FINAL DRAINAGE REPORT

FOR

LOT 1 CROSSROADS MIXED USE FILING NO. 3

EL PASO COUNTY, COLORADO

NOVEMBER 2024

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 #18-007
PCD Filing No.: PPR

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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:____________________________

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 Lot 1, Crossroads Mixed Use Filing No. 3, 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.

A Final Drainage Report for this site and Construction Drawings will be submitted concurrently with the Final Plat.

Project Location and Description

The subject site is located in the south half of Section 8, Township 14 South, Range 65 West of the 6^{th} P.M. in El Paso County, Colorado. The 1.030-acre site is currently undeveloped. The site is bound to the west by Lot 1 of Crossroads Mixed Use Filing No. 2, to the north by Tract A, Crossroads Mixed Use Filing No. 3, to the east by Tract B, Crossroads Mixed Use Filing No. 3, and to the south by Highway 24. The proposed site will be developed as a commercial lot, with parking lot, two private access roads and the extension of Central Rail Point.

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 at average slopes between 1% and 2%. The site lies within the Sand Creek Drainage Basin. No existing drainage facilities or improvements are onsite, however, surrounding drainage facilities are planned and existing 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), which is characterized to be part of Hydrologic Soil Types "A" 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. 08041C0752 G & 08041C0754 G, effective date December 7th, 2018, the site lies within Zone X (area of minimal flood hazard). 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 Lot 1 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.

"Final Drainage Report for Lot 1 Crossroads Mixed Use Filing No.2, prepared by M&S Civil Consultants, Inc., approved October 5, 2023.

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

"Final Drainage Report for Crossroads Mixed Use Filing No.2, prepared by M&S Civil Consultants, Inc., approved November 29, 2023.

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

"Final Drainage Report for Crossroads Mixed Use Filing No.1, prepared by M&S Civil Consultants, Inc., approved June 9, 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 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 proposed 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 lots and surrounding areas had 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. The site and surrounding areas have been since been graded during the development of Lot 1 Crossroads Mixed Use Filing No. 2. 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.

In the existing condition, vegetation remains sparse, consisting primarily of graded soils and weeds with good to fair cover. Areas disturbed by grading activities were reseeded and have since stabilized. Ultimately, all runoff from the site is conveyed to the west towards existing drainage facilities located under Southern Rail Point, which are discharged to an existing FSD Pond located at the southeast corner of Cross Roads Mixed Use Filing No. 1. Ultimately, the drainage from the site discharges into the East Fork of Sand Creek. This section only discusses the changes in basin geometry and drainage pattern and provides a direct comparison of the proposed conditions from Crossroads Mixed Use Filing No. 2 (CMU2) FDR versus the existing conditions of the subject lot.

Design Point 1

Off-site **Basin C** (Q5=1.0, Q100=7.5 cfs) consists of 3.40 acres of the northern portion of commercial Tract C located along the north and east side of the site. An existing private 30" storm sewer (**PR4**) collects and conveys undeveloped flows of Q5=1.0 and Q100=7.5 cfs in the 5 and 100-year storm event, respectively. Intercepted flows are conveyed west underground within the existing Central Rail Point roadway. **PR4** was designed to account for future development per the CMU2 FDR. The acreage and flows in the existing condition have changed from the CMU2 FDR LOT 1 report, in part to the new field survey provided by MS Civil Consultants, Inc.

Design Point 2

Off-site **Basin C1** (Q5=0.4, Q100=2.6 cfs) consists of 1.16 acres of the southern portion of commercial Tract C located along the east side of the site. An existing private 30" storm sewer (**PR4.5**) collects and conveys undeveloped flows of Q5=0.4 and Q100=2.6 cfs in the 5 and 100-year storm event, respectively. Intercepted flows from **PR4** and **PR4.5** are conveyed west underground within the existing Central Rail Point roadway through **PR5, PR6, and PR7** at flow rates of Q5=1.4 and Q100=10.1 cfs. These flows are less than or equivalent to the flows cited in the CMU2 FDR LOT 1 report (Q5=1.4 and Q100=10.4 cfs). **PR4, PR4.5** and **PR5-7** were designed to account for future development per the CMU2 FDR. The acreage and flows in the existing condition have changed from the CMU2 FDR LOT 1 report, in part to the new field survey.

Design Point 8

Off-site **Basin E** (Q5=2.1, Q100=5.6 cfs) consists of 1.58 acres of a portion of undeveloped commercial lots, the northern half of existing Central Rail Point and the western half of existing Pacific Rail Point. An existing private 10' CDOT Type R at-grade inlet (**Inlet 6:** Q5=2.1, Q100=5.6 cfs intercepted; no flow by) is located on the north side of the roadway to intercept developed and undeveloped flows from **Basin E**. Future runoff bypassing this inlet continues to downstream infrastructure. Existing flows collected from the inlet are conveyed to a box base manhole in the center of the existing Central Rail Point via an existing private 30" (**PR9**) storm drain at flow rates of Q5=2.1 and Q100=5.6 cfs. **PR9** was designed to account for future development per the CMU2 FDR. The flows in the existing condition are less than the flows cited in the CMU2 FDR LOT 1 report (Q5=2.3 and Q100=9.1 cfs). The flows from **PR9** then combine with flows from **PR7** and continue to flow through an existing private 36" (**PR10**) storm drain at flow rates of Q5=3.5 and Q100=15.7 cfs. **PR10** was designed to account for future development per the CMU2 FDR. The flows in the existing condition are less than the flows cited in the CMU2 FDR LOT 1 report (Q5=3.8 and Q100=19.6 cfs).

Design Point 9A

On-site **Basin E1A** (Q5=0.2, Q100=1.4 cfs) consists of 0.56 acres of a commercial lot. The undeveloped lot generally drains from south to northwest until the flows exit the basin as sheet flow at **DP9A** (Q5=0.2, Q100=1.4 cfs). The runoff from this design point is conveyed onto the southern half of Central Rail Point and combines with flows within **Basin** ***E1B** and ***E1C.** The acreage and flows in the existing condition have changed from the CMU2 FDR LOT 1 report, in part to the new topography that was provide by the field survey provided by MS Civil Consultants.

<u>Design Point 9B</u>

On-site **Basin *E1B** (Q5=1.8, Q100=3.3 cfs) consists of 0.43 acres of existing commercial Lot 1. The basin generally drains from south to northwest until the flows exit the basin through an existing 3' wide curb chase at **DP9B** (Q5=1.8, Q100=3.3 cfs). The runoff from this design point is conveyed onto the southern half of Central Rail Point and combines with flows within **Basin E1A** and ***E1C.** The **Basin *E1B** developed flows are the same as the developed flows cited in the CMU2 FDR LOT 1 report (Q5=1.8 and Q100=3.3 cfs).

<u>Design Point 9</u>

Off-site **Basin *E1C** (Q5=1.2, Q100=2.2 cfs) consists of 0.27 acres of undeveloped commercial lots, and the southern half of Central Rail Point. An existing private 10' CDOT Type R at-grade inlet (**Inlet 7**: Q5=2.6, Q100=5.7 cfs; with Q100=0.6 cfs of flow by) is located on the south side of the Central Rail Point to intercept developed and undeveloped flows from **Basin *E1C, DP9A and DP9B**. Future runoff bypassing this inlet continues to downstream infrastructure. Existing 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 private 36" (**PR11**) storm drain and continue west underground at flow rates of Q5=6.0 and Q100=21.0 cfs. An existing 42" private storm sewer, then directs the system south under existing Southern Rail Point to an existing manhole and ultimately to the existing FSD pond for treatment. **PR11** and the storm sewer infrastructure was designed to account for future development per the CMU2 FDR. The flows in the existing condition are less than the flows cited in the CMU2 FDR LOT1 report (Q5=7.9 and Q100=30.4 cfs).

<u>Design Point 11</u>

Off-site **Basin D** (Q5=0.5 cfs, Q100=3.6 cfs) consists of 1.62 acres of undeveloped commercial lots and off-site **Basin *G1** (Q5=2.9, Q100=5.4 cfs) consists of 0.69 acres of commercial lots and the east half of existing Southern Rail Point, located west of the subject site. An existing private 15' CDOT Type R sump inlet (**Inlet 9**: Q5=2.6, Q100=8.2 cfs intercepted; no flow by), located on the east side of existing Southern Rail Point collects the developed runoff from **Basin D and Basin *G1** as well as bypass flows from **DP8** and **DP9**, totaling Q5=2.6 and Q100=8.2 cfs. **DP11** was designed to account for future development per the CMU2 FDR. The flows in the existing condition are equivalent to or less than the flows cited in the CMU2 FDR LOT 1 report (Q5=2.9 and Q100=6.7 cfs).

*See Final Drainage Report for Lot 1 Crossroads Mixed Use Filing No.2 ("CMU2 FDR LOT1") by M&S Civil Consultants, Inc. approved October 2023 in the appendix for pre-development conditions at these locations. See Final Drainage Report for Crossroads Mixed Use Filing No.2 ("CMU2 FDR") by M&S Civil Consultants, Inc. approved November 2023 for additional predevelopment, historic, future, and full spectrum detention condition comparison for the intermediate events at these locations.

Four Step Process

Step 1 **Employ Runoff Reduction Practices** –Whenever possible, runoff produced within developable area containing impervious surfaces will be routed through landscaped areas to minimize direct connection of impervious surfaces.

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.

Step 3 Provide Water Quality Capture Volume (WQCV)– The site will utilize an existing 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 one (1) commercial lot and extend the existing access road. The proposed development will extend Central Rail Pont to the east and allow for access to the commercial lot. The following summary generalizes the proposed drainage patterns and drainage improvements required to safely route developed runoff to downstream facilities.

Off-site flows will collect per the existing detailed drainage discussion. Runoff within the western portion of Lot 1 will flow northwest to the existing Central Rail Point (private). Flows within the existing Central Rail Point will be conveyed west and collected by a pair of at-grade inlets located at the west end of the roadway, then routed south and west via existing storm sewer systems to the existing off-site FSD Pond. Central Rail Point (private) will be extended to provide access and utility corridors for the development. Private storm sewer mains, stubs, and inlets will be extended along these corridors to serve the development. Runoff within the middle and eastern portion of Lot 1 will be directed via sheet flow to one of two inlets located within the subject site. Runoff from the proposed building shall be collected by a private roof drain system located on the back of the building. The flows from the building roof drains and two private inlets located within Lot 1 all combine at a proposed underground storm sewer system located the north side of the lot and are conveyed northwest. The existing storm sewer pipe located within Central Ral Point (private) will be extended northeast and the proposed storm sewer pipe conveying runoff from the site will tie in at the northwest boundary of the proposed Central Rail Point. All onsite storm sewer and drainage improvements shall be private. Proposed on-site flows will continue off-site through existing storm pipes, where the flows will combine with adjacent lot flows and continue through existing storm pipes to the existing FSD pond located southwest of the proposed site. The existing outfall from the pond will discharge into the existing borrow ditch located within the north half of the existing CDOT Right of Way as per the CMU1 MDDP. Refer to the "Existing Detailed Drainage Discussion" of this report for all Design Points upstream of Design Point 9, since none of the upstream drainage changes in the proposed conditions. The existing FSD Pond will function as intended and will not require additional maintenance due to the development of these lots. The contractor will be responsible for any reexcavation of sediment and debris that collects in the basin depression to ensure that the basin meets the design grades following construction. The storm lines shall be cleaned and free of sediment once after final stabilization.

Proposed Detailed Drainage Discussion

Design Point 1

Offsite **Basin C** (Q5=1.2 cfs, Q100=8.9 cfs) consists of 3.85 acres of the north portion of Tract B. The undeveloped lot generally drains from southeast to northwest until being intercepted at **DP1** (Q5=1.2 cfs, Q100=8.9 cfs) by an existing exposed 30" storm sewer stub. The collected runoff continues underground via an existing private 30" storm sewer (**PR4**) at peak flow rates of Q5=1.2 and Q100=8.9 cfs in the 5 and 100-year storm event, respectively. Intercepted flows continue west underground within the existing storm sewer system located under the existing Central Rail Point roadway. **PR4** was designed to account for future development per the CMU2 FDR.

Design Point 1.5

Onsite **Basin C1** (Q5=0.4 cfs, Q100=0.7 cfs) consists of 0.08 acres of proposed Central Rail Pt (private) located within Tract A. The developed flows from **Basin C1** drains from east to west until the flows are intercepted at **DP1.5** (Q5=0.4 cfs, Q100=0.7 cfs), a proposed private 10' CDOT Type R at-grade inlet. The runoff from this design point continues underground via a proposed private 18" RCP storm sewer (**PR4.1**) which conveys peak flows of Q5=0.4 cfs and Q100=0.7 cfs. Flows from **PR4 and PR4.1** combine at a proposed private 5' diameter manhole and continue southwest underground via **PR4.2** and peak flow rates of Q5=1.5 cfs and Q100=9.4 cfs.

Basin C8

Onsite **Basin C8** (Q5=0.1 cfs, Q100=0.2 cfs) consists of 0.03 acres of building rooftop. The developed flows are conveyed underground via a proposed private 6" HDPE storm drain (**PR1**) which conveys peak flows of Q5=0.1 cfs and Q100=0.2 cfs.

Basin C7

Onsite **Basin C7** (Q5=0.1 cfs, Q100=0.2 cfs) consists of 0.03 acres of building rooftop. The developed flows are conveyed underground via a proposed private 6" HDPE storm drain (**PR1.5**) which conveys peak flows of Q5=0.1 cfs and Q100=0.2 cfs. **PR1.5** combines with the flows from **PR1** at **PR2** (Q5=0.2 cfs, Q100=0.4 cfs), a proposed private 6" HDPE storm sewer.

Design Point 2

Basin C4 (Q5=0.0, Q100=0.1 cfs) consists of 0.04 acres of the southeast corner of Lot 1. Onsite **Basin C6** (Q5=0.7 cfs, Q100=1.2 cfs) consists of 0.15 acres of commercial lot. The flows form **Basin C4** generally drains from southeast to northwest until the flow exists the basin (as sheet flow) and enters **Basin C6**. The combined flows from **Basin C4 and C6** continue northwest to **DP2** (Q5=0.7 cfs, Q100=1.3 cfs), a proposed private 2'x3' ADS inlet atop a 24" drain basin. The runoff from this design point continues underground via a proposed private 12" PP storm sewer (**PR2.5**) which conveys peak flows of Q5=0.7 cfs and Q100=1.3 cfs. Flows from **PR2.5** continue northwest and combine with the flows from **PR2** at **PR3** (Q5=0.9 cfs, Q100=1.7 cfs), a proposed private 12" PP storm sewer. Flows from **PR3** continue underground.

Design Point 3

Onsite **Basin C3** (Q5=0.0 cfs, Q100=0.1 cfs) consists of 0.03 acres of landscaping along the east boundary. Onsite **Basin C5** (Q5=1.1 cfs, Q100=2.1 cfs) consists of 0.27 acres of commercial lot. The flows from undeveloped **Basin C3** generally drains from southeast to northwest until the flows exit the basin as sheet flow at **Basin C5**. The combined flows from **Basin C3 and Basin C5** continue northwest to **DP3** (Q5=1.1 cfs, Q100=2.1 cfs), a proposed private 5' CDOT Type R sump inlet. The runoff from this design point continues underground via a proposed private 12" PP storm sewer (**PR3.5**) which conveys peak flows of Q5=1.1 cfs and Q100=2.1 cfs. Flows from **PR3.5** continue underground.

Design Point 4

Onsite **Basin C2** (Q5=0.5, Q100=0.9 cfs) consists of 0.11 acres of Tract A. The flows from developed **Basin C2** generally drains from east to west until the flows are intercepted at **DP4** (Q5=0.5 cfs, Q100=0.9 cfs), a proposed private 10' CDOT Type R at-grade inlet. The runoff from this design point combines with the flows from **PR3 and PR3.5** and continues underground via a proposed private 24" RCP storm sewer (**PR4.4**) which conveys peak flows of Q5=2.5 cfs and Q100=4.7 cfs. Flows from **PR4.4** are conveyed northwest to a proposed private 5' diameter manhole. Here, flows combine with the flows (from the future development) located on Tract B at a proposed private 24" RCP storm sewer (**PR4.3**) which collects no flow in the proposed condition. Flows from **PR4.3** and **PR4.4** combine at **PR4.5** (Q5=2.5 fs, Q100=4.7 cfs), a proposed private 30" RCP storm drain. Intercepted flows from **PR4.2** and **PR4.5** are conveyed west underground within the existing Central Rail Point roadway through **PR5, PR6, and PR7** at flow rates of Q5=3.4 and Q100=13.0 cfs. **PR4, PR4.5** and **PR5-7** were designed to account for future development per the CMU2 FDR.

Design Point 9A

Onsite **Basin E1A** (Q5=1.4, Q100=3.0 cfs) consists of 0.50 acres of a commercial lot. Onsite **Basin E1A.5** (Q5=0.0 cfs, Q100=0.1 cfs) consists of 0.04 acres of commercial lot. Flows from both basins are conveyed northwest until the flows exit the basin as at **DP9A** (Q5=1.4 cfs, Q100=3.0 cfs). The runoff from this design pint is conveyed onto the southern half of Central Rail Pt. and ultimately combines with the flows within **Basin *E1C**.

Design Point 9B

Offsite **Basin *E1B** (Q5=1.8, Q100=3.3 cfs) consists of 0.43 acres of proposed commercial Lot 2, CRMU2. The basin generally drains from south to northwest until the flows exit the basin at **DP9B** (Q5=1.8, Q100=3.3 cfs). The runoff from this design point is conveyed onto the southern half of Central Rail Pt. and ultimately combines with flows within **Basin E1C.**

Design Point 7

Off-site **Basin *D** (Q5=0.7 cfs, Q100=5.1 cfs) consists of 2.21 acres of future commercial lot from CRMU2 FDR LOT 1. **Basin *D** is located between existing Meadowbrook Parkway, existing Central Rail Point, existing Pacific Rail Point, and existing Southern Rail Point. **Basin *D** has a private 24" storm drain at the southwest corner, **PR7**, to collect undeveloped peak flows of Q5=0.7 cfs and Q100=5.1 cfs from this basin in the 5 and 100-year storm events, respectively.

Design Point 8

Off-site **Basin *E** (Q5=1.6, Q100=3.9 cfs) consists of 0.99 acres of a portion of undeveloped commercial lots from CRMU2, the northern half of existing Central Rail Point and the western half of existing Pacific Rail Point. An existing private 10' CDOT Type R at-grade inlet, (**Inlet 6:** Q5=1.6, Q100=3.9 cfs intercepted; no flow by) is located on the north side of the roadway at **DP8** (Q5=1.6 cfs, Q100=3.9 cfs) to intercept developed and undeveloped flows from **Basin *E**. Future runoff bypassing this inlet continues to downstream infrastructure. Proposed flows collected from the inlet are conveyed to a box base manhole in the center of the existing Central Rail Point via an existing private 30" (**PR9**) storm drain at flow rates of Q5=2.3 and Q100=9.0 cfs. **PR9** was designed to account for future development per the CMU2 FDR. The flows in the proposed condition are less than or equal to the flows cited in the CMU2 FDR LOT 1 report (Q5=2.3 and Q100=9.1 cfs). The flows from **PR9** then combine with flows from **PR7** and continue to flow through an existing private 36" (**PR10**) storm drain at flow rates of Q5=5.7 and Q100=22.0 cfs. **PR10** was designed to account for future development per the CMU2 FDR.

Design Point 9

Off-site **Basin *E1C** (Q5=1.2, Q100=2.2 cfs) consists of 0.27 acres of undeveloped commercial lots from CRMU2, and the southern half of Central Rail Point. An existing private 10' CDOT Type R at-grade inlet (**Inlet 7**: Q5=4.3, Q100=8.3 cfs; with Q5=0.1 and Q100=1.9 cfs of flow by) is located on the south side of the Central Rail Point at **DP9** (Q5=4.3 cfs, Q100=8.3 cfs) to intercept developed and undeveloped flows from **Basin *E1C, DP9A and DP9B**. Proposed runoff bypassing this inlet continues to downstream infrastructure. Proposed 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 private 36" (**PR11**) storm drain and continue west underground at flow rates of Q5=9.2 and Q100=28.6 cfs. An existing 42" private storm sewer, then directs the system south under existing Southern Rail Point to an existing manhole and ultimately to the existing FSD pond for treatment. **PR11** and the storm sewer infrastructure was designed to account for future development per the CMU2 FDR.

Design Point 11

Off-site **Basin *G1** (Q5=2.9, Q100=5.4 cfs) consists of 0.69 acres of commercial lots and the east half of Southern Rail Point, located west of the existing site. A private 15' CDOT Type R sump inlet (**Inlet 9:** Q5=2.9, Q100=8.8 cfs intercepted; no flow by), located on the southeast side of existing Southern Rail Point collects the runoff from **Basin *G1** as well as bypass flows from **DP8 and DP9**, at **DP11**, totaling Q5=2.9 and Q100=8.8 cfs. **PR14**, an existing 30" private storm sewer, directs runoff west to an underground box base manhole at peak flow rates of 2.9 cfs and 8.8 cfs in the minor and major storm events, respectively. **PR14** and the storm sewer infrastructure was designed to account for future development per the CMU2 FDR.

*See Crossroads Mixed Use Filing No. 2 FDR/MDDP ("CMU2 FDR") by M&S Civil Consultants, Inc. dated November 2022, in the appendix for predevelopment, and existing condition comparison for the events at these lots.
*See Lot 1 Crossroads Mixed Use Filing No. 2 FDR ("Lot 1 CMU2 FDR LOT 1") by M&S Civil Consultants, Inc. dated July 2023, in the appendix for predevelopment, and existing condition comparison for the events at these lots.

Water Quality Provisions and Maintenance

The off-site existing detention pond functions to provide detention and water quality for the proposed development. Refer to the Final Drainage Report for Crossroads Mixed Use Filing No. 1 in the appendix for details and calculations regarding the existing 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 inlet protection, stockpiling, staging, and concrete washout areas. A stormwater management plan is provided to accompany the plans.

2024 Drainage & Bridge Fees:
Drainage fees for the subject site have been previously paid with Filing No. 2.

Construction Cost Estimate (Non-Reimbursable)

Item	Amount	Unit	Unit Cost	Total Cost
2'X3' ADS Inlet Atop 24" Drain Basin	1	EA	$5,611.00	$5,611.00
5' CDOT Type R Inlet	1	EA	$6,703.00	$6.703.00
10' CDOT Type R Inlet	2	EA	$9,890.00	$19,780.00
Type II MH	2	EA	$6,000.00	$12,000.00
6" HDPE SD	85	LF	$30.00	$2,550.00
12" PP SD	116	LF	$50.00	$5,800.00
18" PP SD	11	LF	$70.00	$770.00
24" PP SD	156	LF	$81.00	$12,636.00
TOTAL COST:				**$65,850.00**

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 2024.

Summary

The construction of this site is for the purposes of developing commercial Lot 1 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 lots at **PR11 and PR14**. At **PR11**, the proposed runoff is 26.5 cfs and 33.9 cfs less than the planned (future) runoff from the CMU2 FDR for the 5 and 100-year events of Q5= 35.7 cfs and Q100=62.5, respectively. This difference is due to area adjustments of the basins located within Tract B, drainage within Tract B, as well as Tract B being undeveloped. At **PR14**, the proposed runoff is 0.4 cfs and 0.5 cfs less that the planned (future) runoff from the CMU2 FDR for the 5 and 100-year events, respectively. This difference is due to the fact that as more runoff reached the at grade inlets at **DP8 and DP9**, there is more flow by that reaches **PR14**. Nonetheless, the amount of runoff that reaches the previously assumed FSD Pond from adjacent lots and the proposed site is less than the previously assumed flows at this location from the CMU2 FDR for the 5 and 100-year events, respectively. Thus, the runoff from the proposed site does not affect the size of the previously assumed FSD Pond. Proposed post construction runoff will be discharged from the pond at the same, or lesser, rates than previously assumed for the 5 and 100 year design events from the CMU2 FDR. Thus, the development of the proposed site will not further impact the flows that are planned to be released from the FSD Pond in the CMU2 FDR (see appendix). The construction of Lot 1 Crossroads Mixed Use Filing No. 3 shall not adversely affect adjacent or downstream property.

A future conditions map and the associated calculations have been added to the appendix of this report for further comparison. The future conditions map and calculations illustrate that the flows exiting the future development of CMU3 are less than the proposed flow from the CMU2 FDR.

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.

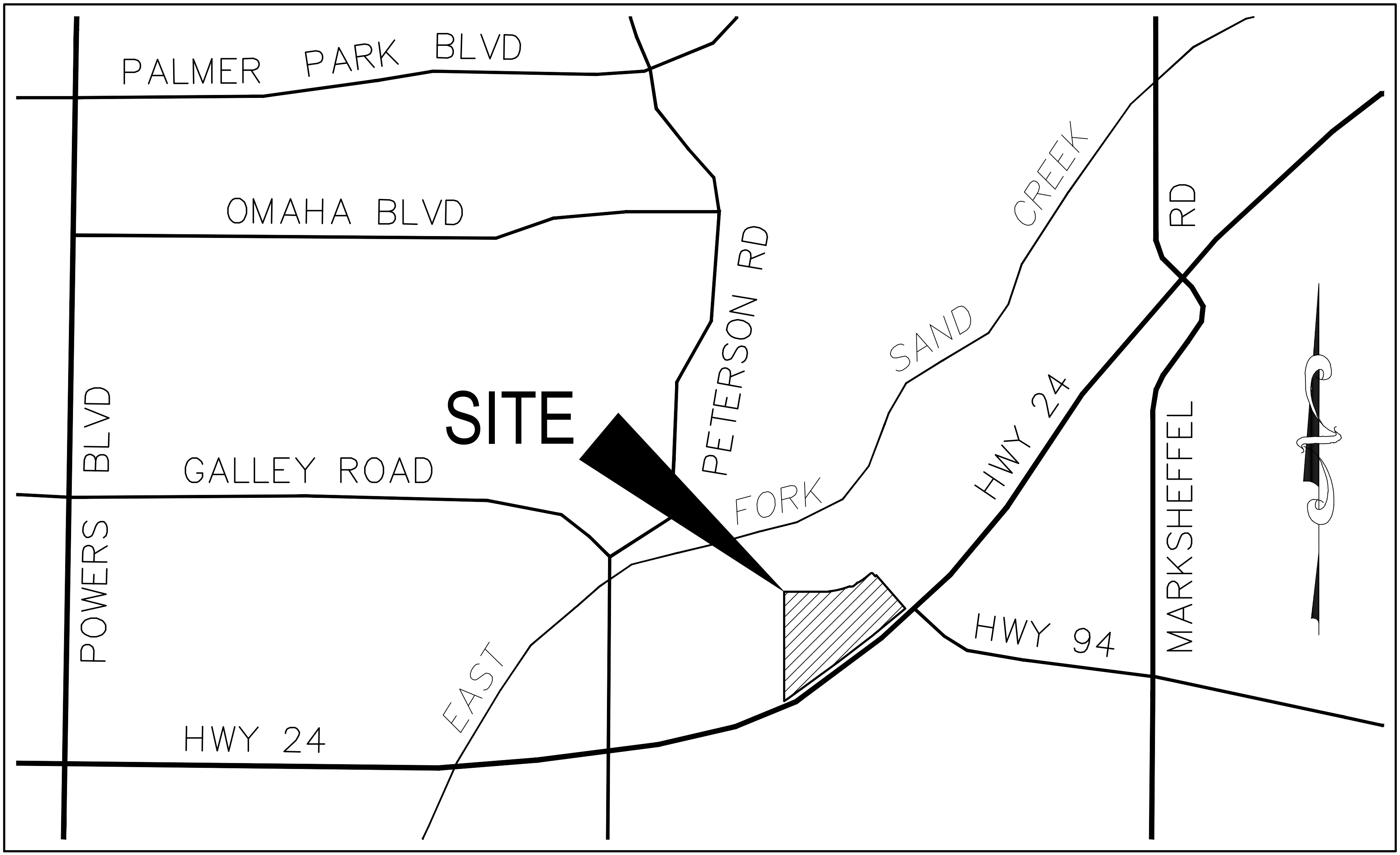
11.) "Final Drainage Report for Crossroads Mixed Use Filing No.1", approved June 2023, by M&S Civil Consultants, Inc.

12.) "Final Drainage Report for Crossroads Mixed Use Filing No.2", approved November 2023, by M&S Civil Consultants, Inc.

13.) "Final Drainage Report for Lot 1 Crossroads Mixed Use Filing No.2", approved October 2023, by M&S Civil Consultants, Inc.

APPENDIX

VICINITY MAP



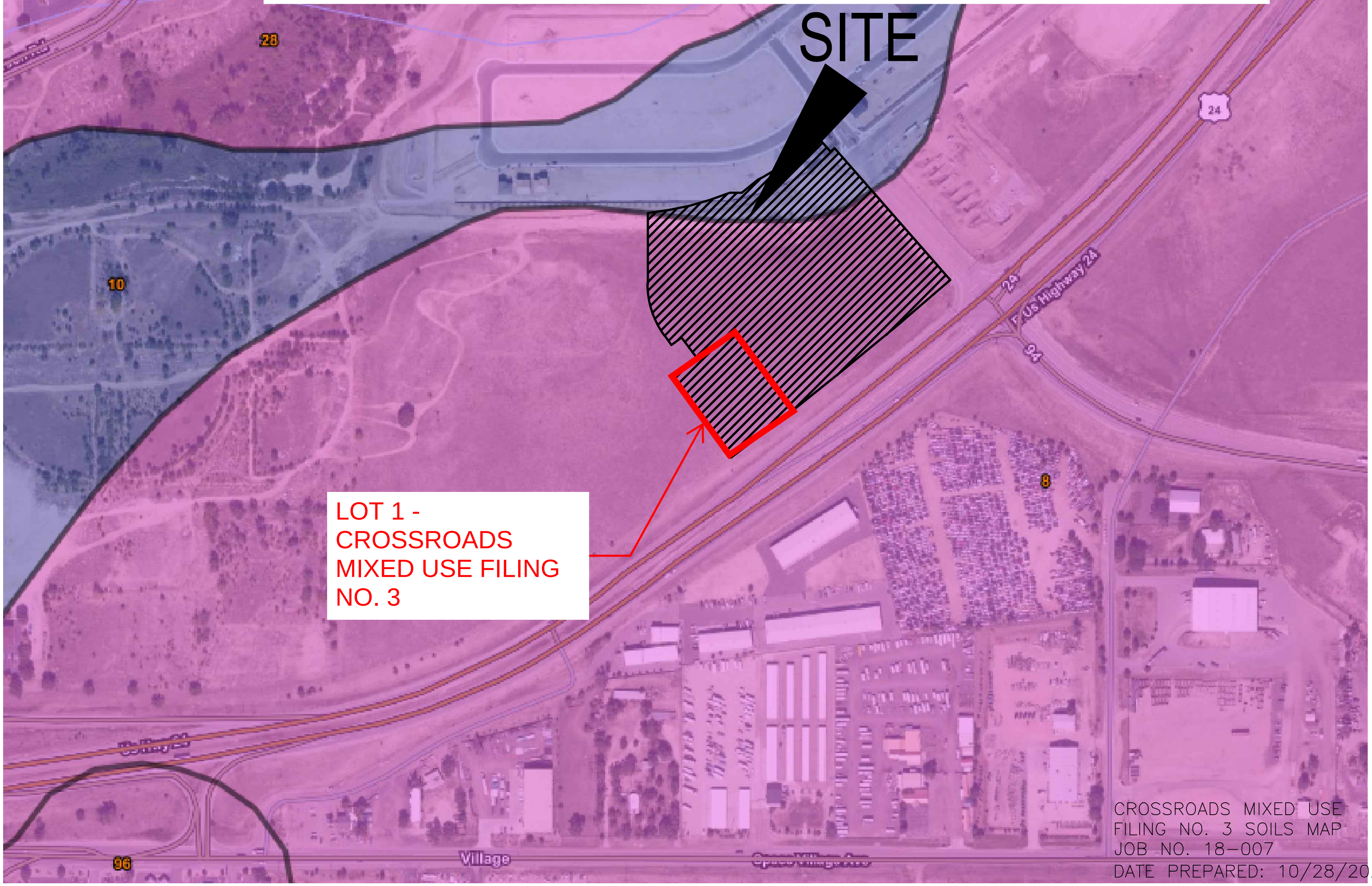
VICINITY MAP

N.T.S.

SOILS MAP

SOILS MAP

CROSSROADS MIXED USE FILING NO. 3



1" = 300

0 150 300 600

Scale in Feet

CROSSROADS MIXED USE FILING NO. 3 SOILS MAP
JOB NO. 18-007
DATE PREPARED: 10/28/2024

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

File: O:\18007A-CRMUR-Lot 2\The Equity Group\Drainage\Soils\SOILS MAP.dwg Plotstamp: 10/28/2024 11:10 AM

FIRM PANELS

National Flood Hazard Layer FIRMette

FEMA

104°42'1"W 38°50'48"N

104°41'24"W 38°50'20"N

Feet
0 250 500 1,000 1,500 2,000

1:6,000

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
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 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.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 11/1/2022 at 6:14 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

HYDROLOGIC CALCULATIONS

LOT 1 CROSSROADS MIXED USE FILING NO. 3
PRELIMINARY DRAINAGE CALCULATIONS
(Existing 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}
Existing Area Drainage Summary													
C	148180	3.40	0.00	0.81	0.88	0.00	0.49	0.62	3.40	0.08	0.35	0.08	0.35
C1	50566	1.16	0.00	0.81	0.88	0.00	0.49	0.62	1.16	0.08	0.35	0.08	0.35
D	70662	1.62	0.00	0.81	0.88	0.00	0.49	0.62	1.62	0.08	0.35	0.08	0.35
E	68614	1.58	0.54	0.90	0.96	0.00	0.81	0.88	1.04	0.08	0.35	0.36	0.56
E1A	24257	0.56	0.02	0.81	0.88	0.00	0.81	0.88	0.54	0.08	0.35	0.11	0.37
*E1B	18815	0.43	0.43	0.81	0.88	0.00	0.81	0.88	0.00	0.08	0.35	0.81	0.88
*E1C	11894	0.27	0.22	0.90	0.96	0.05	0.81	0.88	0.00	0.08	0.35	0.88	0.95
*G1	29974	0.69	0.63	0.90	0.96	0.06	0.12	0.39	0.00	0.08	0.35	0.84	0.91

*FROM FDR FOR LOT 1 CROSSROADS MIXED USE FILING NO. 2

Calculated by: GT
Date: 9/23/2024
Checked by: DLM

LOT 1 CROSSROADS MIXED USE FILING NO. 3
PRELIMINARY DRAINAGE REPORT
(Existing 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**	**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.)*
		From DCM Table 5-1															
Existing Area Drainage Summary																	
C	3.40	0.08	0.35	0.08	50	1.5	9.1	461	2.0%	2.1	3.7	12.7	12.8	3.8	6.3	***1.0***	***7.5***
C1	1.16	0.08	0.35	0.08	50	1.3	9.6	338	2.1%	2.2	2.6	12.2	12.2	3.8	6.4	***0.4***	***2.6***
D	1.62	0.08	0.35	0.08	50	1	10.4	353	1.4%	2.4	2.5	12.8	12.2	3.8	6.3	***0.5***	***3.6***
E	1.58	0.36	0.56	0.36	36	0.25	9.0	538	1.5%	2.4	3.7	12.7	13.2	3.8	6.3	***2.1***	***5.6***
E1A	0.56	0.11	0.37	0.11	50	2	8.0	200	3.3%	1.3	2.6	10.7	12.2	4.0	6.8	***0.2***	***1.4***
****E1B***	0.43	0.81	0.88	0.81	30	2	1.5	285	2.1%	2.9	1.6	5.0	13.2	5.2	8.7	***1.8***	***3.3***
****E1C***	0.27	0.88	0.95	0.88	50	1	2.2	420	1.4%	2.4	3.0	5.2	13.2	5.1	8.6	***1.2***	***2.2***
****G1***	0.69	0.84	0.91	0.84	50	1	2.7	466	1.1%	2.1	2.6	5.3	12.9	5.1	8.5	***2.9***	***5.4***

Intensity equations assume a minimum travel time of 5 minutes.

*VALUES DERIVED USING DATA FROM FDR FOR LOT 1 CROSSROADS MIXED USE FILING NO.2

Calculated by: GT
Date: 9/23/2024
Checked by: DLM

LOT 1 CROSSROADS MIXED USE FILING NO. 3
PRELIMINARY DRAINAGE REPORT
(Existing 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
EXISTING DRAINAGE BASIN ROUTING SUMMARY																	
1	C	0.27	1.19	Tc for C Used								12.7	3.8	6.3	1.0	7.5	Existing 30" RCP Pipe (Pvt)
2	C1	0.09	0.41	Tc for C1 Used								12.2	3.8	6.4	0.4	2.6	Existing 30" RCP Pipe (Pvt)
9A	E1A	0.06	0.21	Tc for E1A Used								10.7	4.0	6.8	0.2	1.4	Existing Paved Access Drive (Pvt)
9B	*E1B	0.35	0.38	Tc for *E1B Used								5.0	5.2	8.7	1.8	3.3	Existing 3' Curb Chase (Pvt)
8	E	0.57	0.88	Tc for *E used								12.7	3.8	6.3	2.1	5.6	Existing 10' CDOT Type R At-Grade Inlet (Pvt)
9	*E1C, DP 9A, DP 9B	0.65	0.84	Tc for DP 9A Used								10.7	4.0	6.8	2.6	5.7	Existing 10' CDOT Type R At-Grade Inlet (Pvt)
11	D, *G1, FB DP 8, FB DP 9	0.70	1.30	Tc for D Used								12.8	3.8	6.3	2.6	8.2	Existing 15' CDOT Type R Sump Inlet (Pvt)

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

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

GT
Date: 9/23/2024
Checked by: DLM

LOT 1 CROSSROADS MIXED USE FILING NO. 3
FINAL DRAINAGE CALCULATIONS
(Existing 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}	
4	DP1	0.27	1.19	12.7	3.8	6.3	1.0	7.5	30" RCP
4.5	DP2	0.09	0.41	12.2	3.8	6.4	0.4	2.6	30" RCP
5	PR4, PR4.5	0.37	1.60	12.7	3.8	6.3	1.4	10.1	30" RCP
6	PR5	0.37	1.60	12.7	3.8	6.3	1.4	10.1	30" RCP
7	PR6	0.37	1.60	12.7	3.8	6.3	1.4	10.1	30" RCP
9	DP8	0.57	0.88	12.7	3.8	6.3	2.1	5.6	30" RCP
10	PR7, PR9	0.93	2.48	12.7	3.8	6.3	3.5	15.7	36" RCP
11	PR10, DP9	1.58	3.32	12.7	3.8	6.3	6.0	21.0	36" RCP

Calculated by: GT
Date: 9/23/2024
Checked by: DLM

DP - Design Point
EX - Existing Design Point

FB- Flow By from Design Point
INT- Intercepted Flow from Design Point

LOT 1 CROSSROADS MIXED USE FILING NO. 3
PRELIMINARY 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}
Existing Area Drainage Summary													
C	167839	3.85	0.00	0.81	0.88	0.00	0.49	0.62	3.85	0.08	0.35	0.08	0.35
C1	3611	0.08	0.08	0.90	0.96	0.00	0.49	0.62	0.00	0.08	0.35	0.90	0.96
C2	4625	0.11	0.11	0.90	0.96	0.00	0.49	0.62	0.00	0.08	0.35	0.90	0.96
C3	1122	0.03	0.00	0.90	0.96	0.00	0.49	0.62	0.03	0.08	0.35	0.08	0.35
C4	1660	0.04	0.00	0.90	0.96	0.00	0.49	0.62	0.04	0.08	0.35	0.08	0.35
C5	11594	0.27	0.24	0.90	0.96	0.00	0.49	0.62	0.03	0.08	0.35	0.81	0.89
C6	6386	0.15	0.14	0.90	0.96	0.00	0.49	0.62	0.00	0.08	0.35	0.87	0.94
C7	1188	0.03	0.03	0.81	0.88	0.00	0.49	0.62	0.00	0.08	0.35	0.81	0.88
C8	1125	0.03	0.03	0.81	0.88	0.00	0.49	0.62	0.00	0.08	0.35	0.81	0.88
*D	96318	2.21	0.00	0.81	0.88	0.00	0.49	0.62	2.21	0.08	0.35	0.08	0.35
*E	42959	0.99	0.41	0.90	0.96	0.00	0.81	0.88	0.57	0.08	0.35	0.42	0.61
E1A	21582	0.50	0.33	0.81	0.88	0.00	0.81	0.88	0.17	0.08	0.35	0.56	0.70
E1A.5	1797	0.04	0.00	0.90	0.96	0.00	0.81	0.88	0.04	0.08	0.35	0.17	0.42
*E1B	18815	0.43	0.43	0.81	0.88	0.00	0.81	0.88	0.00	0.08	0.35	0.81	0.88
*E1C	11894	0.27	0.22	0.90	0.96	0.05	0.81	0.88	0.00	0.08	0.35	0.88	0.95
*G1	29974	0.69	0.63	0.90	0.96	0.06	0.12	0.39	0.00	0.08	0.35	0.84	0.91

*FROM FDR FOR LOT 1 CROSSROADS MIXED USE FILING NO. 2

Date: 10/28/2024
Checked by: DLM

LOT 1 CROSSROADS MIXED USE FILING NO. 3
PRELIMINARY 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.)
Existing Area Drainage Summary																	
C	3.85	0.08	0.35	0.08	31	1.0	7.0	544	1.7%	2.0	4.6	11.5	13.2	3.9	6.6	***1.2***	***8.9***
C1	0.08	0.90	0.96	0.90	45	1.0	1.9	95	1.6%	2.5	0.6	5.0	10.8	5.2	8.7	***0.4***	***0.7***
C2	0.11	0.90	0.96	0.90	50	1.0	2.0	98	1.5%	2.5	0.7	5.0	10.8	5.2	8.7	***0.5***	***0.9***
C3	0.03	0.08	0.35	0.08	15	0.2	6.5					6.5	10.1	4.8	8.0	***0.0***	***0.1***
C4	0.04	0.08	0.35	0.08	37	1.0	8.1	12	4.2%	4.1	0.0	8.1	10.3	4.4	7.5	***0.0***	***0.1***
C5	0.27	0.81	0.89	0.81	50	1.0	3.0	165	1.8%	2.7	1.0	5.0	11.2	5.2	8.7	***1.1***	***2.1***
C6	0.15	0.87	0.94	0.87	25	1.0	1.3	82.4	2.4%	3.1	0.4	5.0	10.6	5.2	8.7	***0.7***	***1.2***
C7	0.03	0.81	0.88	0.81	35	0.5	2.8					5.0	10.2	5.2	8.7	***0.1***	***0.2***
C8	0.03	0.81	0.88	0.81	35	0.5	2.8					5.0	10.2	5.2	8.7	***0.1***	***0.2***
****D***	2.21	0.08	0.35	0.08	50	1	10.4	200	1.5%	1.2	1.1	11.5	11.4	3.9	6.6	***0.7***	***5.1***
****E***	0.99	0.42	0.61	0.42	60	1.2	7.6	700	1.0%	2.0	3.8	11.4	14.2	3.9	6.6	***1.6***	***3.9***
E1A	0.50	0.56	0.70	0.56	25	2.5	2.3	334	1.3%	2.3	2.5	5.0	12.0	5.2	8.7	***1.4***	***3.0***
E1A.5	0.04	0.17	0.42	0.17	25	3	3.7	135	1.1%	1.1	2.1	5.8	10.9	4.9	8.3	***0.0***	***0.1***
****E1B***	0.43	0.81	0.88	0.81	30	2	1.5	285	2.1%	2.9	1.6	5.0	12.0	5.2	8.7	***1.8***	***3.3***
****E1C***	0.27	0.88	0.95	0.88	50	1	2.2	420	1.4%	2.4	2.9	5.1	10.9	5.1	8.6	***1.2***	***2.2***
****G1***	0.69	0.84	0.91	0.84	50	1	2.7	466	1.1%	2.1	2.6	5.3	12.9	5.1	8.5	***2.9***	***5.4***

Intensity equations assume a minimum travel time of 5 minutes.

*VALUES DERIVED USING DATA FROM FDR FOR LOT 1 CROSSROADS MIXED USE FILING NO.2

Calculated by: SPM
Date: 10/28/2024
Checked by: DLM

LOT 1 CROSSROADS MIXED USE FILING NO. 3
FINAL DRAINAGE CALCULATIONS
(Proposed Storm Sewer Routing Summary)

PIPE RUN	*Contributing Pipes/Design Points/Basins*	*Equivalent CA_5*	*Equivalent CA_{100}*	*Maximum T_C*	*Intensity** I_5	*Intensity** I_{100}	*Flow* Q_5	*Flow* Q_{100}	PIPE SIZE
1	**BASIN C8**	0.02	0.02	5.0	5.2	8.7	***0.1***	***0.2***	6" HDPE
1.5	**BASIN C7**	0.02	0.02	5.0	5.2	8.7	***0.1***	***0.2***	6" HDPE
2	**PR1, PR1.5**	0.04	0.05	5.0	5.2	8.7	***0.2***	***0.4***	6" HDPE
2.5	**DP4**	0.13	0.15	5.0	5.2	8.7	***0.7***	***1.3***	12" PP
3	**PR2, PR2.5**	0.17	0.20	5.0	5.2	8.7	***0.9***	***1.7***	12" PP
3.5	**DP3**	0.22	0.25	5.0	5.2	8.7	***1.1***	***2.1***	12" PP
4	**DP1**	0.31	1.35	11.5	3.9	6.6	***1.2***	***8.9***	30" RCP
4.1	**DP1.5**	0.07	0.08	5.0	5.2	8.7	***0.4***	***0.7***	18" RCP
4.2	**PR4, PR4.1**	0.38	1.43	11.5	3.9	6.6	***1.5***	***9.4***	30" RCP
4.3	**FUTURE FLOWS FROM TRACT B**								24" RCP
4.4	**DP2, PR3, PR3.5**	0.49	0.55	5.0	5.2	8.7	***2.5***	***4.7***	24" RCP
4.5	**PR4.3, PR4.4**	0.49	0.55	5.0	5.2	8.7	***2.5***	***4.7***	30" RCP
5	**PR4.2, PR4.5**	0.87	1.97	11.5	3.9	6.6	***3.4***	***13.0***	30" RCP
6	**PR5**	0.87	1.97	11.5	3.9	6.6	***3.4***	***13.0***	30" RCP
7	**PR6**	0.87	1.97	11.5	3.9	6.6	***3.4***	***13.0***	30" RCP
8	**DP7**	0.18	0.77	11.5	3.9	6.6	***0.7***	***5.1***	24" RCP
9	**PR8, DP8 (Inlet 6)**	0.60	1.37	11.5	3.9	6.6	***2.3***	***9.0***	30" RCP
10	**PR7, PR9**	1.46	3.35	11.5	3.9	6.6	***5.7***	***22.0***	30" RCP
11	**PR10, DP9 (Inlet 7)**	2.34	4.35	11.5	3.9	6.6	***9.2***	***28.6***	36" RCP
14	**DP11 (Inlet 9)**	0.58	1.03	5.3	5.1	8.5	***2.9***	***8.8***	30" RCP

DP - Design Point
EX - Existing Design Point

FB- Flow By from Design Point
INT- Intercepted Flow from Design Point

Calculated by: SPM
Date: 10/28/2024
Checked by: DLM

LOT 1 CROSSROADS MIXED USE FILING NO. 3
PRELIMINARY 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
EXISTING DRAINAGE BASIN ROUTING SUMMARY																	
1	C	0.31	1.35	Tc for C Used								11.5	3.9	6.6	1.2	8.9	Existing 30" RCP Pipe (Pvt)
1.5	C1	0.07	0.08	Tc for C1 Used								5.0	5.2	8.7	0.4	0.7	Proposed 10' CDOT Type R At-Grade Inlet (Pvt)
2	C4, C6	0.13	0.15	Tc for C4 Used								5.0	5.2	8.7	0.7	1.3	Proposed 2'x3' ADS Inlet atop Drain Basin (Pvt)
3	C3, C5	0.22	0.25	Tc for C3 Used								5.0	5.2	8.7	1.1	2.1	Proposed 5' CDOT Type R Sump Inlet (Pvt)
4	C2	0.10	0.10	Tc for C2 Used								5.0	5.2	8.7	0.5	0.9	Proposed 10' CDOT Type R At-Grade Inlet (Pvt)
9A	E1A, E1A.5	0.28	0.36	Tc for E1A.5 Used								5.8	4.9	8.3	1.4	3.0	Existing Paved Access Drive (Pvt)
9B	*E1B	0.35	0.38	Tc for *E1B Used								5.0	5.2	8.7	1.8	3.3	Existing 3' Curb Chase (Pvt)
7	*D	0.18	0.77	Tc for D used								11.5	3.9	6.6	0.7	5.1	Existing 24" RCP Pipe (Pvt)
8	*E	0.42	0.60	Tc for E used								11.4	3.9	6.6	1.6	3.9	Existing 10' CDOT Type R At-Grade Inlet (Pvt)
9	*E1C, DP 9A, DP 9B	0.88	1.00	Tc for DP 9A Used								5.8	4.9	8.3	4.3	8.3	Existing 10' CDOT Type R At-Grade Inlet (Pvt)
11	*G1, FB DP 8, FB DP 9	0.58	1.03	Tc for *G1 Used								5.3	5.1	8.5	2.9	8.8	Existing 15' CDOT Type R Sump Inlet (Pvt)

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

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

SPM

Date: 10/28/2024

Checked by: DLM

LOT 1 CROSSROADS MIXED USE FILING NO. 3
PRELIMINARY DRAINAGE CALCULATIONS
(Future 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}
Existing Area Drainage Summary													
C	48363	1.11	1.11	0.81	0.88	0.00	0.49	0.62	0.00	0.08	0.35	0.81	0.88
C1	3611	0.08	0.08	0.90	0.96	0.00	0.49	0.62	0.00	0.08	0.35	0.90	0.96
C2	4625	0.11	0.11	0.90	0.96	0.00	0.49	0.62	0.00	0.08	0.35	0.90	0.96
C3	1122	0.03	0.00	0.90	0.96	0.00	0.49	0.62	0.03	0.08	0.35	0.08	0.35
C4	1660	0.04	0.00	0.90	0.96	0.00	0.49	0.62	0.04	0.08	0.35	0.08	0.35
C5	11594	0.27	0.24	0.90	0.96	0.00	0.49	0.62	0.03	0.08	0.35	0.81	0.89
C6	6386	0.15	0.14	0.90	0.96	0.00	0.49	0.62	0.00	0.08	0.35	0.87	0.94
C7	1188	0.03	0.03	0.81	0.88	0.00	0.49	0.62	0.00	0.08	0.35	0.81	0.88
C8	1125	0.03	0.03	0.81	0.88	0.00	0.49	0.62	0.00	0.08	0.35	0.81	0.88
*D	96318	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	42959	0.99	0.41	0.90	0.96	0.57	0.81	0.88	0.00	0.08	0.35	0.85	0.91
E1A	21582	0.50	0.33	0.81	0.88	0.00	0.81	0.88	0.17	0.08	0.35	0.56	0.70
E1A.5	1797	0.04	0.00	0.90	0.96	0.00	0.81	0.88	0.04	0.08	0.35	0.17	0.42
*E1B	18815	0.43	0.43	0.81	0.88	0.00	0.81	0.88	0.00	0.08	0.35	0.81	0.88
*E1C	11894	0.27	0.22	0.90	0.96	0.05	0.81	0.88	0.00	0.08	0.35	0.88	0.95
*G1	29974	0.69	0.63	0.90	0.96	0.06	0.12	0.39	0.00	0.08	0.35	0.84	0.91
C1A	48482	1.11	1.11	0.81	0.88	0.00	0.12	0.39	0.00	0.08	0.35	0.81	0.88
C2A	27663	0.64	0.64	0.81	0.88	0.00	0.12	0.39	0.00	0.08	0.35	0.81	0.88
C3A	43919	1.01	1.01	0.81	0.88	0.00	0.12	0.39	0.00	0.08	0.35	0.81	0.88

*FROM FDR FOR LOT 1 CROSSROADS MIXED USE FILING NO. 2

Calculated by: SPM
Date: 10/28/2024
Checked by: DLM

LOT 1 CROSSROADS MIXED USE FILING NO. 3
PRELIMINARY DRAINAGE REPORT
(Future 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	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.)
		From DCM Table 5-1															
Existing Area Drainage Summary																	
C	1.11	0.81	0.88	0.81	50	1.0	2.9	296	0.5%	1.4	3.5	6.4	11.9	4.8	8.1	**4.3**	**7.9**
C1	0.08	0.90	0.96	0.90	45	1.0	1.9	95	1.6%	2.5	0.6	5.0	10.8	5.2	8.7	**0.4**	**0.7**
C2	0.11	0.90	0.96	0.90	50	1.0	2.0	98	1.5%	2.5	0.7	5.0	10.8	5.2	8.7	**0.5**	**0.9**
C3	0.03	0.08	0.35	0.08	15	0.2	6.5					6.5	10.1	4.8	8.0	**0.0**	**0.1**
C4	0.04	0.08	0.35	0.08	37	1.0	8.1	12	4.2%	4.1	0.0	8.1	10.3	4.4	7.5	**0.0**	**0.1**
C5	0.27	0.81	0.89	0.81	50	1.0	3.0	165	1.8%	2.7	1.0	5.0	11.2	5.2	8.7	**1.1**	**2.1**
C6	0.15	0.87	0.94	0.87	25	1.0	1.3	82.4	2.4%	3.1	0.4	5.0	10.6	5.2	8.7	**0.7**	**1.2**
C7	0.03	0.81	0.88	0.81	35	0.5	2.8					5.0	10.2	5.2	8.7	**0.1**	**0.2**
C8	0.03	0.81	0.88	0.81	35	0.5	2.8					5.0	10.2	5.2	8.7	**0.1**	**0.2**
***D**	2.21	0.81	0.88	0.81	50	1	2.9	200	1.5%	1.2	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	6.6	14.2	4.7	8.0	**4.0**	**7.2**
E1A	0.50	0.56	0.70	0.56	25	2.5	2.3	334	1.3%	2.3	2.5	5.0	12.0	5.2	8.7	**1.4**	**3.0**
E1A.5	0.04	0.17	0.42	0.17	20	3	3.1	135	1.1%	1.1	2.1	5.2	10.9	5.1	8.6	**0.0**	**0.1**
***E1B**	0.43	0.81	0.88	0.81	30	2	1.5	285	2.1%	2.9	1.6	5.0	12.0	5.2	8.7	**1.8**	**3.3**
***E1C**	0.27	0.88	0.95	0.88	50	1	2.2	420	1.4%	2.4	2.3	5.0	10.9	5.2	8.7	**1.2**	**2.2**
***G1**	0.69	0.84	0.91	0.84	50	1	2.7	466	1.1%	2.1	2.6	5.3	12.9	5.1	8.5	**2.9**	**5.4**
C1A	1.11	0.81	0.88	0.81	50	1	2.9	117	1.3%	2.3	0.9	5.0	10.9	5.2	8.7	**4.7**	**8.5**
C2A	0.64	0.81	0.88	0.81	50	1	2.9	217	1.8%	2.7	2.6	5.6	11.5	5.0	8.4	**2.6**	**4.7**
C3A	1.01	0.81	0.88	0.81	50	1.5	2.6	230	1.7%	2.0	1.9	5.0	11.6	5.2	8.7	**4.2**	**7.7**

Intensity equations assume a minimum travel time of 5 minutes.

*VALUES DERIVED USING DATA FROM FDR FOR LOT 1 CROSSROADS MIXED USE FILING NO.2

Calculated by: SPM
Date: 10/28/2024
Checked by: DLM

LOT 1 CROSSROADS MIXED USE FILING NO. 3
PRELIMINARY DRAINAGE REPORT
(Future 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
	EXISTING DRAINAGE BASIN ROUTING SUMMARY																
1	**C**	0.90	0.98	Tc for C Used								6.4	4.8	8.1	***4.3***	***7.9***	Existing 30" RCP Pipe (Pvt)
1.5	**C1**	0.07	0.08	Tc for C1 Used								5.0	5.2	8.7	***0.4***	***0.7***	Proposed 10' CDOT Type R At-Grade Inlet (Pvt)
1.5A	**C1A**	0.90	0.98	Tc for C1A Used								5.0	5.2	8.7	***4.7***	***8.5***	Future storm pipe
2	**C4, C6**	0.13	0.15	Tc for C4 Used								5.0	5.2	8.7	***0.7***	***1.3***	Proposed 2'x3' ADS Inlet atop Drain Basin (Pvt)
3	**C3, C5**	0.22	0.25	Tc for C3 Used								5.0	5.2	8.7	***1.1***	***2.1***	Proposed 5' CDOT Type R Sump Inlet (Pvt)
4	**C2, C3A**	0.91	0.99	Tc for C2 Used								5.0	5.2	8.7	***4.7***	***8.6***	Proposed 10' CDOT Type R At-Grade Inlet (Pvt)
4A	**C2A**	0.51	0.56	Tc for C2A Used								5.6	5.0	8.4	***2.6***	***4.7***	Future storm pipe
9A	**E1A, E1A.5**	0.28	0.36	Tc for E1A.5 Used								5.2	5.1	8.6	***1.5***	***3.1***	Existing Paved Access Drive (Pvt)
9B	***E1B**	0.35	0.38	Tc for *E1B Used								5.0	5.2	8.7	***1.8***	***3.3***	Existing 3' Curb Chase (Pvt)
7	***D**	1.79	1.95	Tc for D used								5.0	5.2	8.7	***9.3***	***16.9***	Existing 24" RCP Pipe (Pvt)
8	***E**	0.83	0.90	Tc for E used								6.6	4.7	8.0	***4.0***	***7.2***	Existing 10' CDOT Type R At-Grade Inlet (Pvt)
9	***E1C, DP 9A, DP 9B**	0.88	1.00	Tc for DP 9A Used								5.2	5.1	8.6	***4.5***	***8.6***	Existing 10' CDOT Type R At-Grade Inlet (Pvt)
11	***G1, FB DP 8, FB DP 9**	0.58	1.05	Tc for *G1 Used								5.3	5.1	8.5	***2.9***	***8.9***	Existing 15' CDOT Type R Sump Inlet (Pvt)

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

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

SPM

Date: 10/28/2024

Checked by: DLM

LOT 1 CROSSROADS MIXED USE FILING NO. 3
FINAL DRAINAGE CALCULATIONS
(Future Storm Sewer Routing Summary)

PIPE RUN	Contributing Pipes/Design Points/Basins	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity*		Flow		PIPE SIZE
					I_5	I_{100}	Q_5	Q_{100}	
1	BASIN C8	0.02	0.02	5.0	5.2	8.7	0.1	0.2	6" HDPE
1.5	BASIN C7	0.02	0.02	5.0	5.2	8.7	0.1	0.2	6" HDPE
2	PR1, PR1.5	0.04	0.05	5.0	5.2	8.7	0.2	0.4	6" HDPE
2.5	DP2	0.13	0.15	5.0	5.2	8.7	0.7	1.3	12" PP
3	PR2, PR2.5	0.17	0.20	5.0	5.2	8.7	0.9	1.7	12" PP
3.5	DP3	0.22	0.25	5.0	5.2	8.7	1.1	2.1	12" PP
4	DP1	0.90	0.98	6.4	4.8	8.1	4.3	7.9	30" RCP
4.1	DP1.5	0.07	0.08	5.0	5.2	8.7	0.4	0.7	18" RCP
4.2	PR4, PR4.1	0.97	1.06	6.4	4.8	8.1	4.7	8.5	30" RCP
4.3	DP1.5A, DP4A	1.42	1.54	5.6	5.0	8.4	7.1	12.9	24" RCP
4.4	DP2, PR3, PR3.5	1.30	1.43	5.0	5.2	8.7	6.7	12.4	24" RCP
4.5	PR4.3, PR4.4	2.72	2.97	5.0	5.2	8.7	14.1	25.8	30" RCP
5	PR4.2, PR4.5	3.69	4.03	6.4	4.8	8.1	17.7	32.4	30" RCP
6	PR5	3.69	4.03	6.4	4.8	8.1	17.7	32.4	30" RCP
7	PR6	3.69	4.03	6.4	4.8	8.1	17.7	32.4	30" RCP
8	DP7	1.79	1.95	5.0	5.2	8.7	9.3	16.9	24" RCP
9	PR8, DP8 (Inlet 6)	2.62	2.84	5.0	5.2	8.7	13.6	24.7	30" RCP
10	PR7, PR9	6.32	6.87	6.4	4.8	8.1	30.3	55.3	30" RCP
11	PR10, DP9 (Inlet 7)	7.19	7.87	6.4	4.8	8.1	34.5	63.4	36" RCP
14	DP11 (Inlet 9)	0.58	1.05	5.3	5.1	8.5	2.9	8.9	30" RCP

DP - Design Point
EX - Existing Design Point

FB- Flow By from Design Point
INT- Intercepted Flow from Design Point

Calculated by: SPM
Date: 10/28/2024
Checked by: DLM

HYDRAULIC CALCULATIONS

EXISTING

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP8	DP9	DP11
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	2.1	2.6	2.6
Major Q_{Known} (cfs)	5.6	5.7	8.2

Bypass (Carry-Over) Flow from Upstream Inlets must be organized from upstream (left) to downstream (right) in order for bypass flows to be linked.

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**2.1**	**2.6**	**2.6**
Major Total Design Peak Flow, Q (cfs)	**5.6**	**5.7**	**8.2**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	0.6	0.6	N/A

EXISTING

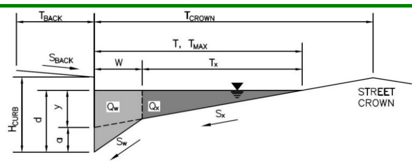
MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: CROSSRAODS MIXED USE FILING NO. 3 (EXISTING)

Inlet ID: DP8



Gutter Geometry:				
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 (check box for yes, leave blank for no)		☐	☑	

		Minor Storm	Major Storm	
Maximum Capacity for 1/2 Street based On Allowable Spread				
Water Depth without Gutter Depression (T * S_x * 12)	y =	3.36	3.36	inches
Vertical Depth between Gutter Lip and Gutter Flowline (W * S_w * 12)	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 (y + a)	d =	4.87	4.87	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	12.0	12.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.425	0.425	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	5.5	5.5	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	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	

		Minor Storm	Major Storm	
Maximum Capacity for 1/2 Street based on Allowable Depth				
Theoretical Water Spread	T_{TH} =	12.0	30.4	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	10.0	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.490	0.191	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	3.4	54.6	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	3.4	42.0	cfs
Discharge within the Gutter Section (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 Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	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

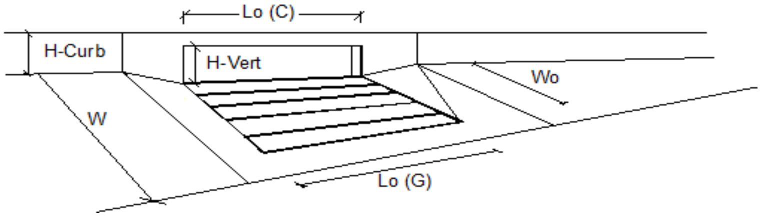
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**6.7**	**49.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.10 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.60 cfs on sheet 'Inlet Management'

EXISTING

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



		MINOR	MAJOR	
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	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	2.1	5.6	cfs
Water Spread Width	T =	6.9	11.1	ft
Water Depth at Flowline (outside of local depression)	d =	3.2	4.2	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.757	0.526	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.5	2.7	cfs
Discharge within the Gutter Section W	Q_w =	1.6	2.9	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.36	0.53	sq ft
Velocity within the Gutter Section W	V_W =	4.4	5.5	fps
Water Depth for Design Condition	d_{LOCAL} =	6.2	7.2	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.162	0.119	ft/ft
Required Length L_T to Have 100% Interception	L_T =	6.84	13.02	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	6.84	10.00	ft
Interception Capacity	Q_i =	2.1	5.2	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	6.84	9.38	ft
Actual Interception Capacity	**Q_a =**	**2.1**	**5.0**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.6**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.1**	**5.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.6**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**90**	**%**

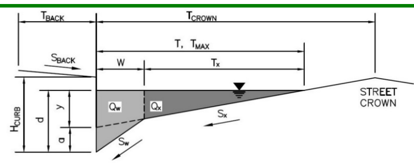
EXISTING

MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: CROSSRAODS MIXED USE FILING NO. 3 (EXISTING)
Inlet ID: DP9



Gutter Geometry:

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 (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	3.36	3.36	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	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 (y + a)	d =	4.87	4.87	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	12.0	12.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.425	0.425	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	5.5	5.5	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	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 (T - W)	$T_{X\ TH}$ =	10.0	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.490	0.191	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	3.4	54.6	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	3.4	42.0	cfs
Discharge within the Gutter Section (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 Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	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

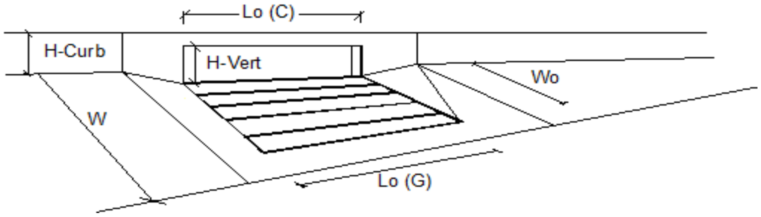
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**6.7**	**49.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.60 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.70 cfs on sheet 'Inlet Management'

EXISTING

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



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	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	2.6	5.7	cfs
Water Spread Width	T =	7.7	11.2	ft
Water Depth at Flowline (outside of local depression)	d =	3.4	4.2	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.704	0.522	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.8	2.7	cfs
Discharge within the Gutter Section W	Q_w =	1.8	3.0	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.40	0.53	sq ft
Velocity within the Gutter Section W	V_W =	4.6	5.6	fps
Water Depth for Design Condition	d_{LOCAL} =	6.4	7.2	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.152	0.118	ft/ft
Required Length L_T to Have 100% Interception	L_T =	7.85	13.17	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	7.85	10.00	ft
Interception Capacity	Q_i =	2.6	5.3	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	7.85	9.38	ft
Actual Interception Capacity	**Q_a =**	**2.6**	**5.1**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.6**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.6**	**5.1**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.6**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**89**	**%**

EXISTING

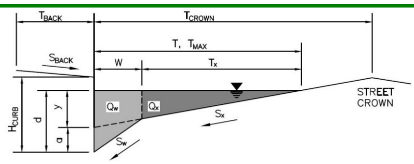
MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: CROSSRAODS MIXED USE FILING NO. 3 (EXISTING)

Inlet ID: DP11



Gutter Geometry:

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} =	22.0	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 =	0.000	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} =	22.0	22.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.4	8.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	5.28	5.28	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	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 (y + a)	d =	6.79	6.79	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	20.0	20.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.269	0.269	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	0.0	0.0	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 =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Capacity for 1/2 Street based on Allowable Depth

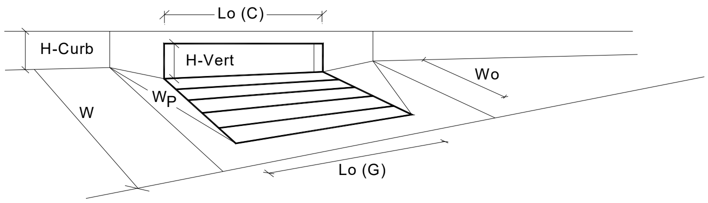
		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	12.0	30.4	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	10.0	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.490	0.191	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	SUMP	SUMP	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	SUMP	SUMP	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

EXISTING

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



		MINOR	MAJOR	
Design Information (Input) CDOT Type R Curb Opening				
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	3	3	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	6.8	inches
Grate Information		MINOR	MAJOR	Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q_{Grate} =	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.31	1.31	
Clogging Factor for Multiple Units	Clog =	0.04	0.04	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	4.0	14.1	cfs
Interception with Clogging	Q_{wa} =	3.9	13.5	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	25.3	31.0	cfs
Interception with Clogging	Q_{oa} =	24.2	29.7	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	9.4	19.5	cfs
Interception with Clogging	Q_{ma} =	9.0	18.6	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q_{Curb} =	**3.9**	**13.5**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	15.00	15.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	12.0	22.0	ft
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	0.0	inches
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.20	0.40	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.67	0.83	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**3.9**	**13.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	2.6	8.2	cfs

PROPOSED

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP1.5	DP2	DP4	DP8	DP9	DP11
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	In Sump	On Grade	On Grade	On Grade	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	0.4	0.7	0.5	1.6	4.3	2.9
Major Q_{Known} (cfs)	0.7	1.3	0.9	3.9	8.3	8.8

Bypass (Carry-Over) Flow from Upstream Inlets must be organized from upstream (left) to downstream (right) in order for bypass flows to be linked.

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)						
Percent Impervious						
NRCS Soil Type						

Watershed Profile

Overland Slope (ft/ft)						
Overland Length (ft)						
Channel Slope (ft/ft)						
Channel Length (ft)						

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)						
One-Hour Precipitation, P_1 (inches)						

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)						
One-Hour Precipitation, P_1 (inches)						

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**0.4**	**0.7**	**0.5**	**1.6**	**4.3**	**2.9**
Major Total Design Peak Flow, Q (cfs)	**0.7**	**1.3**	**0.9**	**3.9**	**8.3**	**8.8**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	N/A	0.0	0.0	0.1	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	0.0	N/A	0.0	0.0	1.9	N/A

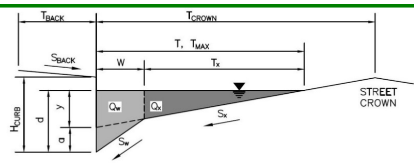
PROPOSED

MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: CROSSRAODS MIXED USE FILING NO. 3 (PROPOSED)
Inlet ID: DP1.5



Gutter Geometry:			
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 (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	3.36	3.36	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	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 (y + a)	d =	4.87	4.87	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	12.0	12.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.425	0.425	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	5.5	5.5	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	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 (T - W)	$T_{X\ TH}$ =	10.0	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.490	0.191	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	3.4	54.6	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	3.4	42.0	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	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 Safety Factor for Minor/Major Storm depth reduction, $d \geq 6"$	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

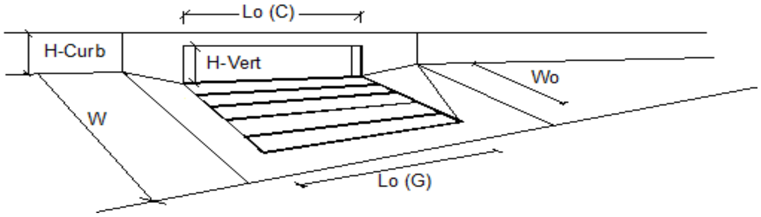
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**6.7**	**49.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.40 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 0.70 cfs on sheet 'Inlet Management'

PROPOSED

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



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	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	0.4	0.7	cfs
Water Spread Width	T =	1.9	2.3	ft
Water Depth at Flowline (outside of local depression)	d =	2.0	2.1	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	1.000	1.000	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.0	0.0	cfs
Discharge within the Gutter Section W	Q_w =	0.4	0.7	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.00	0.18	sq ft
Velocity within the Gutter Section W	V_W =	0.0	3.9	fps
Water Depth for Design Condition	d_{LOCAL} =	5.0	5.1	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.208	0.208	ft/ft
Required Length L_T to Have 100% Interception	L_T =	2.62	3.48	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	2.62	3.48	ft
Interception Capacity	Q_i =	0.4	0.7	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	2.62	3.48	ft
Actual Interception Capacity	**Q_a =**	**0.4**	**0.7**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.4**	**0.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**100**	**%**

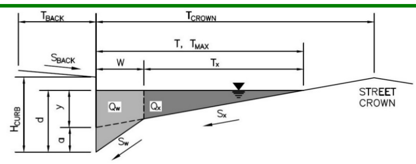
PROPOSED

MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: CROSSRAODS MIXED USE FILING NO. 3 (PROPOSED)
Inlet ID: DP2



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =			ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =			ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =			
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0		ft
Gutter Width	W =	1.00		ft
Street Transverse Slope	S_X =	0.024		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 =	0.000		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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.4	8.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	5.18	5.18	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.0	1.0	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	0.71	0.71	inches
Water Depth at Gutter Flowline (y + a)	d =	5.89	5.89	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	17.0	17.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.156	0.156	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	0.0	0.0	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 =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

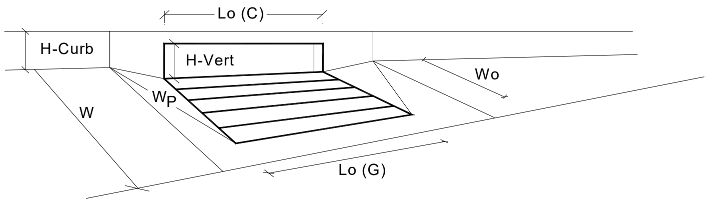
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	12.8	28.1	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	11.8	27.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.221	0.098	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	SUMP	SUMP	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	SUMP	SUMP	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

PROPOSED

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



			MINOR	MAJOR	
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' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	4.4	5.9	inches
Grate Information			MINOR	MAJOR	Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	1.00	1.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Grate Flow Analysis (Calculated)			MINOR	MAJOR	
Clogging Coefficient for Multiple Units		Coef =	N/A	N/A	
Clogging Factor for Multiple Units		Clog =	N/A	N/A	
Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)			MINOR	MAJOR	
Interception without Clogging		Q_{wi} =	N/A	N/A	cfs
Interception with Clogging		Q_{wa} =	N/A	N/A	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)			MINOR	MAJOR	
Interception without Clogging		Q_{oi} =	N/A	N/A	cfs
Interception with Clogging		Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow			MINOR	MAJOR	
Interception without Clogging		Q_{mi} =	N/A	N/A	cfs
Interception with Clogging		Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)		Q_{Grate} =	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)			MINOR	MAJOR	
Clogging Coefficient for Multiple Units		Coef =	1.00	1.00	
Clogging Factor for Multiple Units		Clog =	0.10	0.10	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)			MINOR	MAJOR	
Interception without Clogging		Q_{wi} =	3.7	6.4	cfs
Interception with Clogging		Q_{wa} =	3.3	5.7	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)			MINOR	MAJOR	
Interception without Clogging		Q_{oi} =	8.4	9.7	cfs
Interception with Clogging		Q_{oa} =	7.6	8.7	cfs
Curb Opening Capacity as Mixed Flow			MINOR	MAJOR	
Interception without Clogging		Q_{mi} =	5.2	7.3	cfs
Interception with Clogging		Q_{ma} =	4.7	6.6	cfs
Resulting Curb Opening Capacity (assumes clogged condition)		Q_{Curb} =	**3.3**	**5.7**	**cfs**
Resultant Street Conditions			MINOR	MAJOR	
Total Inlet Length		L =	5.00	5.00	feet
Resultant Street Flow Spread (based on street geometry from above)		T =	12.8	18.0	ft
Resultant Flow Depth at Street Crown		d_{CROWN} =	0.0	0.0	inches
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.28	0.41	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		Q_a =	**3.3**	**5.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		$Q_{PEAK\ REQUIRED}$ =	0.7	1.3	cfs

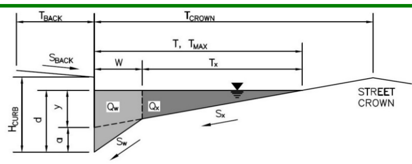
PROPOSED

MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: **CROSSRAODS MIXED USE FILING NO. 3 (PROPOSED)**
Inlet ID: **DP4**



Gutter Geometry:

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 (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (T * S_x * 12)	y =	3.36	3.36	inches
Vertical Depth between Gutter Lip and Gutter Flowline (W * S_w * 12)	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 (y + a)	d =	4.87	4.87	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	12.0	12.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.425	0.425	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	5.5	5.5	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	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 (T - W)	$T_{X\ TH}$ =	10.0	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.490	0.191	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	3.4	54.6	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	3.4	42.0	cfs
Discharge within the Gutter Section (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 Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	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

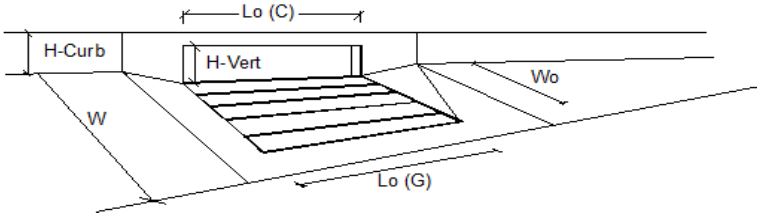
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**6.7**	**49.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.50 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 0.90 cfs on sheet 'Inlet Management'

PROPOSED

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



		MINOR	MAJOR	
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	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	0.5	0.9	cfs
Water Spread Width	T =	2.0	3.9	ft
Water Depth at Flowline (outside of local depression)	d =	2.0	2.5	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	1.000	0.953	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.0	0.0	cfs
Discharge within the Gutter Section W	Q_w =	0.5	0.9	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.17	0.24	sq ft
Velocity within the Gutter Section W	V_W =	3.0	3.5	fps
Water Depth for Design Condition	d_{LOCAL} =	5.0	5.5	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o-GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.208	0.199	ft/ft
Required Length L_T to Have 100% Interception	L_T =	2.93	4.04	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	2.93	4.04	ft
Interception Capacity	Q_i =	0.5	0.9	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	2.93	4.04	ft
Actual Interception Capacity	**Q_a =**	**0.5**	**0.9**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.5**	**0.9**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**100**	**%**

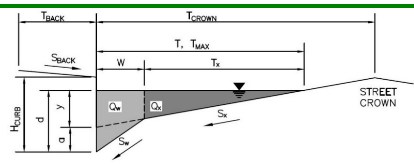
PROPOSED

MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: **CROSSRAODS MIXED USE FILING NO. 3 (PROPOSED)**
Inlet ID: **DP8**



Gutter Geometry:

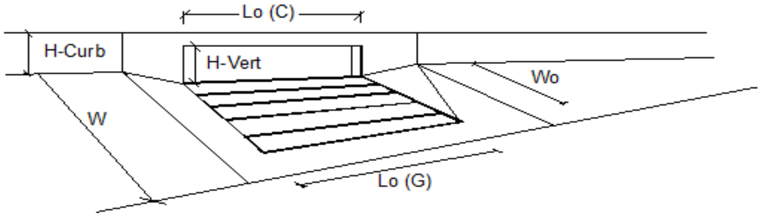
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		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 (check box for yes, leave blank for no)		☐	☑	
MINOR STORM Allowable Capacity is based on Depth Criterion		Minor Storm	Major Storm	
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 peak flow of 1.60 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.90 cfs on sheet 'Inlet Management'

PROPOSED

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



		MINOR	MAJOR	
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	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	1.6	3.9	cfs
Water Spread Width	T =	5.9	9.4	ft
Water Depth at Flowline (outside of local depression)	d =	2.9	3.8	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.826	0.605	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.3	1.5	cfs
Discharge within the Gutter Section W	Q_w =	1.3	2.4	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.32	0.46	sq ft
Velocity within the Gutter Section W	V_W =	4.1	5.1	fps
Water Depth for Design Condition	d_{LOCAL} =	5.9	6.8	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.175	0.134	ft/ft
Required Length L_T to Have 100% Interception	L_T =	5.75	10.25	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	5.75	10.00	ft
Interception Capacity	Q_i =	1.6	3.9	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	5.75	9.38	ft
Actual Interception Capacity	**Q_a =**	**1.6**	**3.9**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.6**	**3.9**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**99**	**%**

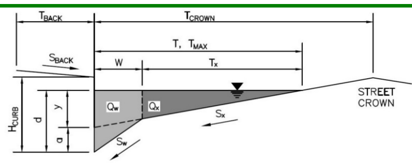
PROPOSED

MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: CROSSRAODS MIXED USE FILING NO. 3 (PROPOSED)
Inlet ID: DP9



Gutter Geometry:

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 (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	3.36	3.36	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	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 (y + a)	d =	4.87	4.87	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	12.0	12.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.425	0.425	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	5.5	5.5	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	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 (T - W)	$T_{X\,TH}$ =	10.0	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.490	0.191	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	3.4	54.6	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	3.4	42.0	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	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 Safety Factor for Minor/Major Storm depth reduction, $d \geq 6"$	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

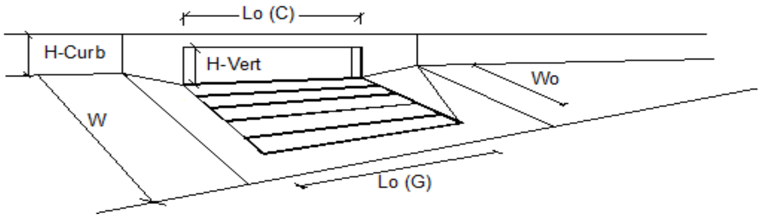
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**6.7**	**49.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 4.30 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 8.30 cfs on sheet 'Inlet Management'

PROPOSED

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



		MINOR	MAJOR	
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	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	4.3	8.3	cfs
Water Spread Width	T =	9.9	13.2	ft
Water Depth at Flowline (outside of local depression)	d =	3.9	4.7	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.583	0.449	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	1.8	4.6	cfs
Discharge within the Gutter Section W	Q_w =	2.5	3.7	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.48	0.61	sq ft
Velocity within the Gutter Section W	V_W =	5.2	6.1	fps
Water Depth for Design Condition	d_{LOCAL} =	6.9	7.7	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.130	0.105	ft/ft
Required Length L_T to Have 100% Interception	L_T =	10.93	16.88	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	10.00	10.00	ft
Interception Capacity	Q_i =	4.2	6.7	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	9.38	9.38	ft
Actual Interception Capacity	**Q_a =**	**4.2**	**6.4**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.1**	**1.9**	**cfs**
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.2**	**6.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.1**	**1.9**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**97**	**77**	**%**

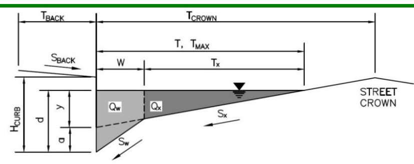
PROPOSED

MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: CROSSRAODS MIXED USE FILING NO. 3 (PROPOSED)
Inlet ID: DP11



Gutter Geometry:

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} =	22.0	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 =	0.000	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} =	22.0	22.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.4	8.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	5.28	5.28	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	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 (y + a)	d =	6.79	6.79	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	20.0	20.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.269	0.269	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	0.0	0.0	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 =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Capacity for 1/2 Street based on Allowable Depth

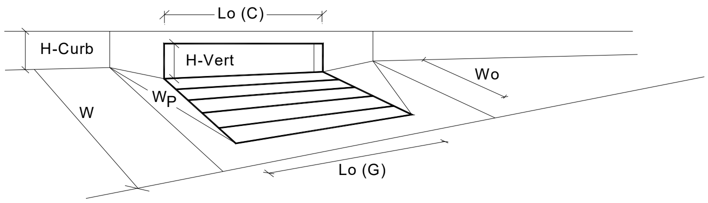
		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	12.0	30.4	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	10.0	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.490	0.191	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	SUMP	SUMP	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	SUMP	SUMP	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

PROPOSED

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



			MINOR	MAJOR	
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' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	3	3	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	4.4	6.8	inches
Grate Information			MINOR	MAJOR	Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Grate Flow Analysis (Calculated)			MINOR	MAJOR	
Clogging Coefficient for Multiple Units		Coef =	N/A	N/A	
Clogging Factor for Multiple Units		Clog =	N/A	N/A	
Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)			MINOR	MAJOR	
Interception without Clogging		Q_{wi} =	N/A	N/A	cfs
Interception with Clogging		Q_{wa} =	N/A	N/A	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)			MINOR	MAJOR	
Interception without Clogging		Q_{oi} =	N/A	N/A	cfs
Interception with Clogging		Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow			MINOR	MAJOR	
Interception without Clogging		Q_{mi} =	N/A	N/A	cfs
Interception with Clogging		Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)		Q_{Grate} =	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)			MINOR	MAJOR	
Clogging Coefficient for Multiple Units		Coef =	1.31	1.31	
Clogging Factor for Multiple Units		Clog =	0.04	0.04	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)			MINOR	MAJOR	
Interception without Clogging		Q_{wi} =	4.0	14.1	cfs
Interception with Clogging		Q_{wa} =	3.9	13.5	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)			MINOR	MAJOR	
Interception without Clogging		Q_{oi} =	25.3	31.0	cfs
Interception with Clogging		Q_{oa} =	24.2	29.7	cfs
Curb Opening Capacity as Mixed Flow			MINOR	MAJOR	
Interception without Clogging		Q_{mi} =	9.4	19.5	cfs
Interception with Clogging		Q_{ma} =	9.0	18.6	cfs
Resulting Curb Opening Capacity (assumes clogged condition)		Q_{Curb} =	**3.9**	**13.5**	**cfs**
Resultant Street Conditions			MINOR	MAJOR	
Total Inlet Length		L =	15.00	15.00	feet
Resultant Street Flow Spread (based on street geometry from above)		T =	12.0	22.0	ft
Resultant Flow Depth at Street Crown		d_{CROWN} =	0.0	0.0	inches
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.20	0.40	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.67	0.83	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		Q_a =	**3.9**	**13.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		$Q_{PEAK\ REQUIRED}$ =	2.9	8.8	cfs

FUTURE

MHFD-Inlet, Version 5.03 (August 2023)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP1.5	DP4	DP8	DP9	DP11
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade	On Grade	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	0.4	4.7	4.0	4.5	2.9
Major Q_{Known} (cfs)	0.7	8.6	7.2	8.6	8.9

Bypass (Carry-Over) Flow from Upstream Inlets must be organized from upstream (left) to downstream (right) in order for bypass flows to be linked.

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)					
Percent Impervious					
NRCS Soil Type					

Watershed Profile

Overland Slope (ft/ft)					
Overland Length (ft)					
Channel Slope (ft/ft)					
Channel Length (ft)					

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)					
One-Hour Precipitation, P_1 (inches)					

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)					
One-Hour Precipitation, P_1 (inches)					

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**0.4**	**4.7**	**4.0**	**4.5**	**2.9**
Major Total Design Peak Flow, Q (cfs)	**0.7**	**8.6**	**7.2**	**8.6**	**8.9**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.2	0.1	0.2	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	0.0	2.1	1.3	2.1	N/A

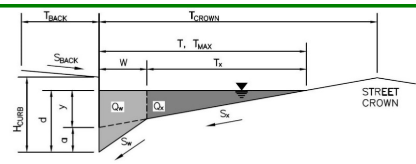
FUTURE

MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: CROSSRAODS MIXED USE FILING NO. 3 (FUTURE)
Inlet ID: DP1.5



<u>Gutter Geometry:</u>

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 (check box for yes, leave blank for no)		☐	☑	

<u>Maximum Capacity for 1/2 Street based On Allowable Spread</u>		Minor Storm	Major Storm	
Water Depth without Gutter Depression (T * S_x * 12)	y =	3.36	3.36	inches
Vertical Depth between Gutter Lip and Gutter Flowline (W * S_w * 12)	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 (y + a)	d =	4.87	4.87	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	12.0	12.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.425	0.425	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	5.5	5.5	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	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	

<u>Maximum Capacity for 1/2 Street based on Allowable Depth</u>		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	12.0	30.4	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	10.0	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.490	0.191	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	3.4	54.6	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	3.4	42.0	cfs
Discharge within the Gutter Section (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 Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	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

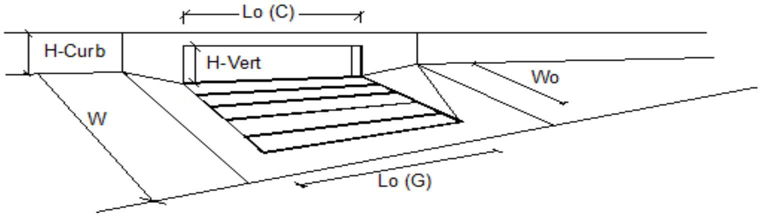
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**6.7**	**49.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.40 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 0.70 cfs on sheet 'Inlet Management'

FUTURE

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



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	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	0.4	0.7	cfs
Water Spread Width	T =	1.9	2.3	ft
Water Depth at Flowline (outside of local depression)	d =	2.0	2.1	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	1.000	1.000	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.0	0.0	cfs
Discharge within the Gutter Section W	Q_w =	0.4	0.7	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.00	0.18	sq ft
Velocity within the Gutter Section W	V_W =	0.0	3.9	fps
Water Depth for Design Condition	d_{LOCAL} =	5.0	5.1	inches

Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**

Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.208	0.208	ft/ft
Required Length L_T to Have 100% Interception	L_T =	2.62	3.48	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	2.62	3.48	ft
Interception Capacity	Q_i =	0.4	0.7	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	2.62	3.48	ft
Actual Interception Capacity	**Q_a =**	**0.4**	**0.7**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	**cfs**

Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.4**	**0.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**100**	**%**

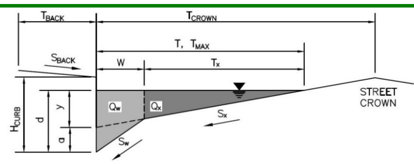
FUTURE

MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: CROSSRAODS MIXED USE FILING NO. 3 (FUTURE)
Inlet ID: DP4



Gutter Geometry:

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 (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	3.36	3.36	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	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 (y + a)	d =	4.87	4.87	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	12.0	12.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.425	0.425	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	5.5	5.5	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	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 (T - W)	$T_{X\ TH}$ =	10.0	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.490	0.191	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	3.4	54.6	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	3.4	42.0	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	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 Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	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

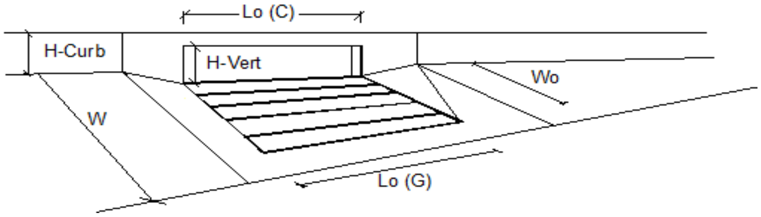
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**6.7**	**49.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 4.70 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 8.60 cfs on sheet 'Inlet Management'

FUTURE

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



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	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	4.7	8.6	cfs
Water Spread Width		T =	10.3	13.4	ft
Water Depth at Flowline (outside of local depression)		d =	4.0	4.7	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.563	0.443	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	2.1	4.8	cfs
Discharge within the Gutter Section W		Q_w =	2.6	3.8	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W		A_W =	0.50	0.62	sq ft
Velocity within the Gutter Section W		V_W =	5.3	6.1	fps
Water Depth for Design Condition		d_{LOCAL} =	7.0	7.7	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.126	0.103	ft/ft
Required Length L_T to Have 100% Interception		L_T =	11.59	17.28	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	10.00	10.00	ft
Interception Capacity		Q_i =	4.6	6.8	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.06	0.06	
Effective (Unclogged) Length		L_e =	9.38	9.38	ft
Actual Interception Capacity		**Q_a =**	**4.5**	**6.5**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.2**	**2.1**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**4.5**	**6.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.2**	**2.1**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**95**	**76**	**%**

FUTURE

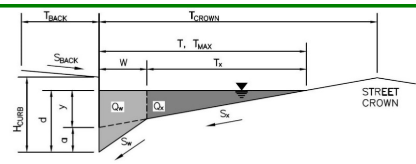
MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: CROSSRAODS MIXED USE FILING NO. 3 (FUTURE)

Inlet ID: DP8



Gutter Geometry:

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 (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression (T * S_x * 12)	y =	3.36	3.36	inches
Vertical Depth between Gutter Lip and Gutter Flowline (W * S_w * 12)	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 (y + a)	d =	4.87	4.87	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	12.0	12.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.425	0.425	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	5.5	5.5	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	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 (T - W)	$T_{X\ TH}$ =	10.0	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.490	0.191	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	3.4	54.6	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	3.4	42.0	cfs
Discharge within the Gutter Section (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 Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	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**

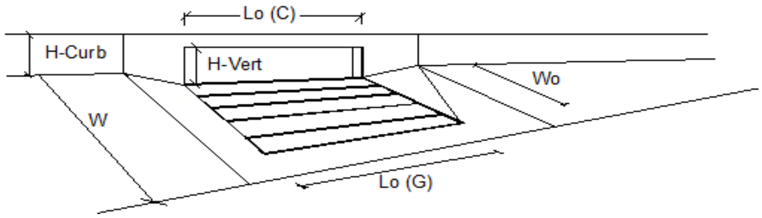
Minor storm max. allowable capacity GOOD - greater than the design peak flow of 4.00 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 7.20 cfs on sheet 'Inlet Management'

FUTURE

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



		MINOR	MAJOR	
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	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	4.0	7.2	cfs
Water Spread Width	T =	9.5	12.4	ft
Water Depth at Flowline (outside of local depression)	d =	3.8	4.5	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.600	0.475	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	1.6	3.8	cfs
Discharge within the Gutter Section W	Q_w =	2.4	3.4	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.47	0.58	sq ft
Velocity within the Gutter Section W	V_W =	5.1	5.9	fps
Water Depth for Design Condition	d_{LOCAL} =	6.8	7.5	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o-GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e	S_e =	0.133	0.109	ft/ft
Required Length L_T to Have 100% Interception	L_T =	10.42	15.37	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	10.00	10.00	ft
Interception Capacity	Q_i =	4.0	6.1	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	9.38	9.38	ft
Actual Interception Capacity	**Q_a =**	**3.9**	**5.9**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.1**	**1.3**	**cfs**
Summary		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% =**	**98**	**82**	**%**

FUTURE

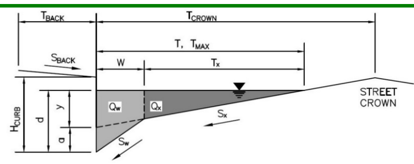
MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: **CROSSRAODS MIXED USE FILING NO. 3 (FUTURE)**

Inlet ID: **DP9**



Gutter Geometry:

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 (check box for yes, leave blank for no)		☐	☑	

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	3.36	3.36	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	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 (y + a)	d =	4.87	4.87	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	12.0	12.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.425	0.425	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	5.5	5.5	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	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 (T - W)	$T_{X\ TH}$ =	10.0	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.490	0.191	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	3.4	54.6	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	3.4	42.0	cfs
Discharge within the Gutter Section (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 Safety Factor for Minor/Major Storm depth reduction, $d \geq 6"$	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

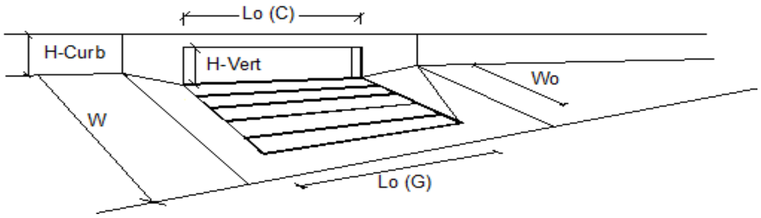
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**6.7**	**49.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 4.50 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 8.60 cfs on sheet 'Inlet Management'

FUTURE

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



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	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	4.5	8.6	cfs
Water Spread Width		T =	10.1	13.4	ft
Water Depth at Flowline (outside of local depression)		d =	3.9	4.7	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.572	0.443	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	1.9	4.8	cfs
Discharge within the Gutter Section W		Q_w =	2.6	3.8	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W		A_W =	0.49	0.62	sq ft
Velocity within the Gutter Section W		V_W =	5.3	6.1	fps
Water Depth for Design Condition		d_{LOCAL} =	6.9	7.7	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		**Q_a =**	**N/A**	**N/A**	**cfs**
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		**Q_b =**	**N/A**	**N/A**	**cfs**
Curb Opening or Slotted Inlet Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e		S_e =	0.128	0.103	ft/ft
Required Length L_T to Have 100% Interception		L_T =	11.27	17.28	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	10.00	10.00	ft
Interception Capacity		Q_i =	4.4	6.8	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoeff =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.06	0.06	
Effective (Unclogged) Length		L_e =	9.38	9.38	ft
Actual Interception Capacity		**Q_a =**	**4.3**	**6.5**	**cfs**
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		**Q_b =**	**0.2**	**2.1**	**cfs**
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**4.3**	**6.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.2**	**2.1**	**cfs**
Capture Percentage = Q_a/Q_o		**C% =**	**96**	**76**	**%**

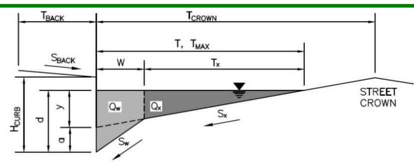
FUTURE

MHFD-Inlet, Version 5.03 (August 2023)

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

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

Project: CROSSRAODS MIXED USE FILING NO. 3 (FUTURE)
Inlet ID: DP11



Gutter Geometry:

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} =	22.0	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 =	0.000	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} =	22.0	22.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.4	8.8	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	5.28	5.28	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	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 (y + a)	d =	6.79	6.79	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	20.0	20.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.269	0.269	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	0.0	0.0	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 =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

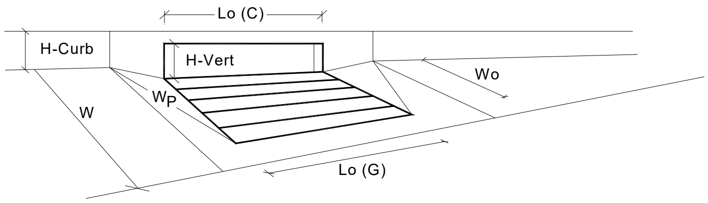
Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	12.0	30.4	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\ TH}$ =	10.0	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.490	0.191	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\ TH}$	$Q_{X\ TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	SUMP	SUMP	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	SUMP	SUMP	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

FUTURE

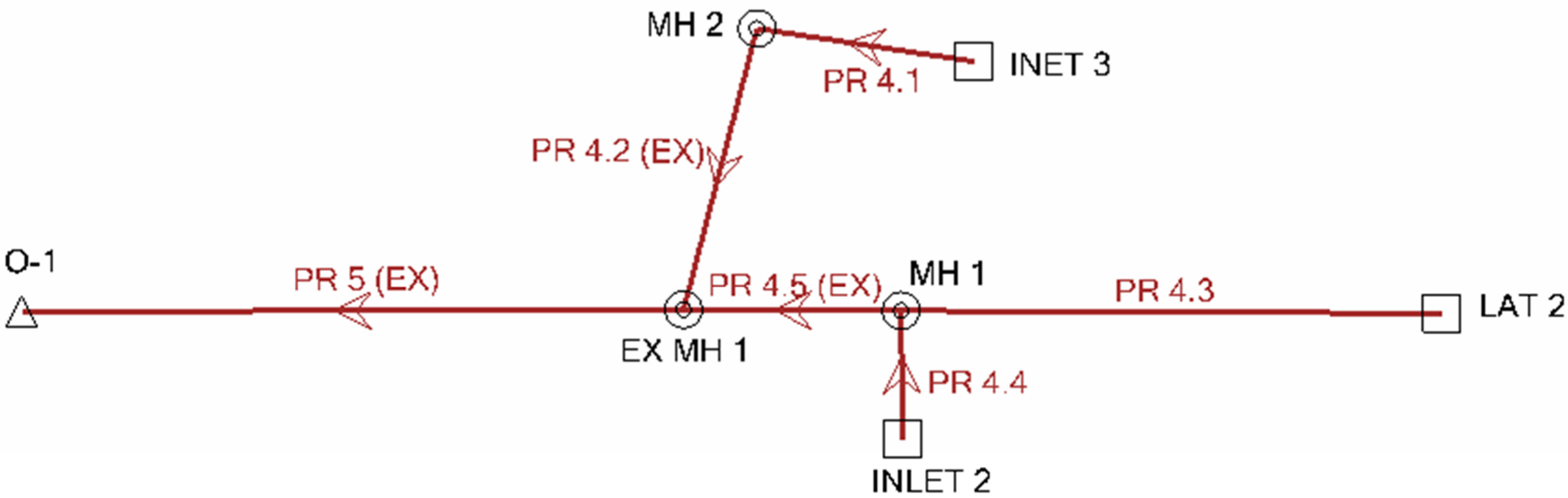
INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)

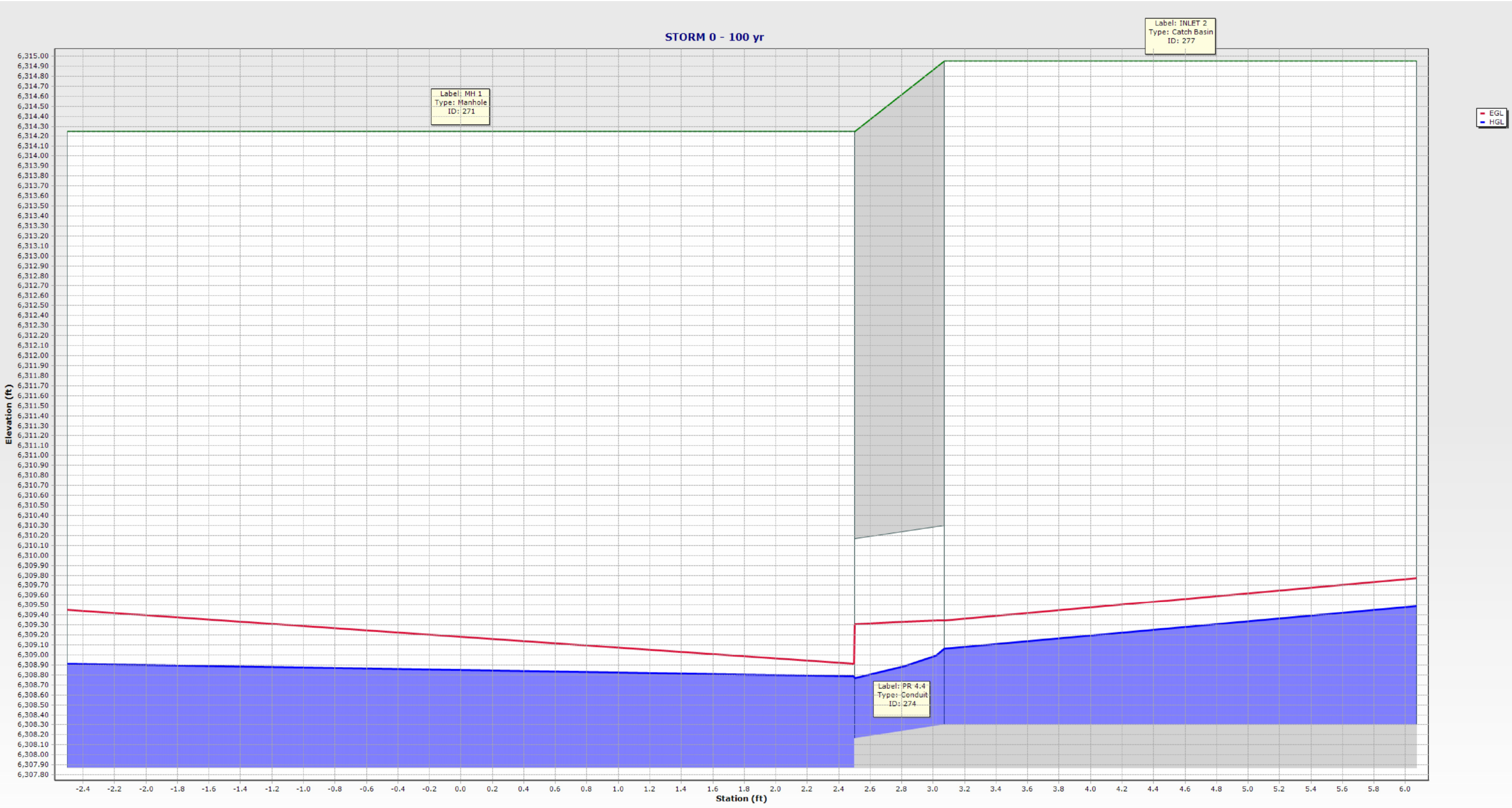


		MINOR	MAJOR	
Design Information (Input) — CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	3	3	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	6.8	inches
Grate Information		MINOR	MAJOR	Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.31	1.31	
Clogging Factor for Multiple Units	Clog =	0.04	0.04	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	4.0	14.1	cfs
Interception with Clogging	Q_{wa} =	3.9	13.5	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	25.3	31.0	cfs
Interception with Clogging	Q_{oa} =	24.2	29.7	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	9.4	19.5	cfs
Interception with Clogging	Q_{ma} =	9.0	18.6	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**3.9**	**13.5**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	15.00	15.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	12.0	22.0	ft
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	0.0	inches
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.20	0.40	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.67	0.83	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**3.9**	**13.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	2.9	8.9	cfs

PROPOSED STORM



PROPOSED STORM



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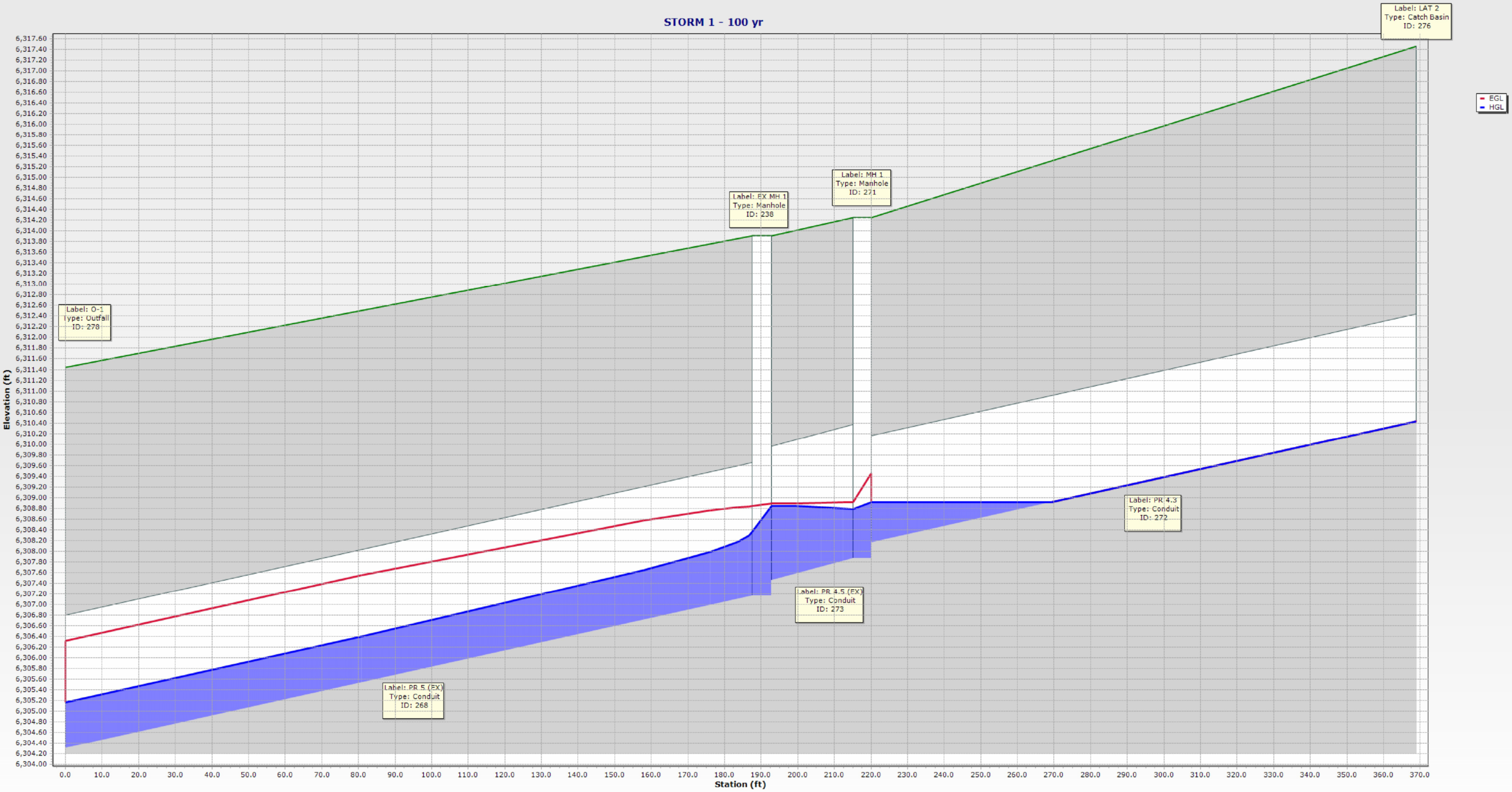

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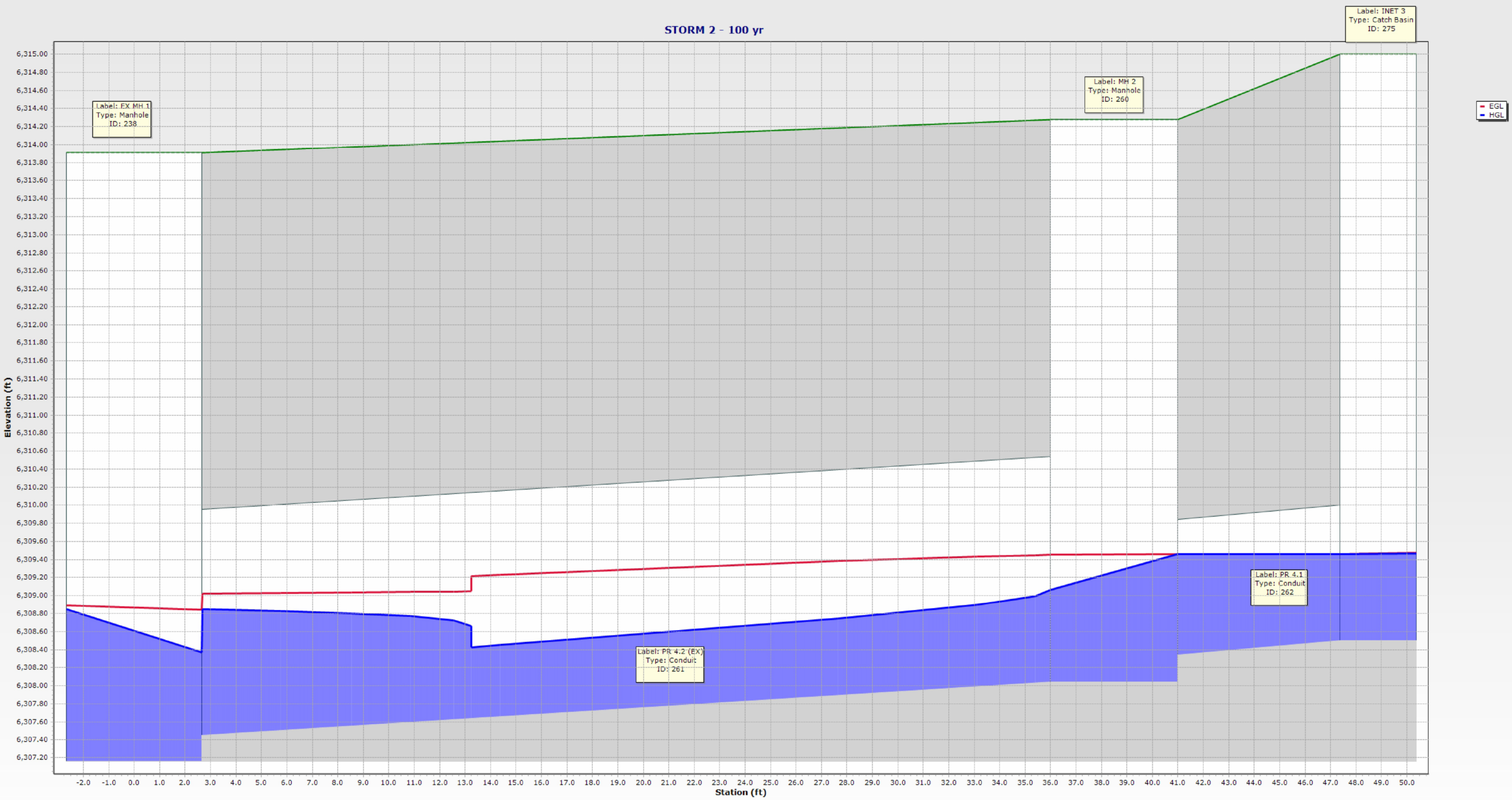


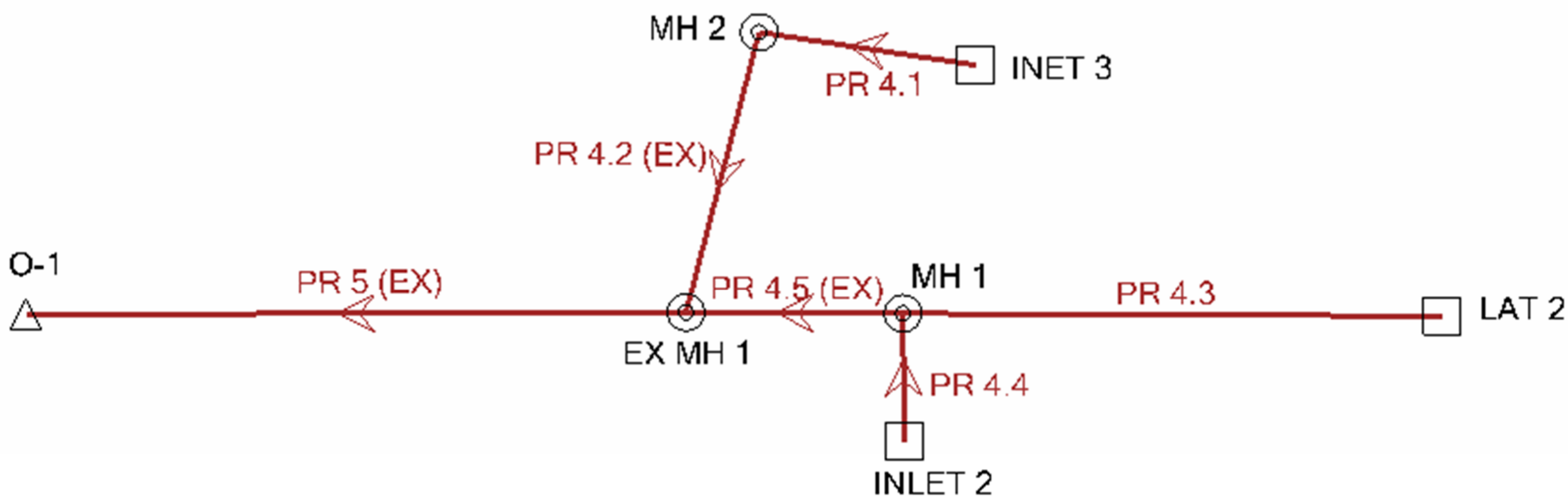
PROPOSED STORM

Conduit FlexTable: 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)
PR 4.2 (EX)	261	MH 2	9.40	18.5	38.5	7.89	0.73	1.02	6,309.45	6,309.02	6,309.07	6,308.85	0.22	6,309.46
PR 4.1	262	INET 3	0.70	5.4	10.4	3.89	0.24	0.31	6,309.46	6,309.46	6,309.46	6,309.46	0.00	6,309.47
PR 5 (EX)	268	EX MH 1	13.00	25.9	190.2	8.59	0.87	1.21	6,308.84	6,306.32	6,308.37	6,305.17	3.20	6,308.85
PR 4.3	272	LAT 2	0.00	0.0	151.3	0.00	(N/A)	0.00	6,310.44	6,308.92	6,310.44	6,308.92	1.52	6,310.44
PR 4.5 (EX)	273	MH 1	4.70	9.4	27.4	6.42	0.52	0.71	6,308.91	6,308.89	6,308.78	6,308.85	-0.06	6,308.92
PR 4.4	274	INLET 2	4.70	12.1	4.6	8.36	0.47	0.76	6,309.35	6,309.31	6,309.06	6,308.77	0.29	6,309.49

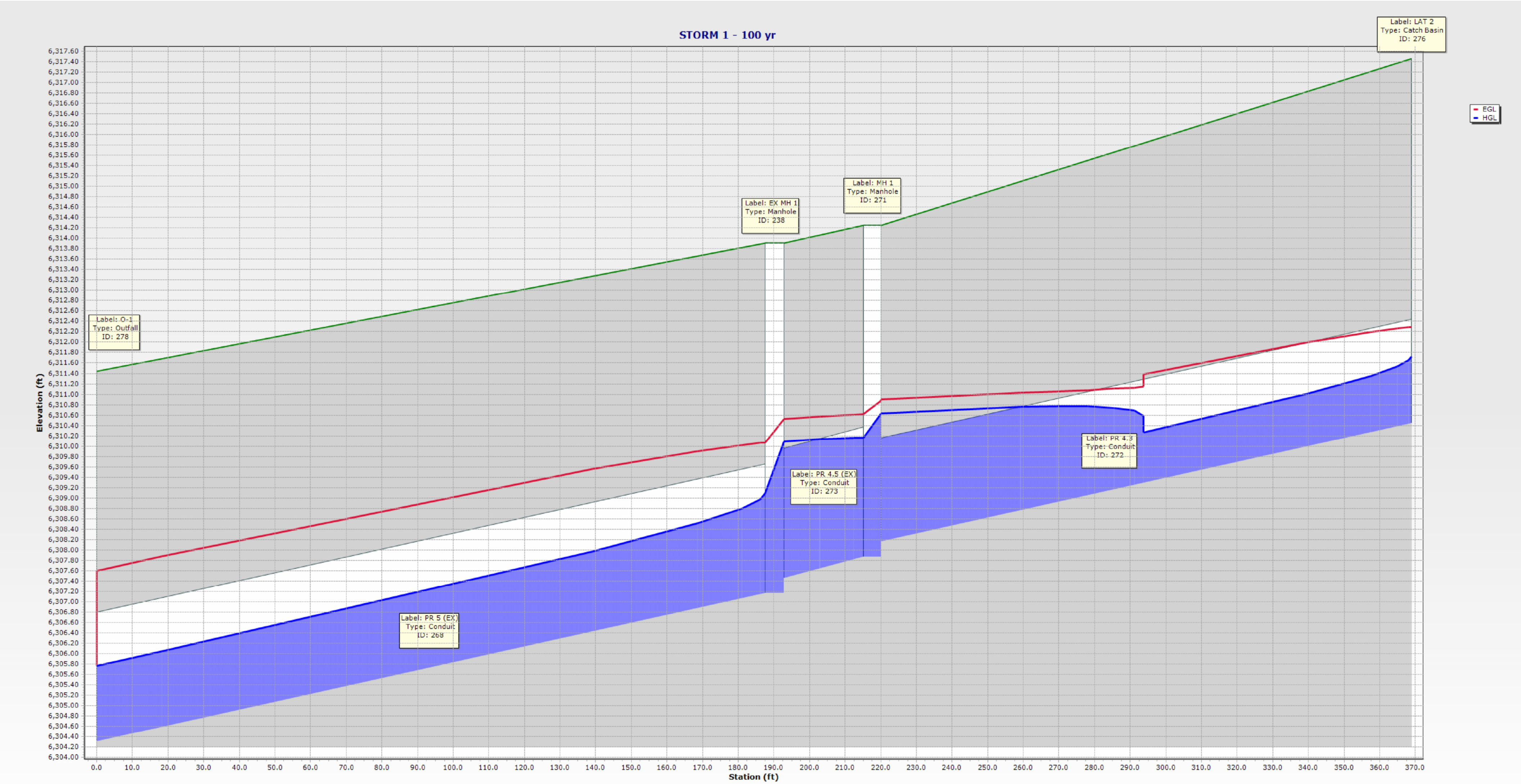
Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Conduit Description
0.50	1.020	6,314.28	6,313.91	6,308.04	6,307.46	Circle - 30.0 in
0.59	1.500	6,315.00	6,314.28	6,308.50	6,308.34	Circle - 18.0 in
1.67	1.020	6,313.91	6,311.44	6,307.16	6,304.30	Circle - 30.0 in
0.00	1.500	6,317.46	6,314.25	6,310.44	6,308.17	Circle - 24.0 in
5.89	1.020	6,314.25	6,313.91	6,307.87	6,307.46	Circle - 30.0 in
4.27	1.500	6,314.95	6,314.25	6,308.30	6,308.17	Circle - 24.0 in

FUTURE STORM



FUTURE STORM

FUTURE STORM



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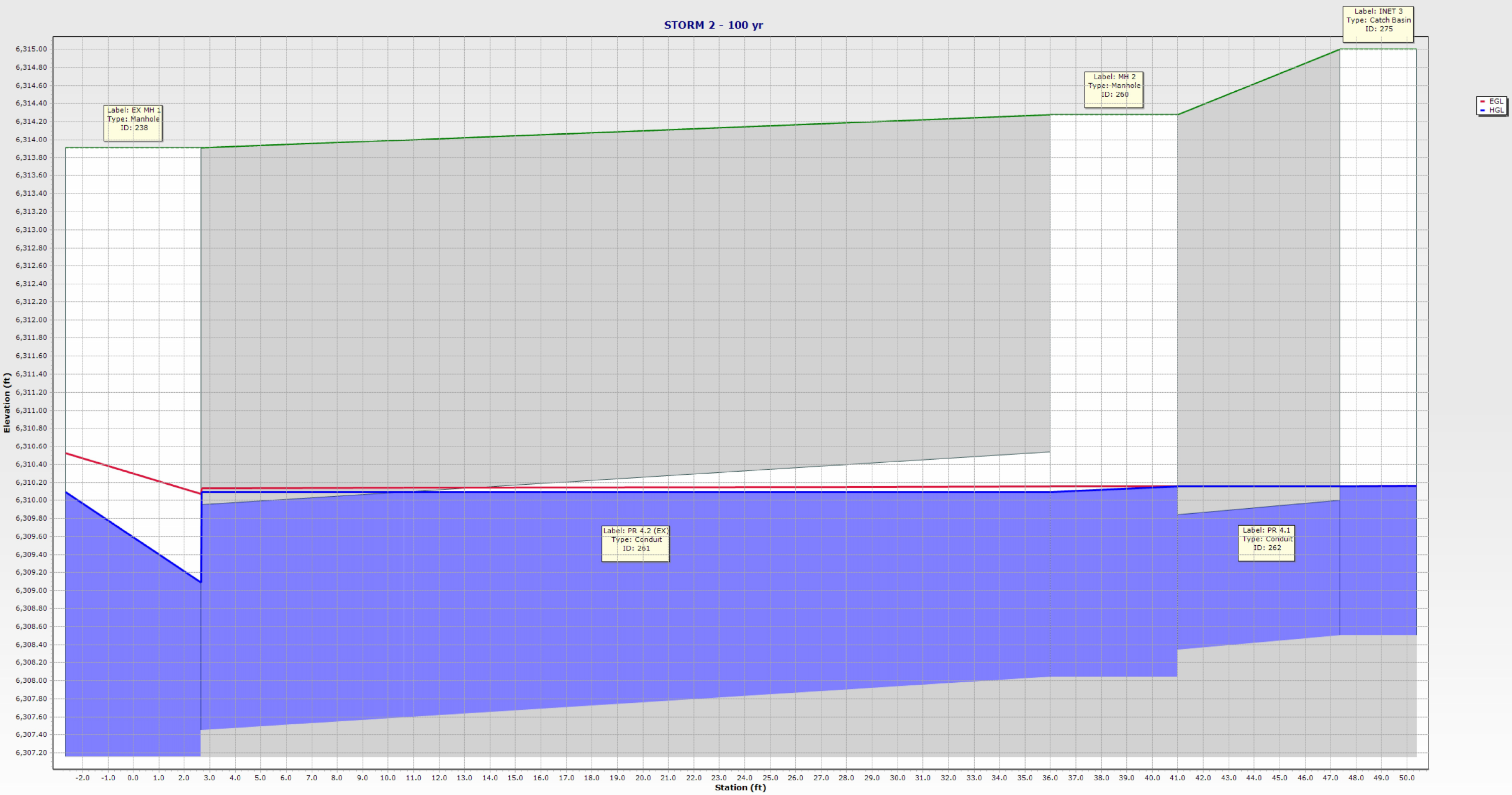


Conduit FlexTable: 100 YR

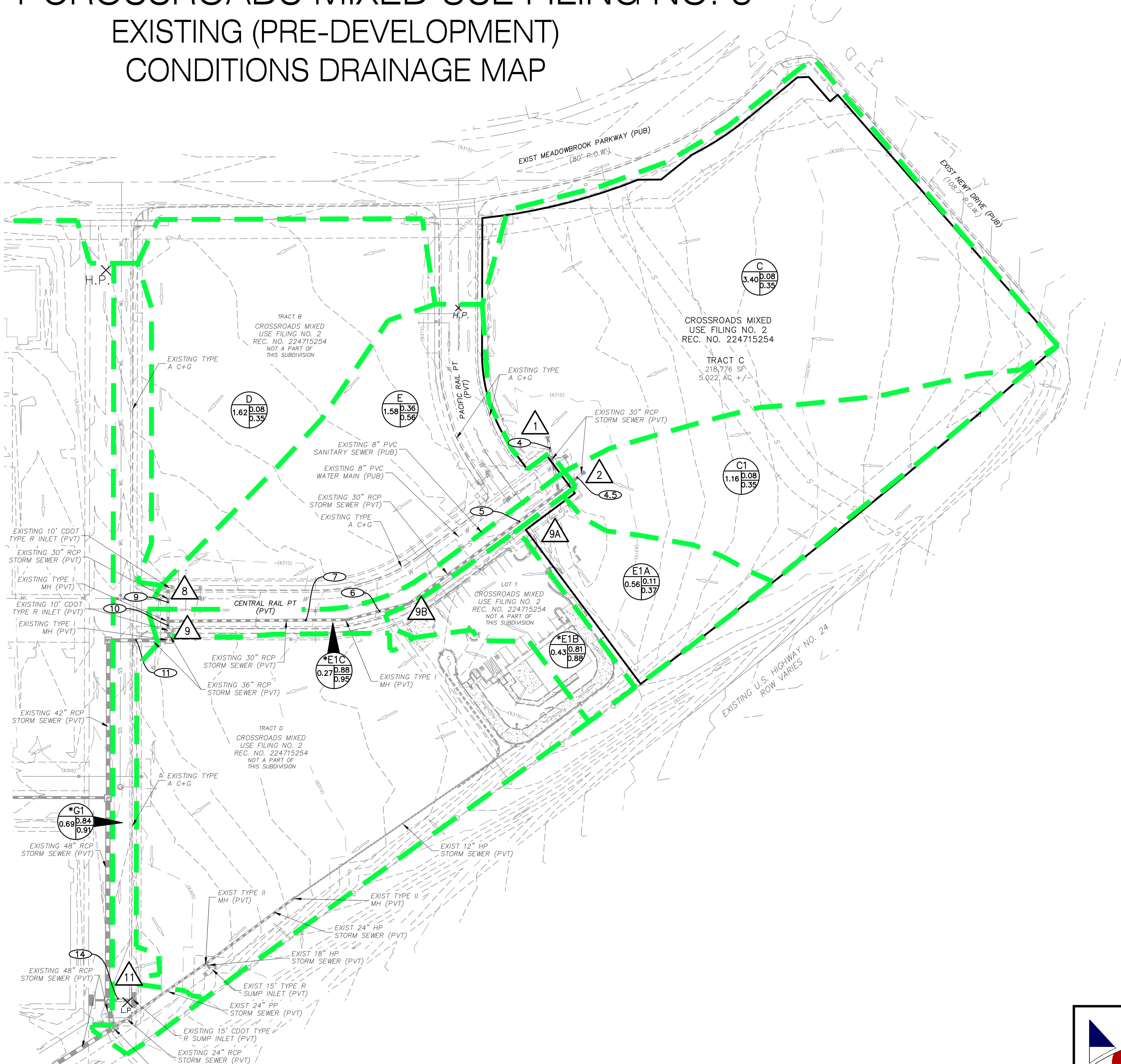
Label	ID	Upstream Structure	Flow (cfs)	Flow / Capacity (Design) (%)	Length (Unified) (ft)	Velocity (ft/s)	Depth (Normal) (ft)	Depth (Critical) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)	Upstream Structure Hydraulic Grade Line (In) (ft)
PR 4.2 (EX)	261	MH 2	8.50	16.8	38.5	7.67	0.69	0.97	6,310.15	6,310.14	6,310.09	6,310.09	0.00	6,310.15
PR 4.1	262	INET 3	0.70	5.4	10.4	0.40	0.24	0.31	6,310.16	6,310.16	6,310.16	6,310.15	0.00	6,310.16
PR 5 (EX)	268	EX MH 1	32.40	64.5	190.2	10.87	1.46	1.94	6,310.07	6,307.60	6,309.09	6,305.76	3.33	6,310.09
PR 4.3	272	LAT 2	12.90	46.6	151.3	8.66	0.96	1.29	6,312.29	6,310.90	6,311.73	6,310.63	1.09	6,312.57
PR 4.5 (EX)	273	MH 1	25.80	51.4	27.4	10.30	1.27	1.73	6,310.62	6,310.52	6,310.16	6,310.09	0.07	6,310.63
PR 4.4	274	INLET 2	12.40	31.9	4.6	3.95	0.78	1.27	6,310.89	6,310.88	6,310.65	6,310.63	0.01	6,311.01

Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Conduit Description
0.40	1.020	6,314.28	6,313.91	6,308.04	6,307.46	Circle - 30.0 in
0.40	1.500	6,315.00	6,314.28	6,308.50	6,308.34	Circle - 18.0 in
5.26	1.020	6,313.91	6,311.44	6,307.16	6,304.30	Circle - 30.0 in
6.01	1.500	6,317.46	6,314.25	6,310.44	6,308.17	Circle - 24.0 in
3.95	1.020	6,314.25	6,313.91	6,307.87	6,307.46	Circle - 30.0 in
3.95	1.500	6,314.95	6,314.25	6,308.30	6,308.17	Circle - 24.0 in

DRAINAGE MAPS

LOT 1 CROSSROADS MIXED USE FILING NO. 3

EXISTING (PRE-DEVELOPMENT) CONDITIONS DRAINAGE MAP



LEGEND

- BASIN DESIGNATION (Z), ACRES (25), C5 (.25), C100 (.35)
- SURFACE DESIGN POINT
- FUTURE BASIN BOUNDARY
- PIPE RUN LABEL
- PROP MAJ CONT
- PROP MIN CONT
- EXIST MAJ CONT
- EXIST MIN CONT
- PROPOSED STORM SEWER PIPE
- PROPOSED STORM SEWER PIPE (OTHERS)
- EXISTING FLOW DIRECTION ARROW
- H.P. HIGH POINT
- L.P. LOW POINT
- EXISTING SWALE
- FILING BOUNDARY
- PROPOSED UTILITY EASEMENT
- PROPOSED DRAINAGE EASEMENT
- PROPOSED LANDSCAPE EASEMENT
- LOT LINE
- EX. SANITARY SEWER LINE
- EX. WATER LINE
- EX. STORM MANHOLE
- EX. STORM INLET
- EX. SANITARY MANHOLE
- EX. WATER VALVE

BASIN SUMMARY

BASIN	AREA (ACRES)	Q_5	Q_{100}
C	3.40	1.0	7.5
C1	1.16	0.4	2.6
D	1.62	0.5	3.6
E	1.58	2.1	5.6
E1A	0.56	0.2	1.4
*E1B	0.43	1.8	3.3
*E1C	0.27	1.2	2.2
*G1	0.69	2.9	5.4

SURFACE ROUTING SUMMARY

DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
1	1.0	7.5	C	EX. 30" RCP PIPE (PVT)
2	0.4	2.6	C1	EX. 30" RCP PIPE (PVT)
9A	0.2	1.4	E1A	EX. PAVED ACCESS DRIVE (PVT)
9B	1.8	3.3	*E1B	EX. 3' CURB CHASE (PVT)
8	2.1	5.6	E	EX. 10' CDOT TYPE R AT-GRADE INLET
9	2.6	5.7	*E1C, DP 9A, DP 9B	EX. 10' CDOT TYPE R AT-GRADE INLET
11	2.6	8.2	D, *G1, PB DP8, FB DP9	EX 15' CDOT TYPE R SUMP INLET (PVT)

STORM SEWER SUMMARY

PIPE RUN	Q_5	Q_{100}	PIPE SIZE	CONTRIBUTING PIPES/DESIGN POINTS
4	1.0	7.5	30" RCP	DP1
4.5	0.4	2.6	30" RCP	DP2
5	1.4	10.1	30" RCP	PR4, PR4.5
6	1.4	10.1	30" RCP	PR5
7	1.4	10.1	30" RCP	PR6
9	2.1	5.6	30" RCP	DP8
10	3.5	15.7	36" RCP	PR7, PR9
11	6.0	21.0	36" RCP	PR10, DP9

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COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

LOT 1-CROSSROADS MIXED USE FILING NO. 3

EXISTING DRAINAGE MAP

PROJECT NO. 18-007	SCALE: HORIZONTAL: 1"=60' VERTICAL: N/A	DATE: 11/01/2024	
DESIGNED BY: GT DRAWN BY: GT CHECKED BY: VAS		SHEET 1 OF 1	EDM

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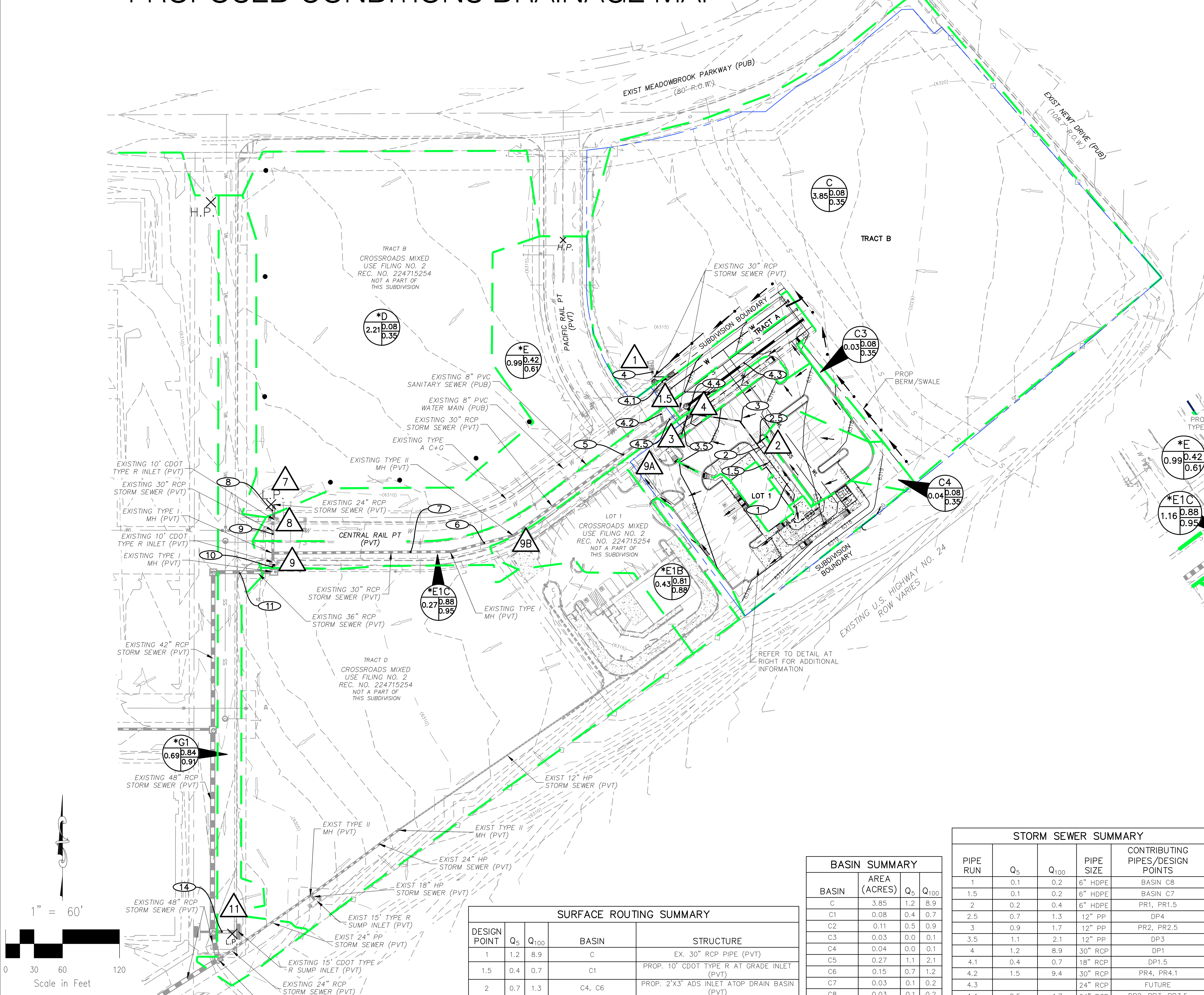
LOT 1 CROSSROADS MIXED USE FILING NO. 3

PROPOSED CONDITIONS DRAINAGE MAP



LEGEND

- BASIN DESIGNATION (Z; ACRES 25; C5 .25; C100 .35)
- SURFACE DESIGN POINT
- FUTURE BASIN BOUNDARY
- PIPE RUN LABEL
- PROP MAJ CONT
- PROP MIN CONT
- EXIST MAJ CONT
- EXIST MIN CONT
- PROPOSED STORM SEWER PIPE
- PROPOSED STORM SEWER PIPE (OTHERS)
- EXISTING FLOW DIRECTION ARROW
- H.P. HIGH POINT
- L.P. LOW POINT
- EXISTING SWALE
- FILING BOUNDARY
- PROPOSED UTILITY EASEMENT
- PROPOSED DRAINAGE EASEMENT
- PROPOSED LANDSCAPE EASEMENT
- LOT LINE
- EX. SANITARY SEWER LINE
- EX. WATER LINE
- PROP SANITARY SEWER SERVICE
- PROP WATER SERVICE
- PROP SANITARY SEWER MAIN
- PROP WATER MAIN
- EX. STORM MANHOLE
- EX. STORM INLET
- EX. SANITARY MANHOLE
- EX. WATER VALVE
- PROPOSED SWALE

SURFACE ROUTING SUMMARY

DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
1	1.2	8.9	C	EX. 30" RCP PIPE (PVT)
1.5	0.4	0.7	C1	PROP. 10' CDOT TYPE R AT GRADE INLET (PVT)
2	0.7	1.3	C4, C6	PROP. 2'X3' ADS INLET ATOP DRAIN BASIN (PVT)
3	1.1	2.1	C3, C5	PROP. 5' CDOT TYPE R SUMP INLET (PVT)
4	0.5	0.9	C2	PROP. 10' CDOT TYPE R AT GRADE INLET (PVT)
9A	1.4	3.0	E1A, EA1.5	EX. PAVED ACCESS DRIVE (PVT)
9B	1.8	3.3	*E1B	EX. 3' CURB CHASE (PVT)
7	0.7	5.1	*D	
8	1.6	3.9	*E	EX. 10' CDOT TYPE R AT-GRADE INLET
9	4.3	8.3	*E1C, DP 9A, DP 9B	EX. 10' CDOT TYPE R AT-GRADE INLET
11	2.9	8.8	*G1, PB DP8, FB DP9	EX 15' CDOT TYPE R SUMP INLET (PVT)

BASIN SUMMARY

BASIN	AREA (ACRES)	Q_5	Q_{100}
C	3.85	1.2	8.9
C1	0.08	0.4	0.7
C2	0.11	0.5	0.9
C3	0.03	0.0	0.1
C4	0.04	0.0	0.1
C5	0.27	1.1	2.1
C6	0.15	0.7	1.2
C7	0.03	0.1	0.2
C8	0.03	0.1	0.2
*D	2.21	0.7	5.1
*E	0.99	1.6	3.9
E1A	0.50	1.4	3.0
E1A.5	0.04	0.0	0.1
*E1B	0.43	1.8	3.3
*E1C	0.27	1.2	2.2
*G1	0.69	2.9	5.4

STORM SEWER SUMMARY

PIPE RUN	Q_5	Q_{100}	PIPE SIZE	CONTRIBUTING PIPES/DESIGN POINTS
1	0.1	0.2	6" HDPE	BASIN C8
1.5	0.1	0.2	6" HDPE	BASIN C7
2	0.2	0.4	6" HDPE	PR1, PR1.5
2.5	0.7	1.3	12" PP	DP4
3	0.9	1.7	12" PP	PR2, PR2.5
3.5	1.1	2.1	12" PP	DP3
4	1.2	8.9	30" RCP	DP1
4.1	0.4	0.7	18" RCP	DP1.5
4.2	1.5	9.4	30" RCP	PR4, PR4.1
4.3			24" RCP	FUTURE
4.4	2.5	4.7	24" RCP	DP2, PR3, PR3.5
4.5	2.5	4.7	30" RCP	PR4.3, PR4.4
5	3.4	13.0	30" RCP	PR4.2, PR4.5
6	3.4	13.0	30" RCP	PR5
7	3.4	13.0	30" RCP	PR6
8	0.7	5.1	24" RCP	DP7
9	2.3	9.0	30" RCP	PR8, DP8 (INLET 6)
10	5.7	22.0	30" RCP	PR7, PR9
11	9.2	28.6	36" RCP	PR10, DP9 (INLET 7)
14	2.9	8.8	30" RCP	DP11 (INLET 9)

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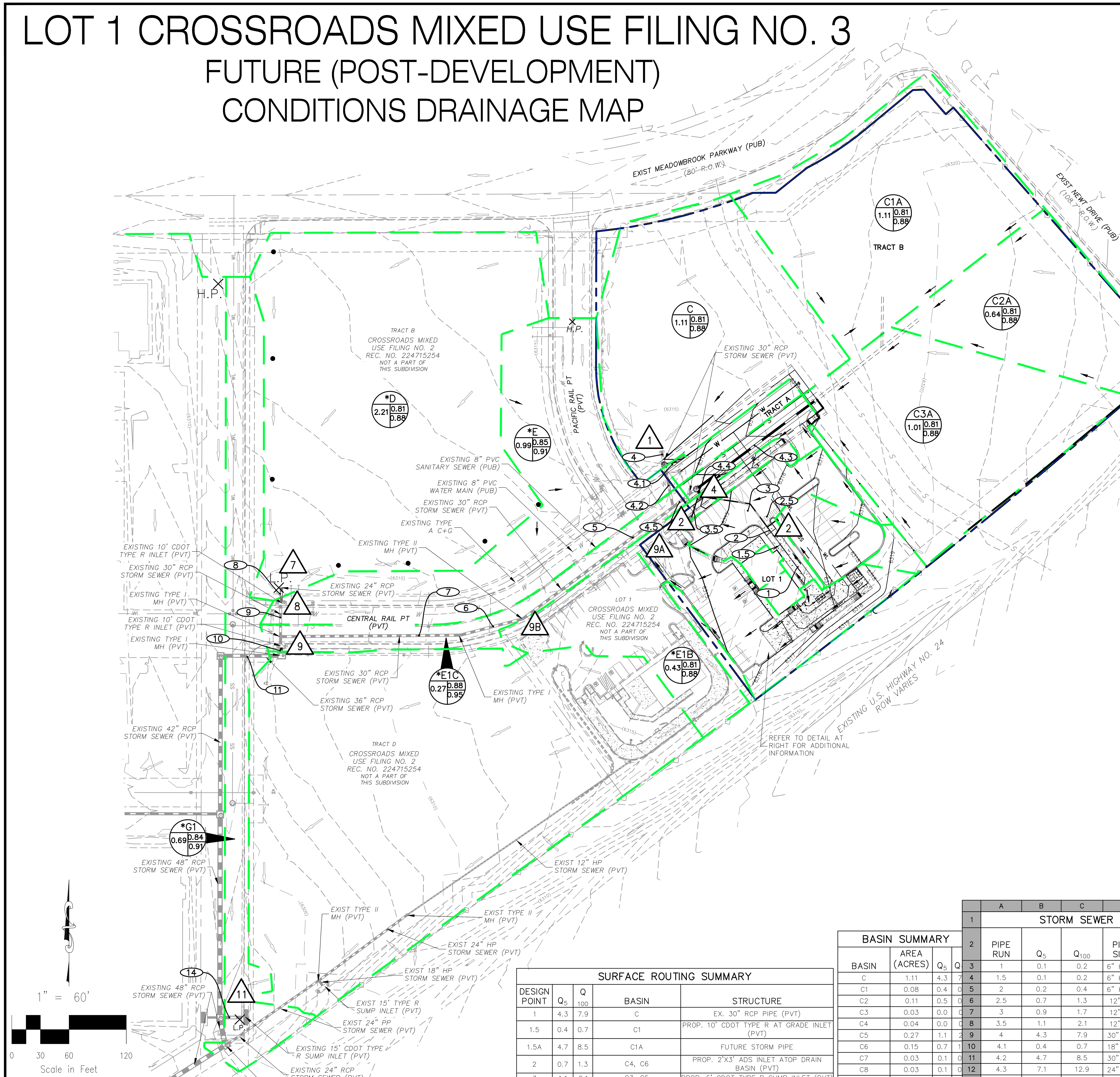
LOT 1-CROSSROADS MIXED USE FILING NO. 3

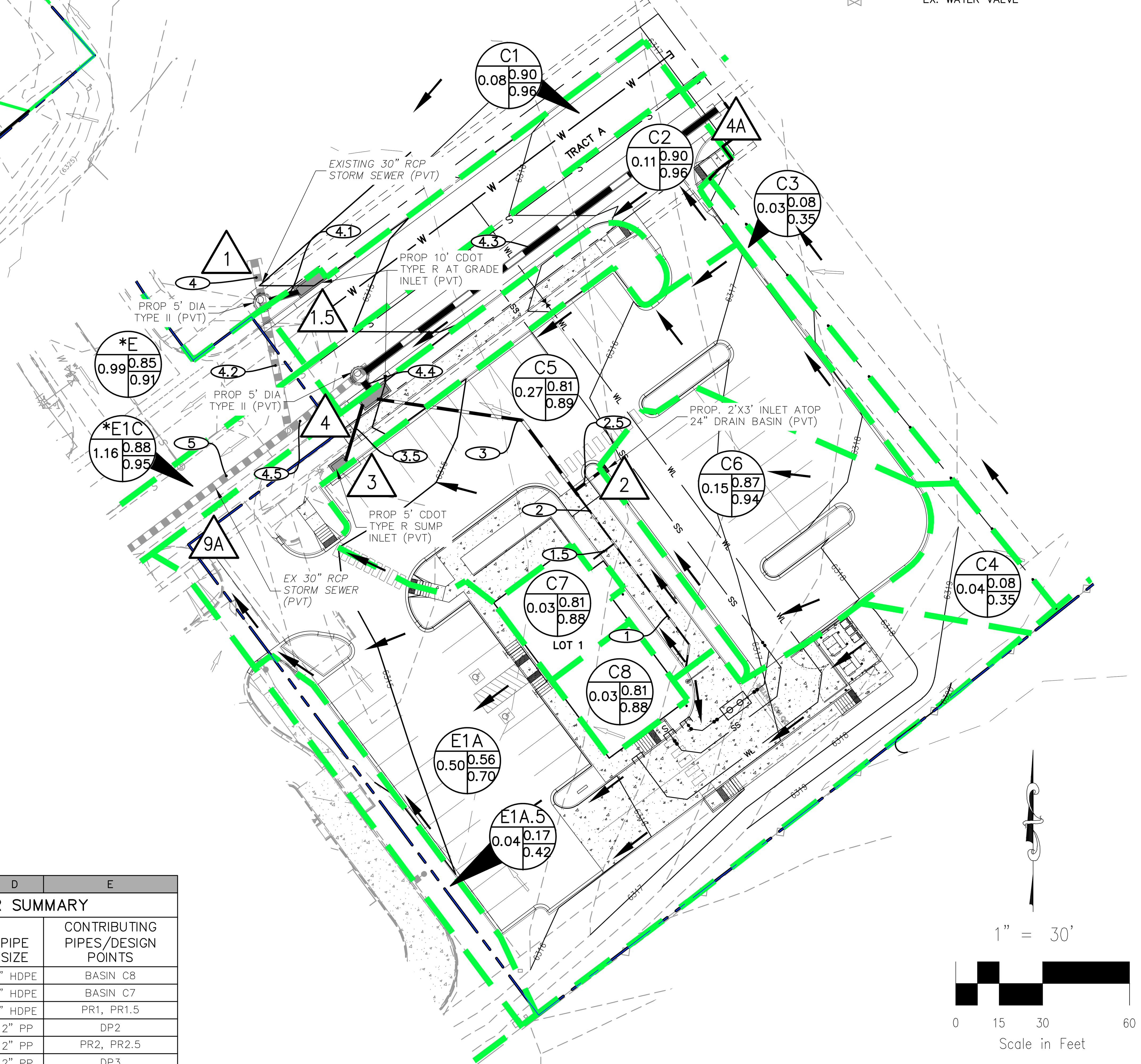
PROPOSED DRAINAGE MAP

PROJECT NO. 18-007	SCALE: HORIZONTAL: 1"=60', 1"=30' VERTICAL: N/A	DATE: 11/01/2024	
DESIGNED BY: GT DRAWN BY: GT CHECKED BY: VAS		SHEET 1 OF 1	PDM

LOT 1 CROSSROADS MIXED USE FILING NO. 3

FUTURE (POST-DEVELOPMENT) CONDITIONS DRAINAGE MAP





SURFACE ROUTING SUMMARY				
DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
1	4.3	7.9	C	EX. 30" RCP PIPE (PVT)
1.5	0.4	0.7	C1	PROP. 10' CDOT TYPE R AT GRADE INLET (PVT)
1.5A	4.7	8.5	C1A	FUTURE STORM PIPE
2	0.7	1.3	C4, C6	PROP. 2'X3' ADS INLET ATOP DRAIN BASIN (PVT)
3	1.1	2.1	C3, C5	PROP. 5' CDOT TYPE R SUMP INLET (PVT)
4	4.7	8.6	C2, C3A	PROP. 10' CDOT TYPE R AT GRADE INLET (PVT)
4A	2.6	4.7	C2A	FUTURE STORM PIPE
9A	1.5	3.1	E1A, EA1.5	EX. PAVED ACCESS DRIVE (PVT)
9B	1.8	3.3	*E1B	EX. 3' CURB CHASE (PVT)
7	9.3	16.9	*D	EX 24" RCP PIPE (PVT)
8	4.0	7.2	*E	EX. 10' CDOT TYPE R AT-GRADE INLET
9	4.5	8.6	*E1C, DP 9A, DP 9B	EX. 10' CDOT TYPE R AT-GRADE INLET
11	2.9	8.9	*G1, PB DP8, FB DP9	EX 15' CDOT TYPE R SUMP INLET (PVT)

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q_5	Q
C	1.11	4.3	7
C1	0.08	0.4	0
C2	0.11	0.5	0
C3	0.03	0.0	0
C4	0.04	0.0	0
C5	0.27	1.1	2
C6	0.15	0.7	1
C7	0.03	0.1	0
C8	0.03	0.1	0
*D	2.21	9.3	16
*E	0.99	4.0	7
E1A	0.50	1.4	3
E1A.5	0.04	0.0	0
*E1B	0.43	1.8	3
*E1C	0.27	1.2	2
*G1	0.69	2.9	5
C1A	1.11	4.7	8
C2A	0.64	2.6	4
C3A	1.01	4.7	7

	A	B	C	D	E
1	STORM SEWER SUMMARY				
2	PIPE RUN	Q_5	Q_{100}	PIPE SIZE	CONTRIBUTING PIPES/DESIGN POINTS
3	1	0.1	0.2	6" HDPE	BASIN C8
4	1.5	0.1	0.2	6" HDPE	BASIN C7
5	2	0.2	0.4	6" HDPE	PR1, PR1.5
6	2.5	0.7	1.3	12" PP	DP2
7	3	0.9	1.7	12" PP	PR2, PR2.5
8	3.5	1.1	2.1	12" PP	DP3
9	4	4.3	7.9	30" RCP	DP1
10	4.1	0.4	0.7	18" RCP	DP1.5
11	4.2	4.7	8.5	30" RCP	PR4, PR4.1
12	4.3	7.1	12.9	24" RCP	DP1.5, DP4A
13	4.4	6.7	12.4	24" RCP	DP2, PR3, PR3.5
14	4.5	14.1	25.8	30" RCP	PR4.3, PR4.4
15	5	17.7	32.4	30" RCP	PR4.2, PR4.5
16	6	17.7	32.4	30" RCP	PR5
17	7	17.7	32.4	30" RCP	PR6
18	8	9.3	16.9	24" RCP	DP7
19	9	13.6	24.7	30" RCP	PR8, DP8 (INLET 6)
20	10	30.3	55.3	30" RCP	PR7, PR9
21	11	34.5	63.4	36" RCP	PR10, DP9 (INLET 7)
22	14	2.9	8.9	30" RCP	DP11 (INLET 9)

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LOT 1–CROSSROADS MIXED USE FILING NO. 3

FUTURE CONDITIONS DRAINAGE MAP

PROJECT NO. 18–007	SCALE: HORIZONTAL: 1"=60', 1"=30' VERTICAL: N/A	DATE: 11/01/2024	
DESIGNED BY: GT DRAWN BY: GT CHECKED BY: VAS		SHEET 1 OF 1	fdm

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