FINAL DRAINAGE REPORT
FOR
CROSSROADS MIXED USE
FILING NO. 2

EL PASO COUNTY, COLORADO

JULY 2023

Prepared for:
Crossroads Development Company, LLC
Mr. Danny Mientka
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Colorado Springs, Colorado Springs 80903

Prepared by:

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Project #18-004
PCD Filing No.: SF2238

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DRAINAGE PLAN STATEMENTS

ENGINEERS STATEMENT

The attached drainage plan and report was prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

Virgil A. Sanchez, P.E. #37160
For and on Behalf of M&S Civil Consultants, Inc

DEVELOPER'S STATEMENT

I, the developer, have read and will comply with all the requirements specified in this drainage report and plan.

BY:_____
Danny Mientka - Owner

DATE: 07/31/2023

ADDRESS: Crossroads Development Company, LLC
90 South Cascade Avenue, Suite 1500
Colorado Springs, CO 80903

EL PASO COUNTY'S STATEMENT

Filed in accordance with the requirements of El Paso County Land Development Code, Drainage Criteria Manual Volumes 1 and 2, and the Engineering Manual, as amended.

BY:_____ DATE:_____
Joshua Palmer, P.E.
County Engineer / ECM Administrator

CONDITIONS:

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APPENDIX

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Purpose

This Final Drainage Report for Crossroads Mixed Use Filing No. 2 is in support of the Final Plat, Preliminary Plan, and Construction Drawings of the subject site. This report functions to identify the existing and proposed runoff patterns and recommend proposed drainage improvements which are intended to safely convey runoff through the proposed development, while minimizing impacts to downstream facilities and adjacent properties.

The Final Plat and Construction Drawings for this site will be submitted concurrently with this report. Individual drainage letters and/or reports shall be required with the development of each lot not otherwise clearly analyzed by this report for Crossroads Mixed Use Filing No. 2.

Project Location and Description

The subject site is located in the south half of Section 8, Township 14 South, Range 65 West of the 6th P.M. in El Paso County, Colorado. The 12.016 Acre site is currently undeveloped. The site is bound to the west by the planned Southern Rail Point, to the north by the Meadowbrook Parkway, south by Highway 24, and to the east by Newt Drive. The proposed site will be developed into two (1) commercial lot, three (4) tracts, and two (2) private roadways through the site.

The majority of the existing site is covered with native grasses with fair to good cover. Known earthwork operations for “borrow material” have occurred over a small area of the eastern portion of the site in early to mid-2019, but have since stabilized. Generally, the site slopes from east to west slightly greater than 1% with some localized depressions. Some of these may be the results of previous earthwork activities. The site lies within the Sand Creek Drainage Basin. No existing drainage facilities or improvements are onsite, however, surrounding drainage facilities are planned and will connect onsite. No known irrigation systems or wells are present.

Soils

Soils in the project area have been determined to be Blakeland Loamy Sand (8) and Blendon Sandy Loam (10), which are characterized to be part of Hydrologic Soil Types "A" & "B" as determined from the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) “Web Soils Survey”. A soils map illustrating the site location and soil types is provided in the appendix of this report.

Floodplain Statement

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Nos. 08041C0754 G & 08041C0752 G, effective date December 7th, 2018, none of the site lies within a designated floodplain. A copy of these annotated maps can be found in the appendix. The Sand Creek East Fork Channel is located to the northwest of the adjacent Meadowbrook Crossing subdivision.

Previous Studies

The area which encompasses Crossroads Mixed Use Filing No. 2 has been previously studied. Below is a short outline of the assumptions regarding the lands of the subject site and those based upon the previously assembled and approved drainage reports and how the assumptions within them impact the subject site.

“Crossroads Mixed Use Filing No.1 Final Drainage Report, prepared by M&S Civil Consultants, Inc., dated February 2021, revised February 2022.

- Establishes all historic, existing, and future drainage patterns and detailed drainage information for the proposed site and adjacent properties.

“Sand Creek Drainage Basin Planning Study, Preliminary Design Report", prepared by Kiowa Engineering Corporation, dated January 1993, revised March 1996.

- Establishes that the subject site falls within the East Fork Sand Creek Drainage Basin, a portion of the larger Sand Creek Watershed
- Establishes that there are no requirements for major infrastructure improvements and subsequently no drainage-improvement related reimbursements with the development of this parcel
- Drainage fees shall be required to plat the subdivision

"Claremont Business Park Filing No.2 prepared by Matrix Design Group, revised November 2006

- Establishes the drainage patterns of offsite Basins 0S-4 and E2 which are to be conveyed within the Meadowbrook Rights of Way
- Established up-gradient offsite drainage to be directed under Meadowbrook north to offsite East Fork Sand Creek Channel, and away from the subject site

"Final Drainage Report, Lot 1 24/94 Business Park Filing No.1 prepared by Core Engineering Group, dated July 14, 2016

- The development of the 24/94 Business Park FDR shows future curb inlets along the future Meadowbrook Parkway extension on the south and west corners of the intersection to capture runoff from up-gradient watersheds in addition to a proposed inlet which was to be located above the intersection at the northwest corner of the subject site.
- Establishes that flows from the parcel upstream of the convenience store (29/94 FDR Basin OS4) EX-B now to be collected by the extension of a 36” RCP along the south side of Meadowbrook Parkway. Runoff within the right of way/roadway separated out as Basin EX-A2.
- Continues assumption that flows from Newt Drive be conveyed north to East Fork Sand Creek.
- Evaluated pre-development drainage patterns for subject site including direct discharge flow rates to the CDOT rights of way of 1.9 and 14.5 cfs for the 5 and 100 year events, respectively. (Basin EX-E).

"Preliminary and Final Drainage Report Meadowbrook Crossing Filing No. 1 and Filing 2, El Paso County, Colorado prepared by Kiowa Engineering Corporation, dated July 25, 2017

- Proposed the installation of a future 10' Type R inlet at the southeast corner of Newt Drive and Meadowbrook Parkway with the extension of Meadowbrook Parkway to the west (along the northern boundary of the subject site). The inlet was to function to collect offsite runoff from a portion of the south half of Meadowbrook Parkway and Newt Drive north of Hwy 24. Intercepted runoff would be conveyed via a proposed 24" storm sewer to the existing storm sewer system within the Meadowbrook Crossings development.
- Proposed the installation of a 10' Type R inlet at the west end of future Meadowbrook Parkway. The inlet was to collect runoff from the north half of the future roadway. An 18" storm drain was proposed to convey collected runoff to the existing water quality pond located within the Meadowbrook Crossings Development. The report indicates a separate forebay or the modification of an existing forebay would be required.
- Shifted the location of the existing 10' Type R curb inlet to be installed upstream of the intersection of Newt Drive (as shown with the 24/94 Business Park FDR), flows in excess of the inlet capacity are to continue within the future Meadowbrook.

"Final Drainage Report for Meadowbrook Dirt Borrow Site, El Paso County Colorado, prepared by M&S Civil Consultants, November 2018.

- Evaluated onsite drainage patterns
- Excluded offsite runoff impacts from areas to the east of site.
- Allowed site to be utilized as a "borrow site" for offsite earthwork activities.

Hydrologic Calculations

Hydrologic calculations were performed using the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual and where applicable the Mile High Flood District Manual. The Rational Method was used to estimate stormwater runoff anticipated from design storms with 5-year and 100-year recurrence intervals.

Hydraulic Calculations

Hydraulic calculations were estimated using the Manning's Formula and the methods described in the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual. Storm drains were designed using parameters and criteria summarized in Chapter 8 of El Paso County's Drainage Criteria Manual Vol. 1 and the City of Colorado Springs Drainage Criteria Manuals. Parameters such as Manning's values of 0.13 were used for concrete pipe flow, and design considerations for minimum freeboard and maximum velocities were applied. The relevant data sheets are included in the appendix of this report. Hydraulic grade line calculations for the storm system in the ultimate (future) condition are provided in the Appendix of this Final Drainage report.

Drainage Criteria

This drainage analysis has been prepared in accordance with current El Paso County Drainage Criteria Manual and, where applicable, City of Colorado Springs and Mile High Flood District Criteria Manuals. Calculations were performed to determine runoff quantities for the 5-year and 100-year frequency storms for developed conditions using the Rational Method as required for basins having areas less than 100 acres. See Appendix for supporting calculations.

Existing Drainage Characteristics

The subject site has been utilized as a "borrow site" to provide surplus earthwork to offsite developments in the area. This recent grading effort occurred during the spring and summer of 2019. At the request of El Paso County, an existing conditions drainage analysis has been provided to show the changes to the topography and drainage patterns as a result of this effort. As the only changes between the two conditions are onsite, the offsite drainage patterns calculations and assumptions determined within the historical analysis will remain the same. Specifically, historical basins **E2, EX-A2, OS-A, and OS-1** correlate to existing **DP1, DP2, and DP3**, respectively. It should be noted that the subject site was not disturbed to the full extent of the approved plan, with limited excavation primarily occurring within the eastern side of the site. For historic (pre-grading) drainage information, refer to the Crossroads Mixed Use Filing No. 1 FDR/MDDP (CMU1 FDR) by M&S Civil Consultants, Inc (see appendix).

In the existing condition, vegetation remains sparse, consisting primarily of native grasses and weeds with good to fair cover. Areas disturbed by grading activities were reseeded and have since stabilized. With regards to historic versus existing drainage basin delineation, the bisecting parcel ridgeline has been relocated further to the south, which results in redirecting more of the runoff to the southwestern part of the site and less to the CDOT rights of way. The few small depressions remain on site, near the west boundary. For the purposes of hydrologic analysis, these small depressions will continue to not be evaluated for their ability to detain runoff. Ultimately, all runoff from the parcel is conveyed to the west towards existing drainage facilities located under Peterson Road and ultimately the East Fork of Sand Creek as in the historic condition.

This section only discusses the changes in basin geometry and drainage pattern and provides a direct comparison of the historic versus existing conditions, utilizing the same outfall (design) points, which have remained undisturbed.

Design Point 1

Basins E2 and EX-A2 geometry were derived from their respective reports. Flow velocity equations, conveyance coefficients, and time of concentration equations have been modified since these reports were approved, therefore, these parameters were remodeled with El Paso's hydrologic criteria current to this report's date. Excerpts of reported calculations for these basins are provided in the Appendix for comparison. **Basin E2 (Claremont Business Park Filing No.2)** consists of a reported 3.86 developed acres of development located along the southeastern half of existing Meadowbrook Parkway, some 1200' northeast of the subject site. Runoff produced by the offsite development (CBPF2 Lot 46) is conveyed to Meadowbrook Parkway at flow rates of Q5=15.1 and Q100=28.6 cfs in the 5 and 100-year storm events respectively. The collected flows combine with runoff from **Basin EX-A2 (Lot 1 24/94 Business Park Filing No.1)** (Q5=2.5, Q100=4.5 cfs) which consists of 0.59 acres of the southeastern half of Meadowbrook Parkway, and is located immediately east of existing

Newt Drive. The collected flows from the two basins culminate at **Design Point 1** at peak rates of Q5=14.2 and Q100=26.5 cfs. An existing 10' CDOT Type R at-grade inlet (**Inlet 1**) intercepts flows of Q5=8.4 and Q100=11.1 cfs, with subsequent by-pass flows of 5.8 and 15.4 cfs in the 5 and 100 year events. Surface flows continue west within the south half of existing Meadowbrook Parkway.

Design Point 2

Basin OS-A (Meadowbrook Crossing Filing 1 and 2) consists of 1.29 acres of the northern half of existing Meadowbrook Parkway located immediately east of Newt Drive. Runoff produced within this basin totals Q5=3.1 and Q100=6.0 cfs. These calculated flows differ 0.1 cfs from reported flows due to the significant digits used for the basin acreage in the flow calculation, yet can be viewed as conservative values since they are higher. An existing 10' CDOT Type R at grade inlet (**Inlet 2**) collects runoff of Q5=3.1 and Q100=5.3 cfs, with subsequent by-pass flows in only the 100 year event of 0.7 cfs. Runoff leaving the design point continuing west within the north half of existing Meadowbrook Parkway.

Design Point 3

Basin OS-1 consists of approximately 1.28 developed acres of existing Newt Drive located along the eastern boundary of the site. Runoff produced within the basin (Q5=5.8 cfs, Q100=10.5 cfs) combine with flow-by from **DP1** in the intersection at peak flow rates of 9.8 cfs, and 22.5 cfs in the 5 and 100-year storm events.

Surface runoff and by-pass flows from both **DP2** and **DP3** enter **Basin A** in the undeveloped rights of way of future Meadowbrook Parkway, at the northeast corner of the site.

Design Point 4

Basin A (Q5=1.5, Q100=11.1 cfs) currently consists of 11.02 acres which continues to drain from east to west eventually discharging along the western boundary of the site, approximately 250' south of the northern property line. Peak runoff, post-grading, is 7.1 and 25.5 cfs in the 5-year and 100-year events respectively.

Design Point 5

Basin B (Q5=2.0, Q100=14.5 cfs) consists of 17.31 acres that drains from northeast to southwest, eventually discharging along the western boundary of the site, approximately 200' north of the southern property line. Peak runoff rates at this location are 2.0 cfs and 14.5 cfs in the 5-year and 100-year events respectively.

Design Point 6

Basin C consists of 3.99 undeveloped acres that drains from east to west into the US HWY 24 Right of Way at the southern boundary of the site. The peak runoff at this location is at 0.9 and 6.3 cfs in the 5-year and 100-year events, respectively.

Design Point 7

Basin OS-2 (Q5=8.7, Q100=19.6 cfs) consists of 4.98 acres of the northern half of the US HWY 24 roadway and adjoining native grass lined barrow ditch. Runoff produced within the basin combines with runoff from **DP6** at lower cumulative peak runoff rates of 9.9 and 28.0 cfs in the 5 and 100-year storm events at **DP7**. A cross section of the ditch at this location was analyzed in the 100 yr event for comparison purposes and is provided in the appendix.

Four Step Process

Step 1 **Employ Runoff Reduction Practices** – Approx. 2.54 acres of the Filing No. 1 development is being set aside for a Full Spectrum Detention (FSD) Pond. Whenever possible, runoff produced within developable area containing impervious surfaces will be routed through landscaped areas or earthen swales (grass-lined where slope exceeds 2%) to minimize direct connection of impervious surfaces. In the interim, runoff will be reduced through the use of (3) temporary sediments basins until the ground has been permanently developed.

Step 2 **Stabilize Drainageways** – The development of this site is not anticipated to have negative effects on downstream drainage ways since flows released will be below historic rates. In the interim, the site proposes three temporary sedimentation basins (including one planned from Filing No. 1), before discharging at the southwest property corner of the site and onto an adjacent undeveloped property via riprap-lined spillways. This ensures that in this stage of the development negative effects on the downstream drainage ways will be avoided.

In the proposed condition, the flow is discharged offsite through an RCP pipe outfall lined with rip rap. From here it continues southwest in CDOT's man-made roadside ditch until it reaches Peterson Road. It is then conveyed to the other side of the road, into a similar earthen channel, via a 36" CMP culvert. The drainage continues southwest in the right of way, until it reaches the East Fork Sand Creek Channel. Existing rip rap barriers are lined throughout this portion of the pathway approximately every 90-100 feet within the ditch to the channel bank. The Drainage way Exhibit provided in the Drainage Maps section of the Appendix provides a visual representation of this information.

Step 3 **Provide Water Quality Capture Volume (WQCV)** – The site will utilize a Full Spectrum Detention (FSD) Pond, located southwest of the subject site, for water quality. The water quality event storm shall be detained and released via the full spectrum detention (FSD) pond which will discharge the WQCV in approximately 40 hours, while reducing the 100 year peak discharge to approximately 90% of the pre-development flow rates. The pond continuously releases or infiltrates at least 97% of all of the runoff from a rainfall event that is less than or equal to a 5-year storm within 72 hours after the end of the event. It also continuously releases as quickly as practicable, but in all cases releases at least 99% of the runoff within 120 hours after the end of events greater than a 5-year storm.

Step 4 **Consider Need For Selecting Industrial And Commercial BMP's** – The proposed development will implement a Stormwater Management Plan including property housekeeping practices, spill containment procedures, and coverage of storage/handling areas. Specialized BMP's are not required since the vertical development of the commercial areas are unknown at this time.

Proposed Drainage Characteristics

The future site will be developed into two (1) commercial lot, three (4) tracts, one tract for two (2) private roadways. The proposed development will extend Pacific Rail Point and Central Rail Point into the site to provide access and a utility corridor to both the commercial and residential developments. At this time, it is anticipated that the development and design of Lot 1 and Tract D (by others) is planned to occur following the construction of the proposed utilities and infrastructure provided by this plan. A separate drainage letter or report will be required for that portion of the

development. For planned drainage information, refer to the Final Drainage Letter for Crossroads Mixed Use Filing No. 1 Final Drainage Report (CMU1 FDR) by M&S Civil Consultants, Inc.

The following summary generalizes the proposed drainage patterns and drainage improvements required to safely route developed runoff to downstream facilities. In this portion of the report and the corresponding proposed drainage map, "existing" refers to surrounding site conditions that have started construction or exist in the field, "planned" refers to surrounding site conditions that have been approved or are in the process of being approved, and "proposed" refers only to site improvements proposed for Crossroads Mixed Use Filing No.2.

Off-site flows within the existing Meadowbrook Parkway will be collected by a pair of sump inlets located at the west end of the roadway, then routed south to the planned off-site FSD pond. Pacific Rail Point (private) and Central Rail Point (private) will provide access and utility corridors for development. Private storm sewer mains, stubs, and inlets will be extended along these corridors to serve the development. The extension of these facilities beyond what is shown by this plan is likely with future development. All onsite storm sewer and drainage improvements shall be private. Storm sewer pipes and inlets will be constructed along, and tie in at the southwest boundary of the proposed Central Rail Point to aid in collecting runoff from the site. These facilities will connect at the west side of the proposed site to the planned system located east of the planned Southern Rail Point. Runoff collected by the infrastructure will be conveyed west and south, then off-site through a 36" storm pipe. Proposed on-site flows will continue off-site through planned storm pipes, where the flows will combine with adjacent lot flows and continue through planned storm pipes to the planned single full spectrum detention (FSD) pond located southwest of the proposed site. The planned outfall from the FSD pond will discharge into the existing barrow ditch located within the north half of the existing CDOT Right of Way as per the CMU1 FDR.

Proposed Detailed Drainage Discussion

Design Point 1*

Off-site **Basin E2 (Claremont Business Park Filing No.2)** consists of a reported 3.86 acres of development located along the southeastern half of existing Meadowbrook Parkway some 1200' northeast of the subject site. Runoff produced by the offsite development (CBPF2 Lot 46) is conveyed to Meadowbrook Parkway at flow rates of Q5=15.1 and Q100=28.6 cfs in the 5 and 100-year storm events respectively. The collected flows combine with runoff from **Basin EX-A2 (Lot 1 24/94 Business Park Filing No.1)** (Q5=2.5, Q100=4.5 cfs) which consists of 0.59 acres of the southeastern half of Meadowbrook Parkway located immediately east of existing Newt Drive. The collected flows from the two basins culminate at **Design Point 1** at peak rates of Q5=14.2 and Q100=26.5 cfs. An existing 10' CDOT Type R at-grade inlet (**Inlet 1**) intercepts flows of Q5=8.4 and Q100=11.1 cfs, with subsequent by-pass flows of 5.8 and 15.4 cfs in the 5 and 100 year events. Surface flows continue west within the south half of existing Meadowbrook Parkway. Flows at **DP1** are consistent with planned flows at this location from the CMU1 FDR.

Design Point 2*

Off-site **Basin OS-A (Meadowbrook Crossing Filing 1 and 2)** consists of 1.29 acres of the northern half of existing Meadowbrook Parkway located immediately east of existing Newt Drive. Runoff produced within this basin totals Q5=3.1 and Q100=6.0 cfs. An existing 10' CDOT Type R at grade inlet (**Inlet 2**) collects runoff of Q5=3.1 and Q100=5.3 cfs, with subsequent by-pass flows in only the 100 year event of 0.7 cfs. Runoff leaving the design point continuing west within the north half of

existing Meadowbrook Parkway. Flows at **DP2** are consistent with planned flows at this location from the CMU1 FDR.

Design Point 3*

In accordance with the assumptions outlined within the Meadowbrook Subdivision Final Drainage Report, an offsite public storm sewer pipe and inlet will be constructed at the southwest corner of the planned roundabout to aid in collecting runoff from a portion of the offsite watershed located to the east of the site. A new manhole is not anticipated to be required to connect the outfall to the existing pipe located inside the existing Meadowbrook Subdivision. As this area is already paved, increases to the imperviousness of this area are not anticipated.

Off-site **Basin OS-1** consists of approximately 1.40 acres of existing Newt Drive that will be retrofitted with new raised median as part of an intersection conversion to a roundabout. Runoff produced within the basin (Q5=6.4 and Q100=11.5 cfs) will combine with flow-by from **DP1** at peak rates of Q5=10.2 and Q100=23.3 cfs at a planned public 10' at-grade inlet (**Inlet 3**: Q5=6.7, Q100=9.8 cfs intercepted; Q5=3.5, Q100=13.5 cfs flowby) located at **DP3**. A planned public 24" storm sewer (**PR1**) will convey water across the intersection to the existing 42" storm sewer with Meadowbrook Crossings in accordance with that subdivision's drainage report. The existing manhole connection has been determined to be sufficient following construction of this planned inlet and storm sewer. It is important to note that this connection also remains feasible as the roundabout is not anticipated to significantly increase the overall imperviousness of the area above that of the existing condition. Runoff in excess of the inlet capacity will continue westward via the curb and gutter of existing Meadowbrook Parkway. Flows at **DP3** are consistent with planned flows at this location from the CMU1 FDR.

Design Point 4*

Off-site **Basin A** consists of 1.67 acres of the north half of existing Meadowbrook Parkway. Runoff within this basin (Q5=6.5 and Q100=11.6 cfs) combines with flow by from **DP2** for total flows of 6.5 and 12.4 cfs in the 5 year and 100 year events, respectively. A planned 15' at-grade inlet (**Inlet 4:** Q5=6.5, Q100=10.6 cfs intercepted; Q5=0.0, Q100=1.8 cfs flowby) is located at the west end of the roadway just before the planned temporary cul-de-sac. This inlet conveys intercepted flows to **PR1.5**, a planned 24" RCP public storm sewer. Flowby from the 100 year event continues west to downstream infrastructure. Flows at **DP4** are consistent with planned flows at this location from the CMU1 FDR.

Design Point 4.5*

1.8 cfs of flowby in the 100 year event continues west from **DP4** towards off-site **Inlet 4.5**, a **NEENAH R-2501 Type C Grate** lid and frame at the low point of the cul-de-sac. Supporting calculations for this non-standard inlet are provided in the Appendix. This inlet is anticipated to reach a maximum depth of 0.5' in order to convey this flow underneath the roadway via a planned public 24" storm sewer (**PR2**). The NEENAH inlet is to be removed and replaced with a standard CDOT 5' Type R inlet when the roadway cul de sac is removed and the roadway is extended to the west with future development. In the case of inlet clogging, overflow will collect at **DP5**, which has an additional 13.3 cfs capacity. Flows at **DP4.5** are consistent with planned flows at this location from the CMU1 FDR.

Design Point 5*

Off-site **Basin B** consists of 1.48 acres of the southern half of existing Meadowbrook Parkway. Runoff produced within this basin (Q5=5.8 and Q100=10.3 cfs) combines with flow-by leaving **DP3** at peak flowrates of Q5=9.9, Q100=25.8 cfs. A planned public 15' sump inlet (**Inlet 5:** Q5=10.1, Q100=26.3 cfs intercepted; no flowby) located at west end of the roadway will prevent developed flows from leaving exiting the roadway corridor. The intercepted runoff will combine with **PR2** flows in a 36" private storm sewer system (**PR3, by others**). Combined flows within the planned system are calculated to reach peak rates of 16.5 and 38.4 cfs. The storm sewer system is to be planned by others through the multi-family site (Lot 11) but ultimately will tie back into the system at **DP15**. In case of inlet clogging, overflows will overtop the curb on the southern side onto the apartment site and be conveyed to the swale on the west side of the site. Flows at **DP5** are consistent with planned flows at this location from the CMU1 FDR.

Design Point 6

Basin C (Q5=9.3, Q100=17.4 cfs) consists of 2.36 acres of the northern portion of commercial Tract C located along the east side of the site. A proposed private 30" storm sewer (**PR4**) is provided to collect and convey flows of Q5=9.3 and Q100=17.4 cfs in the 5 and 100-year storm event, respectively. Intercepted flows are conveyed west underground within the roadway tract. **PR4** was treated as a flared end pipe for rational method calculation purposes, to account for future development.

Design Point 6.5

Basin C1 (Q5=9.3, Q100=17.4 cfs) consists of 2.19 acres of the southern portion of commercial Tract C located along the east side of the site. A TSB and proposed private 30" storm sewer (**PR4.5**) is provided to collect and convey flows of Q5=9.3 and Q100=17.4 cfs in the 5 and 100-year storm event, respectively. Intercepted flows from **PR4** and **PR4.5** are conveyed west underground within the roadway tract through **PR5-PR7** at flow rates of Q5=18.7 and Q100=34.7 cfs.

Design Point 7

Basin D consists of 2.21 acres of commercial Tract B located between existing Meadowbrook Parkway, proposed Central Rail Point, proposed Pacific Rail Point, and planned Southern Rail Point. **Basin D** will require a TSB and a proposed private 24" storm drain (**PR8**) to collect peak flows of Q5=9.3 and Q100=16.9 cfs from this basin in the 5 and 100 year storm events, respectively.

Design Point 8

Basin E (Q5=4.0, Q100=7.2 cfs) consists of 0.99 acres of a portion of commercial lots, the northern half of proposed Central Rail Point and most of proposed Pacific Rail Point. A proposed private 10' CDOT Type R at-grade inlet (**Inlet 6:** Q5=3.9, Q100=5.9 cfs intercepted; Q5=0.1, Q100=1.3 cfs flowby in proposed conditions) is located on the north side of the roadway to intercept flows. Runoff bypassing this inlet continues to downstream infrastructure. Flows collected from the inlet combine with **PR8** and are conveyed to a box base manhole in the center of the proposed Central Rail Point via a proposed private 30" (**PR9**) storm drain at flow rates of Q5=12.4 and Q100=21.4 cfs. Within the manhole, flows from **PR9** then combine with flows from **PR7** and continue to flow through a proposed private 36" (**PR10**) storm drain at flow rates of Q5=29.5 and Q100=53.2 cfs.

Design Point 9

Basin E1 (Q5=5.7, Q100=10.4 cfs) consists of 1.41 acres of commercial lots (a portion of Lot 1 and Tract C) and the southern half of Central Rail Point. Grading in the proposed drainage report for

Basin E1 does not reflect the future grading for Lot 1, however the drainage calculations were based on the future Lot 1 development. A proposed private 10' CDOT Type R at-grade inlet (**Inlet 7:** Q5=5.1, Q100=7.3 cfs intercepted; Q5=0.6, Q100=3.1 cfs flowby) is located on the south side of the Central Rail Point to intercept flows. Runoff bypassing this inlet continues to downstream infrastructure. Flows collected from the inlet combine with flows from (**PR10**) and are conveyed south to a box base manhole on the south side of the roadway via a proposed private 36" (**PR11**) storm drain and continue west underground at flow rates of Q5=35.7 and Q100=62.5 cfs. **PR12**, a planned 42" private storm sewer, then directs the system south from another manhole. Pipe flows at Q5= 6.9 and Q100= 13.8 cfs from the neighboring planned apartment site (**PR11.5**, private 24" RCP) combine with flows from **PR12** in a planned private 48" storm drain (**PR12.5**) at flow rates of Q5=43.3 and Q100=78.0 cfs. The proposed flows exiting the site through **PR11** are 0.7 and 2.0 cfs greater than the planned flows from the CMU1 FDR for the 5 and 100-year events, respectively.

Design Point 10*

Off-site **Basin G** (Q5=2.1, Q100=3.8 cfs) consists of 0.46 acres of multi-family lots and roadway located southwest of the proposed site at the southwest edge of planned Southern Rail Point. A planned private 10' CDOT Type R sump inlet (**Inlet 8**: Q5=2.1, Q100=3.8 cfs; no flowby) located on the west side of the street functions to collect the runoff from **Basin G. PR13**, a proposed 18" private storm sewer, will direct runoff east to a box base manhole at peak flow rates of 2.1 cfs and 3.8 cfs in the minor and major storm events, respectively. In the case of inlet clogging, overflow is directed to the swale at **DP13**. Flows at **DP10** are consistent with planned flows at this location from the CMU1 FDR.

Design Point 11*

Off-site **Basin G1** (Q5=2.8, Q100=4.9 cfs) consists of 0.59 acres of commercial lots and roadway located southwest of the proposed site at the southeast edge of planned Southern Rail Point. A planned private 15' CDOT Type R sump inlet (**Inlet 9:** Q5=3.3, Q100=9.3 cfs intercepted; no flowby), located on the east side of planned Southern Rail Point to collect the runoff from **Basin G1** as well as bypass flows from **DP8** and **DP9**, totaling Q5=3.3 and Q100=9.3 cfs. **PR14**, a planned 30" private storm sewer, will direct runoff west to an underground box base manhole at peak flow rates of 3.3 cfs and 9.3 cfs in the minor and major storm events, respectively. From the junction, flows from **PR12.5**, **PR13**, and **PR14** combine at **PR15** (Q5=47.2, Q100=88.2 cfs), a planned 48" private storm sewer, and are directed south. Flows at **DP11** are 0.4 and 6.0 cfs less than planned flows at this location from the CMU1 FDR.

Design Point 12*

Basin F (Q5=11.7, Q100=21.3 cfs) consists of 2.78 acres of on-site commercial lots (Tract D and portions of Lot 1) located along the southwestern boundary of the site. A TSB and private planned 24" storm drain (**PR16**) are provided to collect the basin flows of Q5=11.7 and Q100=21.3 cfs at **DP12** in the 5 and 100 year events, respectively. Intercepted flows are conveyed southwest underground to the main line where they combine with flows from **PR15** at a manhole junction. **PR17,** a planned private 48" storm drain directs the collected runoff at rates of Q5=55.7 and Q100=103.5 cfs west to a manhole junction. A planned private 30" storm drain, **PR21*** (Q5=2.1, Q100=4.2), contains flows from the planned apartment site (**Basin D-1)** and conveys these flows south to the manhole junction where they join with flows from **PR17** at combined peak flow rates of Q5=56.2 and Q100=104.8 cfs. The collected flows are conveyed southwest to the eastern planned concrete forebay via **PR18** (private planned 48" RCP). Flows at **DP12** are 0.9 and 1.7 cfs greater than the planned flows from the CMU1 FDR for the 5 and 100-year events, respectively.

Design Point 13*

A planned off-site 2' BTM earthen swale is designed to convey overflow runoff from the planned apartment complex site (**Basin D-1 Overflow**:Q5=0.0, Q100=0.9 cfs, **Basin Z-1**:Q5=0.47, Q100=1.27 cfs, and **Basin A-5 Overflow**: Q5=0.9, Q100=7.8 cfs) north of the FSD pond to **DP13**. This results in a total peak flow rates of Q5=1.4, and Q100=10.4 cfs at **DP13** in the 5 and 100 year events, respectively. Flows at **DP13** are 0.1 cfs greater and 0.5 cfs less than the planned flows at this location from the CMU1 FDR for the 5 and 100-year events, respectively. Overflows from the apartment site were obtained by using flow by from the "Final Drainage Report for Aura at Crossroads" MHFD inlet sheets.

Design Point 14*

A planned off-site 2' triangular earthen swale is designed to convey overflow runoff from the planned apartment complex site (**Basin Z-2**: Q5=0.57, Q100=1.43 cfs) north of the FSD pond and flows from **DP13** to **DP14**. This results in a total peak flow rates of Q5=2.1, and Q100=12.4 cfs at **DP14** in the 5 and 100 year events, respectively. Flows at **DP14** are 0.1 cfs and 2.7 cfs greater than the planned flows at this location from the CMU1 FDR for the 5 and 100-year events, respectively. Flows at DP14 are then conveyed south and east. Overflows from the apartment site were obtained by using flow by from the "Final Drainage Report for Aura at Crossroads" MHFD inlet sheets.

Design Point 15*

Off-site **Basin J** (Q5=2.1, Q100=8.9 cfs) consists of 3.26 acres of the planned Tract for the FSD pond located southwest of the proposed site. Flows within this basin reach peak runoff rates of Q5=2.1 and Q100=8.9 cfs and are generally conveyed to the planned FSD pond. A planned private 48" storm drain, **PR19*** (Q5=35.4, Q100=65.5), contains flows from the planned apartment site (**Basin A-5**). **PR19*** conveys these flows south, to the western planned concrete forebay where they combine with runoff flows from **Basin J**, **DP14**, and **PR18** within the FSD pond at **DP15**. Flows at **DP15** reach peak rates of 116.2 cfs and 232.7 cfs for the 5 and 100-year events, respectively. The peak flow rates at **DP15** are 0.5 cfs and 2.3 cfs less than the planned flows at this location from the CMU1 FDR for the 5 and 100-year events, respectively. Flows from the apartment site were obtained by the "Final Drainage Report for Aura at Crossroads" MHFD inlet sheets.

Design Point 16*

Off-site **Basin OS-2** (Q5=8.7, Q100=19.6 cfs) consists of 4.98 acres. Approximately half of this basin is comprised of the paved surface of U.S. Highway 24, while the other half is comprised of the 5 foot bottom earthen swale in CDOT's Right of Way. Runoff produced within this basin (Q5=8.7 and Q100=19.6 cfs) flows from northeast to southwest, combining with outfall flows from the planned FSD pond. Flows exiting the FSD pond will be routed to the existing 5' bottom earthen swale (Planned Section A-A' Analyses) in CDOT's Right of Way at **DP16.** According to the CMU1 FDR, the FSD pond releases flows at peak rates of Q5=1.2 and Q100=11.4 cfs through a private planned 18" storm drain (**PR20**). Thus, the cumulative flows at **DP16** are consistent with planned flows at this location from the CMU1 FDR at combined peak rates of Q5=9.9 and Q100=31.0 cfs. A rip rap pad (Type L, D50=9") is provided as outlet protection. Flows from this design point continue to downstream infrastructure.

*See Crossroads Mixed Use Filing No.1 FDR/MDDP ("CMU1 FDR") by M&S Civil Consultants, Inc. dated February 2022, respectively in the appendix for predevelopment, historic, future, and full spectrum detention condition comparison for the intermediate events at these locations.

Water Quality Provisions and Maintenance

The off-site planned Full Spectrum Detention (FSD) Pond functions to provide detention and water quality for the proposed development. Refer to the CMU1 FDR in the appendix for details and calculations regarding this planned full spectrum detention pond.

Erosion Control

It is the policy of the El Paso County that M&S Civil Consultants submit a grading and erosion control plan with the drainage report. The plan includes proposed silt fence and vehicle tracking control as proposed erosion control measures. The plan also includes provisions for stockpiling, staging, and concrete washout areas. A stormwater management plan is provided to accompany the plans.

2023 Drainage & Bridge Fees

Please revise drainage fees. Fees will be collected for platted lots only (Lot 1) and roadway tracts.Please add a clarifying statement.

Drainage Fees:	12.016 x	94.2%	x	$23,821.00	=	$ 269,631.61
Bridge Fees:	12.016 x	94.2%	x	$9,743.00	=	$ 110,281.72
					Total	**$ 379,913.33**

Drainage fees for Crossroads Mixed Use Filing No. 2 shall be paid at the time of platting. Future development of these lots shall require individual drainage reports.

Construction Cost Estimate (Non-Reimbursable)

Item	Amount	Unit	Unit Cost	Total Cost
10’ CDOT Type R Inlet	2	EA	$ 9,890.00	$ 19,780.00
Type I MH	4	EA	$ 9,800.00	$ 39,200.00
Type II MH	1	EA	$ 6,000.00	$ 6,000.00
24” SD	23	LF	$ 81.00	$ 1,863.00
30" SD	546	LF	$ 100.00	$ 54,585.00
36" SD	12	LF	$ 124.00	$ 1,488.00
TOTAL COST:	**$**			**122,916.00**

M & S Civil Consultants, Inc. (M & S) cannot and does not guarantee the construction cost will not vary from these opinions of probable costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development in particular. The above is only an estimate of the facility cost and drainage basin fee amounts in 2023.

Summary

The construction of this site is for the purposes of creating a commercial site (Lots 1, Tract D, Tract A, Tract B and Tract C) in the proposed condition. The site will be graded and all disturbed areas will be seeded. Proposed post construction runoff will be discharged from the site at **DP9** and **DP12**. At **DP9**, the proposed runoff is 0.7 and 2.0 cfs greater than the planned runoff from the CMU1 FDR for the 5 and 100-year events, respectively. At **DP12**, the proposed runoff is 0.9 and 1.7 cfs greater than the planned runoff from the CMU1 FDR for the 5 and 100-year events, respectively. This difference is due to the area adjustment of **Basin E1 and Basin F** from the planned CMU1 FDR to this site's drainage report. Nevertheless, the amount of runoff that reaches the planned FSD pond from adjacent lots and the proposed site is 0.5 cfs and 2.3 cfs less than the planned flows at this location from the CMU1 FDR for the 5 and 100-year events, respectively. This is due to the decrease of basin area and decrease of flows from surrounding design points (**DP11** and **DP13***) between Filing No. 1 and Filing No. 2 adjustments. Proposed post construction runoff will be discharged from the FSD pond at rates consistent with the planned discharge rates for the 5 and 100 year design events from the CMU1 FDR. Thus, the development of the proposed site will not further impact the flows that are planned to be released from the planned FSD pond in the CMU1 FDR (see appendix).

The construction of Crossroads Mixed Use Filing No. 2 shall not adversely affect adjacent or downstream property. Subsequent drainage reports will be required when the site is developed further than the uses defined within this report.

References

1.) "El Paso County and City of Colorado Springs Drainage Criteria Manual".

2.) "Urban Storm Drainage Criteria Manual"

3.) SCS Soils Map for El Paso County.

4.) Flood Insurance Rate Map (FIRM), Federal Emergency Management Agency, Revised date December 7th, 2018.

5.) "Final Drainage Report for Claremont Business Park Filing No. 2", dated November 2006, by Matrix Design Group, Inc.

6.) "Preliminary and Final Drainage Report Meadowbrook Crossing Filing 1 and Filing 2", dated July 25, 2017, by Kiowa Engineering Corporation.

7.) "Final Drainage Report Lot 1 24/94 Business Park Filing No. 1 on Platte Avenue and Meadowbrook Parkway", dated April 28, 2016 and revised July 14, 2016, by Core Engineering Group, LLC.

8.) "Final Drainage Report for Meadowbrook Dirt Borrow Site ", dated November 2018, by M&S Civil Consultants, Inc.

9.) "Sand Creek Drainage Basin Planning Study", revised March 1996, by Kiowa Engineering Corporation.

10.) “Final Drainage Report for Aura at Crossroads”, dated April 4th, 2022, by Harris Kocher Smith.

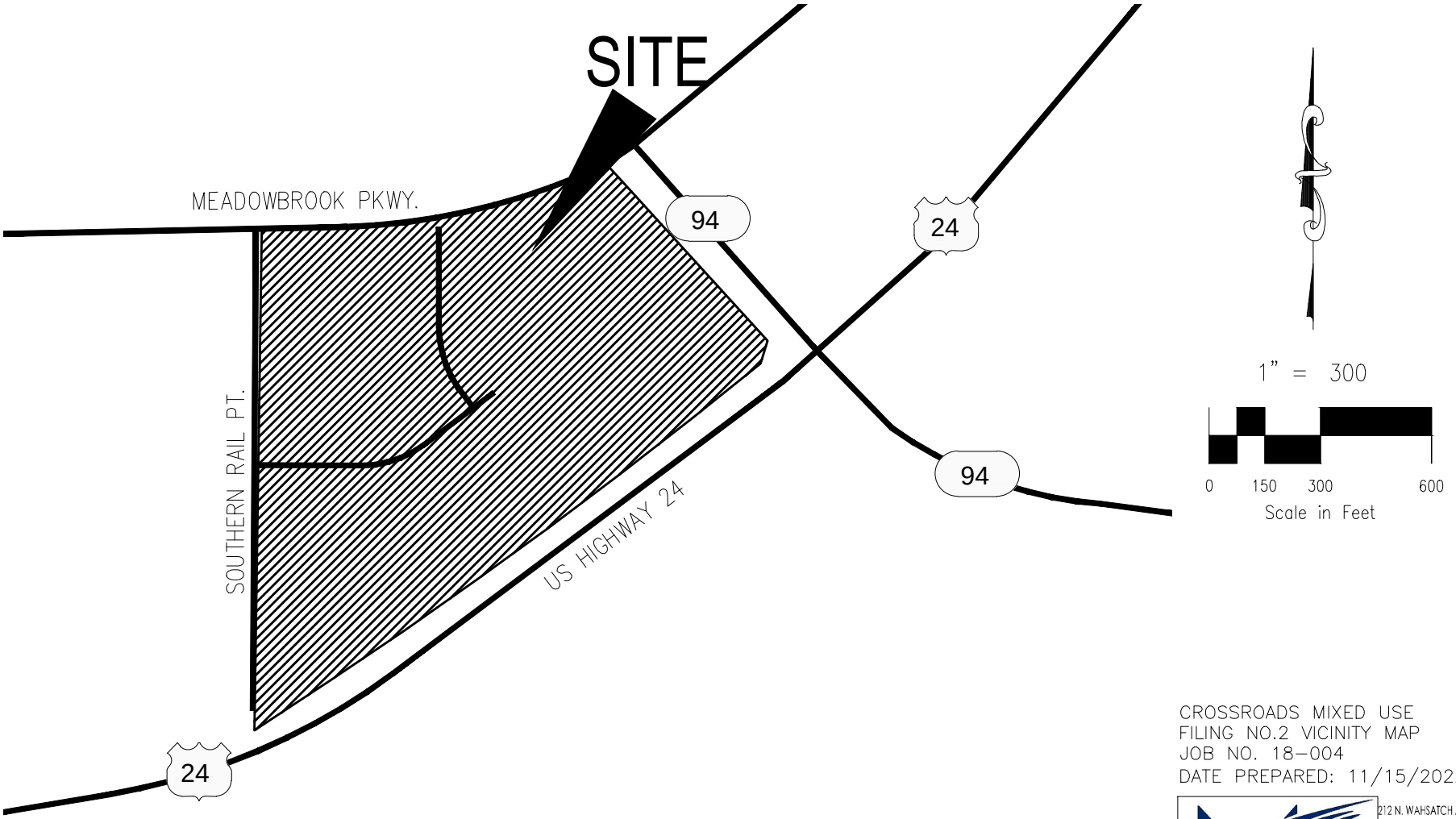
11.) “Final Drainage Report for Crossroads Mixed Use Filing No.1”, dated February 2022, by M&S Civil Consultants, Inc.

APPENDIX

VICINITY MAP

VICINITY MAP

CROSSROADS MIXED USE FILING NO.2



CROSSROADS MIXED USE
FILING NO.2 VICINITY MAP
JOB NO. 18-004
DATE PREPARED: 11/15/2022

CIVIL CONSULTANTS, INC.
212 N. WAHSATCH AVE., STE 305
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

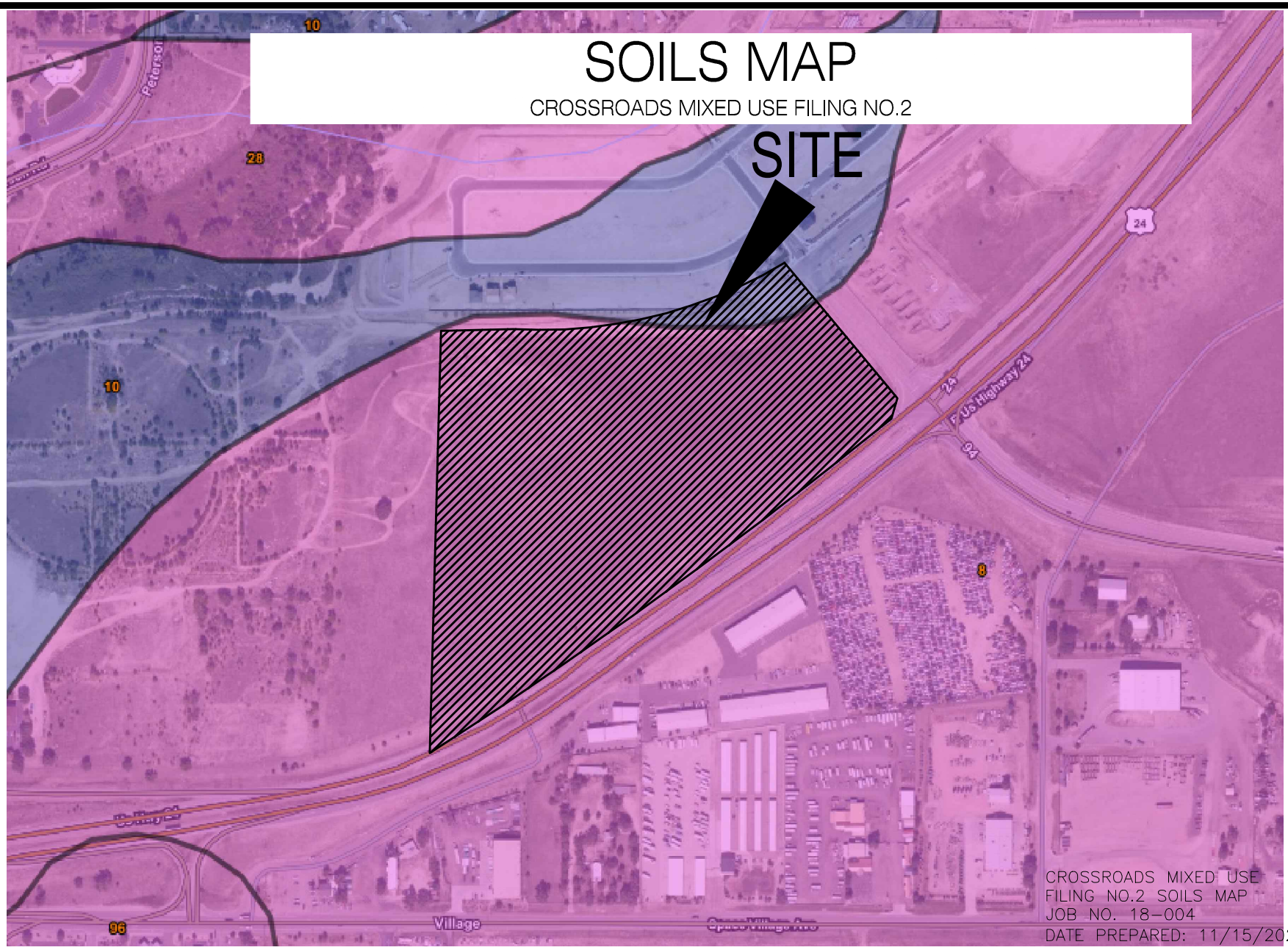
SHEET 1 OF 1

File: O:\18004A-Crossroads MU-Retail\Equity Group\Dwg\Eng Exhibits\VICINITY MAP.dwg Plotstamp: 11/4/2022 12:25 PM

SOILS MAP

SOILS MAP

CROSSROADS MIXED USE FILING NO.2



1" = 300

0 150 300 600

Scale in Feet

CROSSROADS MIXED USE
FILING NO.2 SOILS MAP
JOB NO. 18-004
DATE PREPARED: 11/15/2022

Tables Hydrologic Soil Group Summary By Map Unit

Summary by Map Unit — El Paso County Area, Colorado (CO625)

Summary by Map Unit — El Paso County Area, Colorado (CO625)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	282.3	73.2%
10	Blendon sandy loam, 0 to 3 percent slopes	B	54.2	14.1%
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	A	40.7	10.6%
70	Pits, gravel	A	0.2	0.1%
96	Truckton sandy loam, 0 to 3 percent slopes	A	8.1	2.1%
Totals for Area of Interest			**385.6**	**100.0%**

CIVIL CONSULTANTS, INC.

212 N. WAHSATCH AVE., STE 305
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

SHEET 1 OF 1

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FIRM PANELS

FLOODPLAIN MAP

CROSSROADS MIXED USE FILING NO. 2

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 — Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

CROSSROADS MIXED USE
FILING NO. 2 FLOODPLAIN MAP
FLOODPLAIN MAP
JOB NO. 18-004
DATE PREPARED: 11/15/2022

CIVIL CONSULTANTS, INC.
212 N. WAHSATCH AVE., STE 305
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

File: O:\18004A-Crossroads MU-Retail\Equity Group\Dwg\Eng Exhibits\FLOODPLAIN.dwg Plotstamp: 11/4/2022 12:58 PM

HYDROLOGIC CALCULATIONS

CROSSROADS MIXED USE FILING NO. 2
FINAL DRAINAGE CALCULATIONS
(Proposed Area Runoff Coefficient Summary)

			STREETS / COMMERC.			*MULTI-FAMILY/PARKLAND*			*OVERLAND / UNDEVELOPED*			*WEIGHTED*	
BASIN	**TOTAL AREA** *(Sq Ft)*	**TOTAL AREA** *(Acres)*	**AREA** *(Acres)*	**C_5**	**C_{100}**	**AREA** *(Acres)*	**C_5**	**C_{100}**	**AREA** *(Acres)*	**C_5**	**C_{100}**	**C_5**	**C_{100}**
PROPOSED BASINS													
OS-A***		1.29	1.29	0.62	0.72	0.00	0.49	0.62	0.00	0.08	0.35	***0.62***	***0.72***
E2*		3.86	3.86	0.80	0.90	0.00	0.49	0.62	0.00	0.08	0.35	***0.80***	***0.90***
EX-A2**		0.59	0.59	0.90	0.96	0.00	0.49	0.62	0.00	0.08	0.35	***0.90***	***0.96***
OS-1	***60793.3017***	1.40	1.40	0.90	0.96	0.00	0.49	0.62	0.00	0.08	0.35	***0.90***	***0.96***
OS-2	***217071.1816***	4.98	2.49	0.90	0.96	0.00	0.49	0.62	2.49	0.08	0.35	***0.49***	***0.66***
A	***72787.0873***	1.67	1.67	0.90	0.96	0.00	0.49	0.62	0.00	0.08	0.35	***0.90***	***0.96***
B	***64538.8381***	1.48	1.48	0.90	0.96	0.00	0.49	0.62	0.00	0.08	0.35	***0.90***	***0.96***
C	***102868.78***	2.36	2.22	0.81	0.88	0.00	0.49	0.62	0.15	0.08	0.35	***0.76***	***0.85***
D	***96317.6781***	2.21	2.21	0.81	0.88	0.00	0.49	0.62	0.00	0.08	0.35	***0.81***	***0.88***
E	***42958.775***	0.99	0.41	0.90	0.96	0.58	0.81	0.88	0.00	0.08	0.35	***0.85***	***0.91***
E1	***61480.298***	1.41	0.22	0.90	0.96	1.19	0.81	0.88	0.00	0.08	0.35	***0.82***	***0.89***
F	***121217.57***	2.78	2.78	0.81	0.88	0.00	0.49	0.62	0.00	0.08	0.35	***0.81***	***0.88***
G	***20057.4496***	0.46	0.46	0.90	0.96	0.00	0.12	0.39	0.00	0.08	0.35	***0.90***	***0.96***
J*	***142045.569***	3.26	0.00	0.90	0.96	3.26	0.16	0.41	0.00	0.08	0.35	***0.16***	***0.41***
A-5**	***159865.2***	3.67	0.00	0.90	0.96	3.67	0.68	0.79	0.00	0.08	0.35	***0.68***	***0.79***
Z-1**	***16117.2***	0.37	0.00	0.90	0.96	0.37	0.33	0.52	0.00	0.08	0.35	***0.33***	***0.52***
D-1**	***33976.8***	0.78	0.00	0.90	0.96	0.78	0.62	0.75	0.00	0.08	0.35	***0.62***	***0.75***
Z-2**	***16552.8***	0.38	0.00	0.90	0.96	0.38	0.38	0.56	0.00	0.08	0.35	***0.38***	***0.56***
G1	***25793.524***	0.59	0.59	0.90	0.96	0.00	0.12	0.39	0.00	0.08	0.35	***0.90***	***0.96***
C1	***95425.7528***	2.19	2.04	0.81	0.88	0.00	0.49	0.62	0.15	0.08	0.35	***0.76***	***0.84***

*FROM FDR FOR CROSSROADS MIXED USE FILING NO. 1

**FROM FDR FOR CLAREMONT BUSINESS PARK FILING NO. 2

***FROM FDR FOR MEADOWBROOK CROSSING FILING 1 AND FILING 2

****FROM FDR FOR LOT 1 24/94 BUSINESS PARK FILING NO. 1 ON PLATTE AVENUE AND MEADOWBROOK PARKWAY

*****FROM FDR FOR AURA AT CROSSROADS, DATED OCTOBER 29TH, 2021

Calculated by: TAU
Date: 5/16/2023
Checked by: DLM

CROSSROADS MIXED USE FILING NO. 2
FINAL DRAINAGE REPORT
(Proposed Drainage Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*STREET / CHANNEL FLOW*				*Time of Travel (T_t)*		*INTENSITY #*		*TOTAL FLOWS*	
BASIN	**AREA TOTAL** *(Acres)*	**C_5** *From DCM Table 5-1*	**C_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**CHECK** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*
Proposed Area Drainage Summary																	
OS-A***	1.29	0.62	0.72	0.62	40	0.8	4.4	1310	1.9%	2.8	7.9	12.3	17.5	3.8	6.4	***3.1***	***6.0***
E2*	3.86	0.80	0.90	0.80	50	1	3.0	400	1.3%	2.3	2.9	6.0	12.5	4.9	8.2	***15.1***	***28.6***
EX-A2**	0.59	0.90	0.96	0.90	10	0.2	0.9	916	1.9%	2.7	5.6	6.5	15.1	4.8	8.0	***2.5***	***4.5***
OS-1	1.40	0.90	0.96	0.90	100	3	2.5	490	2.2%	3.0	2.7	5.2	13.3	5.1	8.6	***6.4***	***11.5***
OS-2	4.98	0.49	0.66	0.49	85	8	4.8	1165	1.8%	2.0	9.6	14.5	16.9	3.6	6.0	***8.7***	***19.6***
A	1.67	0.90	0.96	0.90	30	0.6	1.6	1325	0.7%	1.7	7.3	8.9	17.5	4.3	7.2	***6.5***	***11.6***
B	1.48	0.90	0.96	0.90	25	0.5	1.4	1335	0.7%	1.7	7.3	8.8	17.6	4.3	7.3	***5.8***	***10.3***
C	2.36	0.76	0.85	0.76	50	1	3.4	260	1.5%	2.4	1.4	5.0	11.7	5.2	8.7	***9.3***	***17.4***
D	2.21	0.81	0.88	0.81	50	1	2.9	200	1.5%	2.4	1.1	5.0	11.4	5.2	8.7	***9.3***	***16.9***
E	0.99	0.85	0.91	0.85	60	1.2	2.8	700	1.0%	2.0	3.8	6.7	14.2	4.7	8.0	***4.0***	***7.2***
E1	1.41	0.82	0.89	0.82	50	2.5	2.1	700	1.7%	2.6	3.8	5.9	14.2	4.9	8.3	***5.7***	***10.4***
F	2.78	0.81	0.88	0.81	50	2	2.3	400	1.7%	2.6	2.2	5.0	12.5	5.2	8.7	***11.7***	***21.3***
G	0.46	0.90	0.96	0.90	50	1	2.0	466	1.1%	2.1	2.6	5.0	12.9	5.2	8.7	***2.1***	***3.8***
J*	3.26	0.16	0.41	0.16	60	0.3	16.5	134	0.5%	0.5	4.5	21.0	11.1	4.0	6.7	***2.1***	***8.9***
A-5**	3.67	0.68	0.79	0.68	REFER TO "FDR FOR AURA AT CROSSROADS" FOR DETAILS											***8.72***	***17.06***
Z-1**	0.37	0.33	0.52	0.33	REFER TO "FDR FOR AURA AT CROSSROADS" FOR DETAILS											***0.47***	***1.27***
D-1**	0.78	0.62	0.75	0.62	REFER TO "FDR FOR AURA AT CROSSROADS" FOR DETAILS											***2.08***	***4.20***
Z-2**	0.38	0.38	0.56	0.38	REFER TO "FDR FOR AURA AT CROSSROADS" FOR DETAILS											***0.57***	***1.43***
G1	0.59	0.90	0.96	0.90	50	1	2.0	466	1.1%	2.1	2.6	5.0	12.9	5.2	8.7	***2.8***	***4.9***
C1	2.19	0.76	0.84	0.76	50	1	3.4	260	1.5%	2.4	1.4	5.0	11.7	5.2	8.7	***9.3***	***17.4***

Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: TAU
Date: 5/16/2023
Checked by: DLM

*VALUES DERIVED USING DATA FROM FDR FOR CROSSROADS MIXED USE FILING NO.1

**VALUES DERIVED USING DATA FROM FDR FOR CLAREMONT BUSINESS PARK FILING NO. 2

***VALUES DERIVED USING DATA FROM FDR MEADOWBROOK CROSSING FILING 1 AND FILING 2 PAGE 31

****VALUES DERIVED USING DATA FROM FDR LOT 1 24/94 BUSINESS PARK FILING NO. 1 ON PLATTE AVENUE AND MEADOWBROOK PARKWAY

*****FROM FDR FOR AURA AT CROSSROADS, DATED OCTOBER 29th, 2021

CROSSROADS MIXED USE FILING NO. 2
FINAL DRAINAGE REPORT
(Proposed Basin Routing Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*PIPE / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*		
DESIGN POINT	**CONTRIBUTING BASINS**	**CA_5**	**CA_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*	COMMENTS
PROPOSED DRAINAGE BASIN ROUTING SUMMARY																	
1	**E2, EX-A2**	3.62	4.04				6.0	916	1.9%	2.7	5.6	11.6	3.9	6.6	***14.2***	***26.5***	Existing 10' CDOT Type R At-Grade Inlet (Public)
				Tc for E2 Used													
2	**OS-A**	0.80	0.93									12.3	3.8	6.4	***3.1***	***6.0***	Existing 10' CDOT Type R At-Grade Inlet (Public)
				Tc for OS-A Used													
3	**OS-1, FB-DP1**	2.73	3.69				11.6	150	1.0%	2.0	1.3	12.8	3.8	6.3	***10.2***	***23.3***	Planned 10' CDOT Type R At-Grade Inlet (Public)
				Tc for DP1 Used													
4	**A, FB-DP2**	1.50	1.71									8.9	4.3	7.2	***6.5***	***12.4***	Planned 15' CDOT Type R At-Grade Inlet (Public)
				Tc for Basin A used													
4.5	**FB-DP4**	0.00	0.24									8.9	4.3	7.2	***0.0***	***1.8***	Planned NEENAH R-2501 MH Lid and Frame (Public)
				Tc for DP4 used													
5	**B, FB-DP3**	2.28	3.56									8.8	4.3	7.3	***9.9***	***25.8***	Planned 15' CDOT Type R Sump Inlet (Public)
				Tc for Basin B Used													
6	**C**	1.81	2.00									5.0	5.2	8.7	***9.3***	***17.4***	Proposed 30" RCP or PP Storm Sewer, Rip Rap Pad (Private)
				Tc for Basin C Used													
6.5	**C1**	1.81	2.00									5.0	5.2	8.7	***9.3***	***17.4***	Proposed 30" RCP or PP Storm Sewer, Rip Rap Pad (Private)
				Tc for Basin C1 Used													
7	**D**	1.79	1.95									5.0	5.2	8.7	***9.3***	***16.9***	Proposed 24" RCP or PP Storm Sewer, Rip Rap Pad (Private)
				Tc for Basin D Used													
8	**E**	0.84	0.90									6.7	4.7	8.0	***4.0***	***7.2***	Proposed 10' CDOT Type R At-Grate Inlet (Private)
				Tc for Basin E Used													
9	**E1**	1.16	1.26									5.9	4.9	8.3	***5.7***	***10.4***	Proposed 10' CDOT Type R At-Grade Inlet (Private)
				Tc for Basin E1 Used													
10	**G**	0.41	0.44									5.0	5.2	8.7	***2.1***	***3.8***	Planned 10' CDOT Type R Sump Inlet (Private)
				Tc for Basin G Used													
11	**G1**	0.53	0.57									5.6	5.0	8.4	***3.3***	***9.3***	Planned 15' CDOT Type R Sump Inlet (Private)
	FB-DP8	0.01	0.16														
	FB-DP9	0.13	0.38														
		0.66	**1.10**	Weighted Tc Used													
12	**F**	2.25	2.45									5.0	5.2	8.7	***11.7***	***21.3***	Planned 24" RCP or PP Storm Sewer (Private)
				Tc for Basin F Used													
13	**Basin Z-1**	0.12	0.20									12.8	3.8	6.3	***1.4***	***10.4***	Planned 2' Bottom Earthen Swale, Rip Rap Rondown (Private)
	Baisn A-5 (Overflow)	0.26	1.32														
	Basin D-1 (Overflow)	0.00	0.13														
		0.38	**1.65**	Weighted Tc Used													
14	**DP13**	0.38	1.65									11.1	4.0	6.7	***2.1***	***12.4***	Planned Triangular Earthen Swale (Private)
	Basin Z-2	0.14	0.21														
		0.53	**1.87**	Tc for Basin Z-2 Used													
15	**J**	0.52	1.34									6.3	4.8	8.1	***116.2***	***232.7***	Planned Full Spectrum Extended Detention Basin (Private)
	DP14	0.53	1.87														
	PR18	13.00	14.45														
	PR19	10.05	11.09														
		24.10	**28.74**	Weighted Tc Used													
16	**POND OUTFALL**	0.33	1.90									14.5	3.6	6.0	***9.9***	***31.0***	HISTORIC FLOW IN CDOT BARROW DITCH
	OS-2	2.44	3.26														Q5= 10.4 CFS, Q100 = 31.9 CFS
		2.77	**5.16**	Tc for Basin OS-2 Used													PER HISTORIC DRAINAGE ANALYSIS

* Intensity equations assume a minimum travel time of 5 minutes.

Overflow- obtain flows from inlet sheets provided in Background Information Section of Appendix

TAU
Date: 5/16/2023
Checked by: DLM

CROSSROADS MIXED USE FILING NO. 2
FINAL DRAINAGE CALCULATIONS
(Proposed Storm Sewer Routing Summary)

PIPE RUN	*Contributing Pipes/Design Points*	*Equivalent CA_5*	*Equivalent CA_{100}*	*Maximum T_C*	*Intensity**		*Flow*		PIPE SIZE
					I_5	*I_{100}*	*Q_5*	*Q_{100}*	
1	**DP3 (INLET 3)**	1.78	1.55	12.8	3.8	6.3	***6.7***	***9.8***	24" SD
1.5	**DP4 (INLET 4)**	1.50	1.46	8.9	4.3	7.2	***6.5***	***10.6***	24" SD
2	**PR1.5, DP4.5 (INLET 4.5)**	1.50	1.71	9.0	4.3	7.2	***6.4***	***12.3***	24" SD
3	**PR2, DP5 (INLET 5)**	3.78	5.27	9.0	4.3	7.2	***16.2***	***37.9***	36" SD
4	**DP6**	1.81	2.00	5.0	5.2	8.7	***9.3***	***17.4***	30" SD
4.5	**DP6.5**	1.81	2.00	5.0	5.2	8.7	***9.3***	***17.4***	30" SD
5	**PR4, PR4.5**	3.61	4.00	5.0	5.2	8.7	***18.7***	***34.7***	30" SD
6	**PR5**	3.61	4.00	5.0	5.2	8.7	***18.7***	***34.7***	30" SD
7	**PR6**	3.61	4.00	5.0	5.2	8.7	***18.7***	***34.7***	30" SD
8	**DP7**	1.79	1.95	5.0	5.2	8.7	***9.3***	***16.9***	24" SD
9	**PR8, DP8 (Inlet 6)**	2.61	2.69	6.7	4.7	8.0	***12.4***	***21.4***	30" SD
10	**PR7, PR9**	6.23	6.69	6.7	4.7	8.0	***29.5***	***53.2***	36" SD
11	**PR10, DP9 (Inlet 7)**	7.26	7.57	5.9	4.9	8.3	***35.7***	***62.5***	36" SD
*11.5**	**SEE FDR FOR AURA AT CROSSROADS**	1.93	2.30	14.6	3.6	6.0	***6.9***	***13.8***	24" SD
12	**PR11**	7.26	7.57	5.9	4.9	8.3	***35.7***	***62.5***	42" SD
12.5	**PR12, PR11.5**	9.19	9.87	6.8	4.7	7.9	***43.3***	***78.0***	48" SD
13	**DP10 (Inlet 8)**	0.41	0.44	5.0	5.2	8.7	***2.1***	***3.8***	18" SD
14	**DP11 (Inlet 9)**	0.66	1.10	5.6	5.0	8.4	***3.3***	***9.3***	30" SD
15	**PR12.5, PR13, PR14**	10.27	11.42	7.3	4.6	7.7	***47.2***	***88.2***	48" SD
16	**DP12**	2.25	2.45	5.0	5.2	8.7	***11.7***	***21.3***	24" SD
17	**PR15, PR16**	12.52	13.87	8.1	4.4	7.5	***55.7***	***103.5***	48" SD
18	**PR17, PR21***	13.00	14.45	8.8	4.3	7.3	***56.2***	***104.8***	48" SD
*19**	**SEE FDR FOR AURA AT CROSSROADS**	10.05	11.09	15.0	3.5	5.9	***35.4***	***65.5***	48" SD
20	**POND OUTFALL**	PER FIL. NO.1	MHFD	WKSHT			***1.2***	***11.4***	18" SD
*21**	**SEE FDR FOR AURA AT CROSSROADS**	0.48	0.58	9.0	4.3	7.2	***2.1***	***4.2***	30" SD

*REFER TO FDR FOR AURA AT CROSSROADS FOR CONTRIBUTING PIPE FLOW DETAILS

DP - Design Point

EX - Existing Design Point

FB- Flow By from Design Point

INT- Intercepted Flow from Design Point

Calculated by: TAU

Date: 5/16/2023

Checked by: DLM

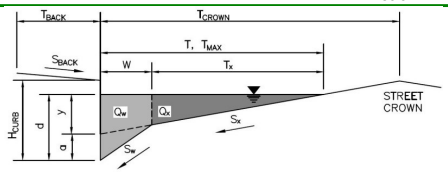
Version 4.06 Released August 2018

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Crossroads Mixed Use

Inlet ID: Inlet 6



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.4	8.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	3.36	3.36	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline	d =	4.87	4.87	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	12.0	12.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.425	0.425	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	5.5	5.5	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.1	4.1	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**9.6**	**9.6**	**cfs**
Flow Velocity within the Gutter Section	V =	6.3	6.3	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.6	2.6	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	11.8	30.4	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	9.8	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.498	0.191	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	3.2	54.6	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	3.2	42.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.2	12.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	3.8	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	6.4	58.7	cfs
Average Flow Velocity Within the Gutter Section	V =	5.7	9.9	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.1	7.3	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	0.83	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**6.4**	**49.0**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.35	8.26	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	3.39	inches

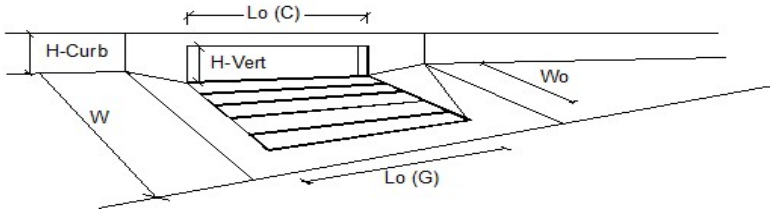
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**6.4**	**49.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.06 Released August 2018



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.9**	**5.9**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.1**	**1.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**99**	**82**	**%**

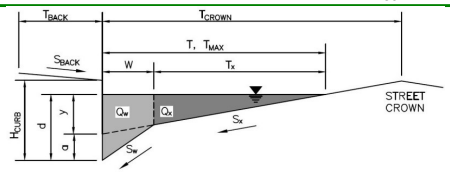
Version 4.06 Released August 2018

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Crossroads Mixed Use

Inlet ID: Inlet 7



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.4	8.8	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	3.36	3.36	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline	d =	4.87	4.87	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	12.0	12.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.425	0.425	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	5.5	5.5	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.1	4.1	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**9.6**	**9.6**	**cfs**
Flow Velocity within the Gutter Section	V =	6.3	6.3	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.6	2.6	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	12.0	30.4	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	10.0	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.490	0.191	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	3.4	54.6	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	3.4	42.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.3	12.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	3.8	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	6.7	58.7	cfs
Average Flow Velocity Within the Gutter Section	V =	5.8	9.9	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.1	7.3	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	0.83	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**6.7**	**49.0**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.40	8.26	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	3.39	inches

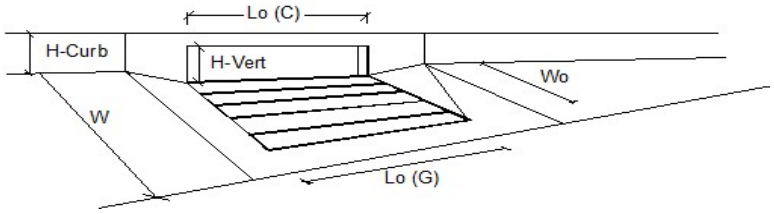
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**6.7**	**49.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.06 Released August 2018

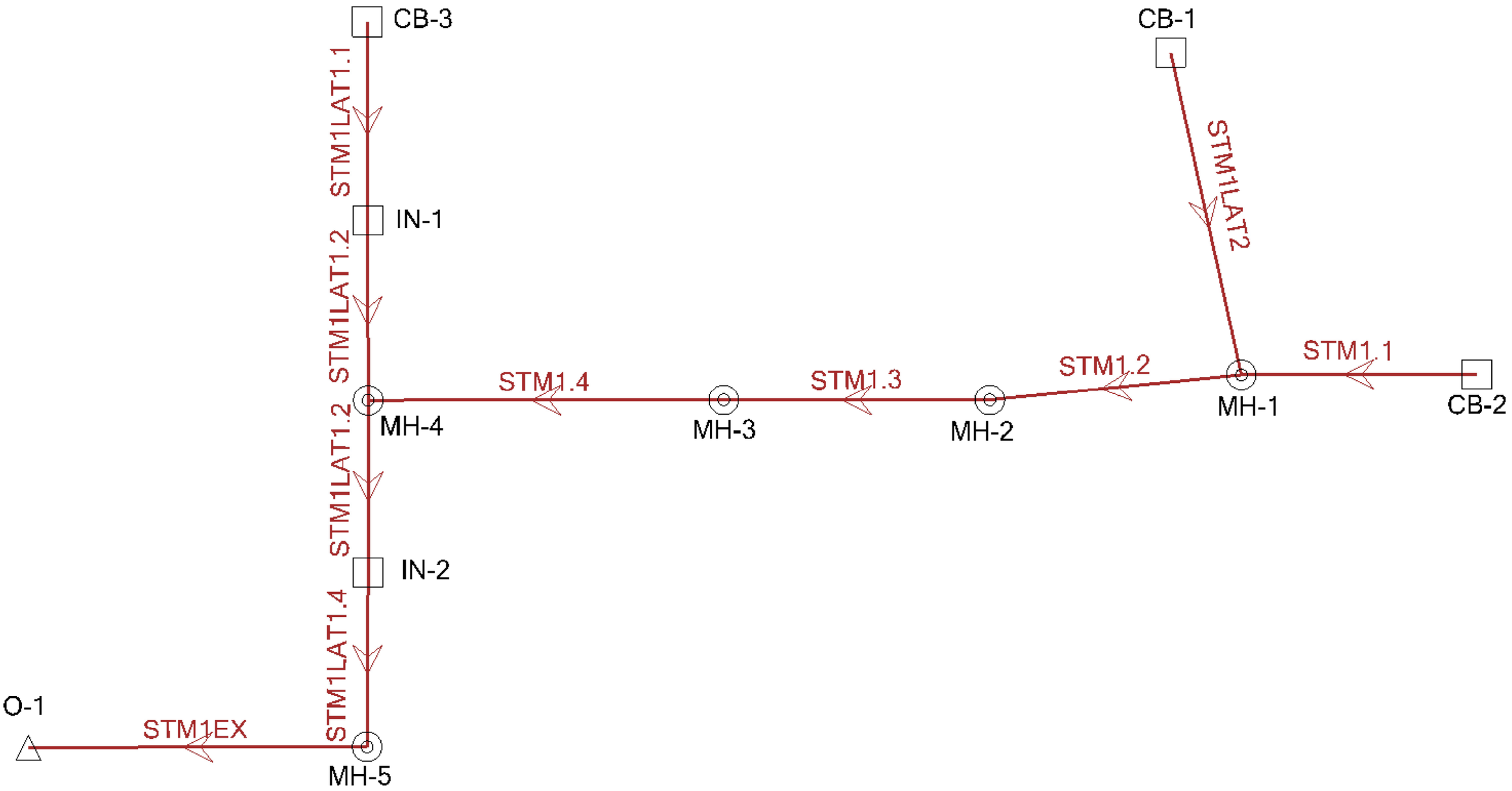


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**5.1**	**7.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.6**	**3.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**90**	**70**	**%**

HYDRAULIC CALCULATIONS

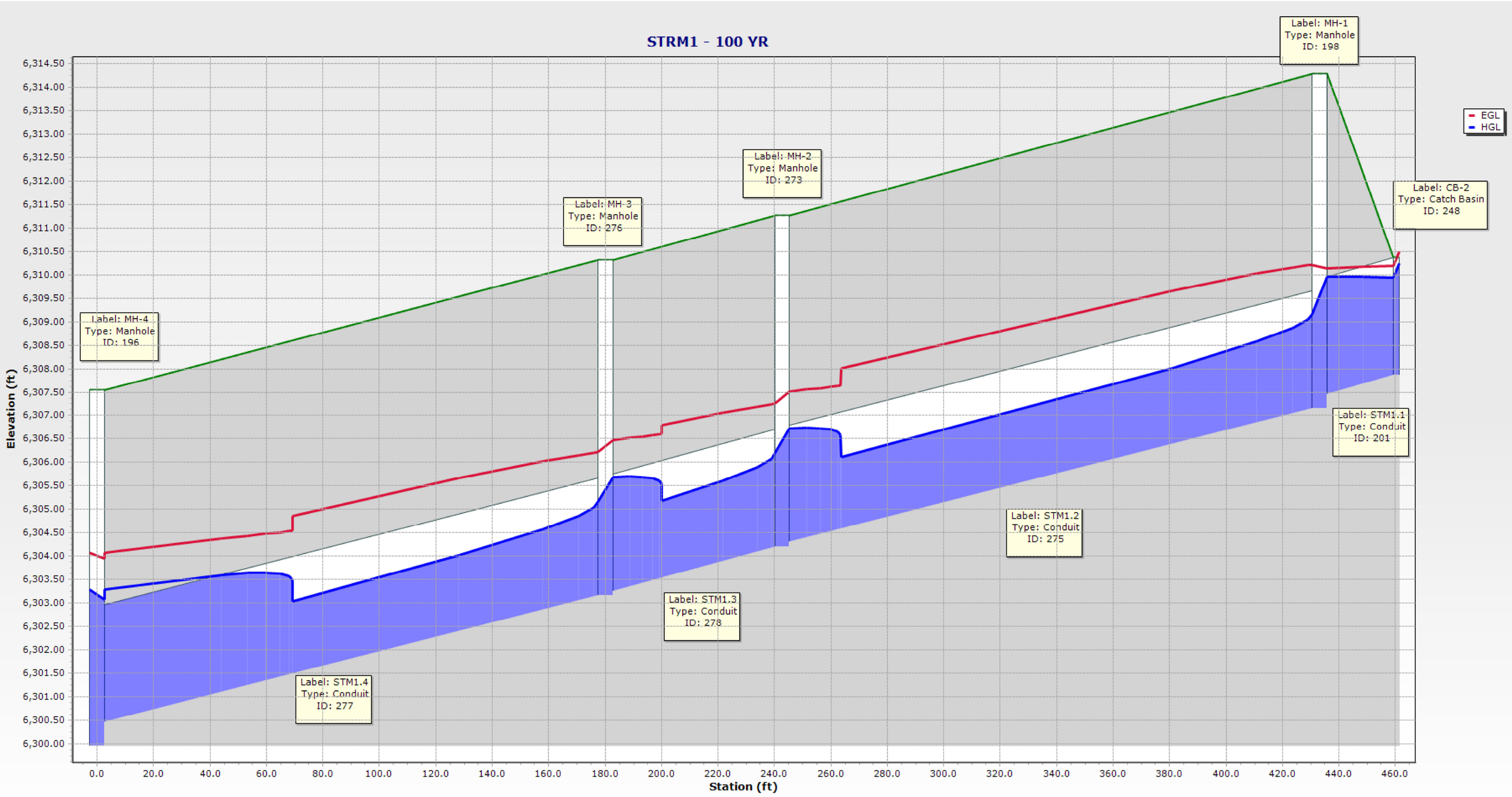
STORM 1, LAT 1, LAT 2 INDEX MAP



Conduit FlexTable: STRM1 100 YR

Label	ID	Upstream Structure	Flow (cfs)	Flow / Capacity (Design) (%)	Length (Unified) (ft)	Velocity (ft/s)	Depth (Normal) (ft)	Depth (Critical) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)	Upstream Structure Hydraulic Grade Line (In) (ft)
STM1.1	201	CB-2	17.40	34.6	27.4	9.30	1.02	1.41	6,310.19	6,310.15	6,309.94	6,309.95	-0.01	6,310.25
STM1LAT2	203	CB-1	17.40	34.8	57.7	9.28	1.02	1.41	6,310.31	6,310.15	6,309.73	6,309.95	-0.22	6,310.45
STM1LAT1.3	207	MH-4	53.20	56.7	5.6	7.53	1.62	2.37	6,303.95	6,303.92	6,303.07	6,303.04	0.04	6,303.29
STM1LAT1.4	210	IN-2	62.50	65.9	6.4	14.32	1.78	2.55	6,303.78	6,303.66	6,302.29	6,302.24	0.06	6,303.04
STM1EX	267	MH-5	62.50	64.4	57.1	14.59	1.75	2.55	6,303.35	6,302.63	6,301.87	6,300.06	1.81	6,302.24
STM1.2	275	MH-1	34.70	69.0	190.2	11.05	1.53	2.00	6,310.22	6,307.52	6,309.16	6,306.73	2.43	6,309.95
STM1.4	277	MH-3	34.70	69.1	180.1	11.04	1.53	2.00	6,306.22	6,304.07	6,305.16	6,303.29	1.87	6,305.69
STM1.3	278	MH-2	34.70	69.1	62.6	11.04	1.53	2.00	6,307.26	6,306.48	6,306.20	6,305.69	0.51	6,306.73
STM1LAT1.2	280	IN-1	21.40	40.5	27.8	10.19	1.11	1.57	6,303.66	6,303.59	6,303.36	6,303.29	0.07	6,303.51
STM1LAT1.1	281	CB-3	16.90	61.6	22.5	9.18	1.14	1.48	6,304.08	6,303.96	6,303.60	6,303.51	0.09	6,304.20

Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Upstream Structure Headloss (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Conduit Description	Manning's n	Friction Slope (ft/ft)	Slope (Calculated) (ft/ft)
4.00	1.250	0.31	6,314.29	6,310.37	6,307.46	6,307.87	Circle - 30.0 in	0.013	0.002	-0.015
6.09	1.250	0.72	6,314.29	6,310.82	6,307.46	6,308.32	Circle - 30.0 in	0.013	0.003	-0.015
7.07	0.250	0.22	6,307.39	6,307.54	6,299.85	6,299.96	Circle - 36.0 in	0.013	0.006	-0.020
7.53	0.500	0.74	6,307.82	6,307.39	6,299.62	6,299.75	Circle - 36.0 in	0.013	0.019	-0.020
9.55	0.250	0.37	6,306.99	6,307.82	6,298.11	6,299.32	Circle - 36.0 in	0.013	0.013	-0.021
3.55	0.750	0.79	6,311.27	6,314.29	6,304.30	6,307.16	Circle - 30.0 in	0.013	0.014	-0.015
7.13	0.500	0.53	6,307.54	6,310.31	6,300.46	6,303.16	Circle - 30.0 in	0.013	0.012	-0.015
7.13	0.500	0.53	6,310.31	6,311.27	6,303.26	6,304.20	Circle - 30.0 in	0.013	0.012	-0.015
5.38	0.500	0.15	6,307.54	6,307.93	6,300.46	6,300.92	Circle - 30.0 in	0.013	0.003	-0.017
5.56	1.250	0.60	6,307.93	6,303.75	6,301.42	6,301.75	Circle - 24.0 in	0.013	0.005	-0.015


STRM1 - 100 YR
Label: MH-1
Type: Manhole
ID: 198
Label: MH-2
Type: Manhole
ID: 273
Label: MH-3
Type: Manhole
ID: 276
Label: MH-4
Type: Manhole
ID: 196
Label: CB-2
Type: Catch Basin
ID: 248
EGL
HGL
Label: STM1.1
Type: Conduit
ID: 201
Label: STM1.2
Type: Conduit
ID: 275
Label: STM1.3
Type: Conduit
ID: 278
Label: STM1.4
Type: Conduit
ID: 277
Elevation (ft)
6,314.50
6,314.00
6,313.50
6,313.00
6,312.50
6,312.00
6,311.50
6,311.00
6,310.50
6,310.00
6,309.50
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6,308.50
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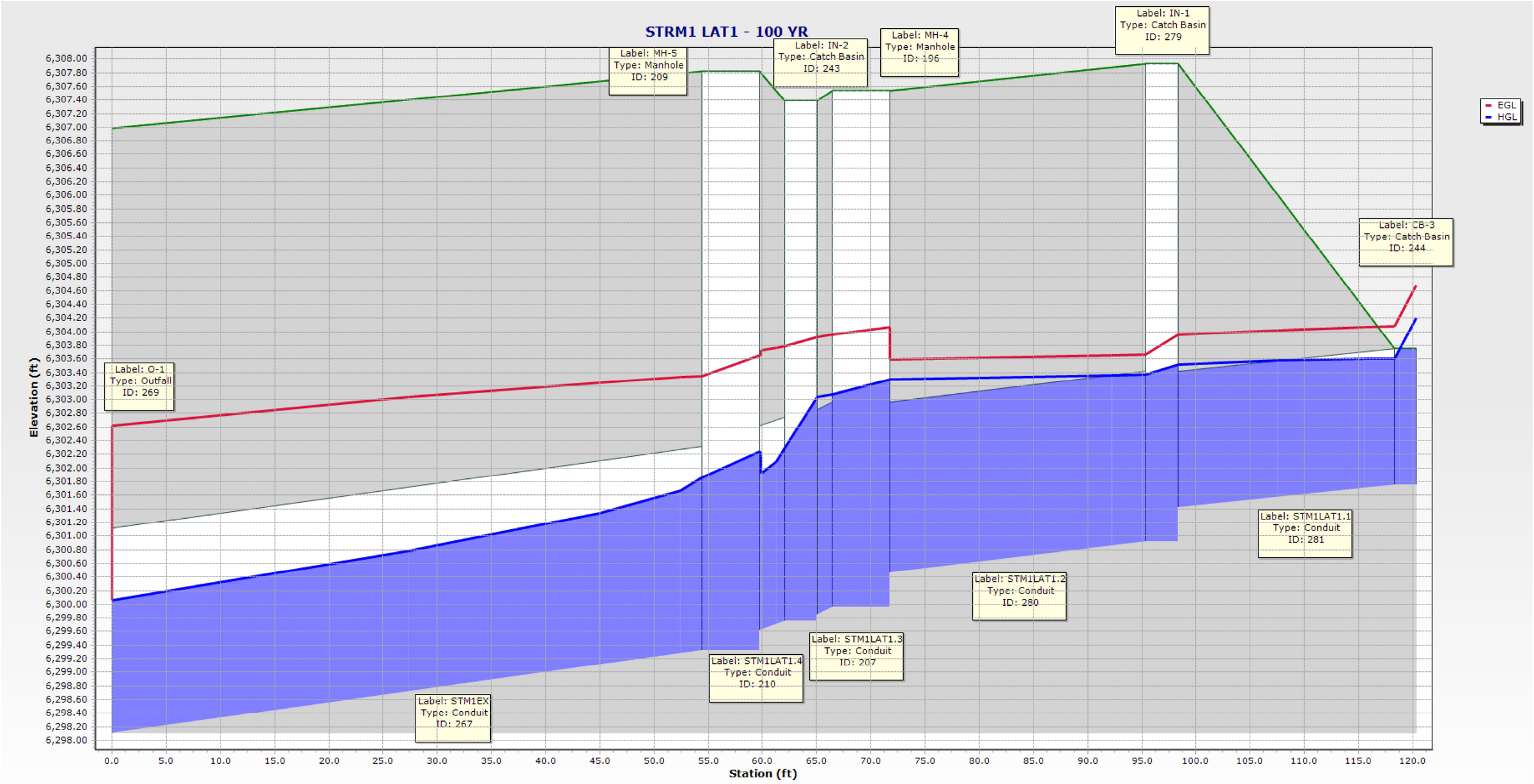
6,303.50
6,303.00
6,302.50
6,302.00
6,301.50
6,301.00
6,300.50
6,300.00
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0
220.0
240.0
260.0
280.0
300.0
320.0
340.0
360.0
380.0
400.0
420.0
440.0
460.0
Station (ft)


STRM1 LAT1 - 100 YR
Label: MH-5
Type: Manhole
ID: 209
Label: IN-2
Type: Catch Basin
ID: 243
Label: MH-4
Type: Manhole
ID: 196
Label: IN-1
Type: Catch Basin
ID: 279
Label: CB-3
Type: Catch Basin
ID: 244
Label: O-1
Type: Outfall
ID: 269
Label: STM1LAT1.1
Type: Conduit
ID: 281
Label: STM1LAT1.2
Type: Conduit
ID: 280
Label: STM1LAT1.3
Type: Conduit
ID: 207
Label: STM1LAT1.4
Type: Conduit
ID: 210
Label: STM1EX
Type: Conduit
ID: 267
EGL
HGL
Elevation (ft)
Station (ft)
6,308.00
6,307.80
6,307.60
6,307.40
6,307.20
6,307.00
6,306.80
6,306.60
6,306.40
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6,304.40
6,304.20
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6,303.40
6,303.20
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6,302.60
6,302.40
6,302.20
6,302.00
6,301.80
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6,301.40
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5.0
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15.0
20.0
25.0
30.0
35.0
40.0
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60.0
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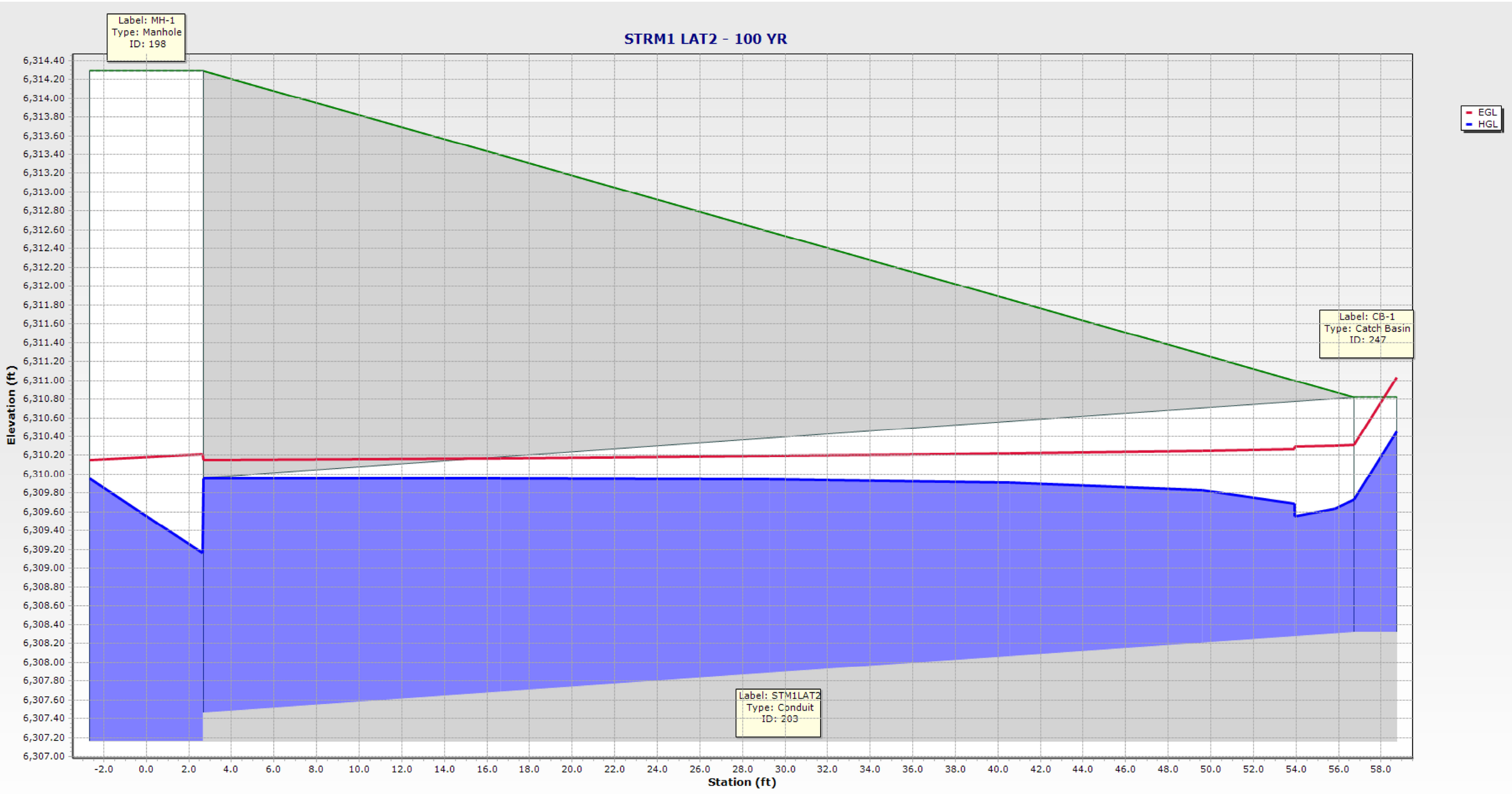
120.0


STRM1 LAT2 - 100 YR
Label: MH-1
Type: Manhole
ID: 198
Label: CB-1
Type: Catch Basin
ID: 247
Label: STM1LAT2
Type: Conduit
ID: 203
EGL
HGL
Elevation (ft)
Station (ft)
6,314.40
6,314.20
6,314.00
6,313.80
6,313.60
6,313.40
6,313.20
6,313.00
6,312.80
6,312.60
6,312.40
6,312.20
6,312.00
6,311.80
6,311.60
6,311.40
6,311.20
6,311.00
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6,308.80
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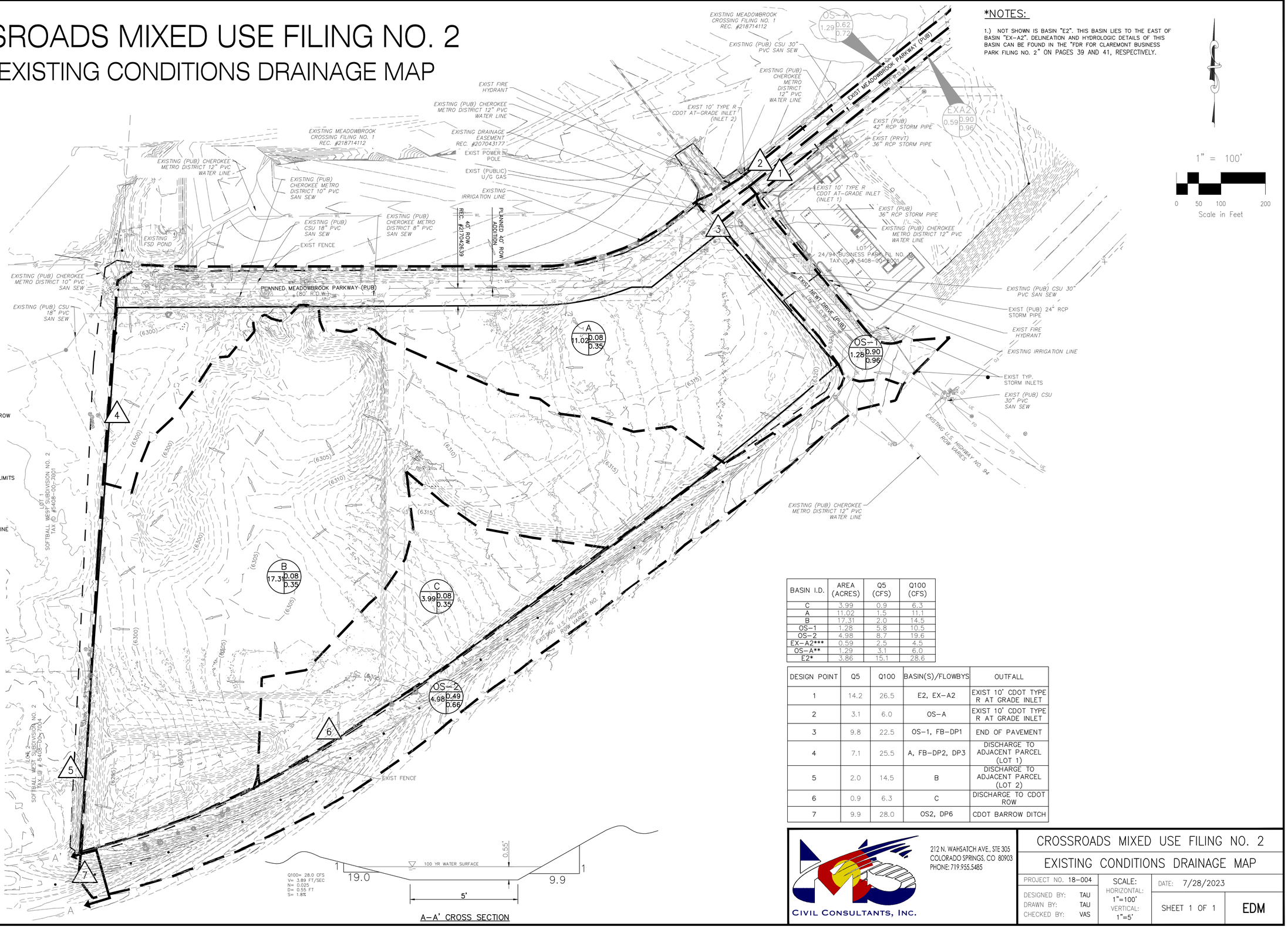
6,307.60
6,307.40
6,307.20
6,307.00
-2.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
22.0
24.0
26.0
28.0
30.0
32.0
34.0
36.0
38.0
40.0
42.0
44.0
46.0
48.0
50.0
52.0
54.0
56.0
58.0

BACKGROUND

DRAINAGE MAPS

CROSSROADS MIXED USE FILING NO. 2

EXISTING CONDITIONS DRAINAGE MAP



A-A' CROSS SECTION

LEGEND

BASIN DESIGNATION: Z | 25 | .25 | .35 | C5 | C100 (ACRES)

- SURFACE DESIGN POINT
- BASIN BOUNDARY
- (7070) EXIST MAJ CONT
- (7072) EXIST MIN CONT
- EXISTING FLOW DIRECTION ARROW
- H.P. HIGH POINT
- L.P. LOW POINT
- PROPOSED SWALE
- EXISTING SWALE
- CONSTRUCTION/DISTURBANCE LIMITS
- SITE BOUNDARY
- R.O.W./EASEMENT
- LOT LINE
- ST EX. STORM SEWER LINE
- UE EX. UNDERGROUND ELECTRIC LINE
- SS EX. SANITARY SEWER LINE
- WL EX. WATER LINE
- ST EX. STORM SEWER LINE
- 9 LOT NUMBER
- ICV EX. IRRIGATION VALVE
- ST EX. STORM INLET
- G EX. GAS TEST NODE
- T EX. TELEPHONE PEDESTAL
- ELVL EX. ELECTRIC VAULT
- SS EX. SANITARY MANHOLE
- EX. WATER VALVE

*NOTES:

1.) NOT SHOWN IS BASIN "E2". THIS BASIN LIES TO THE EAST OF BASIN "EX-A2". DELINEATION AND HYDROLOGIC DETAILS OF THIS BASIN CAN BE FOUND IN THE "FDR FOR CLAREMONT BUSINESS PARK FILING NO. 2" ON PAGES 39 AND 41, RESPECTIVELY.

1" = 100'

0 50 100 200

Scale in Feet

BASIN I.D.	AREA (ACRES)	Q5 (CFS)	Q100 (CFS)
C	3.99	0.9	6.3
A	11.02	1.5	11.1
B	17.31	2.0	14.5
OS-1	1.28	5.8	10.5
OS-2	4.98	8.7	19.6
EX-A2***	0.59	2.5	4.5
OS-A**	1.29	3.1	6.0
E2*	3.86	15.1	28.6

DESIGN POINT	Q5	Q100	BASIN(S)/FLOWBYS	OUTFALL
1	14.2	26.5	E2, EX-A2	EXIST 10' CDOT TYPE R AT GRADE INLET
2	3.1	6.0	OS-A	EXIST 10' CDOT TYPE R AT GRADE INLET
3	9.8	22.5	OS-1, FB-DP1	END OF PAVEMENT
4	7.1	25.5	A, FB-DP2, DP3	DISCHARGE TO ADJACENT PARCEL (LOT 1)
5	2.0	14.5	B	DISCHARGE TO ADJACENT PARCEL (LOT 2)
6	0.9	6.3	C	DISCHARGE TO CDOT ROW
7	9.9	28.0	OS2, DP6	CDOT BARROW DITCH

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212 N. WAHSATCH AVE., STE 305
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

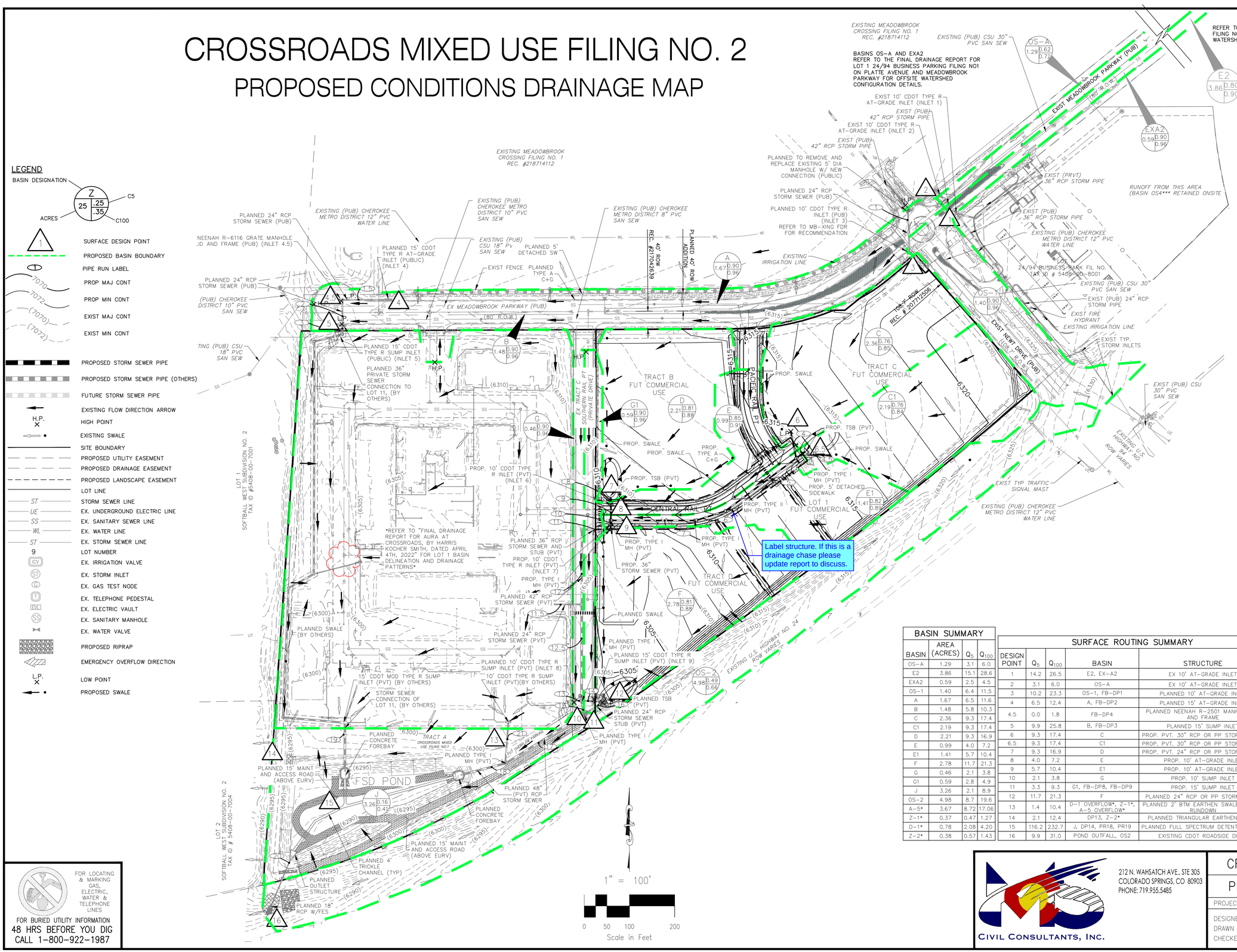
CROSSROADS MIXED USE FILING NO. 2
EXISTING CONDITIONS DRAINAGE MAP

PROJECT NO. 18-004
DESIGNED BY: TAU
DRAWN BY: TAU
CHECKED BY: VAS
SCALE: HORIZONTAL: 1"=100' VERTICAL: 1"=5'
DATE: 7/28/2023
SHEET 1 OF 1
EDM

File: O:\18004A-Crossroads MU-Retail\Equity Group\Drainage\18-004 EXIST DM.dwg Plotstamp: 7/28/2023 2:34 PM

CROSSROADS MIXED USE FILING NO. 2

PROPOSED CONDITIONS DRAINAGE MAP



NOTE:

1. "PLANNED" REFERS TO THE IMPROVEMENTS PROPOSED FOR CONSTRUCTION IN OTHER PROJECTS (FILING NO.1 AND AURA AT CROSSROADS).

2. PROPOSED CONTOURS FOR BASIN E1 DO NOT REFLECT THE DEVELOPMENT OF LOT 1. HOWEVER, THE DRAINAGE MAP DESIGN AND DRAINAGE CALCULATIONS ARE BASED OFF OF THE FUTURE DEVELOPMENT OF LOT 1 WHICH WILL RUNOFF TO CENTRAL POINT WAY AS SHOWN IN THE MAP.

3. TEMPORARY SEDIMENT BASINS (TSB) WILL REMAIN IN PLACE UNTIL ALL UPSTREAM PERMANENT CONSTRUCTION HAS BEEN COMPLETED.

4. *REFER TO FDR FOR AURA AT CROSSROADS, DATED APRIL 4TH 2022, FOR CONTRIBUTING BASIN DETAILS

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q_5	Q_{100}
OS-A	1.29	3.1	6.0
E2	3.86	15.1	28.6
EXA2	0.59	2.5	4.5
OS-1	1.40	6.4	11.5
A	1.67	6.5	11.6
B	1.48	5.8	10.3
C	2.36	9.3	17.4
C1	2.19	9.3	17.4
D	2.21	9.3	16.9
E	0.99	4.0	7.2
E1	1.41	5.7	10.4
F	2.78	11.7	21.3
G	0.46	2.1	3.8
G1	0.59	2.8	4.9
J	3.26	2.1	8.9
OS-2	4.98	8.7	19.6
A-5*	3.67	8.72	17.06
Z-1*	0.37	0.47	1.27
D-1*	0.78	2.08	4.20
Z-2*	0.38	0.57	1.43

SURFACE ROUTING SUMMARY				
DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
1	14.2	26.5	E2, EX-A2	EX 10' AT-GRADE INLET
2	3.1	6.0	OS-A	EX 10' AT-GRADE INLET
3	10.2	23.3	OS-1, FB-DP1	PLANNED 10' AT-GRADE INLET
4	6.5	12.4	A, FB-DP2	PLANNED 15' AT-GRADE INLET
4.5	0.0	1.8	FB-DP4	PLANNED NEENAH R-2501 MANHOLE LID AND FRAME
5	9.9	25.8	B, FB-DP3	PLANNED 15' SUMP INLET
6	9.3	17.4	C	PROP. PVT. 30" RCP OR PP STORM SEWER
6.5	9.3	17.4	C1	PROP. PVT. 30" RCP OR PP STORM SEWER
7	9.3	16.9	D	PROP. PVT. 24" RCP OR PP STORM SEWER
8	4.0	7.2	E	PROP. 10' AT-GRADE INLET
9	5.7	10.4	E1	PROP. 10' AT-GRADE INLET
10	2.1	3.8	G	PROP. 10' SUMP INLET
11	3.3	9.3	G1, FB-DP8, FB-DP9	PROP. 15' SUMP INLET
12	11.7	21.3	F	PLANNED 24" RCP OR PP STORM SEWER
13	1.4	10.4	D-1 OVERFLOW*, Z-1*, A-5 OVERFLOW*	PLANNED 2' BTM EARTHEN SWALE, RIPRAP RUNDOWN
14	2.1	12.4	DP13, Z-2*	PLANNED TRIANGULAR EARTHEN SWALE
15	116.2	232.7	J, DP14, PR18, PR19	PLANNED FULL SPECTRUM DETENTION POND
16	9.9	31.0	POND OUTFALL, OS2	EXISTING CDOT ROADSIDE DITCH

STORM SEWER SUMMARY				
PIPE RUN	Q_5	Q_{100}	PIPE SIZE	CONTRIBUTING PIPES/DESIGN POINTS
1	6.7	9.8	24" SD	DP3 (INLET 3)
1.5	6.5	10.6	24" SD	DP4 (INLET 4)
2	6.4	12.3	24" SD	PR1.5, DP4.5 (INLET 4.5)
3	16.2	37.9	36" SD	PR2, DP5 (INLET 5)
4	9.3	17.4	30" SD	DP6
4.5	9.3	17.4	30" SD	DP6.5
5	18.7	34.7	30" SD	PR4, PR4.5
6	18.7	34.7	30" SD	PR5
7	18.7	34.7	30" SD	PR6
8	9.3	16.9	24" SD	DP7
9	12.4	21.4	30" SD	PR8, DP8 (INLET 6)
10	29.5	53.2	36" SD	PR7, PR9
11	35.7	62.5	36" SD	PR10, DP9 (INLET 7)
11.5*	6.9	13.8	24" SD	SEE FDR FOR AURA AT CROSSROADS
12	35.7	62.5	42" SD	PR11
12.5	43.3	78.0	48" SD	PR12, PR11.5
13	2.1	3.8	18" SD	DP10 (INLET 8)
14	3.3	9.3	30" SD	DP11 (INLET 9)
15	47.2	88.2	48" SD	PR12.5, PR13, PR14
16	11.7	21.3	24" SD	DP12
17	55.7	103.5	48" SD	PR15, PR16
18	56.2	104.8	48" SD	PR17, PR21*
19*	35.4	65.5	48" SD	SEE FDR FOR AURA AT CROSSROADS
20	1.2	11.4	18" SD	POND OUTFALL (SEE FIL NO.1)
21*	2.1	4.2	30" SD	SEE FDR FOR AURA AT CROSSROADS

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212 N. WAHSATCH AVE., STE 305
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

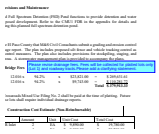
CROSSROADS MIXED USE FILING NO. 2
PROPOSED CONDITIONS DRAINAGE MAP

PROJECT NO. 18-004
DESIGNED BY: TAU
DRAWN BY: TAU
CHECKED BY: VAS
SCALE: HORIZONTAL: 1"=100' VERTICAL: 1"=5'
DATE: 07/28/2023
SHEET 1 OF 1
PDM

File: O:\18004A-Crossroads MU-Retail\Equity Group\Drainage\18-004 PROP DM FSD.dwg Plotstamp: 7/28/2023 2:35 PM

V4_FDR Comments.pdf Markup Summary

Carlos (2)



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Page Label: 15
Author: Carlos
Date: 9/12/2023 4:18:59 PM
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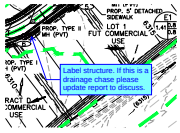
Please revise drainage fees. Fees will be collected for platted lots only (Lot 1) and roadway tracts.Please add a clarifying statement.



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Author: Carlos
Date: 9/12/2023 2:29:40 PM
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Label structure. If this is a drainage chase please update report to discuss.