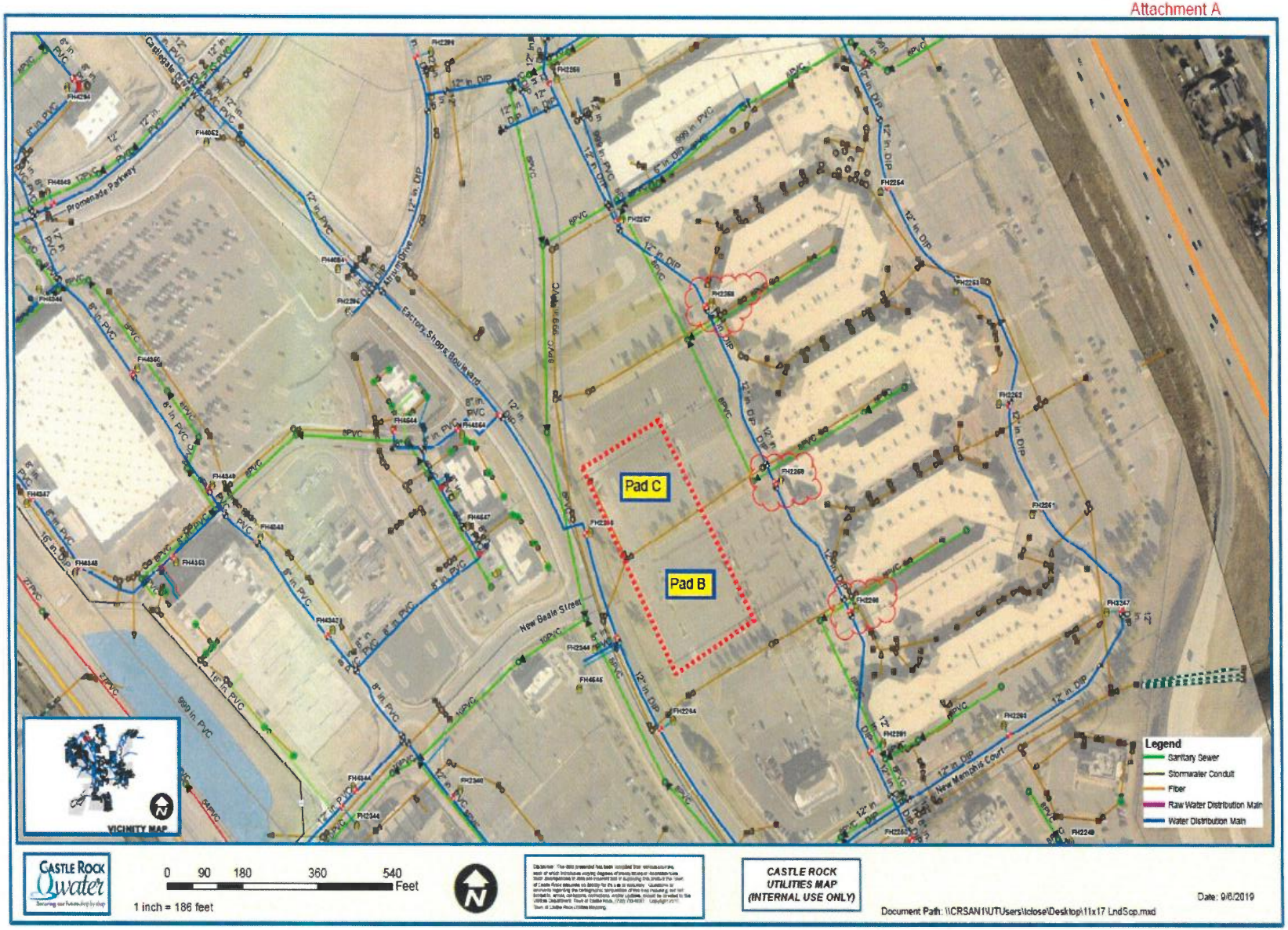
Date: 6/9/2020

1 inch = 250 feet

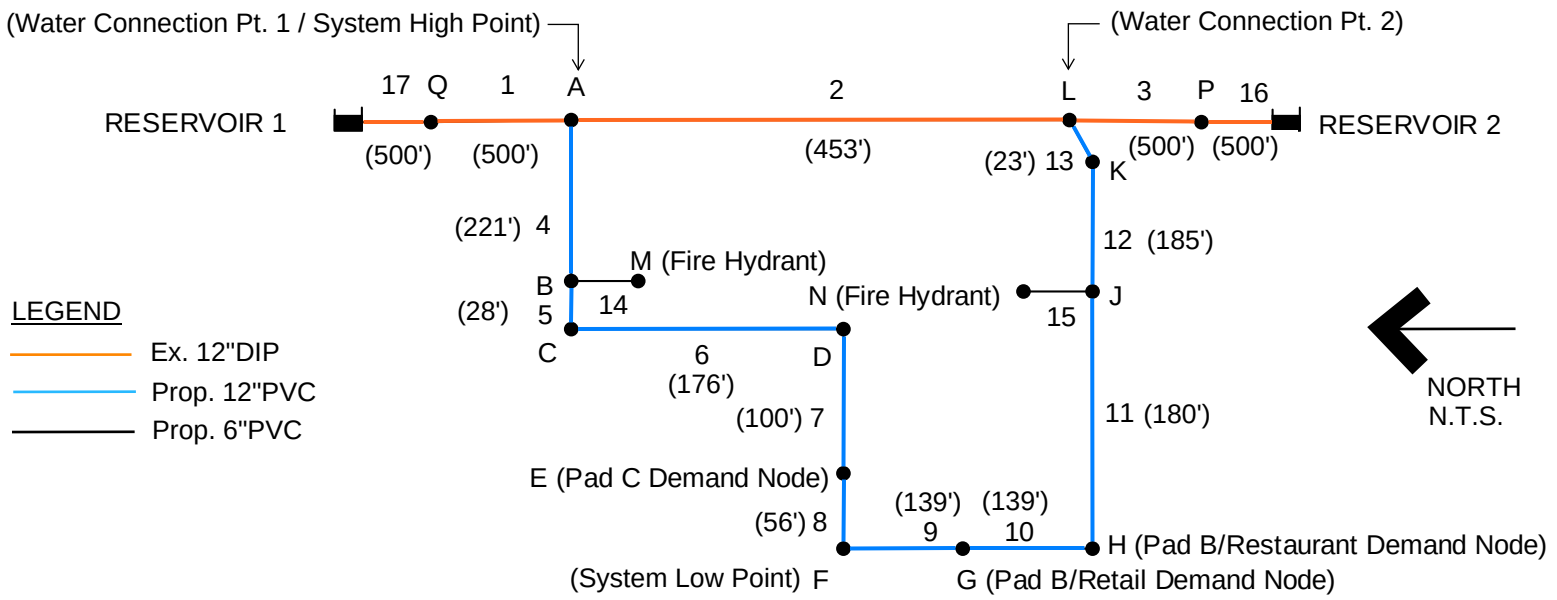
Disclaimer: The data presented has been compiled from various sources, each of which introduces varying degrees of inaccuracies or inconsistencies. Such discrepancies in data are inherent and in supplying this product the Town of Castle Rock assumes no liability for it's use or accuracy. Questions or 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)**

Attachment A



# APPENDIX D – WATER HYDRAULIC ANALYSIS AND MODELING


(Water Connection Pt. 1 / System High Point)
(Water Connection Pt. 2)
17
Q
1
A
2
L
3
P
16
RESERVOIR 1
RESERVOIR 2
(500')
(500')
(453')
(23')
13
K
(500')
(500')
(221')
4
12
(185')
M (Fire Hydrant)
B
(28')
5
14
N (Fire Hydrant)
15
J
LEGEND
Ex. 12"DIP
Prop. 12"PVC
Prop. 6"PVC
C
6
D
(176')
(100')
7
11
(180')
NORTH
N.T.S.
E (Pad C Demand Node)
(56')
8
(139')
9
(139')
10
H (Pad B/Restaurant Demand Node)
(System Low Point)
F
G (Pad B/Retail Demand Node)

# Scenario Static: 20% Tank Storage

| Node ID | Elevation ft | Demand GPM | Head ft | Pressure psi |
|---|---|---|---|---|
| Junc A | 6115.5 | 0.00 | 6333.76 | 94.57 |
| Junc L | 6114.8 | 0.00 | 6333.76 | 94.88 |
| Junc B | 6106.1 | 0.00 | 6333.76 | 98.64 |
| Junc C | 6106.4 | 0.00 | 6333.76 | 98.51 |
| Junc D | 6106.4 | 0.00 | 6333.76 | 98.51 |
| Junc F | 6104.8 | 0.00 | 6333.76 | 99.21 |
| Junc H | 6105.2 | 0.00 | 6333.76 | 99.03 |
| Junc J | 6107.0 | 0.00 | 6333.76 | 98.26 |
| Junc K | 6113.4 | 0.00 | 6333.76 | 95.48 |
| Junc E | 6105.8 | 0.00 | 6333.76 | 98.77 |
| Junc G | 6106.0 | 0.00 | 6333.76 | 98.69 |
| Junc M | 6106.1 | 0.00 | 6333.76 | 98.64 |
| Junc N | 6107.0 | 0.00 | 6333.76 | 98.26 |
| Junc Q | 6115.5 | 0.00 | 6333.76 | 94.57 |
| Junc P | 6114.8 | 0.00 | 6333.76 | 94.88 |
| Resvr 1 | 6333.76 | -0.02 | 6333.76 | 0.00 |
| Resvr 2 | 6333.76 | 0.01 | 6333.76 | 0.00 |

# Scenario Static: 100% Tank Storage

| Node ID | Elevation ft | Demand GPM | Head ft | Pressure psi |
|---|---|---|---|---|
| Junc A | 6115.5 | 0.00 | 6352.00 | 102.48 |
| Junc L | 6114.8 | 0.00 | 6352.00 | 102.78 |
| Junc B | 6106.1 | 0.00 | 6352.00 | 106.55 |
| Junc C | 6106.4 | 0.00 | 6352.00 | 106.42 |
| Junc D | 6106.4 | 0.00 | 6352.00 | 106.42 |
| Junc F | 6104.8 | 0.00 | 6352.00 | 107.11 |
| Junc H | 6105.2 | 0.00 | 6352.00 | 106.94 |
| Junc J | 6107.0 | 0.00 | 6352.00 | 106.16 |
| Junc K | 6113.4 | 0.00 | 6352.00 | 103.39 |
| Junc E | 6105.8 | 0.00 | 6352.00 | 106.68 |
| Junc G | 6106.0 | 0.00 | 6352.00 | 106.59 |
| Junc M | 6106.1 | 0.00 | 6352.00 | 106.55 |
| Junc N | 6107.0 | 0.00 | 6352.00 | 106.16 |
| Junc Q | 6115.5 | 0.00 | 6352.00 | 102.48 |
| Junc P | 6114.8 | 0.00 | 6352.00 | 102.78 |
| Resvr 1 | 6352 | -0.02 | 6352.00 | 0.00 |
| Resvr 2 | 6352 | 0.01 | 6352.00 | 0.00 |

# Scenario F2: MDD+Fire / 16 Closed

Network Table - Nodes

| Node ID | Elevation ft | Demand GPM | Head ft | Pressure psi |
|---|---|---|---|---|
| Junc A | 6115.5 | 0.00 | 6317.95 | 87.72 |
| Junc L | 6114.8 | 0.00 | 6317.00 | 87.61 |
| Junc B | 6106.1 | 0.00 | 6316.84 | 91.31 |
| Junc C | 6106.4 | 0.00 | 6316.84 | 91.18 |
| Junc D | 6106.4 | 0.00 | 6316.86 | 91.19 |
| Junc F | 6104.8 | 0.00 | 6316.88 | 91.89 |
| Junc H | 6105.2 | 22.00 | 6316.92 | 91.74 |
| Junc J | 6107.0 | 0.00 | 6316.96 | 90.98 |
| Junc K | 6113.4 | 0.00 | 6317.00 | 88.22 |
| Junc E | 6105.8 | 41.00 | 6316.87 | 91.46 |
| Junc G | 6106.0 | 3.00 | 6316.90 | 91.38 |
| Junc M | 6106.1 | 1500.00 | 6313.92 | 90.05 |
| Junc N | 6107.0 | 0.00 | 6316.96 | 90.98 |
| Junc Q | 6115.5 | 599.50 | 6324.09 | 90.38 |
| Junc P | 6114.8 | 599.50 | 6316.43 | 87.37 |
| Resvr 1 | 6333.76 | -2765.00 | 6333.76 | 0.00 |
| Resvr 2 | 6333.76 | 0.00 | 6333.76 | 0.00 |

# Scenario F2: MDD+Fire / 16 Closed

Network Table - Links

| Link ID | Length ft | Diameter in | Roughness | Flow GPM | Velocity fps |
|---|---|---|---|---|---|
| Pipe 2 | 453 | 12 | 120 | 831.42 | 2.36 |
| Pipe 4 | 221 | 12 | 120 | 1334.08 | 3.78 |
| Pipe 5 | 28 | 12 | 120 | -165.92 | 0.47 |
| Pipe 6 | 176 | 12 | 120 | -165.92 | 0.47 |
| Pipe 12 | 185 | 12 | 120 | -231.92 | 0.66 |
| Pipe 13 | 23 | 12 | 120 | -231.92 | 0.66 |
| Pipe 7 | 100 | 12 | 120 | -165.92 | 0.47 |
| Pipe 8 | 56 | 12 | 120 | -206.92 | 0.59 |
| Pipe 9 | 139 | 12 | 120 | -206.92 | 0.59 |
| Pipe 10 | 139 | 12 | 120 | -209.92 | 0.60 |
| Pipe 15 | 23 | 6 | 120 | 0.01 | 0.00 |
| Pipe 17 | 500 | 12 | 120 | 2765.00 | 7.84 |
| Pipe 1 | 500 | 12 | 120 | 2165.50 | 6.14 |
| Pipe 3 | 500 | 12 | 120 | 599.50 | 1.70 |
| Pipe 16 | 500 | 12 | 120 | 0.00 | 0.00 |
| Pipe 14 | 16 | 6 | 120 | 1500.00 | 17.02 |
| Pipe 11 | 180 | 12 | 120 | -231.92 | 0.66 |

# Scenario F2: MDD+Fire / 17 Closed

Network Table - Nodes

| Node ID | Elevation ft | Demand GPM | Head ft | Pressure psi |
|---|---|---|---|---|
| Junc A | 6115.5 | 0.00 | 6315.89 | 86.83 |
| Junc L | 6114.8 | 0.00 | 6317.95 | 88.02 |
| Junc B | 6106.1 | 0.00 | 6315.59 | 90.77 |
| Junc C | 6106.4 | 0.00 | 6315.65 | 90.67 |
| Junc D | 6106.4 | 0.00 | 6316.02 | 90.83 |
| Junc F | 6104.8 | 0.00 | 6316.36 | 91.67 |
| Junc H | 6105.2 | 22.00 | 6317.00 | 91.77 |
| Junc J | 6107.0 | 0.00 | 6317.44 | 91.18 |
| Junc K | 6113.4 | 0.00 | 6317.89 | 88.61 |
| Junc E | 6105.8 | 41.00 | 6316.23 | 91.18 |
| Junc G | 6106.0 | 3.00 | 6316.68 | 91.29 |
| Junc M | 6106.1 | 1500.00 | 6312.67 | 89.51 |
| Junc N | 6107.0 | 0.00 | 6317.44 | 91.18 |
| Junc Q | 6115.5 | 599.50 | 6315.32 | 86.58 |
| Junc P | 6114.8 | 599.50 | 6324.09 | 90.69 |
| Resvr 1 | 6333.76 | 0.00 | 6333.76 | 0.00 |
| Resvr 2 | 6333.76 | -2765.01 | 6333.76 | 0.00 |

# Scenario F2: MDD+Fire / 17 Closed

Network Table - Links

| Link ID | Length ft | Diameter in | Roughness | Flow GPM | Velocity fps |
|---|---|---|---|---|---|
| Pipe 2 | 453 | 12 | 120 | -1263.24 | 3.58 |
| Pipe 4 | 221 | 12 | 120 | 663.74 | 1.88 |
| Pipe 5 | 28 | 12 | 120 | -836.26 | 2.37 |
| Pipe 6 | 176 | 12 | 120 | -836.26 | 2.37 |
| Pipe 12 | 185 | 12 | 120 | -902.26 | 2.56 |
| Pipe 13 | 23 | 12 | 120 | -902.26 | 2.56 |
| Pipe 7 | 100 | 12 | 120 | -836.26 | 2.37 |
| Pipe 8 | 56 | 12 | 120 | -877.26 | 2.49 |
| Pipe 9 | 139 | 12 | 120 | -877.26 | 2.49 |
| Pipe 10 | 139 | 12 | 120 | -880.26 | 2.50 |
| Pipe 15 | 23 | 6 | 120 | 0.00 | 0.00 |
| Pipe 17 | 500 | 12 | 120 | 0.00 | 0.00 |
| Pipe 1 | 500 | 12 | 120 | -599.50 | 1.70 |
| Pipe 3 | 500 | 12 | 120 | -2165.51 | 6.14 |
| Pipe 16 | 500 | 12 | 120 | -2765.01 | 7.84 |
| Pipe 14 | 16 | 6 | 120 | 1500.00 | 17.02 |
| Pipe 11 | 180 | 12 | 120 | -902.26 | 2.56 |

# Scenario X: PHD / 16 Closed

Network Table - Nodes

| Node ID | Elevation ft | Demand GPM | Head ft | Pressure psi |
|---|---|---|---|---|
| Junc A | 6115.5 | 0.00 | 6325.60 | 91.03 |
| Junc L | 6114.8 | 0.00 | 6324.92 | 91.04 |
| Junc B | 6106.1 | 0.00 | 6325.44 | 95.04 |
| Junc C | 6106.4 | 0.00 | 6325.42 | 94.90 |
| Junc D | 6106.4 | 0.00 | 6325.29 | 94.85 |
| Junc F | 6104.8 | 0.00 | 6325.19 | 95.50 |
| Junc H | 6105.2 | 48.00 | 6325.06 | 95.27 |
| Junc J | 6107.0 | 0.00 | 6324.99 | 94.46 |
| Junc K | 6113.4 | 0.00 | 6324.93 | 91.65 |
| Junc E | 6105.8 | 89.00 | 6325.22 | 95.07 |
| Junc G | 6106.0 | 6.00 | 6325.13 | 94.95 |
| Junc M | 6106.1 | 0.00 | 6325.44 | 95.04 |
| Junc N | 6107.0 | 0.00 | 6324.99 | 94.46 |
| Junc Q | 6115.5 | 1018.50 | 6327.54 | 91.88 |
| Junc P | 6114.8 | 1018.50 | 6323.40 | 90.39 |
| Resvr 1 | 6333.76 | -2180.00 | 6333.76 | 0.00 |
| Resvr 2 | 6333.76 | 0.00 | 6333.76 | 0.00 |

# Scenario X: PHD / 16 Closed

Network Table - Links

| Link ID | Length ft | Diameter in | Roughness | Flow GPM | Velocity fps |
|---|---|---|---|---|---|
| Pipe 2 | 453 | 12 | 120 | 694.57 | 1.97 |
| Pipe 4 | 221 | 12 | 120 | 466.94 | 1.32 |
| Pipe 5 | 28 | 12 | 120 | 466.93 | 1.32 |
| Pipe 6 | 176 | 12 | 120 | 466.93 | 1.32 |
| Pipe 12 | 185 | 12 | 120 | 323.93 | 0.92 |
| Pipe 13 | 23 | 12 | 120 | 323.93 | 0.92 |
| Pipe 7 | 100 | 12 | 120 | 466.93 | 1.32 |
| Pipe 8 | 56 | 12 | 120 | 377.93 | 1.07 |
| Pipe 9 | 139 | 12 | 120 | 377.93 | 1.07 |
| Pipe 10 | 139 | 12 | 120 | 371.93 | 1.06 |
| Pipe 15 | 23 | 6 | 120 | 0.00 | 0.00 |
| Pipe 17 | 500 | 12 | 120 | 2180.00 | 6.18 |
| Pipe 1 | 500 | 12 | 120 | 1161.50 | 3.29 |
| Pipe 3 | 500 | 12 | 120 | 1018.50 | 2.89 |
| Pipe 16 | 500 | 12 | 120 | 0.00 | 0.00 |
| Pipe 14 | 16 | 6 | 120 | 0.00 | 0.00 |
| Pipe 11 | 180 | 12 | 120 | 323.93 | 0.92 |

# Scenario X: PHD / 17 Closed

Network Table - Nodes

| Node ID | Elevation ft | Demand GPM | Head ft | Pressure psi |
|---|---|---|---|---|
| Junc A | 6115.5 | 0.00 | 6324.92 | 90.74 |
| Junc L | 6114.8 | 0.00 | 6325.60 | 91.34 |
| Junc B | 6106.1 | 0.00 | 6325.01 | 94.85 |
| Junc C | 6106.4 | 0.00 | 6325.02 | 94.73 |
| Junc D | 6106.4 | 0.00 | 6325.08 | 94.75 |
| Junc F | 6104.8 | 0.00 | 6325.15 | 95.48 |
| Junc H | 6105.2 | 48.00 | 6325.31 | 95.38 |
| Junc J | 6107.0 | 0.00 | 6325.45 | 94.65 |
| Junc K | 6113.4 | 0.00 | 6325.58 | 91.94 |
| Junc E | 6105.8 | 89.00 | 6325.12 | 95.03 |
| Junc G | 6106.0 | 6.00 | 6325.23 | 94.99 |
| Junc M | 6106.1 | 0.00 | 6325.01 | 94.85 |
| Junc N | 6107.0 | 0.00 | 6325.45 | 94.65 |
| Junc Q | 6115.5 | 1018.50 | 6323.40 | 90.08 |
| Junc P | 6114.8 | 1018.50 | 6327.54 | 92.18 |
| Resvr 1 | 6333.76 | 0.00 | 6333.76 | 0.00 |
| Resvr 2 | 6333.76 | -2180.01 | 6333.76 | 0.00 |

# Scenario X: PHD / 17 Closed

Network Table - Links

| Link ID | Length ft | Diameter in | Roughness | Flow GPM | Velocity fps |
|---|---|---|---|---|---|
| Pipe 2 | 453 | 12 | 120 | -691.42 | 1.96 |
| Pipe 4 | 221 | 12 | 120 | -327.08 | 0.93 |
| Pipe 5 | 28 | 12 | 120 | -327.09 | 0.93 |
| Pipe 6 | 176 | 12 | 120 | -327.09 | 0.93 |
| Pipe 12 | 185 | 12 | 120 | -470.09 | 1.33 |
| Pipe 13 | 23 | 12 | 120 | -470.09 | 1.33 |
| Pipe 7 | 100 | 12 | 120 | -327.09 | 0.93 |
| Pipe 8 | 56 | 12 | 120 | -416.09 | 1.18 |
| Pipe 9 | 139 | 12 | 120 | -416.09 | 1.18 |
| Pipe 10 | 139 | 12 | 120 | -422.09 | 1.20 |
| Pipe 15 | 23 | 6 | 120 | 0.00 | 0.00 |
| Pipe 17 | 500 | 12 | 120 | 0.00 | 0.00 |
| Pipe 1 | 500 | 12 | 120 | -1018.50 | 2.89 |
| Pipe 3 | 500 | 12 | 120 | -1161.51 | 3.29 |
| Pipe 16 | 500 | 12 | 120 | -2180.01 | 6.18 |
| Pipe 14 | 16 | 6 | 120 | 0.00 | 0.00 |
| Pipe 11 | 180 | 12 | 120 | -470.09 | 1.33 |

# 1st Amendment to the FINAL WATER AND SANITARY SEWER SYSTEM STUDY

**FOR**

## *CASTLE PINES COMMERCIAL PD*
## *CASTLE ROCK, COLORADO*

(Filing 12: PWP 05-004)
(Filing 10A: PWP 03-108)

PREPARED FOR
DEV-VIC LLC
March 14, 2006
**Revised: September 9, 2006**

BY:
TST INC. OF DENVER, CONSULTING ENGINEERS
9222 TEDDY LANE
LONE TREE, COLORADO 80124

PROJECT NO. 771-039/040

TST

# APPENDIX A

# WATER DEMANDS

#454

TOWN OF CASTLE ROCK COLORADO

Utilities Department

Diane

# FIRE FLOW TEST RESULTS

## PRESSURE TEST ONLY (if circled)

### DISCLAIMER NOTICE

The following results are for the determination of fire flow parameters in the immediate area as identified. It shall be expressly understood that the results of the below noted fire flow test are representative of the Town's water system at the time of actual testing. The flow results may be subject to change in the future. The Town shall not be held responsible for any such change due to either system failure or system reconfiguration.

Requested by: Neil Kompcke Company: Kiowa Eng

Phone #: 719-630-7342 Fax #: 719-630-0406

Date requested: 7/26/05 Date of test: 7/27/05

Flow tester: D. Hoag Residual tester: D. Ashcl

Hydrant flowed: 109H16 Location: Castlegate Dr

Hydrant read: 109H17 Location: Castlegate Dr

Project location:

Lot: _____ Block: _____ Address: _____

Type of hydrant: Muller Nozzle: 2.5"

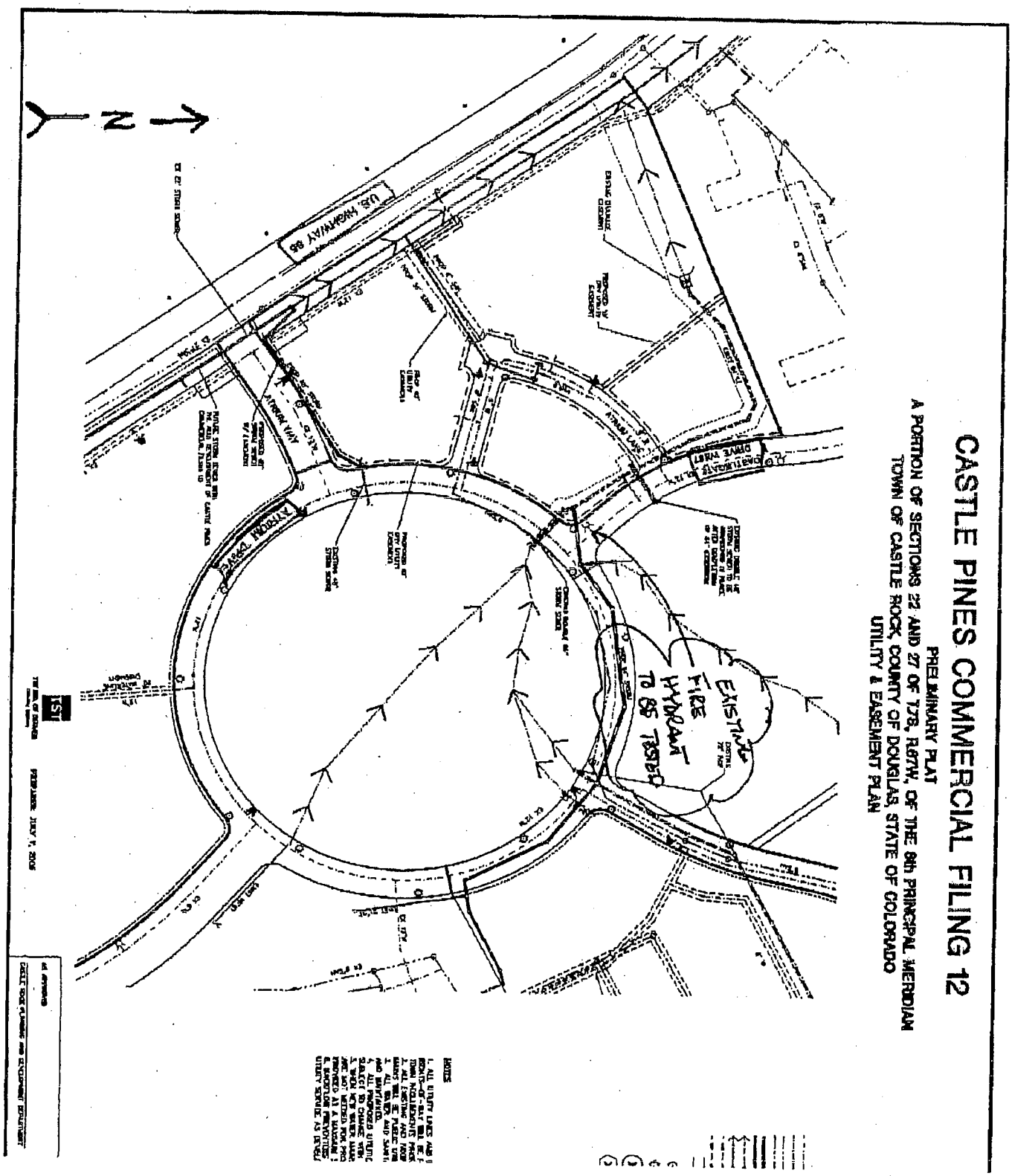
Main line size: 12" Main line type: DNK

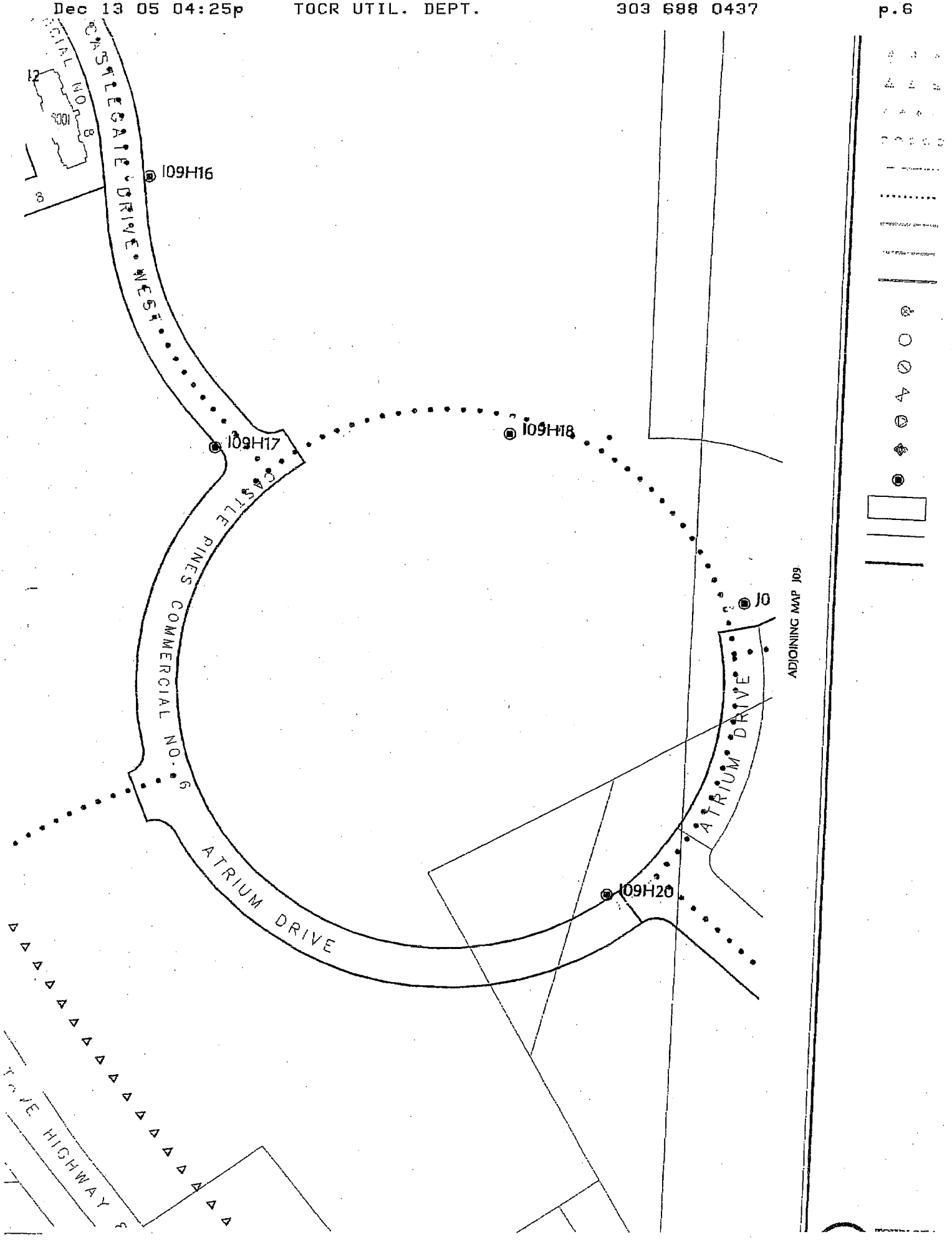
Static pressure: 130 Residual pressure: 117 Pitot reading: 100

Attachments to fax:

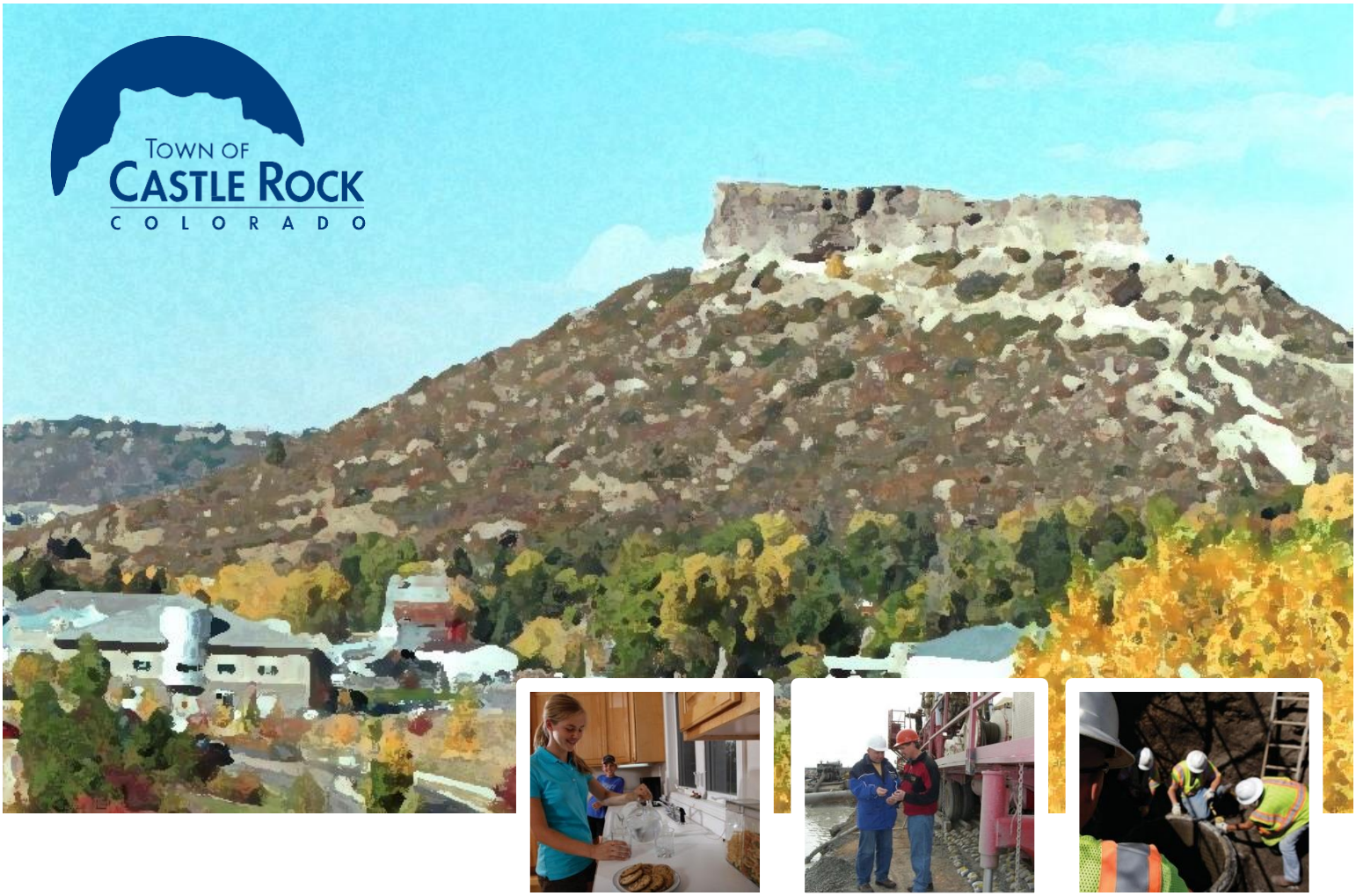
Comments:

EXHIBIT 1


CASTLE PINES COMMERCIAL FILING 12
PRELIMINARY PLAT
A PORTION OF SECTIONS 22 AND 27 OF T7S, R67W, OF THE 6th PRINCIPAL MERDIAN
TOWN OF CASTLE ROCK, COUNTY OF DOUGLAS, STATE OF COLORADO
UTILITY & EASEMENT PLAN
US HIGHWAY 85
EXISTING FIRE HYDRANT TO BE TESTED
N


CASTLEGATE DRIVE WEST
I09H16
I09H17
I09H18
I09H20
J0
CASTLE PINES COMMERCIAL NO. 6
ATRIUM DRIVE
ATRIUM DRIVE
ADJOINING MAP J09

# APPENDIX E – WATER MAPS AND PLANS



TOWN OF CASTLE ROCK

# Water System Design

## 2018 CRITERIA MANUAL

**Published by the Town of Castle Rock, 100 N. Wilcox St., Castle Rock, CO 80104**
**December 4, 2018**

associated with the Town's Concept, Preliminary, and Final Development Packages are documented in Chapter 3 of these Criteria.

### 4.4.1. Design Demands

The tabulation below provides the Average Daily Demand (ADD) rates that shall be applied to compute the demands associated with the various types of land use within the development. Demands shall be computed for intermediate and full build-out phases of the development, and shall be assigned to the appropriate design points within the model to accurately reflect the geographical distribution of land use throughout the site.

| Land Use | Typical ADD/Unit | Typical SFEs/Unit |
|---|---|---|
| Single Family Residential and Duplexes | 400 gpd/dwelling unit | 1.00/dwelling unit |
| Multi-Family Residential (Townhomes and | 260 gpd/dwelling unit | 0.65/dwelling unit |
| Retail/Offices | 0.2 gpd/SF | 0.0005/SF |
| Hotels/Motels | 75 gpd/room | 0.19/room |
| Restaurants | 3.0 gpd/SF | 0.0075/SF |
| Car Washes | 5,000 gpd/facility | 12.5/facility |
| Industrial / Other Commercial | 1,200 gpd/acre | 3.0/acre |
| Institutional | 800 gpd/acre | 2.0/acre |
| Rates for Typical Douglas County | | |
| School Sizes: | | |
| Elementary (10 ac, 675 students) | 3,375 gpd/school | 8.44/school |
| Middle (25 ac, 850 students) | 8,500 gpd/school | 21.25/school |
| High (50 ac, 1,700 students) | 17,000 gpd/school | 42.50/school |
| Rates for Alternate School Sizes: | | |
| Elementary – Domestic | 5 gpd/student | 0.013/student |
| Middle – Domestic | 10 gpd/student | 0.025/student |
| High – Domestic | 10 gpd/student | 0.025/student |
| Elementary Schools – Irrigation | 3,000 gpd/total acreage | 7.5/total acreage |
| Middle Schools – Irrigation | 5,250 gpd/total acreage | 13.1/total acreage |
| High Schools – Irrigation | 4,400 gpd/total acreage | 11.0/total acreage |
| Churches | 600 gpd/church | 1.5/church |
| Gym/Fitness Center | 0.5 gpd/SF | 0.00125 SFE/SF |
| Irrigated Land (Sports Fields and School Sites Excluded) | 3,750 gpd/ irrigated acre | 9.38/acre |

#### 4.4.1.1 Water System Average Daily Demands (ADD)

Notes:
(1) All tabulated ADD rates include irrigation demands with the exception of multi-family residential, car washes, gyms/fitness centers, and schools.
(2) Irrigation demands shall be in accordance with the Irrigation Plan approved by Castle Rock Water and hours of irrigation shall comply with the latest edition of the Town's Water Use Management Plan. Irrigation demands in this Table are for planning purposes only. Peak irrigation rates for 'Irrigated Land' and 'School Irrigation' categories tabulated above shall be in accordance with the approved Irrigation Plan, and shall not be based on the peaking factors identified in the section below.
(3) The "Irrigated Land" rate identified above may be higher for active sports fields (e.g., irrigated fields within parks) as determined by the approved Irrigation Plan.
(4) School sizes in this table are for planning purposes, per the Douglas County School District. Regarding design flows for schools, planned school sizes shall be confirmed with the Douglas County School District and documented in the Utility Report. The tabulated rates shown above shall be applied as appropriate, depending on the information provided by the School District.
(5) Reasonable engineering judgment shall be used in determining the estimated ADD for commercial, industrial and institutional sites. Individual evaluation and justification, including fixture unit counts, shall be provided when the proposed use is not specifically represented in the table above, or when the proposed demands will be inconsistent with the tabulated values. For example, each car wash's unique operating plan, including recycling of wash water, shall be considered. Justification of all non-residential demands shall be addressed in the Utility Report.

#### 4.4.1.2 Demand Factors

Once the ADD has been computed in accordance with the demand rates tabulated above, Maximum Day Demands (MDD) and Peak Hour Demands (PHD) shall be computed by multiplying the ADD by the following factors:

| | | |
|---|---|---|
| Maximum Day Demand/Average Day Demand: | 2.5 | MDD/ADD |
| Peak Hour Demand/Average Day Demand: | 5.5 | PHD/ADD |

Peaking factors are not applied to irrigation ADD demands. Max Day Demand and Peak Hour Demand are calculated by multiplying the ADD demand by the demand factors. If the site's irrigation demands are calculated using the table in section 4.4.1, the irrigation ADD is added to the calculated MDD and PHD, computed as follows:

MDD = Domestic ADD X Maximum Day Factor + Irrigation ADD
PHD = Domestic ADD X Peak Hour Factor + Irrigation ADD

#### 4.4.1.3 Fire Flows

Fire flows shall conform to the latest edition of the International Fire Code (IFC) and shall be confirmed by the Town's Fire Department, as described in section 3.6.XII of

this criteria. A 50 percent reduction in required fire flow may be allowed for approved residential sprinkler systems, and a 75 percent reduction may be allowed for approved commercial sprinkler systems at the discretion of the Town of Castle Rock Fire Chief. The minimum fire flow for the water distribution system is 1,500 gpm, unless otherwise approved by the Fire Department.

### 4.4.2 Storage Requirements

The required storage volume associated with a particular development shall be computed as follows:

Storage Volume (MG) = Maximum Day Demand (MG) + Fire Flow (MG)

Example Calculation:

Based on an assumed 1500 gpm two-hour fire and an MDD rate of 75 gpm, the storage requirement would be:

| | |
|---|---|
| 75 gpm x 60 min/hr x 24 hrs = | 108,000 gallons |
| + 1500 gpm x 60 min/hr x 2 hrs = | 180,000 gallons |
| Total required storage = | 288,000 gallons (0.288 MG) |

Based on the computed storage volume, Castle Rock Water will evaluate whether the development is compatible with the location and magnitude of the existing and master-planned storage volume within the pressure zone, or if additional storage must be considered to provide the appropriate level of service to the development. Due to hydraulic constraints and limitations within the service area, fire storage within the pressure zone may need to be duplicated as determined by Castle Rock Water.

### 4.4.3 Minimum Hydraulic Performance Criteria

All mains shall be sized to provide for domestic, irrigation and fire protection demands to all points in the development without violating the pressure, velocity, and headloss criteria set forth herein. The proposed network shall be evaluated by the engineer under the hydraulic conditions stipulated in the following table using an approved hydraulic network analysis model. In some cases, the Town may require the oversizing of certain mains based on required master-planned sizes associated with the overall Town system. Recovery costs of such oversizing shall be in accordance with the Town Municipal Code, and pursuant to applicable executed agreements.

| Hydraulic Condition | Pressure (psi) |
|---|---|
| **Minimum static pressure with zero demand (20% tank stage)** | **43** |
| **Maximum static pressure with zero demand (100% tank stage)** | **125** |
| **Minimum dynamic pressures (based on 20% tank stage):** | |
| **Max Daily Demand + fire flow (see note below)** | **20** |
| **Peak Hour Demand (see note below)** | **35** |

*Note: Pressure and Velocity criteria listed above for the MDD plus fire flow and PHD conditions shall be satisfied with one critical distribution loop out of service.*

#### 4.4.3.1 Operating Pressures and Pressure Zone Characteristics

The required operating pressures listed above apply to pressures within the mains, and shall be satisfied in accordance with the general pressure zone elevation data tabulated below (Vertical Datum NAVD 88).

| Pressure Zone Designation | Max HGL Elev. | Top Elev. Served | Low Elev. Served |
|---|---|---|---|
| **1 (Orange)** | **6192** | **6072** | **5915** |
| **2 (Yellow)** | **6352** | **6230** | **6065** |
| **3a (Blue-east)** | **6508** | **6389** | **6221** |
| **3b (Blue-west)** | **6523** | **6399** | **6236** |
| **4 (Purple)** | **6594** | **6474** | **6308** |
| **5 (Red)** | **6680** | **6557** | **6393** |
| **6 (Green)** | **6824** | **6700** | **6537** |

Notes: (1) Elevations shown above are general guidelines. Engineer shall contact Castle Rock Water to confirm the appropriate numbers for a specific site. (2) Pressure evaluations in areas served solely by PRVs shall be based on the PRV settings, as provided by Castle Rock Water.

#### 4.4.3.2 Assumed Pressures at Existing System Connections

Primary distribution and transmission mains between the supplying storage tank and

# 1st Amendment to the FINAL WATER AND SANITARY SEWER SYSTEM STUDY

**FOR**

## *CASTLE PINES COMMERCIAL PD*
## *CASTLE ROCK, COLORADO*

(Filing 12: PWP 05-004)
(Filing 10A: PWP 03-108)

PREPARED FOR
DEV-VIC LLC
March 14, 2006
**Revised: September 9, 2006**

BY:
TST INC. OF DENVER, CONSULTING ENGINEERS
9222 TEDDY LANE
LONE TREE, COLORADO 80124

PROJECT NO. 771-039/040

TST

## INTRODUCTION

A previous report entitled Water and Sanitary Sewer System Study, dated November, 1994, was prepared for the overall Castle Pines Commercial PD. Several updates have been prepared to reflect the parcels being developed. This report updates the previous reports and specifically analyzes the requirements for potable water and sanitary sewer lines within Parcels 7 & 16 (Castle Pines Commercial Filing 12) and Parcels 12 and 15 (Castle Pines Commercial Filing 10A). From this analysis, line sizes for the mains are recommended. In making this analysis, representatives of Dev-Vic Ltd. Liability Co. and others were consulted to determine their opinion of the planned build-out density of the development. The densities and uses in this report were primarily based on their opinion of the most intense usage of the property. A copy of the most recent PD has been included in Appendix F.

## LOCATION

The Castle Pines Commercial PD ("PD") lies between Interstate 25 and U.S. Highway 85, primarily on the north side of Meadows Parkway, approximately two miles north of Castle Rock. Parcel 7 and 16, which is west of Atrium Drive, is planned for the development of commercial, office and retail uses. Parcel 12 and 15, which is north of Meadows Parkway, is planned for commercial, office and retail uses. There is currently development either complete or in progress on several other parcels, including the Castle Rock Factory Shops, Castlegate apartments and two other mixed use parcels within the PD. The general location is shown on Figure 1 located in Appendix A.

## WATER SYSTEM ANALYSIS

This analysis of the proposed water distribution system was conducted using the CyberNet network analysis software. The PD distribution system is tied to the Town of Castle Rock system in two locations. The first is the 16-inch line in Meadows Parkway in the Yellow pressure Zone, which is the furthest eastern extent of the Meadows system. For the purposes of this analysis, the Meadows system is assumed to be able to supply flows at 98 PSI at the east side of the Plum Creek bridge on Meadows Parkway, per the *Water and Sanitary Sewer System Study for Castle Pines Commercial P.D.* dated June, 1994 by TST Inc. of Denver. The second source of supply is a tie to the Town's Yellow Zone system through a 16" line in West Castleton Road. The maximum hydraulic grade of the Yellow Zone is 6349'. The hydraulic grade used in this model is 6040 feet. This hydraulic grade was provided by the Town of Castle Rock engineering department for use in the report. Both Filing 10A and Filing 12 can be served by the Yellow Zone at the elevations shown on the construction plans.

The previous looped system of lines within the PD was updated to reflect the actual site layout for this model. The conditions for average day flows, max day flows and peak hour flows were reviewed, along with the available fire flows at max day flow, and the systems for Parcels 7, 12, 15 and 16 were sized based upon these results. Printouts of the results of the

# APPENDIX A

# WATER DEMANDS

# WATER USAGE CALCULATION

TST INC. OF DENVER
CONSULTING ENGINEERS
9222 Teddy Lane Lone Tree, CO 80124
(303)792-0557 (phone)
(303)792-9489 (FAX)

| | |
|---|---|
| PROJECT: | CP COMMERCIAL |
| PROJECT NO.: | 771-039/771-040 |
| ENGINEER: | GLENDON W. BERRETT P.E. |

CRITERIA
TCR PUBLIC WORKS REGULATIONS SECTION II - CHAPTER. 14
ACREAGES - DWELLING UNITS FROM CASTLE PINES COMMERCIAL PD, 4th AMENDMENT
COM - COMMERCIAL - DEMAND 1200 gpad
RMF - MULTIFAMILY RESIDENTIAL - DEMAND 260 gpd/D.U.
*DEMAND RATE PER D.U. OR ACREAGE
MAX DAY FACTOR - 2.65
PEAK HOUR FACTOR - 4.5

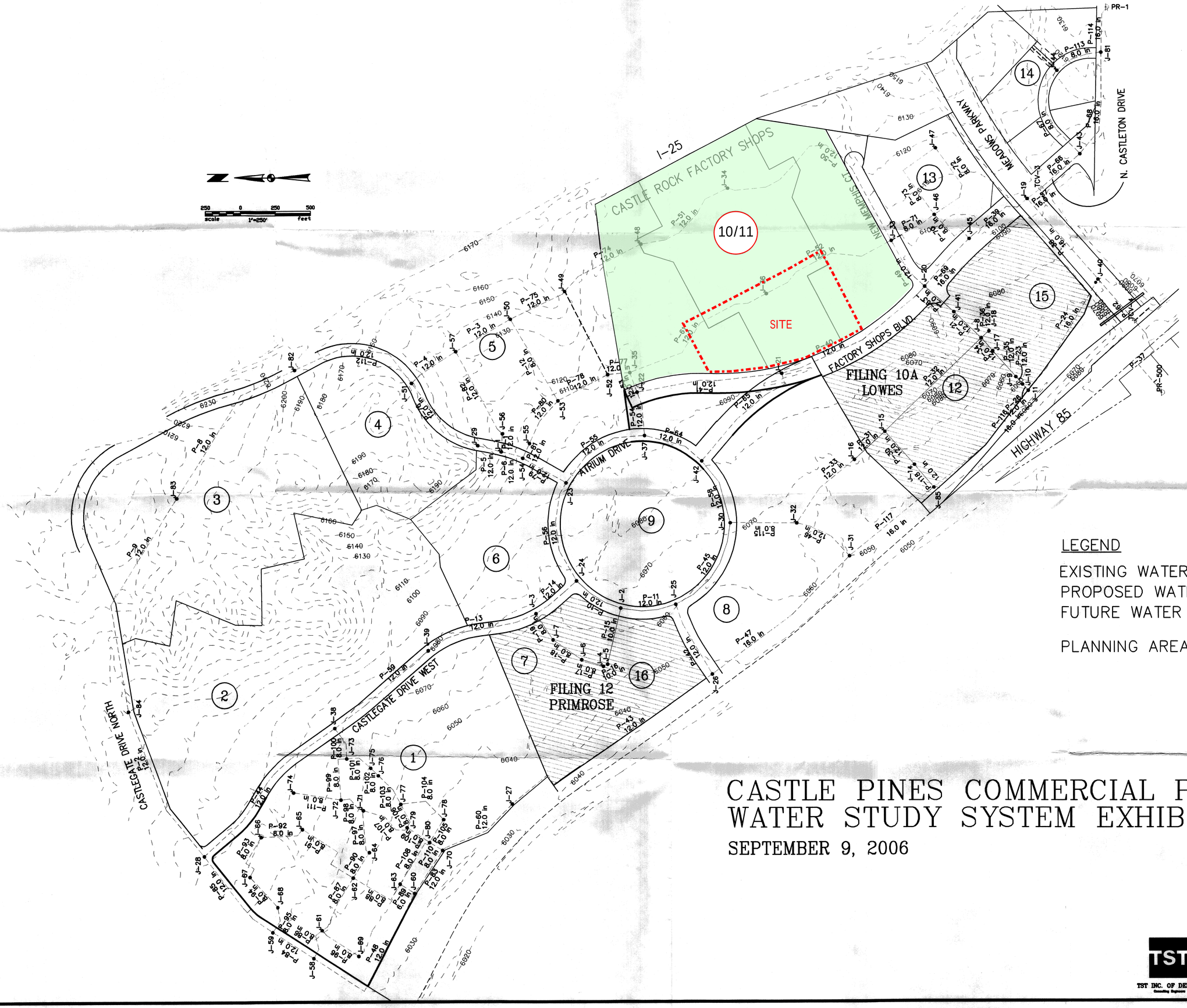
| PLANNING AREA | USE | ACREAGE | DWELLING UNITS | *DEMAND | AV. DAY (gpd) | AV. DAY (gpm) | MAX DAY (gpm) | PEAK HOUR (gpm) | # OF NODES |
|---|---|---|---|---|---|---|---|---|---|
| 01 | RMF | 41.7 | 750 | 260 | 195000 | 135 | 359 | 609 | 24 |
| 02 | RMF | 27.8 | 300 | 260 | 78000 | 54 | 144 | 244 | 4 |
| 03 | RMF | 29.8 | 400 | 260 | 104000 | 72 | 191 | 325 | 2 |
| 04 | COM | 17.8 | | 1200 | 21360 | 15 | 39 | 67 | 2 |
| 05 | COM | 22.1 | | 1200 | 26520 | 18 | 49 | 83 | 7 |
| 06 | COM | 23.9 | | 1200 | 28680 | 20 | 53 | 90 | 3 |
| 07 | COM | 11.8 | | 1200 | 14160 | 10 | 26 | 44 | 2 |
| 08 | COM | 4.0 | | 1200 | 4800 | 3 | 9 | 15 | 3 |
| 09 | COM | 15.8 | | 1200 | 18960 | 13 | 35 | 59 | 7 |
| 10 & 11 | COM | 63.0 | | 1200 | 75600 | 53 | 139 | 236 | 8 |
| 12 | COM | 40.3 | | 1200 | 48360 | 34 | 89 | 151 | 12 |
| 13 | COM | 9.0 | | 1200 | 10800 | 8 | 20 | 34 | 2 |
| 14 | COM | 13.3 | | 1200 | 15960 | 11 | 29 | 50 | 3 |
| 15 | COM | 4.0 | | 1200 | 4800 | 3 | 9 | 15 | 3 |
| 16 | COM | 4.0 | | 1200 | 4800 | 3 | 9 | 15 | 2 |
| | | | | TOTALS | 651800 | 453 | 1199 | 2037 | |

DEMAND PER NODE

| AREA | AV. DAY (gpm) | MAX DAY (gpm) | PEAK HOUR (gpm) |
|---|---|---|---|
| 01 | 6 | 15 | 25 |
| 02 | 14 | 36 | 61 |
| 03 | 36 | 96 | 163 |
| 04 | 7 | 20 | 33 |
| 05 | 3 | 7 | 12 |
| 06 | 7 | 18 | 30 |
| 07 | 5 | 13 | 22 |
| 08 | 1 | 3 | 5 |
| 09 | 2 | 5 | 8 |
| 10 & 11 | 7 | 17 | 30 |
| 12 | 3 | 7 | 13 |
| 13 | 4 | 10 | 17 |
| 14 | 4 | 10 | 17 |
| 15 | 1 | 3 | 5 |
| 16 | 2 | 4 | 8 |

# APPENDIX F

# MAPS/PLANS




LEGEND

EXISTING WATER PIPE ----------

PROPOSED WATER PIPE ——————

FUTURE WATER PIPE ----------

PLANNING AREA NO. (1)

# CASTLE PINES COMMERCIAL P.D.
# WATER STUDY SYSTEM EXHIBIT

SEPTEMBER 9, 2006

TST

TST INC. OF DENVER
Consulting Engineers

# Water Master Plan
# 2017

**Engineering Division**

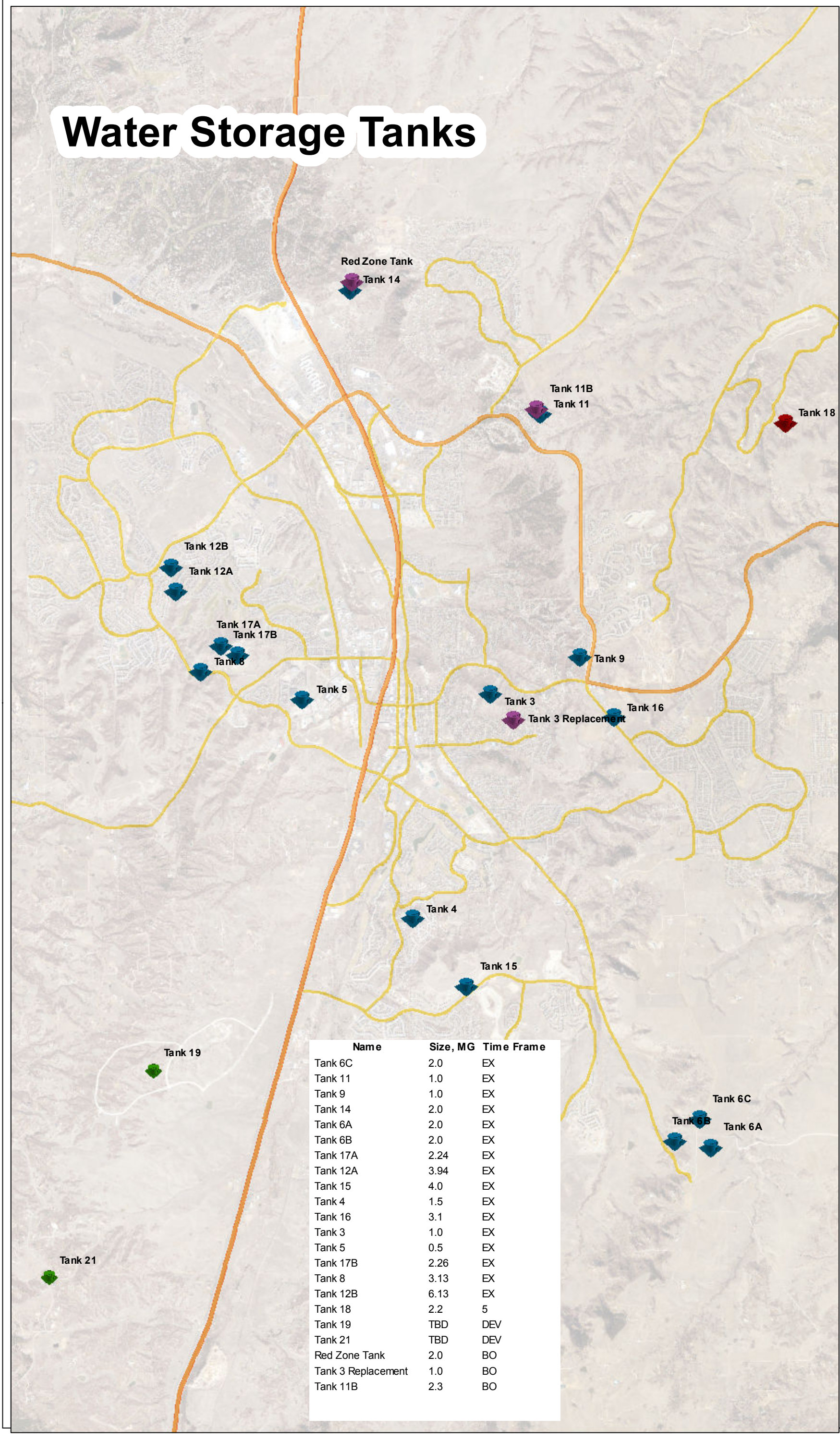
A corrosion control study would include but not be limited to a system-wide water quality evaluation (samples taken at various locations throughout the system for laboratory testing), evaluation of current water treatment methods and possible future changes to treatment or water sources, a review of materials in the distribution system, and an evaluation of corrosion control treatments in the system based on further testing. Study results would be used to prepare a report that evaluates potential additional corrosion control treatments (as needed) and compares their ability to reduce lead and/or copper in private plumbing that contains lead and copper. Completing a corrosion control study would require additional staff time and various costs, such as those for lab testing and engineering consultant services.

Water quality within the Town's distribution network has been historically stable, with no action level exceedances of lead or copper since the Town began testing for these compounds in 1992. The Colorado Primary Drinking Water Regulations (5 CCR 1002-11) allows an exemption from completing the corrosion control study for water systems that already meet specific water quality parameters (currently have optimal corrosion control). CRW met those requirements and submitted a request to CDPHE seeking the exemption from completing the study. CDPHE approved CRW's request to be deemed a system having optimal corrosion control (not having to complete the corrosion control study). CRW will continue to monitor system water quality and report those results to CDPHE and to the public in the annual Consumer Confidence Report (CCR).

## *Water Storage*

Finished water storage is critical for meeting peak demands and fire flow requirements. The Town has fourteen active water storage tanks located in the various pressure zones with a total storage capacity of 35.62 million gallons (MG). Table 3-2 provides an inventory of existing water storage tanks. The Town plans to maintain these existing tanks and add several more as the Town continues to grow. Tank 3, the Town's oldest storage tank, was rehabilitated in 2016. Tank 18 (yellow zone) in Cobblestone Ranch is planned to be constructed in the 2019-2021 planning horizon, dependent on the rate of growth, and will add an additional 2.2 MG of storage. Other future tanks include a new purple zone Tank 11B and a new red zone Tank. Tank 6B has deteriorated to the point that it has been removed from service and will be demolished in 2018. See Figure 3.1 for locations of existing and future tanks.

# Water Storage Tanks




| Name | Size, MG | Time Frame |
|---|---|---|
| Tank 6C | 2.0 | EX |
| Tank 11 | 1.0 | EX |
| Tank 9 | 1.0 | EX |
| Tank 14 | 2.0 | EX |
| Tank 6A | 2.0 | EX |
| Tank 6B | 2.0 | EX |
| Tank 17A | 2.24 | EX |
| Tank 12A | 3.94 | EX |
| Tank 15 | 4.0 | EX |
| Tank 4 | 1.5 | EX |
| Tank 16 | 3.1 | EX |
| Tank 3 | 1.0 | EX |
| Tank 5 | 0.5 | EX |
| Tank 17B | 2.26 | EX |
| Tank 8 | 3.13 | EX |
| Tank 12B | 6.13 | EX |
| Tank 18 | 2.2 | 5 |
| Tank 19 | TBD | DEV |
| Tank 21 | TBD | DEV |
| Red Zone Tank | 2.0 | BO |
| Tank 3 Replacement | 1.0 | BO |
| Tank 11B | 2.3 | BO |



Figure 3.1

**Table 3-2 Finished Water Storage Tank Inventory**

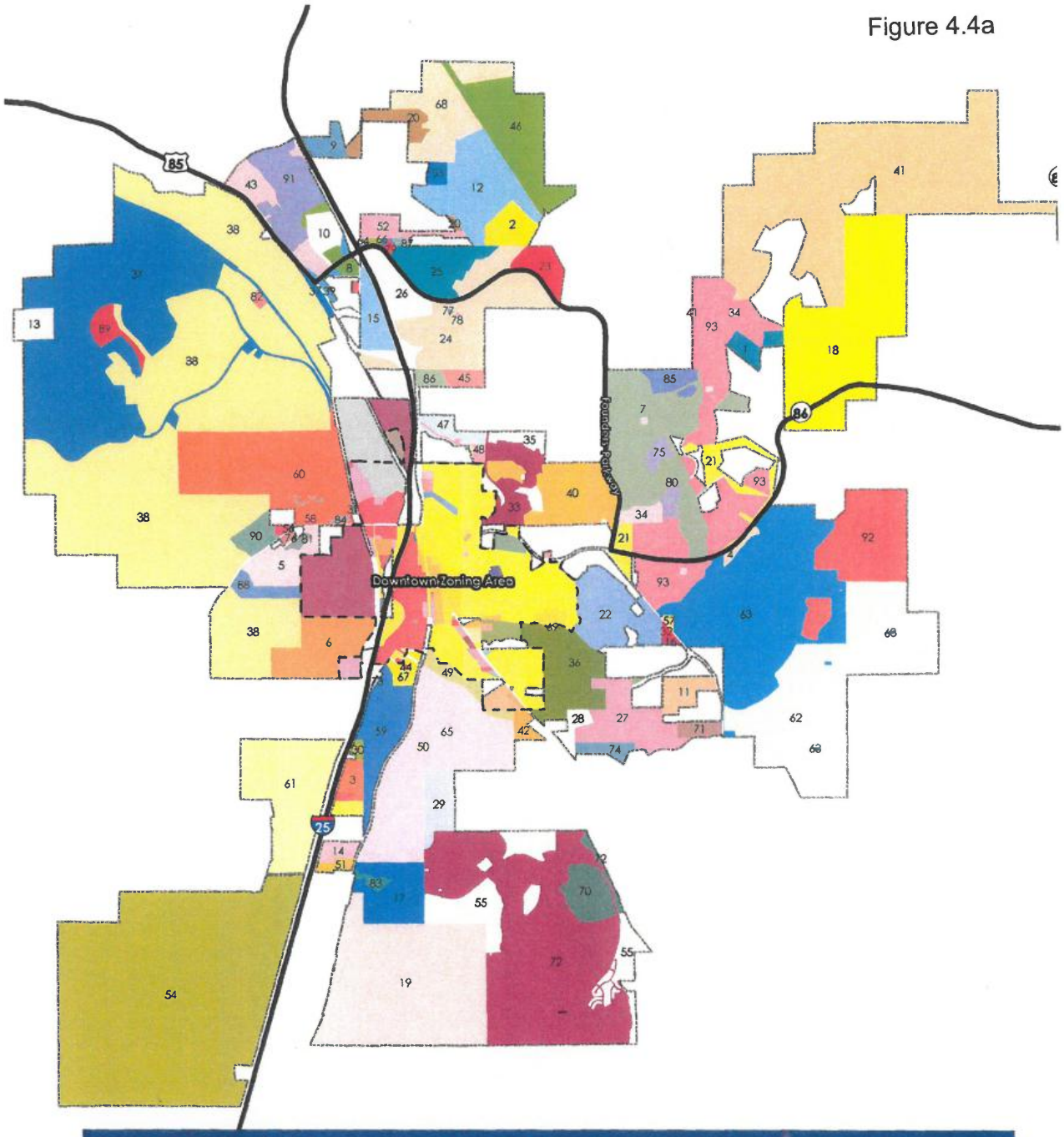
| Tank ID | Year Built | Capacity (MG) | Diameter (ft) | Height (ft) | Pressure Zone | Status |
|---|---|---|---|---|---|---|
| Tank 1 | | | | | | Demolished |
| Tank 3 | 1969 | 1.04 | 92.6 | 19.1 | Purple | Active |
| Tank 4 | 1984 | 1.51 | 118.0 | 18.6 | Blue | Active |
| Tank 5[1] | 1984 | (0.5) | 66.0 | 19.4 | Yellow | Not in Service |
| Tank 6A | 1986 | 2.0 | 120.0 | 23.5 | Green | Active |
| Tank 6B[2] | 1997 | (2.0) | 120.0 | 23.5 | Green | Not in Service |
| Tank 6C | 2010 | 2.22 | 120.0 | 23.5 | Green | Active |
| Tank 7[3] | 1986 | (2.0) | 122.0 | 22.7 | Red | Not in Service |
| Tank 8 | 1987 | 3.13 | 147.0 | 24.8 | Blue | Active |
| Tank 9 | 1989 | 1.0 | 96.0 | 19.3 | Purple | Active |
| Tank 11 | 1998 | 1.0 | 92.5 | 24.0 | Purple | Active |
| Tank 12A | 1999 | 3.94 | 172.0 | 22.8 | Yellow | Active |
| Tank 12B | 2007 | 6.13 | 172.0 | 22.8 | Yellow | Active |
| Tank 14 | 2001 | 2.0 | 121.0 | 23.3 | Red | Active |
| Tank 15 | 2002 | 4.03 | 174.0 | 22.7 | Red | Active |
| Tank 16 | 2004 | 3.11 | 140.0 | 27.0 | Red | Active |
| Tank 17A | 2005 | 2.24 | 136.0 | 20.6 | Red | Active |
| Tank 17B | 2009 | 2.26 | 136.0 | 20.6 | Red | Active |
| **Total Active Storage Capacity** | | 35.6 | | | | |

1 Tank 5 is located in Citadel Station and currently is not in service. It has been physically disconnected from the distribution system and its future use will be evaluated.

2 Tank 6B has been removed from service due to a structural failure. This tank is scheduled for demolition in the 5-year CIP.

3 Tank 7 is located in Dawson Ridge and currently is not in service. This tank will need to be evaluated to determine if it can be used for future use.

Figure 4.4a




# Planned Development Zoning

## Legend

0 0.5 1 2
Miles

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 to the public, The Town of Castle Rock assumes no liability for its use or accuracy. For questions or comments regarding omissions, corrections, or updates please visit CRgov.com/directory for contact information.
Copyright 2016, Town of Castle Rock
This map was approved on 2/22/2005
Ordinance No. 2005-04
Revision Date: 7/28/2016
Coordinate System: SPCS Colorado Central (0501)
Projection: Lambert Conformal Conic
Datum: North American 1983
Units: Foot US

1. 1ST AMD TO CASTLE OAKS PRELIM PD SITE PLAN AMD 1
2. BROOKWOOD PD
3. BURT AT CASTLE ROCK PD
4. CAMBRIDGE HEIGHTS PD
5. CASTLE HIGHLANDS MAJOR MODIFICATION
6. CASTLE MEADOWS INTERCHANGE OVERLAY PDP
7. CASTLE OAKS AMENDMENT NO. 1
8. CASTLE PINES COMMERCIAL AMENDMENT (1995)
9. CASTLE PINES COMMERCIAL MAJOR MODIFICATION
10. CASTLE PINES COMMERCIAL PD
11. CASTLE RIDGE PD
12. CASTLE ROCK ESTATES I AMENDMENT
13. CHURCH OF THE ROCK PD
14. CREEKSIDE PD
15. DOUGLAS COUNTY JUSTICE CENTER MAJOR MODIFICATION
16. FAITH LUTHERAN CHURCH PD
17. HECKENDORF RANCH AMENDMENT NO. 2
18. HERITAGE FARM PD
19. THE LANTERNS AMENDMENT NO. 3
20. MAHER RANCH PD
21. MALL AND OFFICE CENTER INFILL
22. MEMMEN YOUNG INFILL
23. METZLER RANCH 2ND MAJOR AMENDMENT
24. METZLER RANCH PD (1996)
25. METZLER RANCH THIRD MAJOR AMENDMENT
26. MILESTONE OFFICE CAMPUS AMENDED (1998)
27. OAKS OF CASTLE ROCK AMENDMENT NO.1
28. OAKS OF CASTLE ROCK PD
29. PLUM CREEK SOUTH PD
30. PLUM CREEK WEST PD
31. RED HAWK PD32. RIDGE VIEW PD
33. SCOTT RANCH PD
34. VILLAGES AT CASTLE ROCK PD
35. WOODLANDS MINOR MODIFICATION
36. YOUNG AMERICAN PD
37. MEADOWS THIRD AMENDMENT
38. MEADOWS FOURTH AMENDMENT
39. MEADOWS PARKWAY PD
40. WOODLANDS SECOND AMENDMENT
41. LIBERTY VILLAGE 2ND AMENDMENT
42. STANBRO PD
43. CASTLE PINES COMMERCIAL AMENDMENT (2000)
44. CENTRE ON PLUM CREEK FLG 2 AMENDED
45. HAZEN MOORE AMENDMENT
46. MAHER RANCH MAJOR AMENDMENT (PHASE 1)
47. SCOTT II MAJOR MODIFICATION
48. SCOTT II AMENDED
49. PLUM CREEK FIRST AMENDMENT
50. PLUM CREEK SECOND AMENDMENT
51. PLUM CREEK POINTE AMENDMENT
52. COOPER-HOOK PD
53. CASTLE ROCK ESTATES II PD
54. DAWSON RIDGE AMENDMENT
55. CRYSTAL VALLEY RANCH MAJOR AMENDMENT
56. ARBORS PD
57. MT. ZION LUTHERAN CHURCH PD
58. WOLFENSBERGER PDP
59. BROOKSIDE BUSINESS CENTER AMENDED
60. RED HAWK AMENDMENT NO. 1
61. WESTFIELD TRADE CENTER 2ND AMENDMENT
62. CASTLEWOOD RANCH MINOR AMENDMENT
63. FOUNDERS VILLAGE AMENDED (1994)
64. I-25 AND FOUNDERS PKWY CONOCO PD
65. PLUM CREEK AMENDED
66. MAIN PLACE PD
67. MILLER RANCH PD
68. MAHER RANCH MAJOR AMENDMENT (PHASE 2)
69. YOUNG AMERICAN SECOND AMENDMENT
70. CRYSTAL VALLEY RANCH 2ND AMENDMENT
71. OAKS OF CASTLE ROCK AMENDMENT NO. 3
72. CRYSTAL VALLEY RANCH 4TH AMENDMENT
73. DEMIS PD
74. OAKS OF CASTLE ROCK AMENDMENT NO. 4
75. CASTLE OAKS AMEND NO. 1 PPD, 2ND
76. EPIPHANY EVANGELICAL LUTHERAN CHURCH
77. METZLER RANCH PPD 4TH AMENDMENT
78. METZLER RANCH PD 5TH AMENDMENT
79. SHOPPES ON FOUNDERS
80. CASTLE OAKS AMEND NO. 1 PPD, 3RD
81. AUBURN RIDGE PD
82. MEADOWS PDP NO.1
83. HECKENDORF RANCH PDP AMD NO.3
84. RED HAWK CROSSING PDP
85. CASTLE OAKS ESTATES PDP NO. 1
86. HAZEN MOORE PDP NO. 1
87. MONTANA VISTA PDP
88. COVENANT AT CASTLE ROCK PDP
89. MEADOWS PDP NO. 2
90. HILLSIDE PDP
91. PROMENADE AT CASTLE ROCK PDP
92. BELLA MESA PDP
93. TERRAIN PDP

## Build-out Planning Numbers

Figure 4.4b

Data through June 30, 2017, please note that these are estimates, and numbers are subject to change

7/27/2017

| PD # | Planned Developments (year zoned) | MAXIMUM ZONED UNITS SF | MF | Total | PLATTED (SF) SDP (MF) SF | MF* | Total | Full Growth @100% Build Out SF | MF | Total | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 56 | Arbors (2002) | 38 | 80 | 118 | 0 | 0 | 0 | 38 | 80 | 118 | Undeveloped, proposed to be developed in conjunction with Hillside |
| 81 | Auburn Ridge (2013) | 0 | 289 | 289 | 0 | 289 | 289 | 0 | 289 | 289 | Full development is expected in 2018, pending approved zoning & SDP recordation |
| 2 | Brookwood (2003) | 72 | 0 | 72 | 72 | 0 | 72 | 72 | 0 | 72 | Full development is expected |
| 4 | Cambridge Heights (2003) | 0 | 100 | 100 | 0 | 0 | 0 | 0 | 100 | 100 | Undeveloped, no dates for activity |
| 5 | Castle Highlands (1984) | 132 | 358 | 490 | 131 | 200 | 331 | 132 | 358 | 490 | Project completed, no additional lots are platted. |
| 6 | Castle Meadows (1989) | 70 | 218 | 288 | 0 | 0 | 0 | 70 | 218 | 288 | Full development is expected |
| 7, 75, 80, 85, 93 | Castle Oaks /Terrain (2002) | 1992 | 775 | 2767 | 1696 | 0 | 1696 | 1992 | 775 | 2767 | Full development is expected |
| 8, 9, 10, 43, 91 | Castle Pines Commercial / Promenade (1987) | 0 | 1550 | 1550 | 0 | 1062 | 1062 | 0 | 1550 | 1550 | Project re-entitled by Alberta Corporation. Total MF build-out equals 1018 MF units, not the previously-entitled 1550 MF units. |
| 11 | Castle Ridge East (1996) | 30 | 0 | 30 | 28 | 0 | 28 | 30 | 0 | 30 | Project is complete |
| 12 & 53 | Castle Rock Estates - Diamond Ridge (1995) | 126 | 0 | 126 | 126 | 0 | 126 | 126 | 0 | 126 | Project is complete |
| 27 & 71 & 74 & 28 | CastleviewEstates - The Oaks of Castle Rock (1985) | 248 | 326 | 574 | 239 | 0 | 239 | 248 | 326 | 574 | Full development is expected |
| 62 | Castlewood Ranch (1998) | 1300 | 0 | 1300 | 1288 | 0 | 1288 | 1300 | 0 | 1300 | Remaining lots platted for sale, most will be custom homes, full development expected |
| straight zones, downtown | Central Castle Rock (varies) | 1538 | 883 | 2421 | 1522 | 791 | 2313 | 1538 | 883 | 2421 | Development nearly complete, approximately 20 SF units remaining |
| 88 | Covenant At Castle Rock (2014) | 58 | 0 | 58 | 58 | 0 | 58 | 58 | 0 | 58 | Full development is expected |
| 55, 70 | Crystal Valley Ranch (2000) | 2722 | 753 | 3475 | 1306 | 0 | 1306 | 2722 | 753 | 3475 | Full development is expected |
| 54 | Dawson Ridge (1986) | 2447 | 5453 | 7900 | 0 | 0 | 0 | 2447 | 5453 | 7900 | Project was entitled in the late 1980's. The property has bee vacant since the early 1990's with no specific plans for improvement. All involved with property ownership and development discussions agree that a newland use plan, infrastructure plan, Development Agreement and service plans need to be submitted and approved by Council prior to any development of the site no matter what decision are made on the vesting question |
| 63, 92 | Founders Village - Inc. Founders 24 and Bella Mesa (1985) | 1754 | 3667 | 5421 | 2634 | 0 | 2634 | 1754 | 3667 | 5421 | Project is approximately ½ built with the expectation of the entitled 5421 residential units will be constructed. |
| 45, 86 | Hazen Moore (2000) | 243 | 0 | 243 | 161 | 0 | 161 | 243 | 0 | 243 | Full development is expected |
| 17 | Heckendorf Ranch (1985) | 406 | 224 | 630 | 301 | 0 | 301 | 406 | 224 | 630 | A portion of the property is developed. Full development expected. |
| 90 | Hillside (2009) | 120 | 0 | 120 | 0 | 0 | 0 | 120 | 0 | 120 | Full development is expected |
| 19 | Lanterns (2003) | 1200 | 0 | 1200 | 0 | 0 | 0 | 1200 | 0 | 1200 | The property was recently entitled for an increase from 548 units to 1200 homes |
| 41 | Liberty Village (2004) | 1245 | 0 | 1245 | 1212 | 0 | 1212 | 1245 | 0 | 1245 | Full development is expected |
| 20, 46, 68 | Maher Ranch (1988) | 2309 | 100 | 2409 | 761 | 96 | 857 | 2309 | 100 | 2409 | Full development is expected |
| 37, 38, 82, 89 | Meadows (1985) | 6642 | 4002 | 10644 | 7188 | 240 | 7428 | 6642 | 4002 | 10644 | The developer consistently states the intent to build the entitled number of lots. |
| 22 | Memmen Young Infill (1985) | 559 | 476 | 1035 | 0 | 0 | 0 | 559 | 476 | 1035 | The property is entitled and undeveloped but questions remain whether the entitled density can be reached due to topography, skyline / Ridgeline and presence of cap rock throughout the property. |
| 23 & 24 & 25 | Metzler Ranch (1996) | 1056 | 660 | 1716 | 727 | 683 | 1410 | 1056 | 660 | 1716 | It is uncertain at this time if the property will develop to the entitled number of residential homes. |
| 49, 50, 65 | Plum Creek (1983) | 3025 | | 3025 | 1177 | 360 | 1537 | 3025 | 0 | 3025 | There are areas remaining where additional lots could be platte and homes constructed. It is uncertain at this time if or when the remaining lots will be bui |
| no PD number, downtown map | Plum Creek Ridge (2006) | 92 | 70 | 162 | 65 | 45 | 110 | 92 | 70 | 162 | Full development is expected, MF are Townhomes |
| 29 | Plum Creek South (1985) | 307 | 198 | 505 | 140 | 0 | 140 | 307 | 198 | 505 | They are close to completion, approx. 3.5 acres remaining undeveloped on north side of Emerald Drive. Full development is not expectec |
| 60 | Red Hawk (1996) | 658 | 268 | 926 | 887 | 0 | 887 | 658 | 268 | 926 | Full development is expected |
| 47, 48 | Scott II (1987) | 85 | 220 | 305 | 78 | 220 | 298 | 85 | 220 | 305 | This project is complete |
| 42 | Stanbro PD (1987) | 32 | 92 | 124 | 0 | 0 | 0 | 32 | 92 | 124 | Full development is expected |
| 34 | Villages at Castle Rock (1981 | 0 | 626 | 626 | 0 | 0 | 0 | 0 | 626 | 626 | Full development is expected |
| 58 | Wolfensberger - formerly Graham PD (1996) | 0 | 56 | 56 | 0 | 56 | 56 | 0 | 56 | 56 | Full development is expected |
| 40, 33, and 35 | Woodlands - Inc. Scott Ranch (1983) | 1160 | 0 | 1160 | 551 | 0 | 551 | 1160 | 0 | 1160 | Lots platted, but not all built Full development is expected |
| 36 | Young American (1983) | 78 | 1128 | 1206 | 375 | 186 | 561 | 78 | 1128 | 1206 | Full development is expected |
| | | ZONED UNITS | | | PLATTED (SF) SDP (MF) * MF counts shows approved by SDF | | | | | | |
| | | SF | MF | Total | SF | MF* | Total | | | | |
| | TOTAL UNITS | 31,744 | 22,572 | 54,316 | 22,723 | 4,228 | 26,951 | 31,744 | 22,572 | 54,316 | approximately 1,725 SFA units within SF tots |
| | POPULATION ESTIMATES | 96,502 | 45,144 | 141,646 | 69,078 | 8,456 | 77,534 | 95,294 | 45,144 | 140,438 | Persons Per Household (3.04-SFD, 2.34-SFA, 2.00-MF) |

### Tank Mixers

Tank mixers are being installed in some of the tanks to promote mixing, decrease stratification and improve water quality within the tanks. Water age becomes an issue in some of the larger tanks, particularly in the lower demand periods of the year. Five tanks have been outfitted with tank mixers, and several more are planned (Tank 15 and Tank 16), then the program will be complete.

***Tank Mixing Projects Completed:***

- Tank 17A and 17B (Meadows Red Zone)
- Tank 14 (Maher Ranch Red Zone)
- Tanks 12A and 12B (Meadows Yellow Zone)

### New Storage

Liberty Village Yellow Zone Tank (Tank 18)

The Cobblestone Ranch subdivision (formerly known as Liberty Village) currently is served through a long transmission main that crosses three pressure zones. A 2 MG water storage tank is planned to provide dedicated storage for maximum day demand plus fire flow in this area, but construction of the tank is currently contingent upon the timing of new schools in the area since system demand is being provided by Tank 16. The project is planned for 2020 and the estimated cost is $3,246,000. The Cobblestone developer is required to construct almost a mile of 16 inch pipeline to send water to and from the proposed tank.

### Pumping

Ray Waterman Regional Water Treatment Center Pumping Improvements

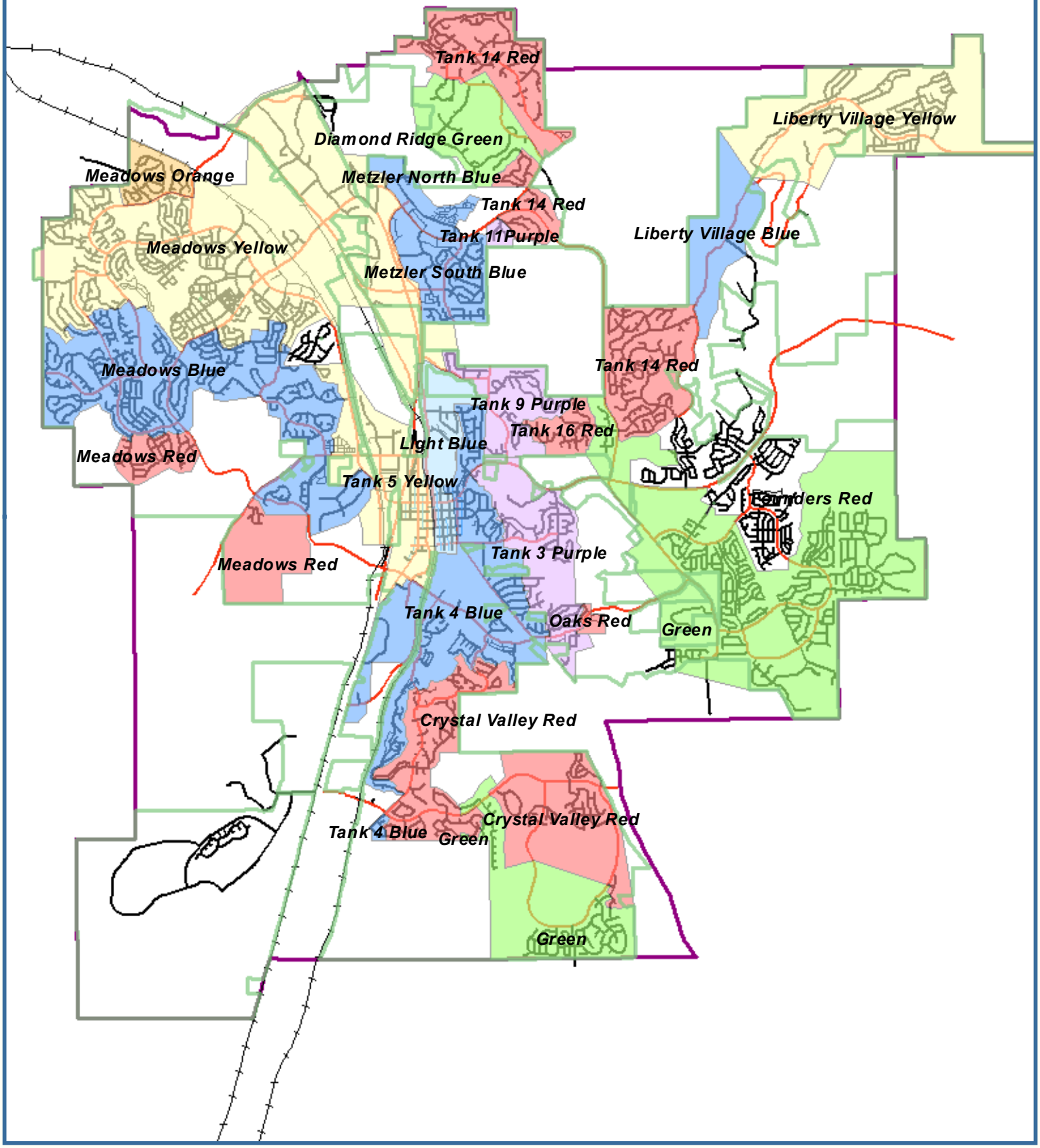
Future pumping improvements will be needed as the WISE water becomes more available. The red zone and green zone pumps at the Ray Waterman Regional Water Treatment Center (RWRWTC) will undergo several phases of upgrades to keep up with future increasing supplies of water to the plant. Phase 1 Red Zone Pumping Upgrades at RWRWTC are planned in this timeframe.

### Transmission Lines

Future transmission lines may be required to efficiently move water supplies around Town. Developers install the distribution lines required to serve their developments, and the Town can request that the lines be “upsized”, with the additional upsize costs incurred by the Town. Future in-fill annexations in the Pine Canyon, Pioneer Ranch, Canyons South, and Southwest Quadrant could require transmission lines. Depending on the timing of developer projects, future demands, and availability of out of service area water supplies, it could be necessary for the Town to build infrastructure, with potential recoupment from future benefited development.

# Pressure Zones

Figure 7.1






CASTLE ROCK WATER DISTRIBUTION SYSTEM PRESSURE ZONES

# APPENDIX F – WASTEWATER FLOWS

STERLING
DESIGN ASSOCIATES
Civil Engineers | Landscape Architects

# Wastewater Analysis

Job Name: CROM Pad - Castle Rock, Colorado

Date: 5/4/22

By: JMN

## CALCULATED FLOWS

| Design Point | Use | [1]Typical ADD/Unit (gpd/sf) | [1]SFEs/Unit (SFE/sf) | Bldg. Area (sf) | ADF (gpd) | ADF (gpm) | ADF (cfs) | [2]PF (calculated) | [2]PF (design) | [3]PDF (gpd) | [3]PDF (gpm) | [3]PDF (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Restaurant (Pad C) | 1.50 | 0.0075 | 7,805 | 11,708 | 8.13 | 0.0181 | 7.71 | 5.00 | 59,708 | 41.46 | 0.0924 |
| | Retail/Offices (Pad B) | 0.10 | 0.0005 | 7,500 | 750 | 0.52 | 0.0012 | 12.23 | 5.00 | 3,825 | 2.66 | 0.0059 |
| | Restaurant (Pad B) | 1.50 | 0.0075 | 4,200 | 6,300 | 4.38 | 0.0097 | 8.55 | 5.00 | 32,130 | 22.31 | 0.0497 |
| 1 | | | | 11,700 | 7,050 | 4.90 | 0.0109 | 8.39 | 5.00 | 35,955 | 24.97 | 0.0556 |
| 2 | Total | | | 19,505 | 18,758 | 13.03 | 0.0290 | 7.12 | 5.00 | 95,663 | 66.43 | 0.1480 |

[1]*Town of Castle Rock, Wastewater Collection Design, 2018 Criteria Manual* ; Section 4.4.1 - Design Flows

[2]*Town of Castle Rock, Wastewater Collection Design, 2018 Criteria Manual* ; Section 4.4.1.2 - Peaking Factor; PF = 3.65*ADF^-0.168 or 5.0 max.

[3]*Town of Castle Rock, Wastewater Collection Design, 2018 Criteria Manual* ; Section 4.4.1.3 - Peak Design Flow Rate; PDF = (ADF*PF) + (0.1*ADF)

# APPENDIX G – WASTEWATER HYDRAULIC ANALYSIS AND MODELING

# PDF - Pad B @ 0.4%

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.00400 | ft/ft |
| Diameter | 0.67 | ft |
| Discharge | 0.0497 | ft³/s |

## Results

| | | |
|---|---|---|
| Normal Depth | 0.106 | ft |
| Flow Area | 0.04 | ft² |
| Wetted Perimeter | 0.55 | ft |
| Hydraulic Radius | 0.065 | ft |
| Top Width | 0.49 | ft |
| Critical Depth | 0.10 | ft |
| Percent Full | 15.9 | % |
| Critical Slope | 0.00495 | ft/ft |
| Velocity | 1.39 | ft/s |
| Velocity Head | 0.03 | ft |
| Specific Energy | 0.14 | ft |
| Froude Number | 0.90 | |
| Maximum Discharge | 0.97 | ft³/s |
| Discharge Full | 0.9032 | ft³/s |
| Slope Full | 0.00001 | ft/ft |
| Flow Type | SubCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.000 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.000 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 15.93 | % |
| Downstream Velocity | Infinity | ft/s |

# PDF - D.P. 1 @ 0.4%

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.00400 | ft/ft |
| Diameter | 0.67 | ft |
| Discharge | 0.0556 | ft³/s |

## Results

| | | |
|---|---|---|
| Normal Depth | 0.112 | ft |
| Flow Area | 0.04 | ft² |
| Wetted Perimeter | 0.56 | ft |
| Hydraulic Radius | 0.069 | ft |
| Top Width | 0.50 | ft |
| Critical Depth | 0.11 | ft |
| Percent Full | 16.8 | % |
| Critical Slope | 0.00491 | ft/ft |
| Velocity | 1.44 | ft/s |
| Velocity Head | 0.03 | ft |
| Specific Energy | 0.14 | ft |
| Froude Number | 0.91 | |
| Maximum Discharge | 0.97 | ft³/s |
| Discharge Full | 0.9032 | ft³/s |
| Slope Full | 0.00002 | ft/ft |
| Flow Type | SubCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.000 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.000 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 16.82 | % |
| Downstream Velocity | Infinity | ft/s |

# PDF - D.P. 2 @ 0.4%

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.00400 | ft/ft |
| Diameter | 0.67 | ft |
| Discharge | 0.1480 | ft³/s |

## Results

| | | |
|---|---|---|
| Normal Depth | 0.183 | ft |
| Flow Area | 0.08 | ft² |
| Wetted Perimeter | 0.73 | ft |
| Hydraulic Radius | 0.106 | ft |
| Top Width | 0.59 | ft |
| Critical Depth | 0.18 | ft |
| Percent Full | 27.4 | % |
| Critical Slope | 0.00462 | ft/ft |
| Velocity | 1.91 | ft/s |
| Velocity Head | 0.06 | ft |
| Specific Energy | 0.24 | ft |
| Froude Number | 0.93 | |
| Maximum Discharge | 0.97 | ft³/s |
| Discharge Full | 0.9032 | ft³/s |
| Slope Full | 0.00011 | ft/ft |
| Flow Type | SubCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.000 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.000 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 27.40 | % |
| Downstream Velocity | Infinity | ft/s |

# PDF - Pad B @ 7.5%

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.07500 | ft/ft |
| Diameter | 0.67 | ft |
| Discharge | 0.0497 | ft³/s |

## Results

| | | |
|---|---|---|
| Normal Depth | 0.052 | ft |
| Flow Area | 0.01 | ft² |
| Wetted Perimeter | 0.38 | ft |
| Hydraulic Radius | 0.034 | ft |
| Top Width | 0.36 | ft |
| Critical Depth | 0.10 | ft |
| Percent Full | 7.9 | % |
| Critical Slope | 0.00495 | ft/ft |
| Velocity | 3.89 | ft/s |
| Velocity Head | 0.24 | ft |
| Specific Energy | 0.29 | ft |
| Froude Number | 3.64 | |
| Maximum Discharge | 4.21 | ft³/s |
| Discharge Full | 3.9109 | ft³/s |
| Slope Full | 0.00001 | ft/ft |
| Flow Type | SuperCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.000 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.000 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 7.87 | % |
| Downstream Velocity | Infinity | ft/s |

# PDF - D.P. 1 @ 7.5%

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.07500 | ft/ft |
| Diameter | 0.67 | ft |
| Discharge | 0.0556 | ft³/s |

## Results

| | | |
|---|---|---|
| Normal Depth | 0.055 | ft |
| Flow Area | 0.01 | ft² |
| Wetted Perimeter | 0.39 | ft |
| Hydraulic Radius | 0.036 | ft |
| Top Width | 0.37 | ft |
| Critical Depth | 0.11 | ft |
| Percent Full | 8.3 | % |
| Critical Slope | 0.00489 | ft/ft |
| Velocity | 4.02 | ft/s |
| Velocity Head | 0.25 | ft |
| Specific Energy | 0.31 | ft |
| Froude Number | 3.65 | |
| Maximum Discharge | 4.21 | ft³/s |
| Discharge Full | 3.9109 | ft³/s |
| Slope Full | 0.00002 | ft/ft |
| Flow Type | SuperCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.000 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.000 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 8.31 | % |
| Downstream Velocity | Infinity | ft/s |

# PDF - D.P. 2 @ 7.5%

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.07500 | ft/ft |
| Diameter | 0.67 | ft |
| Discharge | 0.1480 | ft³/s |

## Results

| | | |
|---|---|---|
| Normal Depth | 0.089 | ft |
| Flow Area | 0.03 | ft² |
| Wetted Perimeter | 0.50 | ft |
| Hydraulic Radius | 0.055 | ft |
| Top Width | 0.45 | ft |
| Critical Depth | 0.18 | ft |
| Percent Full | 13.3 | % |
| Critical Slope | 0.00461 | ft/ft |
| Velocity | 5.38 | ft/s |
| Velocity Head | 0.45 | ft |
| Specific Energy | 0.54 | ft |
| Froude Number | 3.84 | |
| Maximum Discharge | 4.21 | ft³/s |
| Discharge Full | 3.9109 | ft³/s |
| Slope Full | 0.00011 | ft/ft |
| Flow Type | SuperCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.000 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.000 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 13.29 | % |
| Downstream Velocity | Infinity | ft/s |

# PDF - Pad B Slope for Min. Velocity

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.01130 | ft/ft |
| Diameter | 0.67 | ft |
| Discharge | 0.0497 | $ft^3/s$ |

## Results

| | | |
|---|---|---|
| Normal Depth | 0.083 | ft |
| Flow Area | 0.02 | $ft^2$ |
| Wetted Perimeter | 0.48 | ft |
| Hydraulic Radius | 0.052 | ft |
| Top Width | 0.44 | ft |
| Critical Depth | 0.10 | ft |
| Percent Full | 12.4 | % |
| Critical Slope | 0.00495 | ft/ft |
| Velocity | 2.00 | ft/s |
| Velocity Head | 0.06 | ft |
| Specific Energy | 0.14 | ft |
| Froude Number | 1.48 | |
| Maximum Discharge | 1.63 | $ft^3/s$ |
| Discharge Full | 1.5180 | $ft^3/s$ |
| Slope Full | 0.00001 | ft/ft |
| Flow Type | SuperCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.000 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.000 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 12.38 | % |
| Downstream Velocity | Infinity | ft/s |

# PDF - D.P. 1 Slope for Min. Velocity

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.01030 | ft/ft |
| Diameter | 0.67 | ft |
| Discharge | 0.0556 | ft³/s |

## Results

| | | |
|---|---|---|
| Normal Depth | 0.089 | ft |
| Flow Area | 0.03 | ft² |
| Wetted Perimeter | 0.50 | ft |
| Hydraulic Radius | 0.056 | ft |
| Top Width | 0.45 | ft |
| Critical Depth | 0.11 | ft |
| Percent Full | 13.4 | % |
| Critical Slope | 0.00495 | ft/ft |
| Velocity | 2.00 | ft/s |
| Velocity Head | 0.06 | ft |
| Specific Energy | 0.15 | ft |
| Froude Number | 1.42 | |
| Maximum Discharge | 1.56 | ft³/s |
| Discharge Full | 1.4493 | ft³/s |
| Slope Full | 0.00002 | ft/ft |
| Flow Type | SuperCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.000 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.000 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 13.38 | % |
| Downstream Velocity | Infinity | ft/s |

# PDF - D.P. 2 Slope for Min. Velocity

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.00455 | ft/ft |
| Diameter | 0.67 | ft |
| Discharge | 0.1480 | $ft^3/s$ |

## Results

| | | |
|---|---|---|
| Normal Depth | 0.177 | ft |
| Flow Area | 0.07 | $ft^2$ |
| Wetted Perimeter | 0.72 | ft |
| Hydraulic Radius | 0.103 | ft |
| Top Width | 0.59 | ft |
| Critical Depth | 0.18 | ft |
| Percent Full | 26.5 | % |
| Critical Slope | 0.00462 | ft/ft |
| Velocity | 2.00 | ft/s |
| Velocity Head | 0.06 | ft |
| Specific Energy | 0.24 | ft |
| Froude Number | 0.99 | |
| Maximum Discharge | 1.04 | $ft^3/s$ |
| Discharge Full | 0.9633 | $ft^3/s$ |
| Slope Full | 0.00011 | ft/ft |
| Flow Type | SubCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.000 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.000 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 26.49 | % |
| Downstream Velocity | Infinity | ft/s |

# PDF - Pad B Design

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.01200 | ft/ft |
| Diameter | 0.67 | ft |
| Discharge | 0.0497 | ft³/s |

## Results

| | | |
|---|---|---|
| Normal Depth | 0.081 | ft |
| Flow Area | 0.02 | ft² |
| Wetted Perimeter | 0.48 | ft |
| Hydraulic Radius | 0.051 | ft |
| Top Width | 0.44 | ft |
| Critical Depth | 0.10 | ft |
| Percent Full | 12.1 | % |
| Critical Slope | 0.00495 | ft/ft |
| Velocity | 2.04 | ft/s |
| Velocity Head | 0.06 | ft |
| Specific Energy | 0.15 | ft |
| Froude Number | 1.53 | |
| Maximum Discharge | 1.71 | ft³/s |
| Discharge Full | 1.5853 | ft³/s |
| Slope Full | 0.00001 | ft/ft |
| Flow Type | SuperCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.000 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.000 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 12.12 | % |
| Downstream Velocity | Infinity | ft/s |

# PDF - D.P. 1 Design

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.01200 | ft/ft |
| Diameter | 0.67 | ft |
| Discharge | 0.0556 | ft³/s |

## Results

| | | |
|---|---|---|
| Normal Depth | 0.086 | ft |
| Flow Area | 0.03 | ft² |
| Wetted Perimeter | 0.49 | ft |
| Hydraulic Radius | 0.054 | ft |
| Top Width | 0.45 | ft |
| Critical Depth | 0.11 | ft |
| Percent Full | 12.8 | % |
| Critical Slope | 0.00490 | ft/ft |
| Velocity | 2.11 | ft/s |
| Velocity Head | 0.07 | ft |
| Specific Energy | 0.15 | ft |
| Froude Number | 1.53 | |
| Maximum Discharge | 1.71 | ft³/s |
| Discharge Full | 1.5853 | ft³/s |
| Slope Full | 0.00001 | ft/ft |
| Flow Type | SuperCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.000 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.000 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 12.81 | % |
| Downstream Velocity | Infinity | ft/s |

# PDF - D.P. 2 Design

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.01200 | ft/ft |
| Diameter | 0.67 | ft |
| Discharge | 0.1480 | $ft^3/s$ |

## Results

| | | |
|---|---|---|
| Normal Depth | 0.138 | ft |
| Flow Area | 0.05 | $ft^2$ |
| Wetted Perimeter | 0.63 | ft |
| Hydraulic Radius | 0.083 | ft |
| Top Width | 0.54 | ft |
| Critical Depth | 0.18 | ft |
| Percent Full | 20.6 | % |
| Critical Slope | 0.00458 | ft/ft |
| Velocity | 2.82 | ft/s |
| Velocity Head | 0.12 | ft |
| Specific Energy | 0.26 | ft |
| Froude Number | 1.60 | |
| Maximum Discharge | 1.71 | $ft^3/s$ |
| Discharge Full | 1.5853 | $ft^3/s$ |
| Slope Full | 0.00010 | ft/ft |
| Flow Type | SuperCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.000 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.000 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 20.64 | % |
| Downstream Velocity | Infinity | ft/s |

# PDF - D.P. 2 Design

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.02420 | ft/ft |
| Diameter | 0.67 | ft |
| Discharge | 0.1480 | $ft^3/s$ |

## Results

| | | |
|---|---|---|
| Normal Depth | 0.116 | ft |
| Flow Area | 0.04 | $ft^2$ |
| Wetted Perimeter | 0.58 | ft |
| Hydraulic Radius | 0.071 | ft |
| Top Width | 0.51 | ft |
| Critical Depth | 0.18 | ft |
| Percent Full | 17.4 | % |
| Critical Slope | 0.00461 | ft/ft |
| Velocity | 3.61 | ft/s |
| Velocity Head | 0.20 | ft |
| Specific Energy | 0.32 | ft |
| Froude Number | 2.24 | |
| Maximum Discharge | 2.42 | $ft^3/s$ |
| Discharge Full | 2.2513 | $ft^3/s$ |
| Slope Full | 0.00010 | ft/ft |
| Flow Type | SuperCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.000 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.000 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 17.37 | % |
| Downstream Velocity | Infinity | ft/s |

# ADF - Pad B Design

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.01200 | ft/ft |
| Diameter | 0.67 | ft |
| Discharge | 0.0097 | $ft^3/s$ |

## Results

| | | |
|---|---|---|
| Normal Depth | 0.038 | ft |
| Flow Area | 0.01 | $ft^2$ |
| Wetted Perimeter | 0.32 | ft |
| Hydraulic Radius | 0.024 | ft |
| Top Width | 0.31 | ft |
| Critical Depth | 0.04 | ft |
| Percent Full | 5.6 | % |
| Critical Slope | 0.00609 | ft/ft |
| Velocity | 1.24 | ft/s |
| Velocity Head | 0.02 | ft |
| Specific Energy | 0.06 | ft |
| Froude Number | 1.37 | |
| Maximum Discharge | 1.71 | $ft^3/s$ |
| Discharge Full | 1.5853 | $ft^3/s$ |
| Slope Full | 0.00000 | ft/ft |
| Flow Type | SuperCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.000 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.000 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 5.61 | % |
| Downstream Velocity | Infinity | ft/s |

# ADF - D.P. 1 Design

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.01200 | ft/ft |
| Diameter | 0.67 | ft |
| Discharge | 0.0109 | ft³/s |

## Results

| | | |
|---|---|---|
| Normal Depth | 0.040 | ft |
| Flow Area | 0.01 | ft² |
| Wetted Perimeter | 0.33 | ft |
| Hydraulic Radius | 0.026 | ft |
| Top Width | 0.32 | ft |
| Critical Depth | 0.05 | ft |
| Percent Full | 5.9 | % |
| Critical Slope | 0.00590 | ft/ft |
| Velocity | 1.28 | ft/s |
| Velocity Head | 0.03 | ft |
| Specific Energy | 0.07 | ft |
| Froude Number | 1.38 | |
| Maximum Discharge | 1.71 | ft³/s |
| Discharge Full | 1.5853 | ft³/s |
| Slope Full | 0.00000 | ft/ft |
| Flow Type | SuperCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.000 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.000 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 5.94 | % |
| Downstream Velocity | Infinity | ft/s |

# ADF - D.P. 2 Design

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.01200 | ft/ft |
| Diameter | 0.67 | ft |
| Discharge | 0.0290 | ft³/s |

## Results

| | | |
|---|---|---|
| Normal Depth | 0.063 | ft |
| Flow Area | 0.02 | ft² |
| Wetted Perimeter | 0.42 | ft |
| Hydraulic Radius | 0.040 | ft |
| Top Width | 0.39 | ft |
| Critical Depth | 0.08 | ft |
| Percent Full | 9.4 | % |
| Critical Slope | 0.00524 | ft/ft |
| Velocity | 1.74 | ft/s |
| Velocity Head | 0.05 | ft |
| Specific Energy | 0.11 | ft |
| Froude Number | 1.48 | |
| Maximum Discharge | 1.71 | ft³/s |
| Discharge Full | 1.5853 | ft³/s |
| Slope Full | 0.00000 | ft/ft |
| Flow Type | SuperCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.000 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.000 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 9.38 | % |
| Downstream Velocity | Infinity | ft/s |

# ADF - D.P. 2 Design

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.02420 | ft/ft |
| Diameter | 0.67 | ft |
| Discharge | 0.0290 | $ft^3/s$ |

## Results

| | | |
|---|---|---|
| Normal Depth | 0.053 | ft |
| Flow Area | 0.01 | $ft^2$ |
| Wetted Perimeter | 0.38 | ft |
| Hydraulic Radius | 0.034 | ft |
| Top Width | 0.36 | ft |
| Critical Depth | 0.08 | ft |
| Percent Full | 7.9 | % |
| Critical Slope | 0.00518 | ft/ft |
| Velocity | 2.23 | ft/s |
| Velocity Head | 0.08 | ft |
| Specific Energy | 0.13 | ft |
| Froude Number | 2.07 | |
| Maximum Discharge | 2.42 | $ft^3/s$ |
| Discharge Full | 2.2513 | $ft^3/s$ |
| Slope Full | 0.00000 | ft/ft |
| Flow Type | SuperCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.000 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.000 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 7.92 | % |
| Downstream Velocity | Infinity | ft/s |

# 8"PVC Capy

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Discharge |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.01200 | ft/ft |
| Normal Depth | 0.670 | ft |
| Diameter | 0.67 | ft |

## Results

| | | |
|---|---|---|
| Discharge | 1.5853 | $ft^3/s$ |
| Flow Area | 0.35 | $ft^2$ |
| Wetted Perimeter | 2.10 | ft |
| Hydraulic Radius | 0.168 | ft |
| Top Width | 0.00 | ft |
| Critical Depth | 0.59 | ft |
| Percent Full | 100.0 | % |
| Critical Slope | 0.01090 | ft/ft |
| Velocity | 4.50 | ft/s |
| Velocity Head | 0.31 | ft |
| Specific Energy | 0.98 | ft |
| Froude Number | 0.00 | |
| Maximum Discharge | 1.71 | $ft^3/s$ |
| Discharge Full | 1.5853 | $ft^3/s$ |
| Slope Full | 0.01200 | ft/ft |
| Flow Type | SubCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.000 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.000 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 100.00 | % |
| Downstream Velocity | Infinity | ft/s |

# 8"PVC Capy

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Discharge |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.02420 | ft/ft |
| Normal Depth | 0.670 | ft |
| Diameter | 0.67 | ft |

## Results

| | | |
|---|---|---|
| Discharge | 2.2513 | $ft^3/s$ |
| Flow Area | 0.35 | $ft^2$ |
| Wetted Perimeter | 2.10 | ft |
| Hydraulic Radius | 0.168 | ft |
| Top Width | 0.00 | ft |
| Critical Depth | 0.64 | ft |
| Percent Full | 100.0 | % |
| Critical Slope | 0.02106 | ft/ft |
| Velocity | 6.39 | ft/s |
| Velocity Head | 0.63 | ft |
| Specific Energy | 1.30 | ft |
| Froude Number | 0.00 | |
| Maximum Discharge | 2.42 | $ft^3/s$ |
| Discharge Full | 2.2513 | $ft^3/s$ |
| Slope Full | 0.02420 | ft/ft |
| Flow Type | SubCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.000 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.000 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 100.00 | % |
| Downstream Velocity | Infinity | ft/s |

# 8"PVC - AsBuilt

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.00720 | ft/ft |
| Diameter | 0.67 | ft |
| Discharge | 1.21 | $ft^3/s$ |

## Results

| | | |
|---|---|---|
| Normal Depth | 0.54 | ft |
| Flow Area | 0.30 | $ft^2$ |
| Wetted Perimeter | 1.49 | ft |
| Hydraulic Radius | 0.20 | ft |
| Top Width | 0.53 | ft |
| Critical Depth | 0.52 | ft |
| Percent Full | 80.7 | % |
| Critical Slope | 0.00777 | ft/ft |
| Velocity | 3.97 | ft/s |
| Velocity Head | 0.24 | ft |
| Specific Energy | 0.79 | ft |
| Froude Number | 0.92 | |
| Maximum Discharge | 1.32 | $ft^3/s$ |
| Discharge Full | 1.23 | $ft^3/s$ |
| Slope Full | 0.00699 | ft/ft |
| Flow Type | SubCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.00 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.00 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 80.67 | % |
| Downstream Velocity | Infinity | ft/s |

# 8"PVC - Design

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.00720 | ft/ft |
| Diameter | 0.67 | ft |
| Discharge | 1.2900 | $ft^3/s$ |

## Results

| | | |
|---|---|---|
| Normal Depth | 0.599 | ft |
| Flow Area | 0.33 | $ft^2$ |
| Wetted Perimeter | 1.66 | ft |
| Hydraulic Radius | 0.199 | ft |
| Top Width | 0.40 | ft |
| Critical Depth | 0.54 | ft |
| Percent Full | 89.8 | % |
| Critical Slope | 0.00844 | ft/ft |
| Velocity | 3.91 | ft/s |
| Velocity Head | 0.24 | ft |
| Specific Energy | 0.84 | ft |
| Froude Number | 0.76 | |
| Maximum Discharge | 1.30 | $ft^3/s$ |
| Discharge Full | 1.2117 | $ft^3/s$ |
| Slope Full | 0.00816 | ft/ft |
| Flow Type | SubCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.000 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.000 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 89.79 | % |
| Downstream Velocity | Infinity | ft/s |

# 10"PVC - AsBuilt

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.01930 | ft/ft |
| Diameter | 0.83 | ft |
| Discharge | 1.21 | $ft^3/s$ |

## Results

| | | |
|---|---|---|
| Normal Depth | 0.33 | ft |
| Flow Area | 0.20 | $ft^2$ |
| Wetted Perimeter | 1.14 | ft |
| Hydraulic Radius | 0.18 | ft |
| Top Width | 0.82 | ft |
| Critical Depth | 0.49 | ft |
| Percent Full | 40.0 | % |
| Critical Slope | 0.00512 | ft/ft |
| Velocity | 5.94 | ft/s |
| Velocity Head | 0.55 | ft |
| Specific Energy | 0.88 | ft |
| Froude Number | 2.10 | |
| Maximum Discharge | 3.87 | $ft^3/s$ |
| Discharge Full | 3.59 | $ft^3/s$ |
| Slope Full | 0.00219 | ft/ft |
| Flow Type | SuperCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.00 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.00 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 40.00 | % |
| Downstream Velocity | Infinity | ft/s |

# 10"PVC - Design

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.011 | |
| Channel Slope | 0.01930 | ft/ft |
| Diameter | 0.83 | ft |
| Discharge | 1.2900 | ft³/s |

## Results

| | | |
|---|---|---|
| Normal Depth | 0.345 | ft |
| Flow Area | 0.21 | ft² |
| Wetted Perimeter | 1.16 | ft |
| Hydraulic Radius | 0.183 | ft |
| Top Width | 0.82 | ft |
| Critical Depth | 0.51 | ft |
| Percent Full | 41.4 | % |
| Critical Slope | 0.00525 | ft/ft |
| Velocity | 6.05 | ft/s |
| Velocity Head | 0.57 | ft |
| Specific Energy | 0.91 | ft |
| Froude Number | 2.10 | |
| Maximum Discharge | 3.87 | ft³/s |
| Discharge Full | 3.5970 | ft³/s |
| Slope Full | 0.00248 | ft/ft |
| Flow Type | SuperCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.000 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.000 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 41.37 | % |
| Downstream Velocity | Infinity | ft/s |

# APPENDIX H – WASTEWATER MAPS AND PLANS

# 1st Amendment to the FINAL WATER AND SANITARY SEWER SYSTEM STUDY

**FOR**

## *CASTLE PINES COMMERCIAL PD*
## *CASTLE ROCK, COLORADO*

(Filing 12: PWP 05-004)
(Filing 10A: PWP 03-108)

PREPARED FOR
DEV-VIC LLC
March 14, 2006
**Revised: September 9, 2006**

BY:
TST INC. OF DENVER, CONSULTING ENGINEERS
9222 TEDDY LANE
LONE TREE, COLORADO 80124

PROJECT NO. 771-039/040

TST

## INTRODUCTION

A previous report entitled Water and Sanitary Sewer System Study, dated November, 1994, was prepared for the overall Castle Pines Commercial PD. Several updates have been prepared to reflect the parcels being developed. This report updates the previous reports and specifically analyzes the requirements for potable water and sanitary sewer lines within Parcels 7 & 16 (Castle Pines Commercial Filing 12) and Parcels 12 and 15 (Castle Pines Commercial Filing 10A). From this analysis, line sizes for the mains are recommended. In making this analysis, representatives of Dev-Vic Ltd. Liability Co. and others were consulted to determine their opinion of the planned build-out density of the development. The densities and uses in this report were primarily based on their opinion of the most intense usage of the property. A copy of the most recent PD has been included in Appendix F.

## LOCATION

The Castle Pines Commercial PD ("PD") lies between Interstate 25 and U.S. Highway 85, primarily on the north side of Meadows Parkway, approximately two miles north of Castle Rock. Parcel 7 and 16, which is west of Atrium Drive, is planned for the development of commercial, office and retail uses. Parcel 12 and 15, which is north of Meadows Parkway, is planned for commercial, office and retail uses. There is currently development either complete or in progress on several other parcels, including the Castle Rock Factory Shops, Castlegate apartments and two other mixed use parcels within the PD. The general location is shown on Figure 1 located in Appendix A.

## WATER SYSTEM ANALYSIS

This analysis of the proposed water distribution system was conducted using the CyberNet network analysis software. The PD distribution system is tied to the Town of Castle Rock system in two locations. The first is the 16-inch line in Meadows Parkway in the Yellow pressure Zone, which is the furthest eastern extent of the Meadows system. For the purposes of this analysis, the Meadows system is assumed to be able to supply flows at 98 PSI at the east side of the Plum Creek bridge on Meadows Parkway, per the *Water and Sanitary Sewer System Study for Castle Pines Commercial P.D.* dated June, 1994 by TST Inc. of Denver. The second source of supply is a tie to the Town's Yellow Zone system through a 16" line in West Castleton Road. The maximum hydraulic grade of the Yellow Zone is 6349'. The hydraulic grade used in this model is 6040 feet. This hydraulic grade was provided by the Town of Castle Rock engineering department for use in the report. Both Filing 10A and Filing 12 can be served by the Yellow Zone at the elevations shown on the construction plans.

The previous looped system of lines within the PD was updated to reflect the actual site layout for this model. The conditions for average day flows, max day flows and peak hour flows were reviewed, along with the available fire flows at max day flow, and the systems for Parcels 7, 12, 15 and 16 were sized based upon these results. Printouts of the results of the

volume available.

## SANITARY SEWER SYSTEM ANALYSIS

Analysis of the proposed sanitary sewer system was conducted using the wastewater flow rates by land use defined by the Town of Castle Rock Regulation 15.3.1. A peaking factor was calculated based on the formula from the City and County of Denver of PF=3.79 x [(average flow in cfs)$^{-0.168}$], with a maximum of PF=5. This peaking factor converts average day flows to peak rates. These flows were then aggregated in the appropriate lines and the pipes were checked using Manning's equation. A Manning's "n" of 0.011 was used per the Town of Castle Rock's criteria, assuming that PVC pipe would be installed.

**Table 3.1-Wastewater Flow Rates by Land Use**

| Land Use | Demand Rate | Equivalent |
|---|---|---|
| Residential-Single Family (RSF) | 200 GPD/DU | 1 SFE/du |
| Residential-Multi Family (RSF) | 130 GPD/DU | 0.65 SFE/du |
| Commercial (COM) | 600 GPAD | 3 SFE/ac |
| Industrial (IND) | 600 GPAD | 3 SFE/ac |
| Institutional (INS) | 400 GPAD | 2 SFE/ac |
| Churches | 300 PGD/CHU | 1.5 SFE/chu |
| School-Elementary | 9,376 GPD/School | 115 SFE/school |
| School-Junior/Senior High | 37,400 GPD/School | 187 SFE/school |

Off-site wastewater flows from Silver Heights are routed through the sanitary sewer lines in the PD via Line "A-8", east of the existing Castle Rock Factory Shops. Capacity for up to 600 dwelling units has been included in the calculations for this flow. A table, including the sanitary sewer assumptions, and calculations related to use, density, and flow for the PD, is included as Appendix D.

From this analysis, pipes were sized and the minimum slope necessary to carry the capacity was determined, except in the areas where existing lines are in place. In these locations the actual minimum slope was used to calculate capacity of the lines. A printout of this analysis is included in Appendix D. From the analysis of the sanitary system, it was determined that the flows from Silver Heights in the Town's existing line exceed the line capacity based on calculation methods required by the Town of Castle Rock. This is public sanitary sewer line owned and maintained by the Town of Castle Rock. It is recommended that this area be further evaluated by the Town through the Capital Improvements Projects. The schematic layout of the sanitary sewer system is located in the pocket at the back of this report. The system will connect to the East Plum Creek Interceptor at two locations (A-1 and B-1).

For purposes of this analysis, a minimum velocity of 2 ft/sec at peak design flow was used. Final design of the lines should confirm that maximum velocities do not exceed 10 ft/sec. Analysis of the minimum design slope (s=0.54%) within Filing 12 indicated a velocity of 1.83 ft/sec. This is a result of minimal flow entering at the dead end of the sanitary sewer

main. This main serves one lot and has a manhole at the upstream end for maintenance purposes. All other flows exceed the minimum velocity of 2 ft/sec.

Based on the results of the analysis and the calculations shown in Appendix D, a system of 8-inch and 10-inch pipes will be sufficient with a minimum slope of 0.40%.

At full buildout of the Castle Pines Commercial PD, an additional 3.49 cfs (1,567 gpm) will be conveyed to the existing 27" interceptor running parallel to State Highway 85. The restricting slope of the existing 27" interceptor is 300 feet north of Castlegate Drive North at s=0.10%, yielding a capacity of 12.45 cfs (5,587 gpm). Peak flows entering the 27" interceptor upstream of the Castle Pines Commercial PD are 4.38 cfs (1,966 gpm). With the additional 3.49 cfs at full buildout including the development of Parcels 7, 12, 15, and 16, the capacity in the existing 27" interceptor is 63%.

## CONCLUSION

The development of Filing 10A and 12 within the Castle Pines Commercial PD complies with all requirements and standards within the Town of Castle Rock Public Works Regulations, revised February 1999, the *Wastewater and Reclaimed Water Master Plans*, dated December 2003 and the *2000 Water Facilities Master Plan*. This report uses standards required by Town regulations and implements these factors to a design that will provide services to the planned development without any further upgrades to the existing system, using nonrenewable groundwater as established within the Castle Pines Commercial water rights and removing the wastewater in a safe and economical manner.

The analysis included in this report indicates that the Castle Pines Commercial PD as currently planned, and more specifically Parcel 7, 12, 15 and 16, and can be adequately serviced with both potable water and sanitary sewer. Layout of the existing mainline system to accomplish this service is shown on the system schematic in the pocket at the end of this report. As further parcels are developed, they should be linked to the mainlines in conformance with this plan and similar amendments to this report should be developed. Additional data and reports shall be necessary as development plans for Parcel 7, 12, 15 and 16 are firmly identified for the remaining lots.

# APPENDIX D

# WASTEWATER FLOWS

## CASTLE PINES COMMERCIAL PD
## SANITARY SEWER ANALYSIS

| BASIN | LINE NO. | PLAN AREA | ASSUMED OCCUPANCY | ACRES/ DU | GPD/ ACRE | SFE | AVG FLOW (gpd) | Peak Factor | PEAK FLOW | CUM AVG FLOW | Peak Factor | CUM. FLOW IN LINE | LINE SIZE (in.) | MIN. PIPE SLOPE (%) | LINE CAPAC. (gpd) | Velocity at Peak Design Flow (fps) | % Design Peak Flow/Max Capacity | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | | | | | | | | | | | | | | | | | | |
| | A-9 | 5 | RETAIL | 22.11 | 600 | 66 | 13,266 | 5.000 | 66,330 | | | | | | | | | |
| | | | | | | | | | | 13,266 | 5.000 | 66,330 | 8 | 0.40% | 583,443 | 1.82 | 11.4% | |
| | A-8 | S.Hts. | RESIDENTIAL | 600 | 200 | 600 | 120,000 | 5.000 | 600,000 | | | | | | | | | |
| | | | | | | | | | | 133,266 | 4.941 | 658,500 | 8 | 0.40% | 583,443 | 3.25 | 112.9% | 4 |
| | A-7 | 3/4 of 10 | RETAIL | 47.25 | 600 | 142 | 28,350 | 5.000 | 141,750 | | | | | | | | | |
| | | | | | | | | | | 161,616 | 4.784 | 773,122 | 8 | 0.72% | 782,771 | 3.25 | 98.8% | 4 |
| | A-6 | 1/4 of 10 | RETAIL | 15.75 | 600 | 47 | 9,450 | 5.000 | 47,250 | | | | | | | | | |
| | | 13 | COMMERCIAL | 9.00 | 600 | 27 | 5,400 | 5.000 | 27,000 | | | | | | | | | |
| | | | | | | | | | | 14,850 | 5.000 | 74,250 | 8 | 0.40% | 583,443 | 1.87 | 12.7% | |
| | A-4 | 1/2 of 12 | MIXED USE | 20.15 | 600 | 60 | 12,090 | 5.000 | 60,450 | | | | | | | | | |
| | | 15 | COMMERCIAL | 4.00 | 600 | 12 | 2,400 | 5.000 | 12,000 | | | | | | | | | |
| | | | | | | | | | | 14,490 | 5.000 | 72,450 | 8 | 0.40% | 583,443 | 1.87 | 12.4% | |
| | A-2 | 1/2 of 12 | MIXED USE | 20.15 | 600 | 60 | 12,090 | 5.000 | 60,450 | | | | | | | | | |
| | | | | | | | | | | 12,090 | 5.000 | 60,450 | 8 | 0.40% | 583,443 | 1.77 | 10.4% | |
| | A-1 | A-5 | A-6 & A-7 | | | | | | | 176,466 | 4.714 | 831,785 | 10 | 1.00% | 1,672,735 | 3.59 | 49.7% | |
| | | A-3 | A-4 & A-5 | | | | | | | 190,956 | 4.651 | 888,230 | 10 | 1.00% | 1,672,735 | 3.63 | 53.1% | |
| | | A-1 | A-2 & A-3 | | | | | | | 203,046 | 4.604 | 934,776 | 10 | 1.00% | 1,672,735 | 3.67 | 55.9% | |
| B | | | | | | | | | | | | | | | | | | |
| | B-7 | 4 & 5 | RETAIL | 39.90 | 600 | 120 | 23,940 | 5.000 | 119,700 | | | | | | | | | |
| | | | | | | | | | | 23,940 | 5.000 | 119,700 | 8 | 0.40% | 583,443 | 2.16 | 20.5% | |
| | B-6 | 6 | RETAIL | 23.90 | 600 | 72 | 14,340 | 5.000 | 71,700 | | | | | | | | | |
| | | | | | | | | | | 14,340 | 5.000 | 71,700 | 8 | 0.40% | 583,443 | 1.87 | 12.3% | |
| | B-5 | | B-6 & B-7 | | | | | | | | | | | | | | | |
| | | | | | | | | | | 38,280 | 5.000 | 191,400 | 8 | 0.40% | 583,443 | 2.49 | 32.8% | |
| | B-4 | 9 | RETAIL | 15.80 | 600 | 47 | 9,480 | 5.000 | 47,400 | | | | | | | | | |
| | | | | | | | | | | 9,480 | 5.000 | 47,400 | 8 | 0.40% | 583,443 | 1.64 | 8.1% | |
| | B-3 | | B-4 & B-5 | | | | | | | | | | | | | | | |
| | | | | | | | | | | 47,760 | 5.000 | 238,800 | 8 | 0.40% | 583,443 | 2.64 | 40.9% | |
| | B-2 | 7 & 16 | RETAIL | 15.80 | 600 | 47 | 9,480 | 5.000 | 47,400 | | | | | | | | | |
| | | | | | | | | | | 9,480 | 5.000 | 47,400 | 8 | 0.40% | 583,443 | 1.64 | 8.1% | |
| | B-1 | | B-2 & B-3 | | | | | | | | | | | | | | | |
| | | | | | | | | | | 57,240 | 5.000 | 286,200 | 8 | 0.40% | 583,443 | 2.76 | 49.1% | |

NOTES:

1 All pipe material existing is PVC.
2 All proposed sanitary sewer shall be PVC per the Town of Castle Rock requirements.
3 Manning's "n" Value: 0.011 for PVC
4 Existing upstream pipes-See explanation on Page 5.
5 See next sheet for Filing 12 Specific pipe slopes

## CASTLE PINES COMMERCIAL PD
## FILING 12-SANITARY SEWER ANALYSIS

| BASIN | LINE NO. | PLAN AREA | Upstream Manhole Number | Downstream Manhole Number | ASSUMED OCCUPANCY | ACRES/ DU | GPD/ ACRE | SFE | AVG FLOW (gpd) | Peak Factor | PEAK FLOW | CUM AVG FLOW | Peak Factor | CUM. FLOW IN LINE | LINE SIZE (in.) | MIN. PIPE SLOPE (%) | LINE CAPAC. (gpd) | Velocity at Peak Design Flow (fps) | % Design Peak Flow/Max Capacity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B | | | | | | | | | | | | | | | | | | | |
| | B-7 | 4 & 5 | | | RETAIL | 39.90 | 600 | 120 | 23,940 | 5.000 | 119,700 | | | | | | | | |
| | | | | | | | | | | | | 23,940 | 5.000 | 119,700 | 8 | 0.40% | 583,443 | 2.16 | 20.5% |
| | B-6 | 6 | | | RETAIL | 23.90 | 600 | 72 | 14,340 | 5.000 | 71,700 | | | | | | | | |
| | | | | | | | | | | | | 14,340 | 5.000 | 71,700 | 8 | 0.40% | 583,443 | 1.87 | 12.3% |
| | B-5 | | | | B-6 & B-7 | | | | | | | | | | | | | | |
| | | | | | | | | | | | | 38,280 | 5.000 | 191,400 | 8 | 0.40% | 583,443 | 2.49 | 32.8% |
| | B-4 | 9 | | | RETAIL | 15.80 | 600 | 47 | 9,480 | 5.000 | 47,400 | | | | | | | | |
| | | | | | | | | | | | | 9,480 | 5.000 | 47,400 | 8 | 0.40% | 583,443 | 1.64 | 8.1% |
| | B-3 | | SS-MH-B-6 | SS-MH-5 | B-4 & B-5 | | | | | | | | | | | | | | |
| | | | | | | | | | | | | 47,760 | 5.000 | 238,800 | 8 | 2.00% | 1,304,618 | 2.64 | 18.3% |
| | B-2 | 7 & 16 | SS-MH-8 | SS-MH-7 | RETAIL | 15.80 | 600 | 47 | 9,480 | 5.000 | 47,400 | | | | | | | | |
| | | | | | | | | | | | | 9,480 | 5.000 | 47,400 | 8 | 0.54% | 677,899 | 1.64 | 7.0% |
| | B-1 | | SS-MH-2 | EX-SS-MH-1 | B-2 & B-3 | | | | | | | | | | | | | | |
| | | | | | | | | | | | | 57,240 | 5.000 | 286,200 | 8 | 0.93% | 889,631 | 2.76 | 32.2% |

NOTES:

1 All pipe material existing is PVC.
2 All proposed sanitary sewer shall be PVC per the Town of Castle Rock requirements.
3 Manning's "n" Value: 0.011 for PVC

# APPENDIX F

# MAPS/PLANS

LEGEND

SEWER LINE
PARCEL NO. (1)
SEWER SEGMENT A-1-1
BASIN BOUNDARY
DESIGN POINT (1)

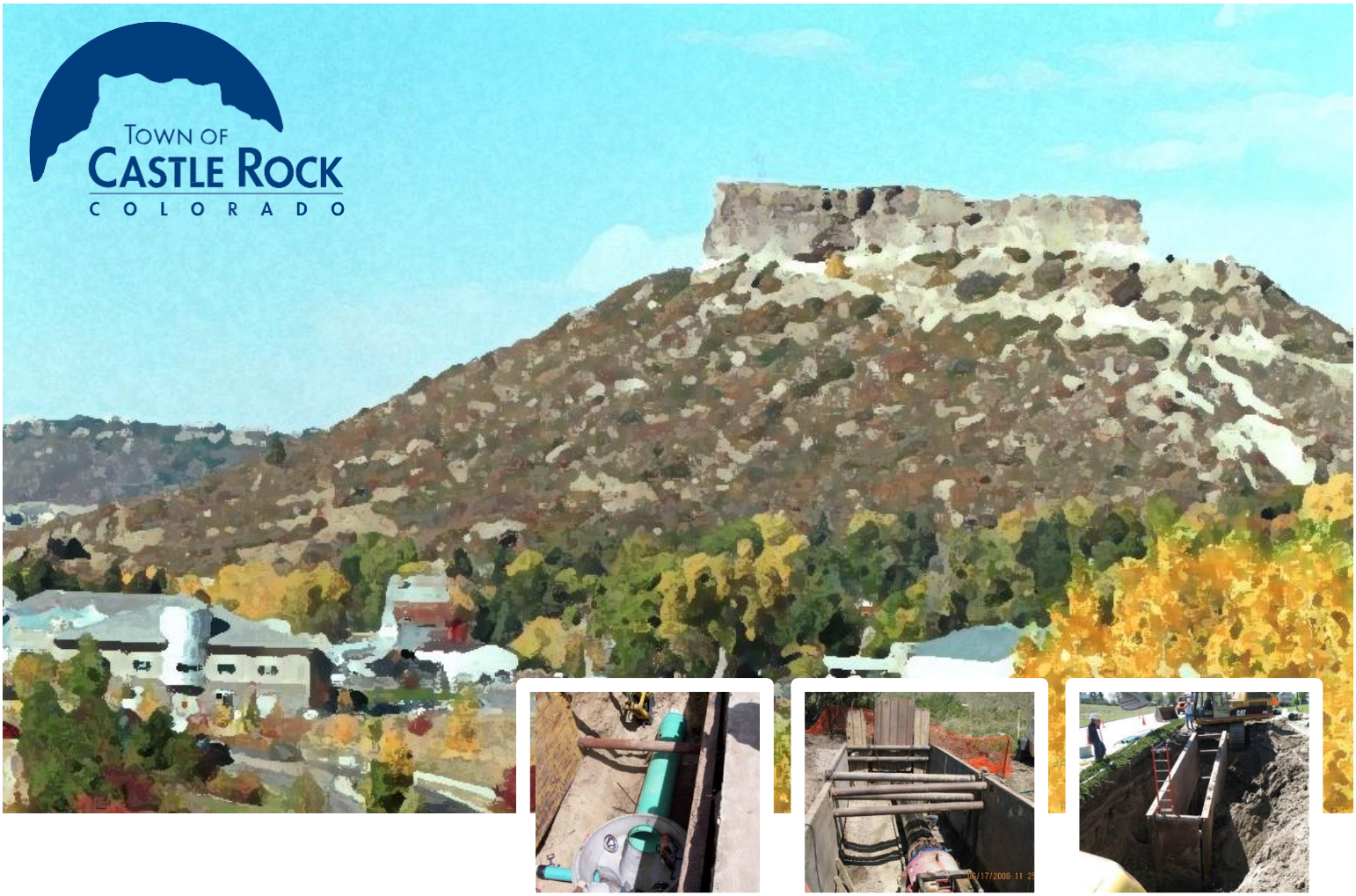
REVISIONS
Description | Date | By

DESIGNED TCG
CHECKED
VIEW BASE
FILE SEWER-OVERALL

# DEV-VIC LLC
# CASTLE PINES COMMERCIAL PD
## SANITARY SEWER MAP

TST
TST INC. OF DENVER
Consulting Engineers

JOB NO. 771-039
SCALE 1"=250'
DATE SEPTEMBER 9, 2006
SHEETS 1
SHEET 1



TOWN OF CASTLE ROCK

# Wastewater Collection Design

## 2018 CRITERIA MANUAL

**Published by the Town of Castle Rock, 100 N. Wilcox St., Castle Rock, CO 80104**
**December 4, 2018**

#### 4.4.1.1 Wastewater System Average Daily Flow (ADF)

| Land Use | Typical ADF/Unit | Typical SFEs/Unit |
|---|---|---|
| **Single Family Residential and Duplexes** | **200 gpd/dwelling unit** | **1.00/dwelling unit** |
| **Multi-Family Residential (Townhomes and Condos)** | **130 gpd/dwelling unit** | **0.65/dwelling unit** |
| **Retail/Offices** | **0.1 gpd/SF** | **0.0005/SF** |
| **Hotels/Motels** | **75 gpd/room** | **0.375/room** |
| **Restaurants** | **1.5 gpd/SF** | **0.0075/SF** |
| **Car Washes** | **5,000 gpd/acre** | **25.0/acre** |
| **Industrial/Other Commercial** | **600 gpd/acre** | **3.0/acre** |
| **Institutional** | **400 gpd/acre** | **2.0/acre** |
| **Churches** | **300 gpd/church** | **1.5/church** |
| **Gym/Fitness Center** | **0.5 gpd/SF** | **0.00125 SFE/SF** |
| **Irrigated Land** | **0 gpd/acre** | **0.0/acre** |
| **Rates for Typical Douglas County School Sizes:** | | |
| **Elementary (10 ac, 675 Students)** | **3,375 gpd/school** | **16.88/school** |
| **Middle (25 ac, 850 students)** | **8,500 gpd/school** | **42.50/school** |
| **High (50 ac, 1700 students)** | **17,000 gpd/school** | **85.00/school** |
| **Rates for Alternate School Sizes:** | | |
| **Elementary** | **5 gpd/student** | **0.025/student** |
| **Middle** | **10 gpd/student** | **0.050/student** |
| **High** | **10 gpd/student** | **0.050/student** |

The demands noted in the table above represent the “winter time” or “dry weather” Average Daily Flow (ADF) with no allowance for infiltration and inflow (I/I). I/I shall be accounted for in accordance with the Peak Design Flow computation discussed in the sections to follow.

Regarding design flows for schools, planned school sizes shall be confirmed with the Douglas County School District and documented in the Utility Report. The tabulated rates

shown above shall be applied as appropriate, depending on the information provided by the School District. Reasonable engineering judgment shall be used in determining the estimated ADF for commercial, industrial and institutional sites. Individual evaluation and justification shall be provided when the proposed use is not specifically represented in the table above, or when the proposed flows will be inconsistent with the tabulated values. Justification of all non-residential flows shall be addressed in the Utility Report.

#### 4.4.1.2 Peaking Factor

The portion of the Peak Design Flow calculation exclusive of I/I shall be determined by multiplying the ADF in the preceding section by a peaking factor (PF). The PF is a function of ADF, and shall be computed as follows: $PF = 3.65 \times [(ADF)^{-0.168}]$.

The maximum PF shall be 5.0, and ADF shall be expressed in units of million gallons per day (MGD).

#### 4.4.1.3 Peak Design Flow Rate

The Peak Design Flow (PDF) shall be computed at all pertinent design points throughout the system, and used to size the corresponding wastewater facilities. The PDF shall be determined by multiplying the ADF by the calculated peaking factor (PF), plus an I/I allowance equal to ten percent of the ADF as expressed by the following formula:

PDF = peak base flow + I/I allowance = (ADF*PF) + (0.1*ADF)

Once computed, the PDF shall be used to determine the sizes of the facilities in accordance with the criteria established below.

### 4.4.2 Hydraulic Design

Wastewater systems shall be designed to provide a minimum velocity of two feet per second at the Peak Design Flow. In situations where the minimum velocity of 2.0 feet per second cannot be met, an explanation and justification shall be included in the Final Utility Report. The maximum velocity shall not exceed ten feet per second. Drop manholes shall be provided to break steep slopes to limit the velocities in conformance with this criterion. Where drop manholes are impractical for velocity reduction, the sewer must be approved by variance and shall be of PVC or other abrasion resistant material approved by Castle Rock Water.

Where actual flow will be much below normal for several years, the minimum velocity shall be achieved by suitable grades at the partial design flow rate. Care shall be taken to design invert elevations at manholes in such a manner that the energy gradient is consistently falling in the direction of the flow. Sanitary sewers shall be sized to convey the Peak Design Flow while flowing no more than 75 percent of the maximum pipe flow capacity. Computation of velocity of flow shall be based on a coefficient of roughness "n" in the Manning formula of 0.011 for PVC. At all junctions where a smaller diameter main discharges into a larger one, the invert of the larger sanitary sewer shall be lowered so that the energy gradients of the sewers at the junction are at the same level. Generally, this condition will be met by placing the 0.80 depth point of both sewers at

# CONCEPT UTILITY LETTER

FOR

# PROMENADE AT CASTLE ROCK PD

(LOTS 2, 3-A AND 4, CASLTE PINES COMMERCIAL FILING 12 & UNPLATTED LAND IN NORTHWEST CASTLE ROCK)

October 24, 2014
Revised: December 10, 2014

OWNER/DEVELOPER:
Promenade Castle Rock, LLC
5750 DTC Parkway, Suite 210
Greenwood Village, CO 80111
303-771-4004

BY:
Bowman | VISION LAND
603 Park Point Drive, Suite 100
Golden, CO 80401
303-801-2900

PROJECT NO: 020029-01-002
TOWN PROJECT NO: PDP 14-0007

Proposed Water System:

Proposed development anticipates the removal of a portion of the existing water system and addition of multiple water mains within the site. The existing water mains in Factory Shops Boulevard, Castlegate Drive West and Atrium Way will be extended and tied together into a 4-way cross at the proposed intersection, the fourth leg of the cross will run under the proposed Atrium Way extension up to its intersection with North Meadows, then down North Meadows to its intersection with Castlegate Drive North. Per Town of Castle Rock Water Standards, loops will be provided in each Planning Area and around building groups to supply adequate domestic and fire pressures, and fire hydrant coverage. Any future development of the existing water infrastructure needed to serve this site is the responsibility of the Developer. There are no proposed supply facilities required to adequately serve the development. See Appendix A for water demand calculations.

## Wastewater System:

Existing Wastewater System:

Currently there are multiple sanitary mains that run near and within the site:

- 54" & 27" PVC – Along east side of State Highway 85
- 8" PVC – New Abbey Lane – Outfall to 27" along State Highway 85
- 3 x 8" PVC – Stubs in Castlegate Drive West from the existing Castlegate Apartments (Castle Pines Commercial Filing 2, 6 and 8).
- 8" PVC – Along the north side of the Outlets at Castle Rock
- 10" PVC – New Beale Street

The 8" PVC in New Abbey Lane takes flows from the existing developed lots in Filing 12 (Primrose School and Christian Brothers Automotive), while the 8" PVC mains that end at Castlegate Drive West take contribution flows from the existing Castlegate Apartments.

Proposed Wastewater System:

Proposed development anticipates a main extension within Atrium Way from State Highway 85 to the north end of the development to serve the majority of the site (Planning Areas 1-4). Planning Area 5 will be serviced by connecting to the existing 8" main in New Abbey Lane. Planning Area 6 will be serviced by connecting into the 27" main along State Highway 85, or connect to the sewer main in Atrium Way. Planning Area 7 will tie into the sanitary stubs that exist in Castegate Drive West and then outfall through Castlegate Apartments and into the 27" main along State Highway 85. Any future development of the existing wastewater infrastructure needed to serve this site is the responsibility of the Developer. There are no proposed wastewater facilities that are anticipated for this development. See Appendix A for wastewater demand calculations.

There are 5 Design Points in the site that analyze in depth the adequacy of existing and proposed sanitary pipes. Design Points 1 and 2 analyze the flows from the proposed Planning Area 7. Design Point 3 is at the existing connection of the Filing 12 sanitary to the Interceptor along State Highway 85, and is taken at the critical slope at the connection. It currently takes flows from Primrose School and Christian Brothers Automotive, and will take flows from Planning Area 5. Design Point 4 will be a new connection at the intersection of Atrium Way and State Highway 85, and will convey flows from Planning Areas 1-4, and 6. Design Point 5 is at the lower extent of the site and receives flows from the entire site and flows from further upstream. Analysis of Design Points can be found in Appendix A in a routing table, and correspond to the Design Points in Appendix C. These show that the existing and proposed pipes on site will be able to convey lows through the site.

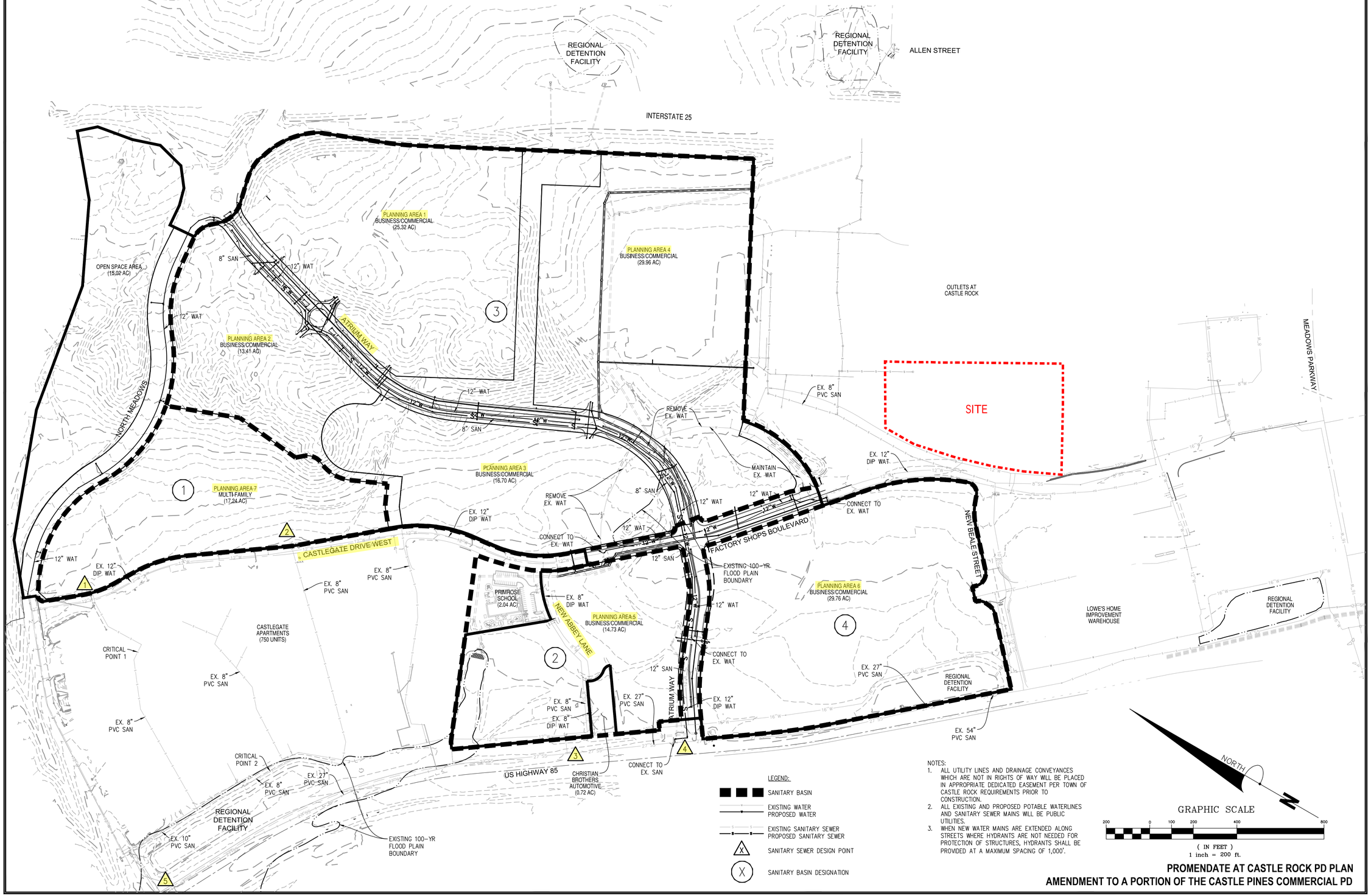
Critical Points are used to verify that existing pipes on site can convey existing and proposed flows. There are 2 Critical Points in the existing Castlegate Apartments at critical slopes downstream of proposed Planning Area 7 and the existing Castlegate Apartments. Critical slopes were determined by as-built drawings in Appendix A. Critical Point 1 passes flows from half of Planning Area 7 (180 units) and flows from 1/4 of the Castlegate Apartments (188 units). Whereas Critical Point 2 also passes flows from half of Planning Area 7 (180 units) and flows from 1/2 of the existing Castlegate Apartments (375 units). Analysis of Critical Points can be found in Appendix A, and correspond to the Critical Points in Appendix C.

Design Point 3 was estimated in the 1st Amendment to the Final Water and Sanitary Sewer System Study for Castle Pines Commercial PD from March 2007 (PD Utility Report) to convey 0.442 cfs, however, in this report it conveys 0.45 cfs. While this is larger than the planned value, it is still lower than the pipe capacity of 1.01 cfs, which results in the pipe being 44% of maximum capacity. Also, in the PD Utility Report, Design Point 5 was estimated to have a capacity of 12.45 cfs and at full buildout was estimated to convey 7.87 cfs. In this report, the full buildout flow is 6.41 cfs, and the pipe max capacity is 8.68 cfs, which results in the pipe being 74% of maximum capacity. Overall, the sanitary flows from the site will convey through the proposed and existing pipes.

**Appendix C: Planned Development Plan**

# PROMENADE AT CASTLE ROCK PD PLAN
# AMENDMENT TO A PORTION OF THE CASTLE PINES COMMERCIAL PD

**A PORTION OF SECTIONS 22 AND 27 OF TOWNSHIP 7 SOUTH, RANGE 67 WEST OF THE 6TH PRINCIPAL MERIDIAN**
**TOWN OF CASTLE ROCK, COUNTY OF DOUGLAS, STATE OF COLORADO**




NOTES:
1. ALL UTILITY LINES AND DRAINAGE CONVEYANCES WHICH ARE NOT IN RIGHTS OF WAY WILL BE PLACED IN APPROPRIATE DEDICATED EASEMENT PER TOWN OF CASTLE ROCK REQUIREMENTS PRIOR TO CONSTRUCTION.
2. ALL EXISTING AND PROPOSED POTABLE WATERLINES AND SANITARY SEWER MAINS WILL BE PUBLIC UTILITIES.
3. WHEN NEW WATER MAINS ARE EXTENDED ALONG STREETS WHERE HYDRANTS ARE NOT NEEDED FOR PROTECTION OF STRUCTURES, HYDRANTS SHALL BE PROVIDED AT A MAXIMUM SPACING OF 1,000'.

**PROMENDATE AT CASTLE ROCK PD PLAN**
**AMENDMENT TO A PORTION OF THE CASTLE PINES COMMERCIAL PD**


Galloway
Planning. Architecture. Engineering.
5300 DTC Parkway, Suite 100
Greenwood Village, CO 80111
303.770.8884 O
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ALBERTA DEVELOPMENT PARTNERS, LLC

STAMP

NOT FOR CONSTRUCTION

**PROMENADE AT CASTLE ROCK**
**CASTLE ROCK, COLORADO**
**PROMENADE CASTLE ROCK, LLC**

| # | Date | Issue / Description |
|---|---|---|
| - | 10/24/2014 | Submittal |
| - | 12/19/2014 | Re-Submittal |

| | |
|---|---|
| Project No: | |
| Drawn By: | JJ/KS |
| Checked By: | LT |
| Date: | 10/9/14 |
| Disk File: | |

SHEET TITLE:
UTILITY PLAN

137657

# CASTLE ROCK FACTORY SHOPS
# CONSTRUCTION PLANS

PREPARED FOR

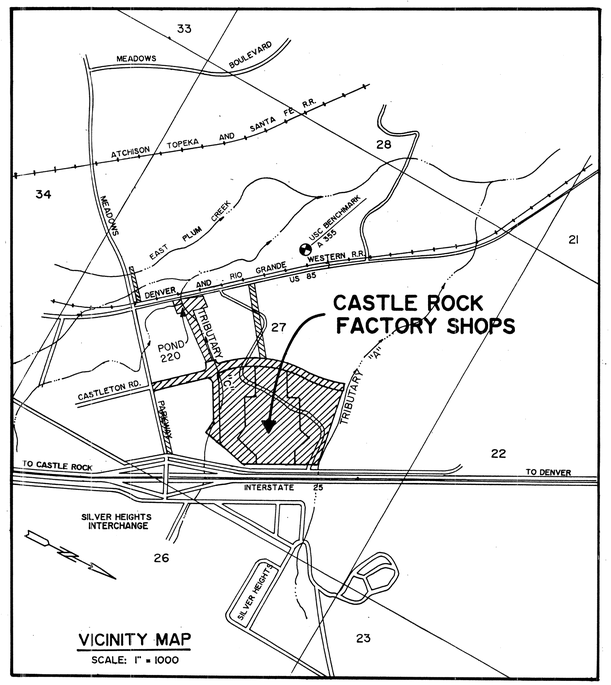
THE PRIME GROUP, INC.
36 SOUTH CHARLES STREET, SUITE 2401
BALTIMORE, MARYLAND 21201
PHONE: (301) 234-0782


RMC ROCKY MOUNTAIN CONSULTANTS
8301 EAST PRENTICE AVENUE, SUITE 101
ENGLEWOOD, COLORADO 80111
(303) 741-6000


REVISIONS

| NO | DESCRIPTION | DATE | BY |
|---|---|---|---|
| - | REISSUED | 6/18/92 | WHK |

CASTLE ROCK FACTORY SHOPS
CONSTRUCTION PLANS




VICINITY MAP
SCALE: 1" = 1000

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46E OF 46 DEMOLITION PLAN


AS BUILT

DUWAYNE M. PHILLIPS L.S. NO.9329
FOR AND ON BEHALF OF
ROCKY MOUNTAIN CONSULTANTS, INC.
DATE 12/6/93 FIELD BOOK

CALL UTILITY NOTIFICATION CENTER OF COLORADO
**1-800-922-1987**
OR **534-6700** IN METRO DENVER
CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

ORIGIN BENCHMARK

U.S.C. AND G.S. BENCHMARK A 355
ELEVATION = 6,047.50
3 1/2" BRASS CAP AT NORTH END OF A CONCRETE HEADWALL, EAST SIDE OF DENVER AND RIO GRANDE WESTERN RAILROAD TRACKS, APPROXIMATELY 3.1 MILES NORTH OF CASTLE ROCK STATION (SEE VICINITY MAP FOR APPROXIMATE LOCATION).

PROJECT BENCHMARK

RMC TBM #95026
ELEVATION = 6,090.55 (U.S.C. AND G.S.)
SOUTHEAST BONNET BOLT ON FIRE HYDRANT AT THE SOUTH SIDE OF MEADOWS PARKWAY AT STATION 340+50, 700 FEET EAST OF CENTERLINE INTERSECTION OF HIGHWAY 85 AND MEADOWS PARKWAY.

THE PLANS ARE REVIEWED FOR CONCEPT ONLY AND THE REVIEW DOES NOT IMPLY RESPONSIBILITY BY THE REVIEWING DEPARTMENT, THE TOWN ENGINEER OR THE TOWN OF CASTLE ROCK FOR ACCURACY AND CORRECTNESS OF CALCULATION. THE REVIEW DOES NOT IMPLY THAT QUANTITIES OF ITEMS INDICATED ON THE PLANS ARE THE FINAL QUANTITIES REQUIRED, THE REVIEW SHALL NOT BE CONSTRUED FOR ANY REASON AS ACCEPTANCE OF FINANCIAL RESPONSIBILITY BY THE TOWN OR REVIEWING DEPARTMENTS FOR ADDITIONAL ITEMS AND ADDITIONAL QUANTITIES OF ITEMS SHOWN THAT MAY BE REQUIRED DURING THE CONSTRUCTION PHASE.

ALL WORK SHALL BE CONSTRUCTED TO THE MOST RECENT TOWN OF CASTLE ROCK STANDARD CONSTRUCTION SPECIFICATIONS.

PREPARED UNDER THE SUPERVISION _____

APPROVED FOR ONE YEAR FROM THIS DATE

Town Engineer _____ Date _____

Director of Public Works _____ Date _____

Fire Department _____ Date _____

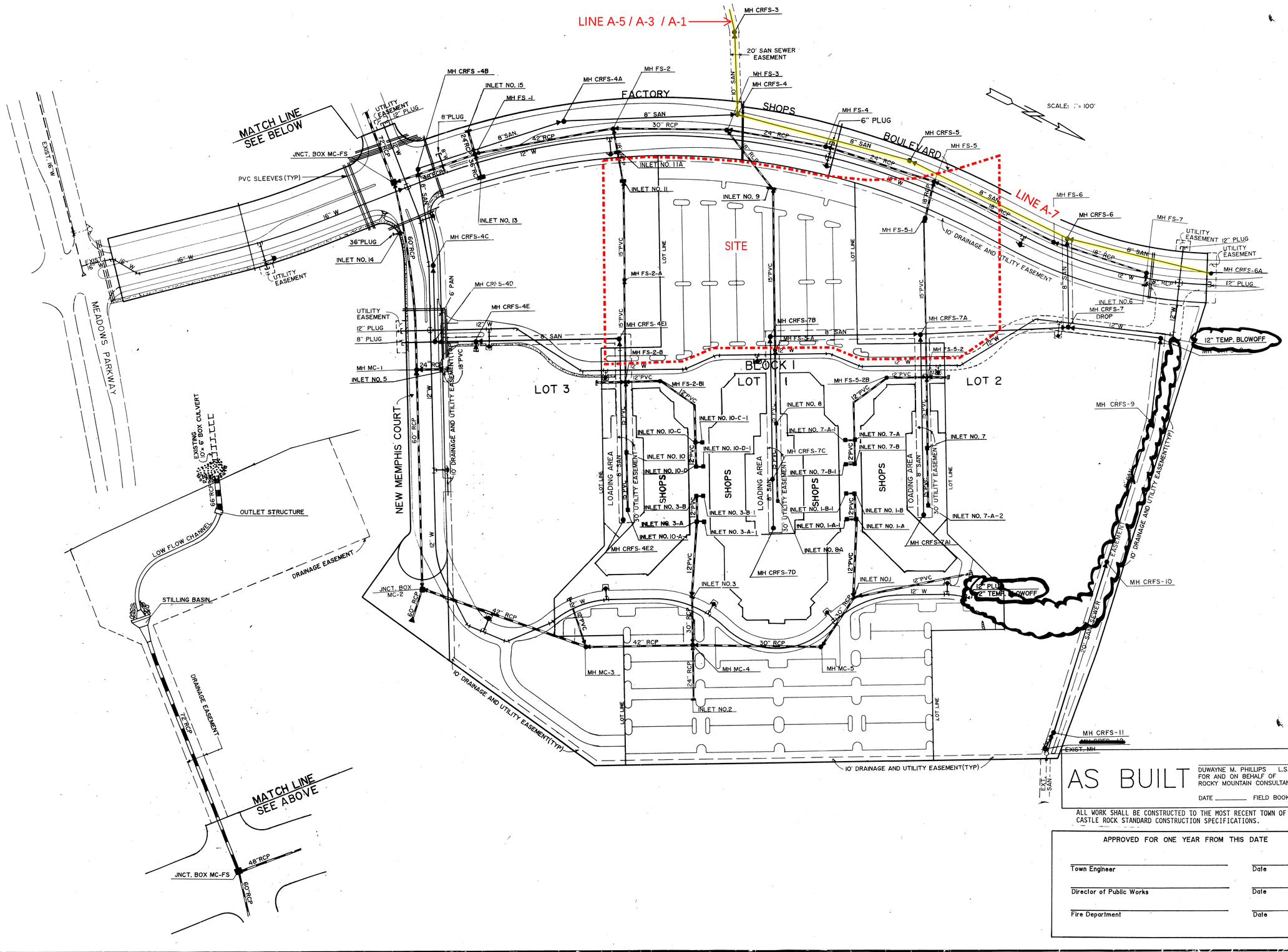
DATE MAR. 27 1992
DESIGNED BY ____
DRAWN BY ____
CHECKED BY ____

JOB NO. 1811-001-02

SHEET 1 OF 46

- REISSUED 6/18/92 WHK

PHASE MA03J002
Castle Rock Factory Shops
Phase I - Streets, Utility, Grading
RMC
12/6/93




ROCKY MOUNTAIN CONSULTANTS
8301 EAST PRENTICE AVENUE, SUITE 101
ENGLEWOOD, COLORADO 80111
(303) 741-6000

REVISIONS

| NO. | DESCRIPTION | DATE | BY |
|---|---|---|---|
| 1 | REVISED PER LETTER DATED 10/21/92 AND REVISED LINES & ANNOTATION 12/4/92 | 12/4/92 | HRH |
| 2 | REISSUED | 6/18/92 | HRH |

# CASTLE ROCK FACTORY SHOPS
## OVERALL UTILITY PLAN

AS BUILT

DUWAYNE M. PHILLIPS L.S. NO.9329
FOR AND ON BEHALF OF
ROCKY MOUNTAIN CONSULTANTS, INC.

DATE _____ FIELD BOOK _____

ALL WORK SHALL BE CONSTRUCTED TO THE MOST RECENT TOWN OF CASTLE ROCK STANDARD CONSTRUCTION SPECIFICATIONS.

APPROVED FOR ONE YEAR FROM THIS DATE

| | |
|---|---|
| Town Engineer | Date |
| Director of Public Works | Date |
| Fire Department | Date |

DATE: MAY 21, 1992
DESIGNED BY: _____
DRAWN BY: HRH
CHECKED BY: R.K.

JOB NO. 1811-001-02

SHEET 12 OF 46

PHASE I ORIGINAL

ORIGIN BENCHMARK

U.S.C. AND G.S. BENCHMARK A 355
ELEVATION = 6,047.50
3 1/2" BRASS CAP AT NORTH END OF A CONCRETE HEADWALL; EAST SIDE OF DENVER AND RIO GRANDE WESTERN RAILROAD TRACKS, APPROXIMATELY 3.1 MILES NORTH OF CASTLE ROCK STATION.

PROJECT BENCHMARK

RMC TBM #95026
ELEVATION = 6,090.55 (U.S.C. & G.S.)
SOUTHEAST BONNET BOLT ON FIRE HYDRANT AT THE SOUTH SIDE OF MEADOWS PARKWAY AT STATION 340+00.

**CALL UTILITY NOTIFICATION CENTER OF COLORADO**
**1-800-922-1987**
**or 534-6700 IN METRO DENVER**
CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

SCALE: HORZ. 1" = 50'
VERT. 1" = 10'

KEY MAP

D & R.G.W. RAIL ROAD

US HIGHWAY 85

EXISTING MH
MH EPC-19
RIM ELEV. 50.5
INV. IN (NE) = 38.77
INV. IN (SE) = 39.02
INV OUT = 38.74

320.0 L.F. ~ 27" PVC

30' UTILITY EASEMENT

EXISTING 500.0 L.F. ~ 27" PVC

TRACT "C"

R.O.W.

N 191620.465
E 210230.799
MH CRFS-1
MARKER POST

350.00 L.F. ~ 10" PVC
N 49°53'08" E

MH CRFS-1-1

25.00 L.F. ~ 10" PVC

EXISTING MH
MH EPC-20
RIM. ELEV. 62.0
INV. IN = 48.56
INV. OUT= 48.51

N 191862.083
E 210517.584
MH CRFS-2
MARKER POST

752.54'
400.0 L.F. ~ 10" PVC
N 49°53'08" E
749.83'
180°00'00"
20' UTILITY EASEMENT

LINE A-5 / A-3 / A-1

SEE SECTION A - A THIS SHEET FOR PROPOSED GRADING (TYP.)

Δ = 00°42'22"
R = 1498.98'
L = 20.22

N 192119.809
E 210823.488
MH CRFS-3
MARKER POST

159.54'
186.42 L.F. ~ 10" PVC
N 61°08'03" E
154.63'
168°45'05"
105°36'36"
90°

MH CRFS-4
℄ STA. 15+38.73
FACTORY/SHOPS BLVD.
35.95 OFF ℄

8" PVC
SEE SHEET 28

8" PVC
SEE SHEET 24

FACTORY SHOPS BOULEVARD

20' UTILITY EASEMENT
5' 10' 5'
2.0%
1.0'
1.0'
℄ 10" PVC
EXISTING GROUND

SECTION A - A
N.T.S.

ROCKY MOUNTAIN CONSULTANTS
8301 EAST PRENTICE AVENUE, SUITE 101
ENGLEWOOD, COLORADO 80111
(303) 741-6000

| NO. | DESCRIPTION | DATE | BY |
|---|---|---|---|
| - | REISSUED | 6/18/92 | WHK |

REVISIONS

**CASTLE ROCK FACTORY SHOPS**
10" SANITARY SEWER OUTFALL LINE
PLAN AND PROFILE

PLAN
SURVEYED
PLOTTED
NOTE BOOK
No.
DATE
BY
ALIGNMENT CHECKED
RT. OF WAY CHECKED

PROFILE
SURVEYED
PLOTTED
GRADES CHECKED
B. M.'s NOTED
NOTE BOOK
No.
STRUCTURE NOTATIONS CHECKED
DATE
BY

6090
6080
6070
6060
6050
6040

MH CRFS-1
RIM ELEV. 57.5

MH CRFS-1-1
RIM ELEV. 56.0

MH CRFS-2
RIM ELEV. 61.2

MH CRFS-3
RIM ELEV. 67.8

MH CRFS-4
℄ STA. 15+38.73
FACTORY SHOPS BLVD.
RIM ELEV. 68.3

25.00 L.F. ~ 10" PVC @ 3.12%
350.00 L.F. ~ 10" PVC @ 3.12%
400.0 L.F. ~ 10" PVC @ 2.88%
186.42 L.F. ~ 10" PVC @ 1.93%
(Critical Section)

CUT 12.4
CUT 10.1
CUT 10.0
CUT 11.8

EXISTING GROUND
FINISHED GRADE
ROW

INV. @ (27") = 45.12
INV IN (8") = 47.37
INV. OUT = 48.15
INV. IN PIPE THROUGH MANHOLE = 48.15

INV. OUT = 59.07
INV. IN = 59.27

INV. OUT = 70.79
INV. IN = 70.99

INV. OUT = 74.59
INV. IN (NW) = 74.79
INV. IN (SE) = 74.79

*FIELD VERIFY ELEVATION OF EXISTING SANITARY SEWER PRIOR TO CONSTRUCTION.

AS BUILT
DUWAYNE M. PHILLIPS L.S. NO.9329
FOR AND ON BEHALF OF
ROCKY MOUNTAIN CONSULTANTS, INC.
DATE _____ FIELD BOOK _____

ALL WORK SHALL BE CONSTRUCTED TO THE MOST RECENT TOWN OF CASTLE ROCK STANDARD CONSTRUCTION SPECIFICATIONS.

APPROVED FOR ONE YEAR FROM THIS DATE

Town Engineer _____ Date _____

Director of Public Works _____ Date _____

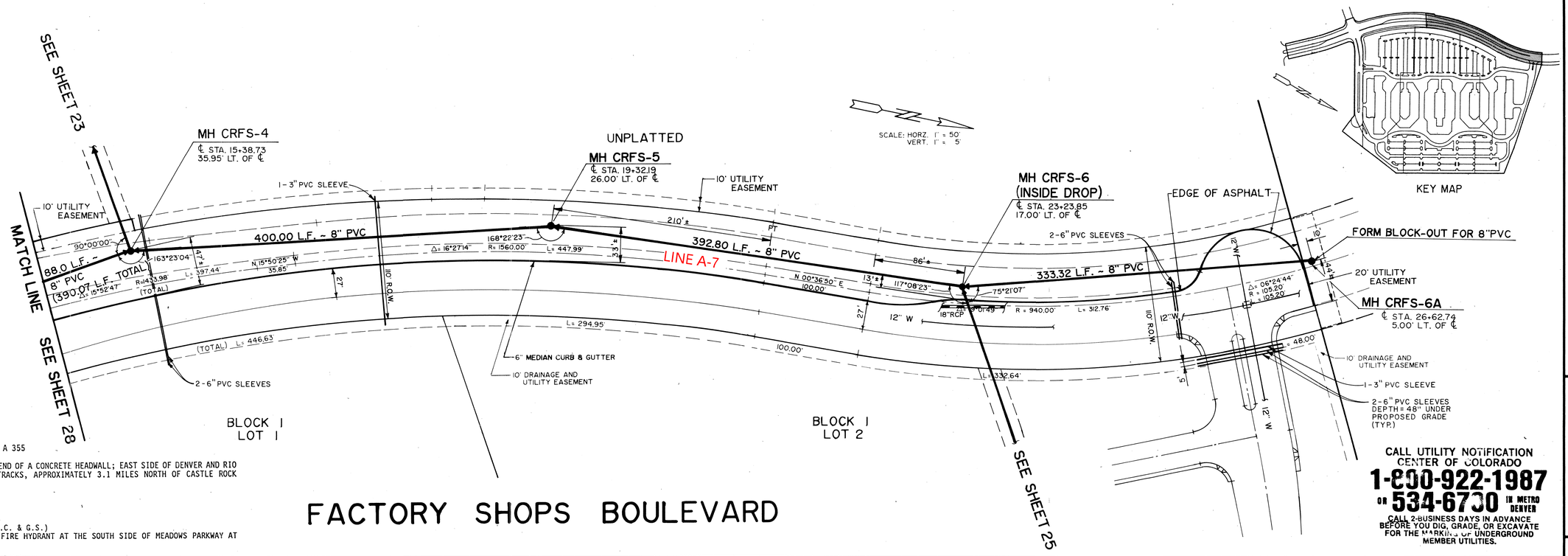
Fire Department _____ Date _____

DATE: MAR. 27, 1992
DESIGNED BY: HRH
DRAWN BY: HRH
CHECKED BY: _____

JOB NO.
1811-001-02

SHEET
23 OF 46

TELEPHONE POST MH#23




# FACTORY SHOPS BOULEVARD

ORIGIN BENCHMARK

U.S.C. AND G.S. BENCHMARK A 355
ELEVATION = 6,047.50
3 1/2" BRASS CAP AT NORTH END OF A CONCRETE HEADWALL; EAST SIDE OF DENVER AND RIO GRANDE WESTERN RAILROAD TRACKS, APPROXIMATELY 3.1 MILES NORTH OF CASTLE ROCK STATION.

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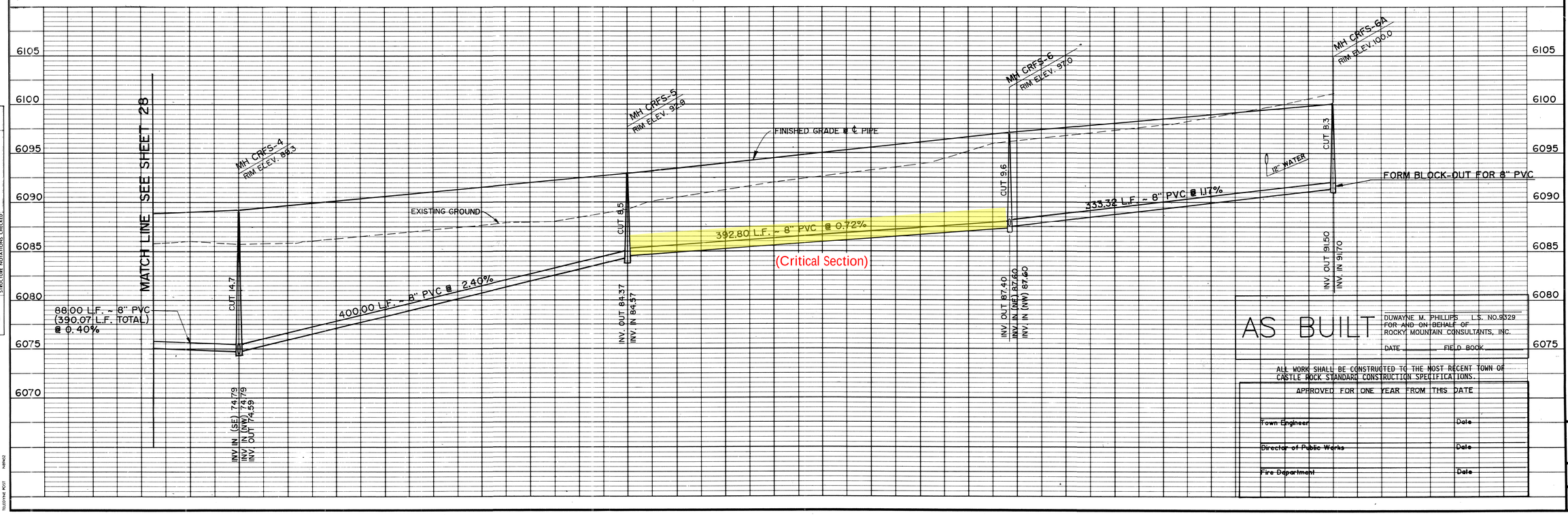


AS BUILT

DUWAYNE M. PHILLIPS L.S. NO.9329
FOR AND ON BEHALF OF
ROCKY MOUNTAIN CONSULTANTS, INC.
DATE _____ FIELD BOOK _____

ALL WORK SHALL BE CONSTRUCTED TO THE MOST RECENT TOWN OF CASTLE ROCK STANDARD CONSTRUCTION SPECIFICATIONS.

APPROVED FOR ONE YEAR FROM THIS DATE

Town Engineer _____ Date _____
Director of Public Works _____ Date _____
Fire Department _____ Date _____


ROCKY MOUNTAIN CONSULTANTS
8301 EAST PRENTICE AVENUE, SUITE 101
ENGLEWOOD, COLORADO 80111
(303) 741-6000


| NO. | DESCRIPTION | DATE | BY |
|---|---|---|---|
| - | REISSUED | 6/18/92 | WHK |

# CASTLE ROCK FACTORY SHOPS
## FACTORY SHOPS BOULEVARD
## SANITARY SEWER PLAN AND PROFILE

DATE MAR. 27, 1992
DESIGNED BY GTW
DRAWN BY HRH
CHECKED BY:

JOB NO. 1811-001-02

SHEET 24 OF 46

PLAN / PROFILE — SURVEYED, PLOTTED, NOTE BOOK, GRADES CHECKED, ALIGNMENT CHECKED, BY, DATE, No., STATIONS/LOCATIONS CHECKED

**Castle Rock Water**
175 Kellogg Court, Castle Rock CO 80109
720-733-6000

# Final Utility Report Checklist

The Final 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 Final Utility Report, the Preliminary Utility Report and associated hydraulic modeling shall be thoroughly updated to reflect the final design and layout of all water/wastewater system facilities and mains since the approval of the Site Development Plan (SDP), and as now shown on the Construction Drawings (CDs). The Final Utility Report shall describe adherence to the Preliminary Utility Report or describe deviations, and shall resolve any outstanding issues regarding the Town's ability to serve the development. As applicable, hydraulic modeling shall be provided for both the initial phase of development represented on the CDs, and for full build-out of the overall site. The Final Utility Report shall include a discussion of applicable SCADA requirements.

The following outline sets forth the **required minimum** content to be provided in the Final Utility Report that shall be submitted with the CDs. 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 Final 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 | |
|---|---|---|
| X | | **TITLE SHEET** |
| X | | A. Name of Project, including legal name of development |
| X | | B. Address |
| X | | C. Owner |
| X | | D. Developer |
| X | | E. Engineer |
| X | | F. Submittal date and revision dates as applicable |
| X | | **APPROVAL BLOCK SHEET** (Available on Town's website) |
| X | | **TABLE OF CONTENTS** |
| X | | **PROJECT LOCATION AND DESCRIPTION** |
| X | | A. Site Location |
| X | | B. Description of Property and Land Use |
| X | | **CALCULATED WATER DEMANDS** |
| X | | A. Average Day Demands (ADD) |
| X | | B. Max Day Demands (MDD) |

# Final Utility Report – Formatting Checklist

| Included | N/A | |
|---|---|---|
| | | **CALCULATED WATER DEMANDS (CONT.)** |
| X | | C. Peak Hour Demands (PHD) |
| X | | D. Irrigation Demands |
| X | | **EXISTING WATER SYSTEM** |
| X | | A. Existing Distribution System |
| X | | B. Existing Supply Facilities |
| X | | **PROPOSED WATER SYSTEM** |
| X | | A. Proposed Distribution System |
| X | | B. Proposed Supply Facilities |
| X | | C. Required Fire Flows |
| X | | D. Land Dedication Requirements |
| X | | **PROPOSED WATER SYSTEM ANALYSIS AND MODELING** |
| X | | A. Hydraulic Models |
| X | | B. Hydraulic Modeling Scenarios |
| X | | C. Hydraulic Modeling Output and Required Schematics |
| X | | D. Fire Flow Test Results |
| X | | **CALCULATED WASTEWATER FLOWS** |
| X | | A. Average Day Wastewater Flows (ADF) |
| X | | B. Peaking Factor (PF) |
| X | | C. Peak Design Flows (PDF) |
| X | | **EXISTING WASTEWATER SYSTEM** |
| X | | A. Existing Collection System |
| X | | **PROPOSED WASTEWATER SYSTEM** |
| X | | A. Proposed Collection System |
| X | | B. Proposed Wastewater Facilities |
| X | | C. Land Dedication Requirements |
| X | | **PROPOSED WASTEWATER SYSTEM ANALYSIS AND MODELING** |
| X | | A. Hydraulic Models |
| X | | B. Hydraulic Modeling Scenarios |
| X | | C. Hydraulic Modeling Output and Required Schematics |
| | X | **POTENTIAL SUBDIVISION IMPROVEMENTS AGREEMENT (SIA) ITEMS** |
| X | | **POTENTIAL PERMITTING REQUIREMENTS** |
| X | | **REFERENCES** |

# Final Utility Report – Formatting Checklist

| Included | N/A | |
|---|---|---|
| X | | **APPENDICES** |
| X | | Appendix B — Water Demands |
| | X | Water Fixture Unit Counts and Tap/Meter Sizing Calculations |
| X | | Irrigation Demands |
| X | | Hydraulic Worksheet(s) and Irrigation Chart(s) |
| X | | Appendix C — Water Storage |
| X | | Confirmation Memo for Required Fire Flow |
| X | | Appendix D — Water Hydraulic Analysis and Modeling |
| X | | Fire Flow Test Results |
| X | | Appendix F — Wastewater Flows |
| X | | Appendix G — Wastewater Hydraulic Modeling |
| X | | Appendix A — Maps and Plans |
| X | | A. Vicinity Map |
| X | | B. Utility Map(s) provided by the Utilities Department |
| X | | C. Overall Utility Plan from the CDs |
| X | | D. Water/Wastewater Utility Plan(s) |

**Notes/Comments:**