FINAL DRAINAGE REPORT

CARRIAGE MEADOWS NORTH
FILING NO. 1

DECEMBER, 2017
REVISED JANUARY 25, 2018

Prepared for:

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ENGINEER'S STATEMENT

The attached drainage plan and report were 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 El Paso 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.

Richard L. Schindler, P.E. #33997 Date
For and on Behalf of Core Engineering Group, LLC

OWNER'S STATEMENT

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

Lorson, LLC Date

By
Jeff Mark

Title
Manager

Address
212 N. Wahsatch Avenue, Suite 301, Colorado Springs, CO 80903

FLOODPLAIN STATEMENT

To the best of my knowledge and belief, this development is located within a designated floodplain as shown on Flood Insurance Rate Map Panel No. 08041C0957 F, Dated March 17, 1997, Revised to Reflect LOMR Case Number 06-08-B643P Effective Aug. 29, 2007. (See Appendix A, FEMA FIRM Exhibit)

Richard L. Schindler, #33997, Date
For and on Behalf of Core Engineering Group, LLC

EL PASO COUNTY

Filed in accordance with the requirements of the El Paso County Land Development Code, Drainage Criteria Manual, Volume 1 and 2, and Engineering Criteria Manual, As Amended.

(Jennifer Irvine), County Engineer / ECM Administrator Date

Conditions:

1.0 LOCATION and DESCRIPTION

The purpose of this Final Drainage Report is to provide an overview of the overall drainage impacts/mitigation due to development in the proposed Carriage Meadows North Filing No. 1 development located in Lorson Ranch. The study area of this report is approximately 68.67 acres. See ***Appendix A*** for vicinity map.

Carriage Meadows North Filing No. 1 is located in the SW quarter of Section 14 and SE quarter of Section 15, Township 15 South, Range 65 West of the 6th Principal Meridian; it is currently unplatted and zoned PUD. The property is bounded to the north by the Banning Lewis Ranch Company, LLC, to the east by Jimmy Camp Creek, to the south by Fontaine Boulevard, and to the west by Marksheffel Road. A vicinity map is included in Appendix A of this report. Also included in this report and plan is the proposed layout for Carriage Meadows North Filing No. 1 which is located north of the intersection of Fontaine Boulevard and Carriage Meadows Drive. The land is currently owned by Cradlan, LLC and Lorson LLC or its nominees for Lorson Ranch. The first phase of development will consist of 155 single-family homes and two tracts of land for future development as commercial land uses.

The site is currently unplatted and zoned PUD.

According to the current FEMA Flood Insurance Rate Maps (FIRM), there are portions of this site located in a Zone AE floodplain. A LOMR was approved by FEMA as Case Number 06-08-B643P, effective date August 29, 2007.

1.1 COMPLIANCE WITH DBPS, MDDP, and ADJACENT DRAINAGE REPORTS

Carriage Meadows is surrounded by adjacent developments on the west, east, and south. These adjacent developments have approved drainage reports and Lorson Ranch as has complied with the recommendations/requirements of those studies and all of the infrastructure within Lorson Ranch required by the drainage reports has been built. The following is a brief summary of the adjacent drainage studies and how we are in compliance.

1.1.1 Conformance with applicable Drainage Basin Planning Studies

There is an existing (unapproved) DBPS for Jimmy Camp Creek prepared by Wilson & Company in 1987 [3], adopted by El Paso County, and is referenced in this report. The only major drainage improvements for this study area according to the 1987 Wilson study was the reconstruction of the main stem of Jimmy Camp Creek. In 2006 the main stem of Jimmy Camp Creek and the FMIC relocation within Lorson Ranch was reconstructed in accordance with the 1987 study. In 2015 a new DBPS for Jimmy Camp Creek was completed by Kiowa Engineering. The Kiowa Engineering DPBS has been adopted by the City of Colorado Springs and is allowed for use by El Paso County for the entire Jimmy Camp Creek Basin, including the main channel of Jimmy Camp Creek located on the east side of this site. El Paso county has not approved the drainage fees detailed in the Kiowa DBPS so current county drainage fees apply to this development. The Kiowa DBPS shows the reconstructed channel of Jimmy Camp Creek and the existing Fontaine Boulevard bridge over the main channel. According to the Kiowa DBPS all major drainage infrastructure has been constructed and there are no new

requirements for channel/bridge improvements on Jimmy Camp Creek for development of Carriage Meadows North Filing No. 1.

1.1.2 Conformance with Carriage Meadows South at Lorson Ranch Filing No. 1 Preliminary Drainage Report/MDDP

Carriage Meadows North does include areas south of the relocated FMIC that contain the two future commercial development tracts that are covered in the Carriage Meadows South PDR/MDDP. Detention and water quality for these two future development tracts is provided by Carriage Meadows South at Lorson Ranch Filing No. 1 in Pond G1/G2. Existing storm sewer under Fontaine will convey developed runoff to the south

1.1.3 Conformance with Cottonwood Meadows Final Drainage Report (FDR), Dated October, 1999 by HMS Group – Cottonwood Meadows is an existing subdivision located west of Marksheffel Road and north of Fontaine Boulevard. Cottonwood Meadows drainage flows south via internal streets to a detention facility located adjacent to the existing FMIC within the subdivision. The stormwater is detained and discharges into the FMIC channel. The FMIC accepted the stormwater into their ditch system on the west side of Marksheffel but is required to discharge the water to Jimmy Camp Creek just east of Marksheffel Road. When Lorson Ranch was reconstructing Jimmy Camp Creek, FMIC required Lorson to reconstruct the outfall structure that separated stormwater from FMIC irrigation water at Jimmy Camp Creek. The outlet structure and upstream FMIC channel design was thoroughly analyzed in the FDR for Marksheffel/Old Glory/Fontaine prepared by Pentacor Engineering. Compliance with the Cottonwood Meadows FDR was maintained by accepting their stormwater runoff into the FMIC channel and separating the stormwater from the irrigation water at Jimmy Camp Creek.

1.1.4 Final Drainage Report for Fontaine Boulevard, Old Glory Drive, and Marksheffel Road Phase 1 Improvements. This FDR was the basis for much of the offsite and on-site stormwater infrastructure design in Carriage Meadows. The Lorson Ranch FDR addresses FMIC issues, future runoff from Marksheffel Road and on-site runoff from the commercial area to Fontaine Boulevard. The FMIC historically consisted of an open channel from Cottonwood Meadows to Jimmy Camp Creek (culvert under Marksheffel). Upon development of Lorson Ranch in 2007, a 48" pipe was installed from Cottonwood Meadows west and under Marksheffel Road. The 48" pipe carries FMIC water (50cfs) and stormwater to the east side of Marksheffel Road where a reconstructed open channel directs water east to Carriage Meadows Drive. In addition, this open channel section is designed to handle runoff from the full buildout of Marksheffel Road which is carried in a 30" RCP under Marksheffel Road. The 30" RCP is located directly north of the 48" FMIC pipe. Stormwater and FMIC water (113cfs & 214cfs in 5/100 year storm) travels east to Carriage Meadows Drive where a diversion structure and a box culvert effectively separate stormwater from FMIC water. The diversion structure is a 25' D-10-R inlet with a 1.5' opening and the box culvert is a 3x4 culvert with a gate to regulate or shut off flow. During times of FMIC operation, the gate is adjusted so that only the FMIC water is allowed to pass east in the FMIC channel. Additional runoff at this gate will pond up and flow into the 25' diversion structure. During times the FMIC is not operating, the gate is closed which forces all runoff into the 25' diversion structure. The outlet structure is drained by a 48" RCP that flows east under Carriage Meadows Drive. A 60" RCP at 0.95% slope continues east and outlets directly into Jimmy Camp Creek with a capacity of 270cfs. Just north of the 60" RCP, a 36" stub has been constructed to accept flows from a WQ basin in the Carriage Meadows residential areas. This entire system is in place and has been fully operational since August, 2006. In addition to addressing runoff from the residential areas of

Carriage Meadows, Lorson Ranch was required to address future runoff from the commercial areas of Carriage Meadows. The future commercial areas flow west to a low point on the north side of Fontaine Boulevard between Carriage Meadows Drive and Marksheffel Road. A large storm sewer collects the future runoff and directs it south under Fontaine Boulevard. These commercial areas will be detained to the south within Lorson Ranch. Infrastructure for this drainage report was constructed in 2007.

1.1.5 Reconstruction of Jimmy Camp Creek and FMIC relocation

In 2006 Jimmy Camp Creek was re-aligned and reconstructed within Lorson Ranch from the southern boundary to the northern boundary. The construction plans were prepared by Drexel Barrell & Company (project number C-7668-2) and were approved on September 6, 2005 by El Paso County (#2801). Construction was based more or less on recommendations in the 1987 Wilson DBPS for Jimmy Camp Creek. The construction consisted of a trapezoidal channel section, armored creek banks with a sand bottom. Construction started at the south property line of Lorson Ranch and extended north 5,300 feet to the north line of Lorson Ranch. In 2006 the FMIC ditch in Lorson Ranch was also relocated in conjunction with the creek improvements. The FMIC through Lorson Ranch was relocated adjacent to the creek on the west bank and was constructed at the same time as the creek improvements. Pentacor Engineering prepared the FMIC relocation construction plans (project number 6000.0002) which were approved by El Paso County on November 22, 2005. Both the creek and FMIC relocation were completed in 2006 from the south property line of Lorson Ranch and extended north 5,300 feet to the north line of Lorson Ranch

1.1.6 Conformance with Marksheffel Road Drainage Report

Marksheffel Road on the west side of Carriage Meadows was re-constructed in 2015 by El Paso County. As part of the County's construction plans a drainage report was prepared by HDR in 2015. Marksheffel Road reconstruction uses infrastructure constructed in 2007 by Lorson Ranch to convey runoff from Marksheffel Road east to Jimmy Camp Creek per the FDR for Fontaine Boulevard. The County did remove an existing 72" CMP pipe and replace it with a 4'x7' CBC which is designated as Pipe P228. Per the HDR report Offsite Drainage Basin 226L (65.2acres) generates 20cfs and 73.0cfs in the 5/100 year storm events. P228 conveys the flow east under Marksheffel Road into a temporary swale flowing NE to an existing 60" RCP at the north property line. There is no additional overland drainage entering Carriage Meadows North because the constructed roadside swale conveys runoff south to the FMIC channel prior to entering this site.

1.1.7 Final Drainage Report for Peaceful Ridge at Fountain Valley prepared by Kiowa Engineering. This FDR was prepared to address development of Peaceful Ridge which is located directly west of Carriage Meadows and Marksheffel Road. Peaceful Ridge will construct an on-site detention pond to detain on-site flows and will direct to pond outflow to an existing 4'x7' CBC under Marksheffel Road. The CBC was constructed in 2015 as part of the Marksheffel Road improvements. A significant amount of offsite runoff from north of Peaceful Ridge enters the roadside swale on the west side of Marksheffel Road and also flows south to the existing CBC. Lorson Ranch and the developers of Peaceful Ridge have agreed to direct the offsite flows north of Peaceful Ridge under Marksheffel Road (via a 48" RCP) and runoff from the east end of the CBC north (via a 48" RCP) to the north property line of Carriage Meadows where they will connect and flow east to Jimmy Camp Creek via a 60" RCP. These recommendations have been incorporated into the FDR and the construction drawings for Carriage Meadows.

2.0 DRAINAGE CRITERIA

The supporting drainage design and calculations were performed in accordance with the City of Colorado Springs and El Paso County "Drainage Criteria Manual (DCM)", dated November, 1991, the El Paso County "Engineering Criteria Manual", Chapter 6 and Section 3.2.1 Chapter 13 of the City of Colorado Springs Drainage Criteria Manual dated May 2014, and the UDFCD "Urban Storm Drainage Criteria Manual" Volumes 1, 2 and 3 for full spectrum pond sizing. No deviations from these published criteria are requested for this site. The proposed improvements to the development will be in substantial compliance with the "Jimmy Camp Creek Drainage Basin Planning Study", prepared by Kiowa Engineering Corp., Colorado Springs, CO and all improvements to Jimmy Camp Creek have been completed.

The Rational Method as outlined in Section 6.3.0 of the May 2014 "Drainage Criteria Manual" and in Section 3.2.8.F of the El Paso County "Engineering Criteria Manual" was used for basins less than 130 acres to determine the rainfall and runoff conditions for the proposed development of the site. The runoff rates for the 5-year initial storm and 100-year major design storm were calculated. Runoff values in Table 6-6 in the DCM update are a bit lower than what is used for this report. To be consistent with the previous approve drainage report we kept the higher "C" values which will result in a slightly more conservative storm sewer/inlet design. Using the higher "C" values will not affect the full spectrum pond design.

Current updates to the Drainage Criteria manual for El Paso County states the if detention is necessary, Full Spectrum Detention will be included in the design, based on this criteria, Full Spectrum Detention will be required for this development

3.0 EXISTING HYDROLOGICAL CONDITIONS

The site is currently undeveloped with vegetation (grass with no shrubs) that has been used as an irrigated hayfield and moderate slopes to the south and east to Jimmy Camp Creek.

The majority of onsite soil consists of Manzanola clay loam according to the Soil Survey of El Paso County Area [2]. Other onsite soil types consist of Bressler sandy loam, Ellicott loamy course sand and Razor-Midway complex. Since the majority of this site consists of import material, soil type C/D has been assumed for the hydrologic conditions. See Appendix A for SCS Soils Map.

Existing Soil Types:
The following table summarizes the characteristics of the soil type.

Table 3.1: SCS Soils Survey

Soil	Hydro. Group	Shrink/Swell Potential	Permeability	Surface Runoff Potential	Erosion Hazard
11-Bresser Sandy Loam	B	Moderate	Moderate	Slow to Medium	Moderate

28-Ellicot Loamy Sand	A	Low	Rapid	Low	Moderate
52-Manzanola Clay Loam	C	High	Slow	Medium	Moderate

This site was graded as part of the Jimmy Camp Creek Channel Improvements and the adjacent land on three sides has been developed/constructed with the exception of the north side which is the future Banning Lewis Ranch. On the west no overland drainage from Marksheffel Road will enter Carriage Meadows North because Marksheffel Road was reconstructed in 2015 which includes a roadside swale directing runoff south to existing drainage facilities. The only runoff from Marksheffel Road entering the site is from an existing 4'x7' CBC constructed in 2015. Carriage Meadows North will pipe the flow from the CBC north and east to Jimmy Camp Creek into an existing 60" RCP on the north property line. On the south an existing storm sewer constructed as part of Fontaine Boulevard in 2006 will collect runoff from the southern portions of the site and convey it south. On the east Jimmy Camp Creek was reconstructed in 2006.

Basin 226L

Basin 226L is an off-site undeveloped basin located west of Marksheffel Road and north of the Cottonwood Meadows subdivision. This basin has steep slopes and flows overland east to Marksheffel Road, then south to an existing 4'x7'" CBC under Marksheffel Road, then east under Marksheffel Road to Jimmy Camp Creek. This basin was studied in the FDR for Marksheffel Road prepared by HDR. The total pre-developed flow from this basin is 20 cfs and 73 cfs in the 5 and 100-year storm events.

Basin EX-E1

Basin EX-E1 is an on-site undeveloped basin located east of Marksheffel Road, north of the existing FMIC channel, and north of Fontaine Boulevard. This basin has gentle slopes on the east and flows east and south overland directly to Jimmy Camp Creek. The total historic flow from this basin is 20.0 cfs and 112.0 cfs in the 5 and 100-year storm events.

Basin EX-E2

Basin EX-E2 is an on-site undeveloped basin located east of Marksheffel Road, south of the existing FMIC channel, and north of Fontaine Boulevard. This basin has moderate slopes and flows overland south downstream to Fontaine Boulevard to an existing storm sewer under Fontaine Boulevard. The total pre-developed flow from this basin is 7.0 cfs and 39.1 cfs in the 5 and 100-year storm events.

EXISTING DESIGN PT. 226L

Existing Design Point 22L is located on the west side of Marksheffel Road north of Fontaine Boulevard and is the entrance to an existing 4'x7'CBC culvert that drains east under Marksheffel Road and continues east in a swale to Jimmy Camp Creek. The total pre-developed flow at this design point is 20.0 cfs and 73.0 cfs in the 5 and 100-year storm events per the FDR for Marksheffel Road prepared by HDR.

EXISTING DESIGN PT. 23

Existing Design Point 23 is located at an existing on the east side of Marksheffel Road north of Fontaine Boulevard and is on the FMIC ditch. The FMIC ditch at this point has roughly a 50cfs maximum base irrigation flow which combines with stormwater from

Marksheffel Road and Cottonwood Meadows for a total of 113cfs and 214 in the 5 and 100-year storm events per the FDR for Fontaine Boulevard prepared by Pentacor Engineering.

4.2 DEVELOPED HYDROLOGICAL CONDITIONS

Carriage Meadows Filing No. 1 will have multiple sub-basins within the site depending on the need for storm inlets and street capacity. The general drainage concept allows runoff to flow from the northwest corner of the site to the southeast corner of the residential area just north of the relocated FMIC irrigation channel. A full spectrum pond will be located in the southeast corner of the site. Offsite runoff has been addressed through a 48" RCP on Marksheffel Road (flows north) and a 60" RCP that flows east to Jimmy Camp Creek on the north property line. These developed drainage condition concepts are in compliance with the FDR's detailed in Section 4.1

Drainage concepts for each of the basins are briefly discussed as follow:

Basin E1.1 thru E1.3
These basins consist of residential lots located adjacent to Meadow Bank Lane north of Chalkstone Lane. The runoff flows southerly via curb and gutter to on-grade storm sewer inlets in Meadow Bank Lane. The storm sewer flows south and east to the full spectrum pond in the southeast portion of the residential area. See the excel spreadsheet in Appendix B and the Developed Conditions Drainage Map (Map Pocket) for the 5-year and 100-year storm event amounts.

Basin E1.4, E1.4A, E1.5, E1.6
Basin E1.4, E1.4a/b, E1.5 and E1.6 flows consist of runoff from residential lots on Cider Mill Place. Runoff from these basins flows south to the east end of Coyote Run. Storm sewer inlets will collect runoff and convey it south to the full spectrum pond in the southeast portion of the residential area. The storm sewer system is designed for the 100year storm event. See the excel spreadsheet in Appendix B and the Developed Conditions Drainage Map (Map Pocket) for the 5-year and 100-year storm event amounts.

Basin E1.7-E1.11
These basins consist of residential lots located adjacent to Meadow Bank Lane, Coyote Run Drive, Borderpine Way, Chalkstone Lane, and Carriage Meadows Drive north of the FMIC relocated channel. The runoff flows southerly and easterly via curb and gutter to storm sewer inlets in Borderpine Way, and Carriage Meadows Drive. The storm sewer flows south and east to the full spectrum pond in the southeast portion of the residential area. See the excel spreadsheet in Appendix B and the Developed Conditions Drainage Map (Map Pocket) for the 5-year and 100-year storm event amounts.

Basin E1.12
Basin E1.12 flows are primarily generated by residential lots and open areas and drain directly to the water quality pond. The runoff from this sub-basin is 4.0 and 9.4 cfs for the 5-year and 100-year storm respectively.

Basin E1.13
Basin E1.13 flows are primarily generated by the backyards of residential lots and open areas. Runoff from this basin drains overland (no channelization) easterly directly to Jimmy Camp Creek. Roof drains on the proposed houses will be required to direct

downspouts to the front of the lot. Runoff from this basin in not included in the water quality calculations. A deviation will be submitted to allow the direct flow to Jimmy Camp Creek without treatment of WQ since this area is only backyards and open space. There is a 20' open space buffer between the backlot lines and JCC which will provide some treatment of runoff. This basin comprises of about 2.54acres of backyards which calculates about 5.26% of the total site (48.2ac). The runoff from this sub-basin is 9.2 and 19.2 cfs for the 5-year and 100-year storm respectively.

Basin E2.1

Basin E2.1 flows are primarily generated by roof and parking lot runoff of future commercial areas. The runoff flows to the south to a storm sewer constructed as part of the Lorson Ranch Phase 1 improvements at Design Point 19. The runoff from this sub-basin is 30.8 cfs and 58.0 cfs for the 5-year and 100-year storm respectively. Runoff from this basin will be detained and treated downstream per the FDR for Carriage Meadows South at Lorson Ranch Filing No. 1.

Basin E2.2

Basin E2.2 flows are primarily generated street runoff from Carriage Meadows Drive. The runoff flows southerly down Carriage Meadows Drive is collected by a 5' Type R inlet at Design Point 18 (sump). The runoff from this sub-basin is 2.3 cfs and 4.9 cfs for the 5-year and 100-year storm respectively. Runoff from this basin will be detained and treated downstream per the FDR for Carriage Meadows South at Lorson Ranch Filing No. 1.

Basin E2.3

Basin E2.3 flows are primarily generated by roof and parking lot runoff of future commercial areas. The runoff flows southwesterly and is collected by a 20' Type R inlet at Design Point 17 (sump). The runoff from this sub-basin is 11.6 cfs and 22.2 cfs for the 5-year and 100-year storm respectively. Runoff from this basin will be detained and treated downstream per the FDR for Carriage Meadows South at Lorson Ranch Filing No. 1.

Basin E2.4

Basin E2.4 flows are primarily generated by street runoff from Fontaine Boulevard. The runoff flows westerly down Fontaine Boulevard to an inlet at Design Point 17 (sump). The runoff from this sub-basin is 5.1 cfs and 9.6 cfs for the 5-year and 100-year storm respectively. Runoff from this basin will be detained and treated downstream per the FDR for Carriage Meadows South at Lorson Ranch Filing No. 1.

Basin E2.5

Basin E2.5 flows are primarily generated by roof and parking lot runoff of future commercial areas. The runoff flows southwesterly and is all collected by an18" RCP stub at Design Point 17a, then westerly to Type R inlet at Design Point 17 (sump). The runoff from this sub-basin is 5.3cfs and 10.2cfs for the 5-year and 100-year storm respectively. Runoff from this basin will be detained and treated downstream per the FDR for Carriage Meadows South at Lorson Ranch Filing No. 1.

5.0 HYDRAULIC SUMMARY

Hydraulic and pond calculations have been performed using an excel spreadsheet, Hydraflow for Storm Sewers and Hydraflow Express by Intellisolve. Street runoff capacities are calculated by using irregular channel calculations based on local street

typical sections and using Hydraflow Express and varying street slopes, a rating curve was developed for both the 5-year and 100-year storm events. The street capacities for the 5/100 year storm events adhere to requirements set forth in Table 6.1 in the DCM.

It is the intent of this FDR to use the proposed curb/gutter and storm sewer in the streets to convey runoff to water quality ponds where runoff can be treated prior to discharge into Jimmy Camp Creek. Inlet locations have been indicated on the developed conditions drainage map and have been sized for either the 5-year or 100-year storms based on location. See Appendix C for detailed hydraulic calculations and the storm sewer model.

The sizing of the storm sewer was prepared by using the *StormSewers* and *Hydrographs* computer software programs developed by Intellisolve, which conforms to the methods outlined in the "City of Colorado Springs/El Paso County Drainage Criteria Manual". Inlet sizing was performed by Denver Urban Drainage Excel Spreadsheets.

It is the intent of this drainage report to use the proposed curb/gutter and storm sewer in the streets to convey runoff to detention and water quality ponds then to Jimmy Camp Creek. See Appendix C for detailed hydraulic calculations and the storm sewer model.

All storm sewer is to be part of a public system. Detention Pond CMN1 is full spectrum detention pond including water quality and will be owned an maintained by Lorson Ranch Metro District.

Table 1: Street Capacities (100-year capacity is only ½ of street)

Street Slope	Residential Local		Residential Collector		Principal Arterial	
	5-year	100-year	5-year	100-year	5-year	100-year
0.5%	6.3	26.4	9.7	29.3	9.5	28.5
0.6%	6.9	28.9	10.6	32.1	10.4	31.2
0.7%	7.5	31.2	11.5	34.6	11.2	33.7
0.8%	8.0	33.4	12.3	37.0	12.0	36.0
0.9%	8.5	35.4	13.0	39.3	12.7	38.2
1.0%	9.0	37.3	13.7	41.4	13.4	40.2
1.4%	10.5	44.1	16.2	49.0	15.9	47.6
1.8%	12.0	45.4	18.4	50.4	18.0	50.4
2.2%	13.3	42.8	19.4	47.5	19.5	47.5
2.6%	14.4	40.7	18.5	45.1	18.5	45.1
3.0%	15.5	39.0	17.7	43.2	17.8	43.2
3.5%	16.7	37.2	16.9	41.3	17.0	41.3
4.0%	17.9	35.7	16.2	39.7	16.3	29.7
4.5%	19.0	34.5	15.7	38.3	15.7	38.3
5.0%	19.9	33.4	15.2	37.1	15.2	37.1

Note: all flows are in cfs (cubic feet per second)

Design Point 1

(5-year storm)

Tributary Basins:	E1.1	**Inlet/MH Number:**	DP-1
Upstream Bypass:	0 cfs	**Total Street Flow:**	6.7 cfs
Flow Intercepted:	5.8 cfs	**Flow Bypassed:**	1.0 cfs to Inlet DP-2

Inlet Size: 10-foot, on-grade, Type R
Street Capacity: 7.5 cfs at 0.74% --- street capacity okay

(100-year storm)

Tributary Basins:	E1.1	**Inlet/MH Number:**	DP-1
Upstream Bypass:	0 cfs	**Total Street Flow:**	14.2 cfs
Flow Intercepted:	8.6 cfs	**Flow Bypassed:**	5.6 cfs to Inlet DP-2

Inlet Size: 10-foot, on-grade, Type R
Street Capacity: 31 cfs at 0.74% --- street capacity okay

Comments:

Design Point 2

(5-year storm)

Tributary Basins:	E1.2	**Inlet/MH Number:**	DP-2
Upstream Bypass:	1.0 cfs	**Total Street Flow:**	6.6 cfs
Flow Intercepted:	5.7 cfs	**Flow Bypassed:**	0.9 cfs to Inlet DP-8

Inlet Size: 10-foot, on-grade, Type R
Street Capacity: 7.5 cfs at 0.74% --- street capacity okay

(100-year storm)

Tributary Basins:	E1.2	**Inlet/MH Number:**	DP-2
Upstream Bypass:	5.6 cfs	**Total Street Flow:**	17.4 cfs
Flow Intercepted:	9.5 cfs	**Flow Bypassed:**	7.9 cfs to Inlet DP-8

Inlet Size: 10-foot, on-grade, Type R
Street Capacity: 31 cfs at 0.74% --- street capacity okay

Comments:

Design Point 3

(5-year storm)
Tributary Basins: E1.3 **Inlet/MH Number:** DP-3
Upstream Bypass: 0 cfs **Total Street Flow:** 3.5 cfs
Flow Intercepted: 3.5 cfs **Flow Bypassed:** 0
Inlet Size: 10-foot, on-grade, Type R
Street Capacity: 7.5 cfs at 0.74% --- street capacity okay

(100-year storm)
Tributary Basins: E1.3 **Inlet/MH Number:** DP-3
Upstream Bypass: 0 cfs **Total Street Flow:** 7.3 cfs
Flow Intercepted: 6.1 cfs **Flow Bypassed:** 1.2 cfs to Inlet DP-5
Inlet Size: 10-foot, on-grade, Type R
Street Capacity: 31 cfs at 0.74% --- street capacity okay

Comments:

Design Point 4

(5-year storm)
Tributary Basins: E1.4 **Inlet/MH Number:** DP-4
Upstream Bypass: **Total Street Flow:** 7.5cfs
Flow Intercepted: 6.1cfs **Flow Bypassed:** 1.4cfs to Inlet DP-4a
Inlet Size: 10-foot, on-grade, Type R
Street Capacity: 7.5 cfs at 0.74% --- street capacity okay

(100-year storm)
Tributary Basins: E1.4 **Inlet/MH Number:** DP-4
Upstream Bypass: n/a **Total Street Flow:** 15.6cfs
Flow Intercepted: 9.0cfs **Flow Bypassed:** 6.6cfs to Inlet DP-4a
Inlet Size: 10-foot, on-grade, Type R
Street Capacity: 31 cfs at 0.74% --- street capacity okay

Comments:

Design Point 4a

(5-year storm)
Tributary Basins: E1.4a **Inlet/MH Number:** DP-4a
Upstream Bypass: 1.4 cfs **Total Street Flow:** 6.3 cfs
Flow Intercepted: 5.5 cfs **Flow Bypassed:** 0.8 cfs to Inlet DP-4b
Inlet Size: 10-foot, on-grade, Type R
Street Capacity: 7.5 cfs at 0.74% --- street capacity okay

(100-year storm)
Tributary Basins: E1.4a **Inlet/MH Number:** DP-4a
Upstream Bypass: 6.6 cfs **Total Street Flow:** 16.7 cfs
Flow Intercepted: 9.3 cfs **Flow Bypassed:** 7.4 cfs to Inlet DP-4b
Inlet Size: 10-foot, on-grade, Type R
Street Capacity: 31 cfs at 0.74% --- street capacity okay

Comments:

Design Point 4b

(5-year storm)
Tributary Basins: E1.4b **Inlet/MH Number:** DP-4b
Upstream Bypass: 0.8 cfs **Total Street Flow:** 5.7 cfs
Flow Intercepted: 5.7 cfs **Flow Bypassed:**
Inlet Size: 15-foot, SUMP, Type R
Street Capacity: 7.5 cfs at 0.7% --- street capacity okay

(100-year storm)
Tributary Basins: E1.4b **Inlet/MH Number:** DP-4b
Upstream Bypass: 7.4 cfs **Total Street Flow:** 17.5 cfs
Flow Intercepted: 17.5 cfs **Flow Bypassed:**
Inlet Size: 15-foot, SUMP, Type R
Street Capacity: 31 cfs at 0.7% --- street capacity okay

Comments:

Design Point 5

(5-year storm)
Tributary Basins: E1.5 **Inlet/MH Number:** DP-5
Upstream Bypass: 0 cfs **Total Street Flow:** 2.3 cfs
Flow Intercepted: 2.3 cfs **Flow Bypassed:** 0 cfs
Inlet Size: 5-foot, SUMP, Type R
Street Capacity: 7.5 cfs at 0.7% --- street capacity okay

(100-year storm)
Tributary Basins: E1.5 **Inlet/MH Number:** DP-5
Upstream Bypass: 1.2cfs **Total Street Flow:** 5.9 cfs
Flow Intercepted: 5.9cfs **Flow Bypassed:** 0 cfs
Inlet Size: 5-foot, SUMP, Type R
Street Capacity: 31 cfs at 0.7% --- street capacity okay

Comments:

Design Point 6

(5-year storm)
Tributary Basins: E1.6 **Inlet/MH Number:** DP-6
Upstream Bypass: 0 cfs **Total Street Flow:** 5.1 cfs
Flow Intercepted: 5.1 cfs **Flow Bypassed:** 0 cfs
Inlet Size: 10' sump inlet, Type R
Street Capacity: 7.5 cfs at 0.7% --- street capacity okay

(100-year storm)
Tributary Basins: E1.6 **Inlet/MH Number:** DP-6
Upstream Bypass: 0 cfs **Total Street Flow:** 10.5 cfs
Flow Intercepted: 10.5 cfs **Flow Bypassed:** 0 cfs
Inlet Size: 10' sump inlet, Type R
Street Capacity: 31 cfs at 0.7% --- street capacity okay

Comments:

Design Point 7

(5-year storm)
Tributary Basins: E1.7 **Inlet/MH Number:** DP-7
Upstream Bypass: 0 cfs **Total Street Flow:** 5.2 cfs
Flow Intercepted: 5.2 cfs **Flow Bypassed:** 0 cfs
Inlet Size: 10-foot, sump inlet, Type R
Street Capacity: 9.0 cfs at 1.0% --- street capacity okay

(100-year storm)
Tributary Basins: E1.7 **Inlet/MH Number:** DP-7
Upstream Bypass: 0 cfs **Total Street Flow:** 10.9 cfs
Flow Intercepted: 10.9 cfs **Flow Bypassed:** 0 cfs
Inlet Size: 10-foot, sump inlet, Type R
Street Capacity: 37 cfs at 1.0% --- street capacity okay

Comments:

Design Point 8

(5-year storm)
Tributary Basins: E1.8 **Inlet/MH Number:** DP-8
Upstream Bypass: 0.9 cfs **Total Street Flow:** 8.4 cfs
Flow Intercepted: 8.4 cfs **Flow Bypassed:**
Inlet Size: 10-foot, SUMP, Type R
Street Capacity: 7.5 cfs at 0.7% --- street capacity okay

(100-year storm)
Tributary Basins: E1.8 **Inlet/MH Number:** DP-8
Upstream Bypass: 7.9 cfs **Total Street Flow:** 23.4 cfs
Flow Intercepted: 16.3 cfs **Flow Bypassed:** 7.1cfs to DP-10
Inlet Size: 10-foot, SUMP, Type R
Street Capacity: 31 cfs at 0.7% --- street capacity okay

Comments:

Design Point 9

(5-year storm)
Tributary Basins: E1.9 **Inlet/MH Number:** DP-9
Upstream Bypass: 0 cfs **Total Street Flow:** 5.2 cfs
Flow Intercepted: 5.2 cfs **Flow Bypassed:** 0 cfs
Inlet Size: 5-foot, sump, Type R
Street Capacity: 7.5 cfs at 0.7% --- street capacity okay

(100-year storm)
Tributary Basins: E1.9 **Inlet/MH Number:** DP-9
Upstream Bypass: 0 cfs **Total Street Flow:** 10.7 cfs
Flow Intercepted: 9.3 cfs **Flow Bypassed:** 1.4 cfs to DP-10
Inlet Size: 5-foot, sump, Type R
Street Capacity: 31 cfs at 0.7% --- street capacity okay

Comments:

Design Point 10

(5-year storm)
Tributary Basins: E1.10 **Inlet/MH Number:** DP-10
Upstream Bypass: 0 cfs **Total Street Flow:** 3.1 cfs
Flow Intercepted: 3.1 cfs **Flow Bypassed:** 0 cfs
Inlet Size: 10-foot, sump, Type R
Street Capacity: 8.0 cfs at 0.80% --- street capacity okay

(100-year storm)
Tributary Basins: E1.10 **Inlet/MH Number:** DP-10
Upstream Bypass: 8.5 cfs **Total Street Flow:** 14.7 cfs
Flow Intercepted: 14.7 cfs **Flow Bypassed:** 0 cfs
Inlet Size: 10-foot, sump, Type R
Street Capacity: 33 cfs at 0.80% --- street capacity okay

Comments: Inlet in sump. In 5-yr storm, 1.0 cfs is from south and does not exceed street cap. A clogging factor of 1.25 was used in this inlet.

Design Point 11

(5-year storm)
Tributary Basins: E1.11 **Inlet/MH Number:** DP-11
Upstream Bypass: 0 cfs **Total Street Flow:** 2.1 cfs
Flow Intercepted: 2.1 cfs **Flow Bypassed:** 0 cfs
Inlet Size: 5-foot, sump, Type R
Street Capacity: 8.0 cfs at 0.80% --- street capacity okay

(100-year storm)
Tributary Basins: E1.11 **Inlet/MH Number:** DP-11
Upstream Bypass: **Total Street Flow:** 4.2 cfs
Flow Intercepted: 4.2 cfs **Flow Bypassed:** 0 cfs
Inlet Size: 5-foot, sump, Type R
Street Capacity: 33 cfs at 0.80% --- street capacity okay

Comments:

Design Point 12

(5-year storm) (100-year storm)
Flow into pond: 24.2 cfs **Flow into pond:** 61.1cfs

Comments: This design point is the total developed flow entering Pond CMN-1 from Basins E1.1 to E1.12. The flow rates are from the excel spreadsheets for Full Spectrum Detention Ponds. The total tributary area is 29.84acres and has an imperviousness of 50%.

Design Point 13 (Full Spectrum Pond CMN-1)

(2-year storm)	(5-year storm)	(100-year storm)
Pond Outflow: 1.7 cfs	Pond Outflow: 2.6cfs	Pond Outflow: 27.2 cfs

Comments: See Section 7.0 for Full Spectrum Pond Sizing

Design Point 14

(5-year storm)	(100-year storm)
Runoff: 113cfs	Runoff: 214cfs

Comments: Design Point 14 is located on the west end the FMIC channel at Marksheffel Rd. The existing channel accepts runoff from Marksheffel Road, detention pond outflow from Cottonwood Meadows Subdivision, and irrigation baseflows of 50cfs. The channel conveys the flow east to a diversion structure at Design Point 15 where the storm runoff will be diverted into an existing diversion structure while the irrigation baseflow of 50cfs will be allowed to flow east under Carriage Meadows Drive. This flow data was taken from the Final Drainage Report for Fontaine Boulevard.

Design Point 15

((5-year storm)	(100-year storm)
Runoff: 63cfs	Runoff: 164cfs

Comments: Design Point 15 is located on the west side of Carriage Meadows Drive and the FMIC open channel and is the total storm runoff entering a 25' D10R diversion structure constructed as part of the FMIC Channel improvements in 2006. A diversion structure at this point will divert 63cfs/164 cfs into an existing modified D10R inlet and allow the 50 cfs irrigation base flow to remain in the FMIC channel and flow east in an existing box culvert. The diversion concept consists of a 3'x4' box under Carriage Meadows Drive (for 50cfs of irrigation) while the storm runoff overflows into an existing modified 25' type D10R inlet. When the ditch is not running a slide gate on the box culvert is closed and a gate on the D10R inlet is opened so all storm runoff enters the inlet. A 48" storm sewer conveys the diverted runoff from the D10R inlet east to an existing 60" storm sewer where it will combine with runoff from Design Point 13 (from Carriage Meadows North WQ Pond) and flow directly east to Jimmy Camp Creek. The FMIC ditch system east of Carriage Meadows Drive has been converted from an open channel to a piped system in 2015. This flow data was taken from the Final Drainage Report for Fontaine Boulevard.

Design Point 16

(5-year storm)	(100-year storm)
Runoff: 63+2.6 = 65.6cfs	Runoff: 164+27.2 = 191.2cfs

Comments: Design Point 16 is located at Jimmy Camp Creek and is the total flow in the 60" RCP at 0.95% slope from the FMIC storm diversion structure (modified 25' D10R) at Design Point 15 and flow from the WQ/Detention Pond at Design Point 13. The 60" RCP has a flow depth of 3.5' for 191.2cfs and has a full flow capacity of 270cfs which exceeds the flows required. The existing 60" pipe has an existing cut-off wall and rip rap channel into JCC and no additional improvements are necessary in JCC.

Design Point 17a

(5-year storm)
Tributary Basins: E2.5 **Inlet/MH Number:**
Flow Intercepted: 5.3 cfs

(100-year storm)
Tributary Basins: E2.5 **Inlet/MH Number:**
Flow Intercepted: 10.2 cfs

Comments: This design point collects flow from Basin E2.5 which is a future commercial area. Basin E2.5 will be required to direct all flow to the southwest to an 18" RCP stub provided by this construction, then west to Design Point 17. Both the 5 and 100-year storm events will need to be collected by the storm sewer stub. No runoff will be allowed to flow west to discharge directly to Carriage Meadows Drive. Runoff from this basin will be treated for water quality and volume downstream to the south as part of Carriage Meadows South Filing No. 1 development. See Carriage Meadows South Filing No. 1 PDR/MDDP.

Design Point 17

(5-year storm)
Tributary Basins: E2.3 & E2.4 **Inlet/MH Number:** DP-17
Upstream Bypass: 0 **Total Street Flow:** 11.6 cfs
Flow Intercepted: 11.6 cfs **Flow Bypassed:** 0
Inlet Size: 20-foot, sump, Type R **Flow in Pipe:** 16.9 cfs, 30" RCP
Street Capacity: 16.2 cfs at 1.5% grade ---- residential collector okay

(100-year storm)
Tributary Basins: E2.3 & E2.4 **Inlet/MH Number:** DP-17
Upstream Bypass: 0 **Total Street Flow:** 22.2 cfs
Flow Intercepted: 22.2 cfs **Flow Bypassed:** 0
Inlet Size: 20-foot, sump, Type R **Flow in Pipe:** 32.0 cfs, 30" RCP
Street Capacity: 49cfs at 1.5% grade --- residential collector okay

Comments: Storm sewer is designed for 100-year storm and flows west to Design Point 18 via a 30" RCP at 0.5%. Runoff from this basin will be treated for water quality and volume downstream on Carriage Meadows South at Lorson Ranch Filing No. 1.

Design Point 18

(5-year storm)

Tributary Basins: E2.2	**Inlet/MH Number:** DP-18
Upstream Bypass: 0	**Total Street Flow:** 2.6 cfs
Flow Intercepted: 2.6 cfs	**Flow Bypassed:** 0
Inlet Size: 5-foot, sump, Type R	**Flow in Pipe:** 19.2 cfs, 30" RCP

Street Capacity: 16.2 cfs at 1.5% grade ---- okay

(100-year storm)

Tributary Basins: E2.2	**Inlet/MH Number:** DP-18
Upstream Bypass: 0	**Total Street Flow:** 4.9 cfs
Flow Intercepted: 4.9 cfs	**Flow Bypassed:** 0
Inlet Size: 5-foot, sump, Type xxR	**Flow in Pipe:** 37.1 cfs, 30" RCP

Street Capacity: 49 cfs at 1.5% grade --- okay

Comments: Storm sewer is designed for 100-year storm and flows west to Design Point 19 via a 30" RCP at 0.5%. At Design Point 19, a new manhole will be constructed over an existing 24X53" stub. The Lorson Ranch improvements have been designed to accept runoff from Basin E2.2, 2.3, 2.4 and E2.5 (upstream flow). Runoff from this basin will be treated for water quality and volume downstream on Carriage Meadows South Filing No. 1 at Lorson Ranch.

Design Point 19

(5-year storm)
Tributary Basins: E2.1
Basin Flow: 30.7 cfs
Total Flow in Pipe: 48.3 cfs in 36" RCP pipe okay, 52cfs allowed per Lorson Ranch Phase 1 FDR.

(100-year storm)
Tributary Basins: E2.1
Basin Flow: 58.0 cfs
Total Flow in Pipe: 90.9 cfs in 36" pipe okay, 97cfs allowed per Lorson Ranch Phase 1 FDR.

Comments: This design point collects flow from Basin E2.1 which is a future commercial area. Basin E2.1 will be required to direct all flow to the south to an existing 34X53" RCP stub provided by Lorson Ranch Phase 1 improvements. Runoff from Basins E2.1-E2.5 is then directed south under Fontaine Boulevard via a storm sewer system constructed as part of Lorson Ranch Phase 1 improvements. Both the 5 and 100-year storm events will need to be collected by the storm sewer stub. . Runoff from this basin will be treated for water quality and volume downstream on Carriage Meadows South Lorson Ranch Filing No. 1.

Design Point 20

(5-year storm)
Total Flow in Pipe: 20.0 cfs in ex. 4'x7'CBC

(100-year storm)
Total Flow in Pipe: 75.4 cfs in ex. 4'x7'CBC

Comments: This design point is located on the east side of Marksheffel Road at an existing 4'x7'CBC pipe crossing under Marksheffel Road constructed in 2015. Drainage flows east onto Carriage Meadows. The design flows above have been taken from a Final Drainage Report for Marksheffel Road by HDR. Carriage Meadows North will construct a 48" RCP north to Peaceful Ridge Drive at Design Point 22. The transition from a 4'x7' CBC will occur in Type I manhole constructed at the east end. The crown of the 48" will match the top of the CBC. The 48" outlet pipe is at a 45degree angle which has a elliptical cross section (4'hx5.38'w) with an area of 16.89sf in the type 1 manhole compared to a circular cross section which has an area of 12.57sf. This larger opening will help make the transition north smoother. There is a potential for clogging at this manhole but with the pipe size of 48" the potential is reduced. If clogging becomes an issue a trash rack could be installed on the west end of the CBC.

Design Point 21

(5-year storm)
Total Flow in Pipe: 40.7 cfs

(100-year storm)
Total Flow in Pipe: 104.1cfs

Comments: This design point is located on the east side of Marksheffel Road at Peaceful Ridge Drive. The design flows above have been taken from a Final Drainage Report from a proposed subdivision called Peaceful Ridge at Fountain Valley prepared by Kiowa Engineering. A 48" RCP will convey the flows to a proposed manhole in Peaceful Ridge Drive where is combines with flow from Design Point 20 and flows east to JCC. In 2015 the portion of the 48" RCP under Marksheffel Road was constructed so we need to connect to the existing stub and extend it east to the proposed manhole at Design Point 22.

Design Point 22

(5-year storm)
Total Flow in Pipe: 60.7 cfs in 60" RCP (developed conditions)

(100-year storm)
Total Flow in Pipe: 179.5 cfs in 60" RCP (developed conditions)

Comments: This design point is located on the west side of Marksheffel Road at the north property line of Carriage Meadows on Peaceful Ridge Drive. Carriage Meadows will construct a 60" RCP east to an existing 60" RCP at Jimmy Camp Creek. No improvements are necessary in Jimmy Camp Creek.

6.0 DETENTION AND WATER QUALITY PONDS

Detention and Storm Water Quality for Carriage Meadows North Filing No. 1 is required per El Paso County criteria. We have implemented the Full Spectrum approach for detention for Carriage Meadows North Filing No. 1 per the Denver Urban Drainage Districts specifications. Pond CMN-1 will incorporate storm water quality features into the full spectrum pond. Detention Pond CMN-1 will be owned and maintained by the Lorson Ranch Metropolitan District No. 1.

Detention Pond CMN-1 (Full Spectrum Design)

This is an on-site permanent full spectrum detention pond that includes water quality and discharges directly into Jimmy Camp Creek. Pond CMN-1 is designed using the UDCF Full Spectrum spreadsheets. The outlet structure is a standard 4'x20' full spectrum sloped outlet structure and the overflow spillway is a weir set above the outlet structure designed by the full spectrum spreadsheets to match pre-developed rates. The full spectrum print outs are in the appendix of this report. See map in appendix for watershed areas.

- Watershed Ares: 29.84 acres
- Watershed Imperviousness: 52%
- Hydrologic Soils Group C/D
- Forebay: 0.025ac-ft (see spreadsheet in appendix), Top=5707.00, Btm=5705.5, 6" rectangular notch in wall
- Zone 1 WQCV: 0.482ac-ft, WSEL: 5706.44
- Zone 2 EURV: 1.22ac-ft, WSEL: 5707.79, Top outlet structure set at 5709.20, 4'x20' outlet with 6:1 slope, 1.8cfs
- (5-yr): 1.61ac-ft, WSEL: 5708.39, 3.1cfs
- Zone 3 (100-yr): 2.65ac-ft, WSEL: 5709.86, 27.3cfs
- Pipe Outlet: 24" RCP at 0.5% with restrictor plate up 18 inches
- Overflow Spillway: 21' wide bottom, elevation=5710.00, 4:1 side slopes, flow depth=0.92' at 61.1cfs and 1.08' of freeboard
- Pre-development release rate into creek compliance from full spectrum pond spreadsheets
- Pond Bottom Elevation: 5704.00
-

Design: Full Spectrum Excel Worksheets Only

	WQ	EURV	5-yr	100-yr
Peak Inflow	6.8cfs	18.9cfs	25.1cfs	61.8cfs
Peak Outflow	0.2cfs	1.9cfs	3.1cfs	27.3cfs
Ponding Depth	2.44ft	3.79ft	4.39ft	5.86ft
Stored Volume	0.482ac-ft	1.22ac-ft	1.61ac-ft	2.66ac-ft
Spillway Stage	6.00ft, 21' wide			
Structure Type:	4'x20' outlet structure with 6:1 slopes. Top at stage 5.2ft			

7.0 DRAINAGE AND BRIDGE FEES

Carriage Meadows North Filing No. 1 is located within the Jimmy Camp Creek drainage basin which is currently a fee basin in El Paso County. Current El Paso County regulations require drainage and bridge fees to be paid for platting of land as part of the plat recordation process. Lorson Ranch Metro District has negotiated a development agreement with El Paso County which defines major drainage infrastructure to be constructed as part of the district.

Lorson Ranch Metro District will compile and submit to the county on a yearly basis the Drainage and bridge fees for the approved plats, and shall show all credits they have received for the same yearly time frame.

Carriage Meadows North Filing No. 1 contains 68.67 acres. The 68.67 acres will be assessed Drainage, Bridge and Surety fees. This project is estimated to have impervious percentages as shown in Table 1 for the different land uses.

The 2017 drainage fees are $16,270, bridge fees are $761 and Drainage Surety fees are $7,285 per impervious acre per Resolution 17-71, Reception No. 2017021072. The fees are due at plat recordation and are calculated as follows:

Table 1: Drainage/Bridge Fees

Type of Land Use	Total Area (ac)	Imperviousness	Drainage Fee	Bridge Fee	Surety Fee
Residential Area	34.22	52%	$289,514	$13,541	$129,632
Jimmy Camp Creek	20.5	2%	$6,670	$312	$2,986
Commercial	13.95	77%	$174,764	$8,174	$78,251
		Total	$470,948	$22,027	$210,869

Table 2: Storm Drainage Facility Costs (non-reimbursable)

Item	Quantity	Unit	Unit Cost	Item Total
Rip Rap Overflow	1	EA	$4000/EA	$4,000
Inlets/Manholes	30	EA	$5000/EA	$150,000
18” Storm	880	LF	$35	$30,800
24” Storm	1290	LF	$40	$51,600
30” Storm	413	LF	$45	$18,585
36” Storm	283	LF	$55	$15.656
42” Storm	334	LF	$65	$21,710
48” Storm	440	LF	$85	$37,400
60” Storm	610	LF	$200	$122,000
			Subtotal	$451,660
			Eng/Cont (15%)	$67,749
			Total Est. Cost	$519,409

Table 3: Lorson Ranch Metro District Drainage Facility Costs (non-reimbursable)

Item	Quantity	Unit	Unit Cost	Item Total
Full Spectrum Ponds and Outlet	1	LS	$90,000	$90,000
			Subtotal	$90,000
			Eng/Cont (15%)	$13,500
			Total Est. Cost	$103,500

8.0 WATER QUALITY

Water quality for the majority of the site (29.84ac) is provided by an on-site full spectrum pond (Pond CMN-1) including water quality provisions.

Water quality for the commercial areas in the future development tracts is provided in Carriage Meadows South at Lorson Ranch Filing No. 1 as stated in the FDR for Carriage Meadows South.

There is a small drainage area (adjacent to Jimmy Camp Creek from backyards that flows east to Jimmy Camp Creek. Carriage Meadows North has included a 17' buffer strip behind the backyards to partially treat the runoff for water quality. However, the county does require all areas to be treated so a deviation for the small area will be required. The area comprises of about 2.54acres of backyards which calculates to 5.26% of the total site (48.2ac).

The Lorson Ranch Metropolitan District will own/maintain all ponds including WQ ponds.

9.0 FOUR STEP PROCESS

The site has been developed to minimize wherever possible the rate of developed runoff that will leave the site and to provide water quality management for the runoff produced by the site as proposed on the development plan. The following four step process should be considered and incorporated into the storm water collection system and storage facilities where applicable.

Step 1: Employ Runoff Reduction Practices

Carriage Meadows North Filing No. 1 has employed several methods of reducing runoff.

- The street configuration was laid out to minimize the length of streets.
- Jimmy Camp Creek with a natural sand bottom and vegetated slopes has been preserved through this site
- Lots on the east side of the site discharge runoff eastward over a 20' open space buffer prior to discharge

- Runoff from Marksheffel Road enters a vegetated roadside swale prior to discharge into the storm sewer system
- A buffer tract has been added along Marksheffel Road which reduces impervious areas
- Construct Full Spectrum Detention Pond CMN-1. The full spectrum detention mimics existing storm discharges

Step 2: Implement BMP's that Slowly Release the Water Quality Capture Volume

Treatment and slow release of the water quality capture volume (WQCV) is required. Carriage Meadows North Filing No. 1 will construct a full spectrum stormwater detention pond which includes Water Quality Volume and a WQ outlet structure.

Step 3: Stabilize Drainageways

Jimmy Camp Creek is a major drainageway located within this site. In 2006 JCC was reconstructed and stabilized per county criteria. The design included a natural sand bottom, soil rip rap armored sides, and rip rap drop structures.

Step 4: Implement Site Specific & Source Control BMP's

There are no potential sources of contaminants that could be introduced to the County's MS4. During construction source control will be provided with the proper installation of erosion control BMPs to limit erosion and transport of sediment. Area disturbed by construction will be seeded and mulched. Cut and fill slopes will be reseeded, and the slopes equal to or greater than three-to-one will be protected with erosion control fabric. Silt fences will be placed at the bottom of re-vegetated and rough graded slopes. Inlet protection will be used around proposed inlets. In addition a temporary sediment basin will be constructed so runoff will be treated prior to discharge. Construction BMPs in the form of vehicle tracking control, sediment basins, concrete washout area, rock socks, buffers, and silt fences will be utilized to protect receiving waters.

10.0 CONCLUSIONS

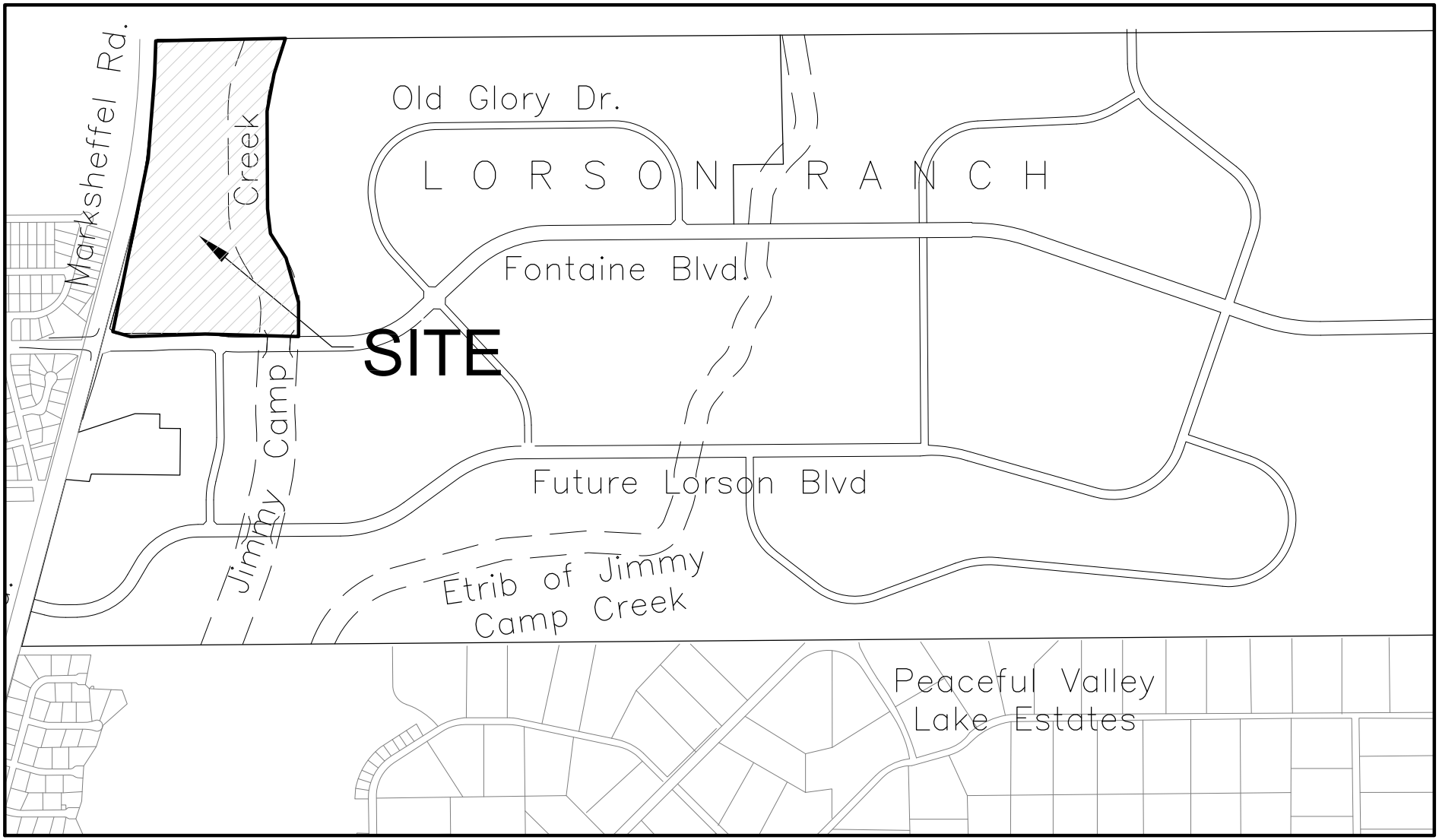
This drainage report has been prepared in accordance with the City of Colorado Springs/El Paso County Drainage Criteria Manual. The proposed development and drainage infrastructure will not cause adverse impacts to adjacent properties or properties located downstream. Several key aspects of the development discussed above are summarized as follows:

- Developed runoff will be conveyed via curb/gutter and storm sewer facilities
- Jimmy Camp Creek is realigned and Marksheffel Road has been reconstructed within this study area
- Detention and water quality for this study area has been provided

11.0 REFERENCES

1. City of Colorado Springs/El Paso County Drainage Criteria Manual DCM, dated November, 1991
2. Chapter 6 and Section 3.2.1 Chapter 13 of the City of Colorado Springs Drainage Criteria Manual dated May 2014
3. Soil Survey of El Paso County Area, Colorado by USDA, SCS
4. Jimmy Camp Creek Drainage Basin Planning Study, 1987, Wilson & Co.
5. City of Colorado Springs "Drainage Criteria Manual, Volume 2
6. El Paso County "Engineering Criteria Manual"
7. Final Drainage Report for Fontaine Boulevard, Old Glory Drive, and Marksheffel Road Phase 1 Improvements, Dated February 6, 2006, Revised September 7, 2006, by Pentacor Engineering.
8. Drainage Basin Planning Study, Dated March 9, 2015, by Kiowa Engineering Corporation
9. Final Drainage Report for Marksheffel Road South by HDR dated August, 2015
10. Jimmy Camp Creek Reconstruction plans by Drexel, Barrell & Co, dated September 6, 2005, county plans #2801.
11. Master Development Drainage Plan and Preliminary Drainage Report for Carriage Meadows South at Lorson Ranch by Core Engineering Group, dated June, 2017 and revised March, 2017.
12. Peaceful Ridge at Fountain Valley Final Drainage Report, Dated December 7, 2005, Revised July 20, 2006, by Kiowa Engineering
13. Cottonwood Meadows Final Drainage Report, Dated October, 1999 by HMS Group

APPENDIX A – VICINITY MAP, SOILS MAP, FEMA MAP



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VICINITY MAP
NO SCALE

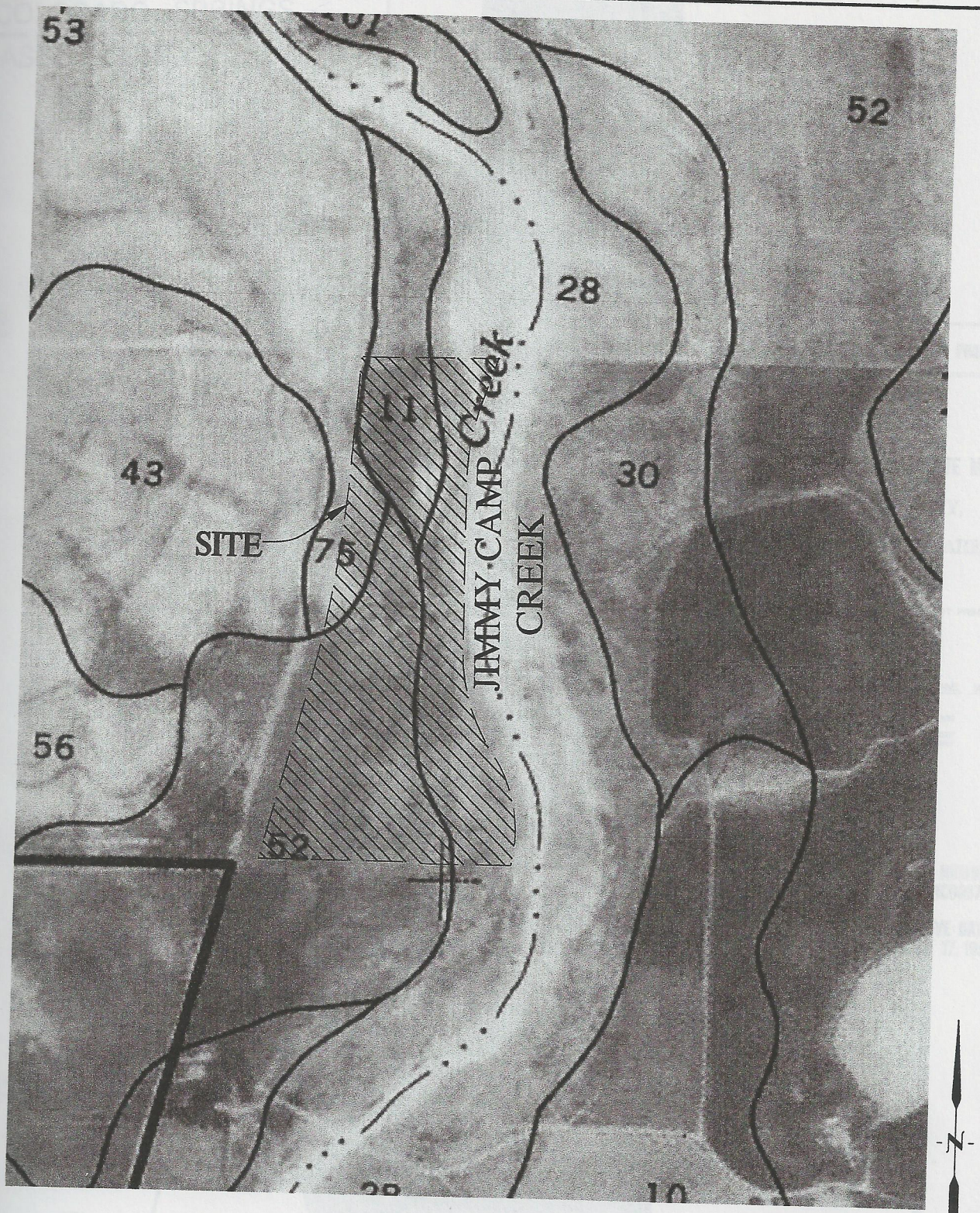
CORE
ENGINEERING GROUP

15004 1ST AVE. S.
BURNSVILLE, MN 55306
PH: 719.570.1100

CONTACT: RICHARD L. SCHINDLER, P.E.
EMAIL: Rich@ceg1.com

CARRIAGE MEADOWS NORTH FILING NO. 1
VICINITY MAP

SCALE:	DATE:	FIGURE NO.
NTS	DECEMBER, 2017	--



CARRIAGE MEADOWS

SCS SOILS MAP

SCALE:
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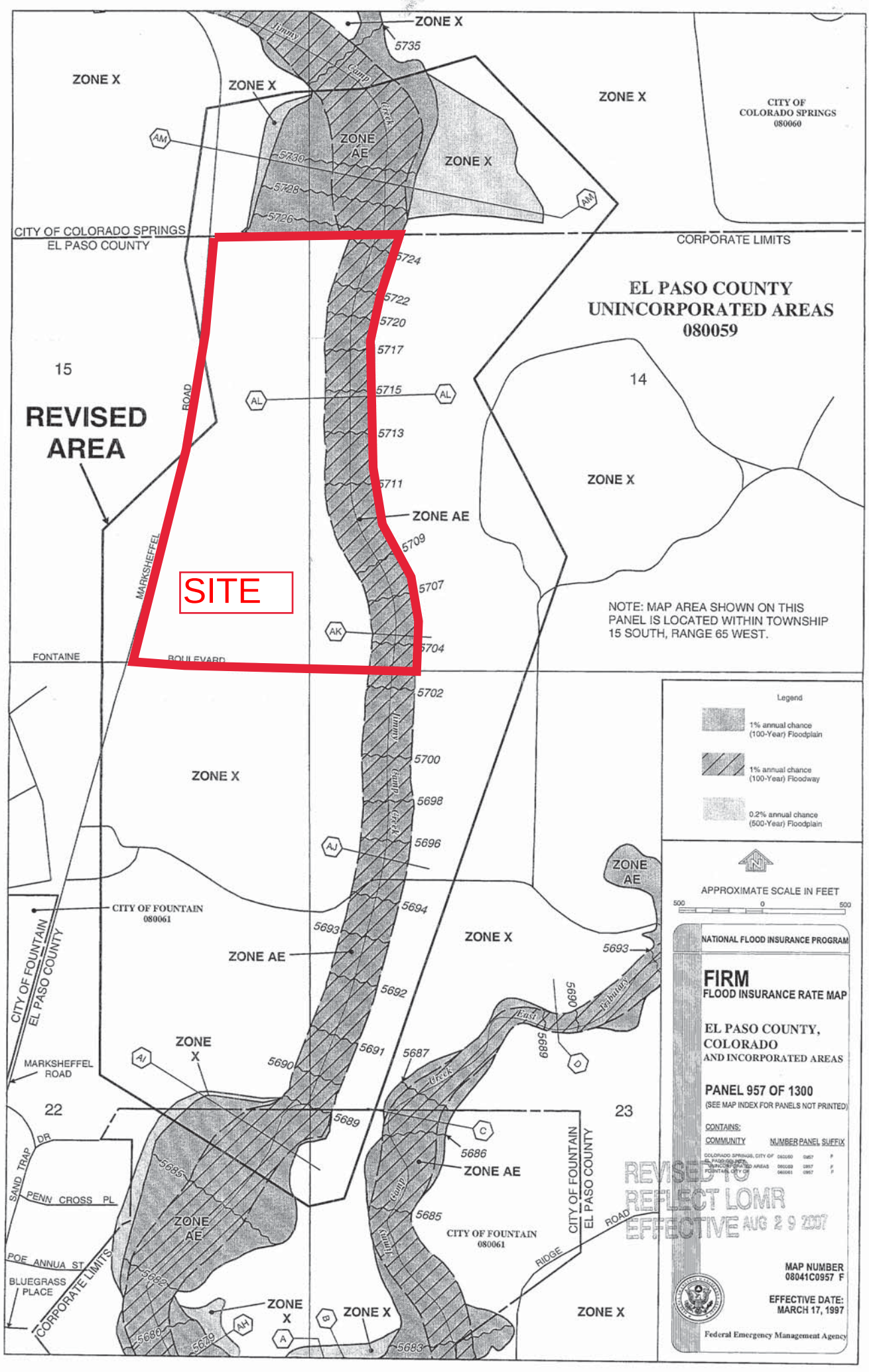
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NOTE: MAP AREA SHOWN ON THIS
PANEL IS LOCATED WITHIN TOWNSHIP
15 SOUTH, RANGE 65 WEST.
FONTAINE
BOULEVARD
ZONE X
ZONE AE
CITY OF FOUNTAIN
080061
CITY OF FOUNTAIN
EL PASO COUNTY
ZONE AE
ZONE X
ZONE X
MARKSHEFFEL
ROAD
22
23
SAND TRAP DR
PENN CROSS PL
POE ANNUA ST
BLUEGRASS
PLACE
CORPORATE LIMITS
ZONE AE
CITY OF FOUNTAIN
080061
CITY OF FOUNTAIN
EL PASO COUNTY
RIDGE
ROAD
ZONE X
ZONE X
ZONE X
Legend
1% annual chance
(100-Year) Floodplain
1% annual chance
(100-Year) Floodway
0.2% annual chance
(500-Year) Floodplain
APPROXIMATE SCALE IN FEET
500 0 500
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY,
COLORADO
AND INCORPORATED AREAS
PANEL 957 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
COLORADO SPRINGS, CITY OF 080060 0957 F
EL PASO COUNTY,
UNINCORPORATED AREAS 080059 0957 F
FOUNTAIN, CITY OF 080061 0957 F
REVISED TO
REFLECT LOMR
EFFECTIVE AUG 2 9 2007
MAP NUMBER
08041C0957 F
EFFECTIVE DATE:
MARCH 17, 1997
Federal Emergency Management Agency

Federal Emergency Management Agency

Washington, D.C. 20472

MAY 07 2007

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Dennis Hisey
Chairman, El Paso County
Board of Commissioners
27 East Vermijo Avenue
Colorado Springs, CO 80903

IN REPLY REFER TO:
Case No.: 06-08-B643P
Follows Conditional
Case No.: 05-08-0286R
Community Name: El Paso County, CO
Community No.: 080059
Effective Date of This Revision: AUG 29 2007

Dear Mr. Hisey:

The Flood Insurance Study report and Flood Insurance Rate Map for your community have been revised by this Letter of Map Revision (LOMR). Please use the enclosed annotated map panel(s) revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals issued in your community.

Additional documents are enclosed which provide information regarding this LOMR. Please see the List of Enclosures below to determine which documents are included. Other attachments specific to this request may be included as referenced in the Determination Document. If you have any questions regarding floodplain management regulations for your community or the National Flood Insurance Program (NFIP) in general, please contact the Consultation Coordination Officer for your community. If you have any technical questions regarding this LOMR, please contact the Director, Federal Insurance and Mitigation Division of the Department of Homeland Security's Federal Emergency Management Agency (FEMA) in Denver, Colorado, at (303) 235-4830, or the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Sincerely,

Patrick F. Sacbibit, P.E., CFM, Project Engineer
Engineering Management Section
Mitigation Division

For: William R. Blanton Jr., CFM, Chief
Engineering Management Section
Mitigation Division

List of Enclosures:

Letter of Map Revision Determination Document
Annotated Flood Insurance Rate Map
Annotated Flood Insurance Study Report

cc: The Honorable Lionel Rivera
Mayor, City of Colorado Springs

The Honorable Jeri Howells
Mayor, City of Fountain

[redacted]
Pentacor Engineering LLC

[redacted]
Landhuis Company

Mr. Phil Wuthier, P.E., CFM
Regional Floodplain Administrator
Pikes Peak Regional Building Department

APPENDIX B – HYDROLOGIC CALCULATIONS

CORE ENGINEERING GROUP
15004 1st Avenue South
Burnsville, MN 55306

PROJECT NAME: *Carriage Meadows North Filing No. 1*
PROJECT NUMBER: *100.002*
ENGINEER: *LAB*
DATE: *January, 2018*

Preliminary Drainage Plan
PRE-DEVELOPED CONDITIONS COEFFICIENT "C" CALCULATIONS

BASIN	Soil No.	Hydro Group	Area	Cover (%)	C5	Wtd. C5	C100	Wtd. C100	Impervious	Type of Cover
Basin EX-1		A/B	0.00	0.00%	0.08	0.00	0.36	0.00		Natural Ground Cover
		C	37.30	100.00%	0.15	0.15	0.50	0.50	7.0%	Natural Ground Cover
			37.30	100.00%		0.15		0.50		
Basin EX-2		A/B	0.00	0.00%	0.08	0.00	0.35	0.00		Natural Ground Cover
		C	12.40	100.00%	0.15	0.15	0.50	0.50	7.0%	Natural Ground Cover
			12.40	100.00%		0.15		0.50		

CORE ENGINEERING GROUP

Standard Form SF-1. Time of Concentration-Pre-Development

Calculated By: Leonard Beasley
Date: January, 2018
Checked By: Richard Schindler

Job No: 100.002
Project: Carriage Meadows North Fil No. 1

Sub-Basin Data				Initial Overland Time (t_i)				Travel Time (t_t)					t_c Check (urbanized Basins)		Final t_c
BASIN or DESIGN	C_5	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_i minutes	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_t minutes	Computed t_c Minutes	TOTAL LENGTH (L) feet	Regional tc tc=(L/180)+10 minutes	USDCM Recommended $t_c=t_i+t_t$ (min)
EX-1	0.15	15.54	7.0	200.00	2.00%	0.17	19.37	800.00	1.00%	0.70	19.05	38.42	800.00	14.44	14.44
EX-2	0.15	4.87	7.0	200.00	2.00%	0.17	19.37	500.00	1.00%	0.70	11.90	31.28	500.00	12.78	12.78

CORE ENGINEERING GROUP

Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)

Calculated By: Leonard Beasley
Date: January, 2018
Checked By: Richard Schindler

Job No: 100.002
Project: Carriage Meadows North Fil. No. 1
Design Storm: **5 & 100 - Year Event, Pre-Dev. Conditions**

Street or Basin	Design Point	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			Remarks
		Area Design	Area (A)	Runoff Coeff. (C)	t_c	CA	i	Q	t_c	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	t_t	
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
5 - Year Event, Pre-Developed Conditions																					
Basin EX-E1			37.30	0.15	14.4	5.60	3.58	20.0													
Basin EX-E2			12.40	0.15	12.8	1.86	3.76	7.0													
100 - Year Event, Pre-Developed Conditions																					
Basin EX-1			37.30	0.50	14.4	18.65	6.01	112.0													
Basin EX-2			12.40	0.50	12.8	6.20	6.31	39.1													

CORE ENGINEERING GROUP

PROJECT NAME: Carriage Meadows Filing No. 1 FDR
PROJECT NUMBER: 100.002
ENGINEER: RLS
DATE: 9/1/2006, Rev. 11/1/2017

DEVELOPED CONDITIONS HYDROLOGY CALCULATIONS

BASIN	CRITERIA REFERENCE[1]	E1.1	E1.2	E1.3	E1.4	E1.4a	E1.4b	E1.5	E1.6
AREA, A [ACRE]	-	3.29	2.56	1.53	3.32	2.19	2.23	0.93	2.43
RUN-OFF COEFFICIENT, C_5	-	0.58	0.59	0.60	0.60	0.60	0.60	0.60	0.60
OVERLAND DROP [FT]	-	3.00	3.40	1.00	2.60	4.10	4.10	3.40	1.40
OVERLAND FLOW LENGTH, L_O [FT]	-	150.00	150.00	50.00	130.00	205.00	205.00	170.00	70.00
OVERLAND SLOPE, S_O [%]	-	2.00%	2.27%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
OVERLAND FLOW TIME, t_i [MIN]	-	9.07	8.59	5.05	8.14	10.23	10.23	9.31	5.98
TRAVEL FLOW DROP [FT]	-	5.92	4.44	7.80	5.20	2.80	3.15	2.50	9.10
TRAVEL FLOW LENGTH, Lt [FT]	-	800.00	600.00	1050.00	650.00	400.00	450.00	220.00	1300.00
TRAVEL SLOPE, S_t [%]	-	0.74%	0.74%	0.74%	0.80%	0.70%	0.70%	1.14%	0.70%
TRAVEL VELOCITY, V_t [FT/SEC][3]	$V=1.486/n * R^{2/3} * S^{1/2}$	2.54	2.54	2.54	2.64	2.47	2.47	3.14	2.47
TRAVEL TIME, t_t [MIN]	-	5.26	3.94	6.88	4.11	2.70	3.04	1.17	8.78
TIME OF CONCENTRATION, t_c	t_i+t_t	14.32	12.53	11.94	12.25	12.93	13.27	10.48	14.76
	-								
5-YR RUN-OFF COEFFICIENT, C_5	-	0.58	0.59	0.60	0.60	0.60	0.60	0.60	0.60
5-YR RAINFALL INTENSITY, I_5 [IN/HR]	-	3.54	3.75	3.82	3.78	3.70	3.66	4.03	3.49
5-YR MAXIMUM RUN-OFF, Q_5 [CFS]	Q=CIA	6.8	5.6	3.5	7.5	4.9	4.9	2.2	5.1
100-YR RUN-OFF COEFFICIENT, C_{100}		0.68	0.69	0.70	0.70	0.70	0.70	0.70	0.70
100-YR RAINFALL INTENSITY, I_{100} [IN/HR]	-	6.28	6.66	6.79	6.72	6.57	6.50	7.16	6.20
100-YR MAXIMUM RUN-OFF, Q_{100} [CFS]	Q=CIA	14.2	11.8	7.3	15.6	10.1	10.1	4.7	10.5

CORE ENGINEERING GROUP

PROJECT NAME: Carriage Meadows Filing No. 1 FDR
PROJECT NUMBER: 100.002
ENGINEER: RLS
DATE: 9/1/2006, Rev. 11/1/2017

DEVELOPED CONDITIONS HYDROLOGY CALC

BASIN	CRITERIA REFERENCE[1]	E1.7	E1.8	E1.9	E1.10	E1.11	E1.12	E1.13	E2.1
AREA, A [ACRE]	-	1.95	3.46	1.96	1.00	0.57	2.42	3.23	7.90
RUN-OFF COEFFICIENT, C_5	-	0.60	0.60	0.60	0.69	0.73	0.40	0.60	0.85
OVERLAND DROP [FT]	-	1.00	3.00	0.80	1.20	0.80	2.00	1.60	2.00
OVERLAND FLOW LENGTH, L_O [FT]	-	50.00	150.00	40.00	60.00	40.00	100.00	80.00	100.00
OVERLAND SLOPE, S_O [%]	-	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
OVERLAND FLOW TIME, t_i [MIN]	-	5.05	8.75	4.52	4.54	3.34	10.01	6.39	3.57
TRAVEL FLOW DROP [FT]	-	5.70	5.80	4.80	5.40	1.83			6.50
TRAVEL FLOW LENGTH, Lt [FT]	-	500.00	760.00	600.00	540.00	260.00			650.00
TRAVEL SLOPE, S_t [%]	-	1.14%	0.76%	0.80%	1.00%	0.70%			1.00%
TRAVEL VELOCITY, V_t [FT/SEC][3]	$V=1.486/n * R^{2/3} * S^{1/2}$	3.15	2.58	2.64	2.95	2.47			2.95
TRAVEL TIME, t_t [MIN]	-	2.65	4.92	3.79	3.05	1.75			3.67
TIME OF CONCENTRATION, t_c	t_i+t_t	7.70	13.67	8.31	7.59	5.09	10.01	6.39	7.24
	-								
5-YR RUN-OFF COEFFICIENT, C_5	-	0.60	0.60	0.60	0.69	0.73	0.40	0.60	0.85
5-YR RAINFALL INTENSITY, I_5 [IN/HR]	-	4.50	3.61	4.39	4.52	5.08	4.10	4.77	4.59
5-YR MAXIMUM RUN-OFF, Q_5 [CFS]	Q=CIA	5.3	7.5	5.2	3.1	2.1	4.0	9.2	30.8
100-YR RUN-OFF COEFFICIENT, C_{100}		0.70	0.70	0.70	0.78	0.81	0.53	0.70	0.90
100-YR RAINFALL INTENSITY, I_{100} [IN/HR]	-	8.00	6.41	7.79	8.04	9.03	7.28	8.48	8.16
100-YR MAXIMUM RUN-OFF, Q_{100} [CFS]	Q=CIA	10.9	15.5	10.7	6.2	4.2	9.4	19.2	58.0

CORE ENGINEERING GROUP

PROJECT NAME: Carriage Meadows Filing No. 1 FDR
PROJECT NUMBER: 100.002
ENGINEER: RLS
DATE: 9/1/2006, Rev. 11/1/2017

DEVELOPED CONDITIONS HYDROLOGY CALC

BASIN	CRITERIA REFERENCE[1]	E2.2	E2.3	E2.4	E2.5	E2.1 to 2.5
AREA, A [ACRE]	-	0.57	2.00	1.14	1.28	12.89
RUN-OFF COEFFICIENT, C_5	-	0.80	0.71	0.87	0.82	0.85
OVERLAND DROP [FT]	-	0.52	1.00	1.22	1.00	1.00
OVERLAND FLOW LENGTH, L_O [FT]	-	26.00	50.00	61.00	50.00	100.00
OVERLAND SLOPE, S_O [%]	-	2.00%	2.00%	2.00%	2.00%	1.00%
OVERLAND FLOW TIME, t_i [MIN]	-	2.19	3.99	2.54	2.87	4.50
TRAVEL FLOW DROP [FT]	-	9.43	3.50	6.01	3.00	6.50
TRAVEL FLOW LENGTH, Lt [FT]	-	519.00	480.00	489.00	300.00	650.00
TRAVEL SLOPE, S_t [%]	-	1.82%	0.73%	1.23%	1.00%	1.00%
TRAVEL VELOCITY, V_t [FT/SEC][3]	$V=1.486/n * R^{2/3} * S^{1/2}$	3.98	2.52	3.27	2.95	2.95
TRAVEL TIME, t_t [MIN]	-	2.18	3.18	2.49	1.70	3.67
TIME OF CONCENTRATION, t_c	t_i+t_t	5.00	7.17	5.00	5.00	8.17
	-					
5-YR RUN-OFF COEFFICIENT, C_5	-	0.80	0.71	0.87	0.82	0.85
5-YR RAINFALL INTENSITY, I_5 [IN/HR]	-	5.10	4.61	5.10	5.10	4.41
5-YR MAXIMUM RUN-OFF, Q_5 [CFS]	Q=CIA	2.3	6.5	5.1	5.3	48.3
100-YR RUN-OFF COEFFICIENT, C_{100}		0.95	0.81	0.93	0.88	0.90
100-YR RAINFALL INTENSITY, I_{100} [IN/HR]	-	9.07	8.19	9.07	9.07	7.84
100-YR MAXIMUM RUN-OFF, Q_{100} [CFS]	Q=CIA	4.9	13.3	9.6	10.2	90.9

CORE ENGINEERING GROUP

PROJECT NAME: Carriage Meadows-FDR
PROJECT NUMBER: 100.002
ENGINEER: RLS
DATE: 9/8/2006

BASIN RUNOFF COEFFICIENTS

Basin	Area (AC.)	Cover (%)	C_5	Wtd. C_5	C_{100}	Wtd. C_{100}	CN	Wtd. CN	Type of Cover
E1.1	0.60	18.24%	0.30	0.05	0.45	0.08			Grass
	2.29	69.60%	0.60	0.42	0.70	0.49			1/8 Ac. Lots
	0.40	12.16%	0.90	0.11	0.95	0.12			Pavement//ROW
	3.29	100.00%		0.58		0.68			
E1.2	0.50	19.53%	0.30	0.06	0.45	0.09			Grass
	1.66	64.84%	0.60	0.39	0.70	0.45			1/8 Ac. Lots
	0.40	15.63%	0.90	0.14	0.95	0.15			Pavement
	2.56	100.00%		0.59		0.69			
E1.3	0.00	0.00%	0.30	0.00	0.45	0.00			Grass
	1.53	100.00%	0.60	0.60	0.70	0.70			1/8 Ac. Lots
	0.00	0.00%	0.90	0.00	0.95	0.00			Pavement
	1.53	100.00%		0.60		0.70			
E1.4	0.00	0.00%	0.30	0.00	0.45	0.00			Grass
	4.13	100.00%	0.60	0.60	0.70	0.70			1/8 Ac. Lots
	0.00	0.00%	0.90	0.00	0.95	0.00			Pavement
	4.13	100.00%		0.60		0.70			
E1.4A & b	0.00	0.00%	0.30	0.00	0.45	0.00			Grass
	0.66	73.33%	0.60	0.44	0.70	0.51			1/8 Ac. Lots
	0.24	26.67%	0.90	0.24	0.95	0.25			Pavement
	0.90	100.00%		0.68		0.77			
E1.5	0.00	0.00%	0.30	0.00	0.45	0.00			Grass
	0.93	100.00%	0.60	0.60	0.70	0.70			1/8 Ac. Lots
	0.00	0.00%	0.90	0.00	0.95	0.00			Pavement
	0.93	100.00%		0.60		0.70			
E1.6	0.00	0.00%	0.30	0.00	0.45	0.00			Grass
	2.43	100.00%	0.60	0.60	0.70	0.70			1/8 Ac. Lots
	0.00	0.00%	0.90	0.00	0.95	0.00			Pavement
	2.43	100.00%		0.60		0.70			

CORE ENGINEERING GROUP

PROJECT NAME: Carriage Meadows-FDR
PROJECT NUMBER: 100.002
ENGINEER: RLS
DATE: 9/8/2006

BASIN RUNOFF COEFFICIENTS

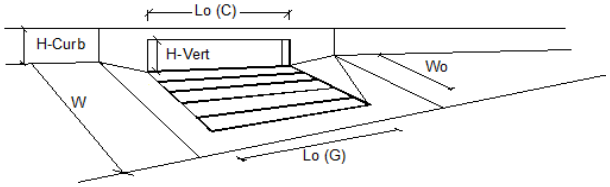
Basin	Area (AC.)	Cover (%)	C_5	Wtd. C_5	C_{100}	Wtd. C_{100}	CN	Wtd. CN	Type of Cover
E1.7	0.00	0.00%	0.30	0.00	0.45	0.00			Grass
	1.95	100.00%	0.60	0.60	0.70	0.70			1/8 Ac. Lots
	0.00	0.00%	0.90	0.00	0.95	0.00			Pavement
	1.95	100.00%		0.60		0.70			
E1.8	0.00	0.00%	0.30	0.00	0.45	0.00			Grass
	3.46	100.00%	0.60	0.60	0.70	0.70			1/8 Ac. Lots
	0.00	0.00%	0.90	0.00	0.95	0.00			Pavement
	3.46	100.00%		0.60		0.70			
E1.9	0.00	0.00%	0.30	0.00	0.45	0.00			Grass
	1.96	100.00%	0.60	0.60	0.70	0.70			1/8 Ac. Lots
	0.00	0.00%	0.90	0.00	0.95	0.00			Pavement
	1.96	100.00%		0.60		0.70			
E1.10	0.00	0.00%	0.30	0.00	0.45	0.00			Grass
	0.70	70.00%	0.60	0.42	0.70	0.49			1/8 Ac. Lots
	0.30	30.00%	0.90	0.27	0.95	0.29			Pavement
	1.00	100.00%		0.69		0.78			
E1.11	0.00	0.00%	0.30	0.00	0.45	0.00			Grass
	0.35	56.45%	0.60	0.34	0.70	0.40			1/8 Ac. Lots
	0.27	43.55%	0.90	0.39	0.95	0.41			Pavement
	0.62	100.00%		0.73		0.81			
E1.12	1.62	66.94%	0.30	0.20	0.45	0.30			Grass
	0.80	33.06%	0.60	0.20	0.70	0.23			1/8 Ac. Lots
	0.00	0.00%	0.90	0.00	0.95	0.00			Pavement
	2.42	100.00%		0.40		0.53			
E1.13	0.00	0.00%	0.30	0.00	0.45	0.00			Grass
	4.23	100.00%	0.60	0.60	0.70	0.70			1/8 Ac. Lots
	0.00	0.00%	0.90	0.00	0.95	0.00			Pavement
	4.23	100.00%		0.60		0.70			
E2.3	0.20	10.00%	0.30	0.03	0.45	0.05			Grass
	0.00	0.00%	0.60	0.00	0.70	0.00			1/8 Ac. Lots
	1.80	90.00%	0.75	0.68	0.85	0.77			commercial
	2.00	100.00%		0.71		0.81			
E2.4	0.05	4.55%	0.30	0.01	0.45	0.02			Grass
	0.00	0.00%	0.60	0.00	0.70	0.00			1/8 Ac. Lots
	1.05	95.45%	0.90	0.86	0.95	0.91			pavement
	1.10	100.00%		0.87		0.93			
E2.5	0.18	14.06%	0.30	0.04	0.45	0.06			Grass
	0.00	0.00%	0.60	0.00	0.70	0.00			1/8 Ac. Lots
	1.10	85.94%	0.90	0.77	0.95	0.82			Pavement
	1.28	100.00%		0.82		0.88			

APPENDIX C – HYDRAULIC CALCULATIONS

INLET ON A CONTINUOUS GRADE

Project: Carriage Meadows North #100.002

Inlet ID: Inlet DP-1 (Basin E1.1)

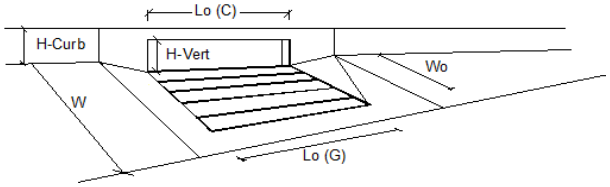


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grade or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grade or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	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 < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Design Discharge for Half of Street (from Sheet *Q-Peak*)	**Q_o =**	5.9	12.4	cfs
Water Spread Width	T =	14.8	17.0	ft
Water Depth at Flowline (outside of local depression)	d =	5.1	6.3	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.7	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.403	0.298	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	3.5	8.7	cfs
Discharge within the Gutter Section W	Q_w =	2.4	3.7	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	2.31	4.03	sq ft
Velocity within the Gutter Section W	V_W =	2.6	3.1	fps
Water Depth for Design Condition	d_{LOCAL} =	8.1	9.3	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	GrateCoef =	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 or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.096	0.076	ft/ft
Required Length L_T to Have 100% Interception	L_T =	13.21	21.42	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 =	5.4	8.4	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	8.75	8.75	ft
Actual Interception Capacity	**Q_a =**	5.3	8.1	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	0.6	4.3	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**5.30**	**8.08**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.6**	**4.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**90**	**65**	**%**

INLET ON A CONTINUOUS GRADE

Project: Carriage Meadows North #100.002

Inlet ID: Inlet DP-2 (Basin E1.2)

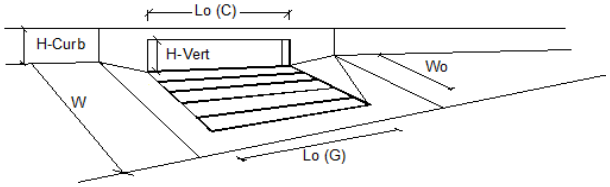


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grade or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grade or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	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 < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Design Discharge for Half of Street (from Sheet *Q-Peak*)	**Q_o =**	6.6	17.4	cfs
Water Spread Width	T =	15.5	17.0	ft
Water Depth at Flowline (outside of local depression)	d =	5.2	7.0	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	1.4	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.385	0.264	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	4.1	12.7	cfs
Discharge within the Gutter Section W	Q_w =	2.5	4.5	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.2	cfs
Flow Area within the Gutter Section W	A_W =	2.53	5.04	sq ft
Velocity within the Gutter Section W	V_W =	2.6	3.4	fps
Water Depth for Design Condition	d_{LOCAL} =	8.2	10.0	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	GrateCoef =	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 or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.092	0.070	ft/ft
Required Length L_T to Have 100% Interception	L_T =	14.22	26.36	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 =	5.9	9.9	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	8.75	8.75	ft
Actual Interception Capacity	**Q_a =**	5.7	9.5	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	0.9	7.9	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**5.69**	**9.49**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.9**	**7.9**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**86**	**55**	**%**

INLET ON A CONTINUOUS GRADE

Project: Carriage Meadows North #100.002

Inlet ID: Inlet DP-3 (Basin E1.3)

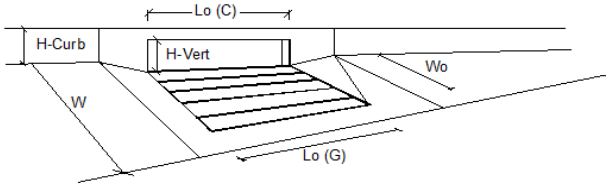


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	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 < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Design Discharge for Half of Street (from Sheet *Q-Peak*)	**Q_o =**	3.5	7.3	cfs
Water Spread Width	T =	11.9	16.2	ft
Water Depth at Flowline (outside of local depression)	d =	4.4	5.4	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 =	0.497	0.369	
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 =	1.7	2.7	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	1.53	2.74	sq ft
Velocity within the Gutter Section W	V_W =	2.3	2.7	fps
Water Depth for Design Condition	d_{LOCAL} =	7.4	8.4	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	GrateCoef =	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 or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.113	0.089	ft/ft
Required Length L_T to Have 100% Interception	L_T =	9.36	15.19	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	9.36	10.00	ft
Interception Capacity	Q_i =	3.5	6.2	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	8.75	8.75	ft
Actual Interception Capacity	**Q_a =**	3.5	6.1	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	0.0	1.2	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.50**	**6.05**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.2**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**83**	**%**

INLET ON A CONTINUOUS GRADE

Project: Carriage Meadows North #100.002

Inlet ID: Inlet DP-4 (Basin E1.4)

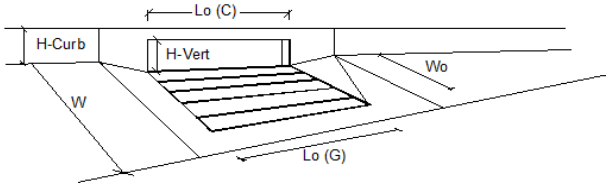


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	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 < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Design Discharge for Half of Street (from Sheet *Q-Peak*)	**Q_o =**	7.5	15.6	cfs
Water Spread Width	T =	16.5	17.0	ft
Water Depth at Flowline (outside of local depression)	d =	5.5	6.8	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	1.2	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.361	0.272	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	4.8	11.3	cfs
Discharge within the Gutter Section W	Q_w =	2.7	4.2	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.1	cfs
Flow Area within the Gutter Section W	A_W =	2.85	4.78	sq ft
Velocity within the Gutter Section W	V_W =	2.6	3.2	fps
Water Depth for Design Condition	d_{LOCAL} =	8.5	9.8	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	GrateCoef =	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 or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.088	0.071	ft/ft
Required Length L_T to Have 100% Interception	L_T =	15.47	24.68	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 =	6.3	9.4	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	8.75	8.75	ft
Actual Interception Capacity	**Q_a =**	6.1	9.0	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	1.4	6.6	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**6.15**	**9.02**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**1.4**	**6.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**82**	**58**	**%**

INLET ON A CONTINUOUS GRADE

Project: Carriage Meadows North #100.002

Inlet ID: Inlet DP-4a (Basin E1.4a)

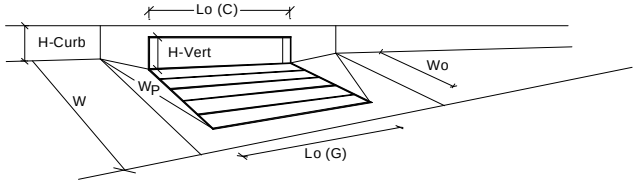


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	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 < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Design Discharge for Half of Street (from Sheet *Q-Peak*)	**Q_o =**	6.3	16.7	cfs
Water Spread Width	T =	15.4	17.0	ft
Water Depth at Flowline (outside of local depression)	d =	5.2	7.0	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	1.4	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.388	0.265	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	3.9	12.1	cfs
Discharge within the Gutter Section W	Q_w =	2.4	4.4	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.2	cfs
Flow Area within the Gutter Section W	A_W =	2.49	5.00	sq ft
Velocity within the Gutter Section W	V_W =	2.5	3.3	fps
Water Depth for Design Condition	d_{LOCAL} =	8.2	10.0	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	GrateCoef =	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 or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.093	0.070	ft/ft
Required Length L_T to Have 100% Interception	L_T =	13.80	25.70	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 =	5.7	9.7	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	8.75	8.75	ft
Actual Interception Capacity	**Q_a =**	5.5	9.3	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	0.8	7.4	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**5.53**	**9.31**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.8**	**7.4**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**88**	**56**	**%**

INLET IN A SUMP OR SAG LOCATION

Project = Carriage Meadows North #100.002

Inlet ID = Inlet DP-4b-Sump

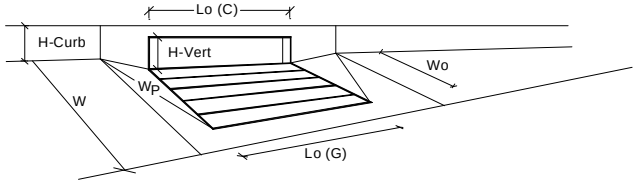


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.1	8.0	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
Area Opening 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) =	15.00	15.00	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 (see USDCM Figure ST-5)	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 UDFCD - 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 a Orifice (based on UDFCD - 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 Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	10.83	21.18	cfs
Interception with Clogging	Q_{wa} =	10.36	20.25	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	29.58	33.57	cfs
Interception with Clogging	Q_{oa} =	28.29	32.11	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	16.65	24.80	cfs
Interception with Clogging	Q_{ma} =	15.92	23.72	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**10.36**	**20.25**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	15.00	15.00	feet
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	19.3	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.5	2.4	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**10.4**	**20.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.7	17.5	cfs

INLET IN A SUMP OR SAG LOCATION

Project = Carriage Meadows North #100.002

Inlet ID = Inlet DP-5-Sump

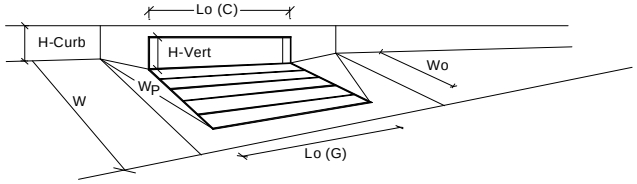


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.1	8.0	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
Area Opening 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 (see USDCM Figure ST-5)	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 UDFCD - 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 a Orifice (based on UDFCD - 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 Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	6.29	10.97	cfs
Interception with Clogging	Q_{wa} =	5.66	9.87	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	9.86	11.19	cfs
Interception with Clogging	Q_{oa} =	8.87	10.07	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	7.33	10.30	cfs
Interception with Clogging	Q_{ma} =	6.59	9.27	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**5.66**	**9.27**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	5.00	5.00	feet
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	19.3	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.5	2.4	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.7**	**9.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.2	5.9	cfs

INLET IN A SUMP OR SAG LOCATION

Project = Carriage Meadows North #100.002

Inlet ID = Inlet DP-6-Sump

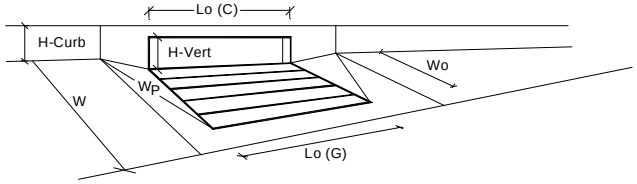


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.1	8.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
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
Area Opening 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) =	10.00	10.00	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 (see USDCM Figure ST-5)	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 UDFCD - 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 a Orifice (based on UDFCD - 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 =	1.25	1.25	
Clogging Factor for Multiple Units	Clog =	0.06	0.06	
Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	9.38	17.34	cfs
Interception with Clogging	Q_{wa} =	8.79	16.26	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	19.72	22.38	cfs
Interception with Clogging	Q_{oa} =	18.49	20.98	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	12.65	18.32	cfs
Interception with Clogging	Q_{ma} =	11.86	17.18	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**8.79**	**16.26**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.00	10.00	feet
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	19.3	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.5	2.4	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.8**	**16.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.1	10.5	cfs

INLET IN A SUMP OR SAG LOCATION

Project = Carriage Meadows North #100.002

Inlet ID = Inlet DP-7-Sump

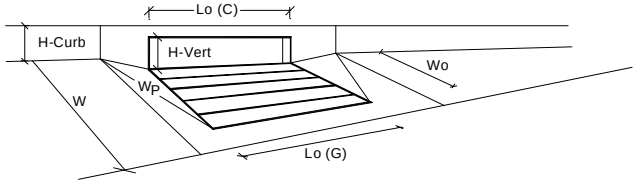


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.1	8.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
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
Area Opening 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) =	10.00	10.00	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 (see USDCM Figure ST-5)	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 UDFCD - 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 a Orifice (based on UDFCD - 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 =	1.25	1.25	
Clogging Factor for Multiple Units	Clog =	0.06	0.06	
Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	9.38	17.34	cfs
Interception with Clogging	Q_{wa} =	8.79	16.26	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	19.72	22.38	cfs
Interception with Clogging	Q_{oa} =	18.49	20.98	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	12.65	18.32	cfs
Interception with Clogging	Q_{ma} =	11.86	17.18	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**8.79**	**16.26**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.00	10.00	feet
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	19.3	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.5	2.4	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.8**	**16.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.3	10.9	cfs

INLET IN A SUMP OR SAG LOCATION

Project = Carriage Meadows North #100.002

Inlet ID = Inlet DP-8-Sump

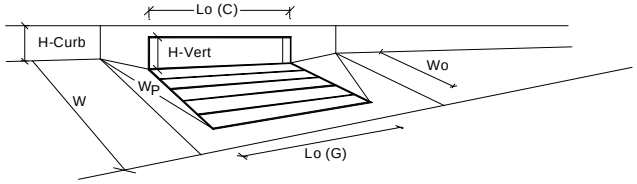


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.1	8.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
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
Area Opening 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) =	10.00	10.00	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 (see USDCM Figure ST-5)	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 UDFCD - 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 a Orifice (based on UDFCD - 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 =	1.25	1.25	
Clogging Factor for Multiple Units	Clog =	0.06	0.06	
Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	9.38	17.34	cfs
Interception with Clogging	Q_{wa} =	8.79	16.26	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	19.72	22.38	cfs
Interception with Clogging	Q_{oa} =	18.49	20.98	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	12.65	18.32	cfs
Interception with Clogging	Q_{ma} =	11.86	17.18	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**8.79**	**16.26**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.00	10.00	feet
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	19.3	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.5	2.4	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.8**	**16.3**	**cfs**
WARNING: Inlet Capacity less than Q Peak for MAJOR Storm	$Q_{PEAK\ REQUIRED}$ =	8.4	23.4	cfs

INLET IN A SUMP OR SAG LOCATION

Project = Carriage Meadows North #100.002

Inlet ID = Inlet DP-9-Sump

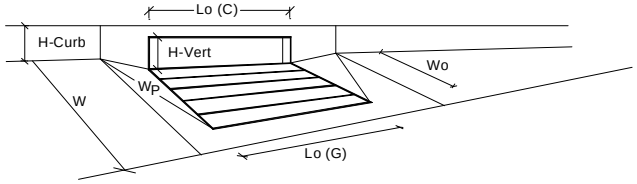


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.1	8.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
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
Area Opening 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 (see USDCM Figure ST-5)	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 UDFCD - 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 a Orifice (based on UDFCD - 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 Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	6.29	10.97	cfs
Interception with Clogging	Q_{wa} =	5.66	9.87	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	9.86	11.19	cfs
Interception with Clogging	Q_{oa} =	8.87	10.07	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	7.33	10.30	cfs
Interception with Clogging	Q_{ma} =	6.59	9.27	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**5.66**	**9.27**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	5.00	5.00	feet
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	19.3	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.5	2.4	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.7**	**9.3**	**cfs**
WARNING: Inlet Capacity less than Q Peak for MAJOR Storm	$Q_{PEAK\ REQUIRED}$ =	5.2	10.7	cfs

INLET IN A SUMP OR SAG LOCATION

Project = Carriage Meadows North #100.002

Inlet ID = Inlet DP-10-Sump



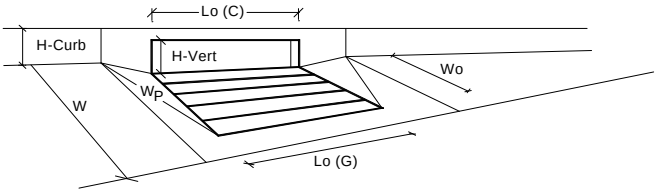
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.1	8.0	inches
Grate Information		MINOR	MAJOR	
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
Area Opening 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) =	10.00	10.00	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 (see USDCM Figure ST-5)	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 UDFCD - 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 a Orifice (based on UDFCD - 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 =	1.25	1.25	
Clogging Factor for Multiple Units	Clog =	0.06	0.06	
Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	9.38	17.34	cfs
Interception with Clogging	Q_{wa} =	8.79	16.26	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	19.72	22.38	cfs
Interception with Clogging	Q_{oa} =	18.49	20.98	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	12.65	18.32	cfs
Interception with Clogging	Q_{ma} =	11.86	17.18	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**8.79**	**16.26**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.00	10.00	feet
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	19.3	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.5	2.4	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.8**	**16.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	3.1	14.7	cfs

Override Depths

INLET IN A SUMP OR SAG LOCATION

Project = Carriage Meadows North #100.002

Inlet ID = Inlet DP-11-Sump

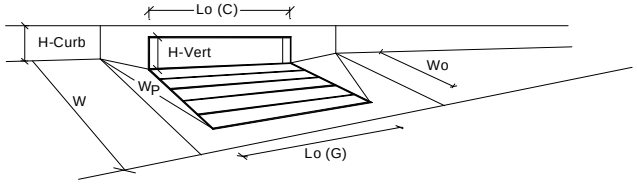


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.1	8.0	inches ☑ Override Depths
Grate Information		MINOR	MAJOR	
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
Area Opening 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 (see USDCM Figure ST-5)	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 UDFCD - 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 a Orifice (based on UDFCD - 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 Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	6.29	10.97	cfs
Interception with Clogging	Q_{wa} =	5.66	9.87	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	9.86	11.19	cfs
Interception with Clogging	Q_{oa} =	8.87	10.07	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	7.33	10.30	cfs
Interception with Clogging	Q_{ma} =	6.59	9.27	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**5.66**	**9.27**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	5.00	5.00	feet
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	19.3	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.5	2.4	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.7**	**9.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.1	4.2	cfs

INLET IN A SUMP OR SAG LOCATION

Project = Carriage Meadows North #100.002

Inlet ID = Inlet DP-17-Sump

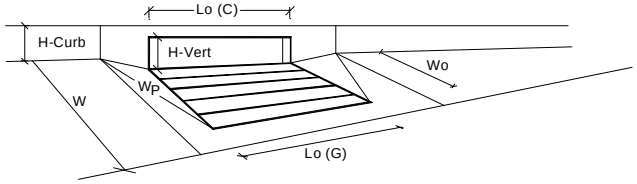


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.1	8.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
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
Area Opening 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) =	20.00	20.00	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 (see USDCM Figure ST-5)	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 UDFCD - 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 a Orifice (based on UDFCD - 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 =	1.33	1.33	
Clogging Factor for Multiple Units	Clog =	0.03	0.03	
Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	13.74	26.87	cfs
Interception with Clogging	Q_{wa} =	13.29	25.98	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	39.44	44.76	cfs
Interception with Clogging	Q_{oa} =	38.13	43.28	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	21.65	32.26	cfs
Interception with Clogging	Q_{ma} =	20.93	31.18	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**13.29**	**25.98**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	20.00	20.00	feet
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	19.3	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.5	2.4	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**13.3**	**26.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	11.6	22.2	cfs

INLET IN A SUMP OR SAG LOCATION

Project = Carriage Meadows North #100.002

Inlet ID = Inlet DP-18-Sump



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	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 =	6.1	8.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
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
Area Opening 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 (see USDCM Figure ST-5)	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 UDFCD - 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 a Orifice (based on UDFCD - 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 Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	6.29	10.97	cfs
Interception with Clogging	Q_{wa} =	5.66	9.87	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	9.86	11.19	cfs
Interception with Clogging	Q_{oa} =	8.87	10.07	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	7.33	10.30	cfs
Interception with Clogging	Q_{ma} =	6.59	9.27	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**5.66**	**9.27**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	5.00	5.00	feet
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	19.3	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.5	2.4	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.7**	**9.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.6	4.9	cfs

Channel Report

Hydraflow Express by Intelisolve | Wednesday, Nov 1 2017, 6:11 AM

Existing 60-inch RCP at JCC

Circular

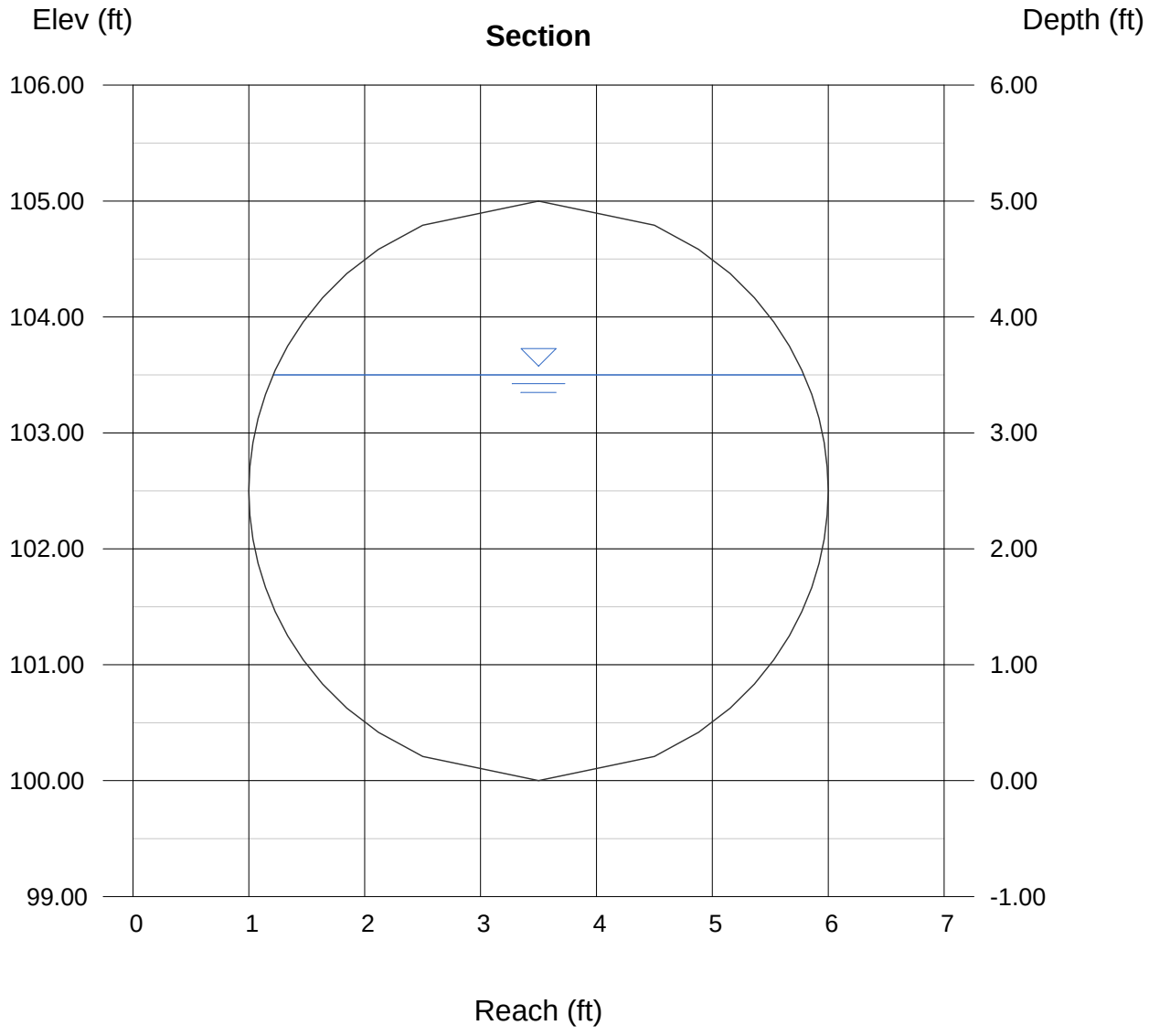
Diameter (ft)	= 5.00
Invert Elev (ft)	= 100.00
Slope (%)	= 0.95
N-Value	= 0.013

Calculations

Compute by:	Q vs Depth
No. Increments	= 10

Highlighted

Depth (ft)	= 3.50
Q (cfs)	= 213.05
Area (sqft)	= 14.71
Velocity (ft/s)	= 14.48
Wetted Perim (ft)	= 9.92
Crit Depth, Yc (ft)	= 3.75
Top Width (ft)	= 4.58
EGL (ft)	= 6.76



Channel Report

Hydraflow Express by Intelisolve — Sunday, Oct 8 2017, 6:52 AM

Overflow from Coyote to Carriage Meadows Drive

Trapezoidal

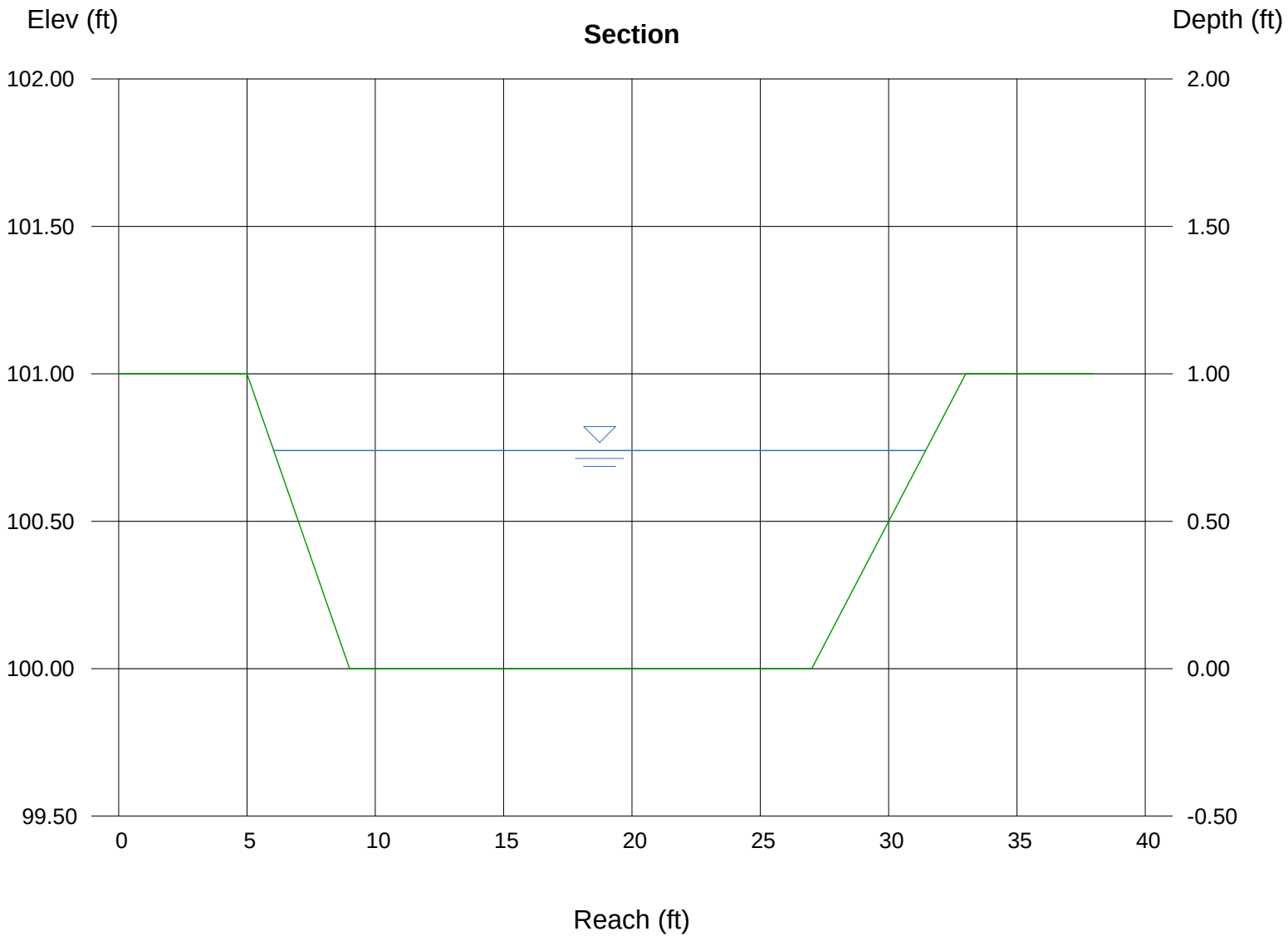
Botom Width (ft)	= 18.00
Side Slope (z:1)	= 4.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 100.00
Slope (%)	= 0.90
N-Value	= 0.025

Calculations

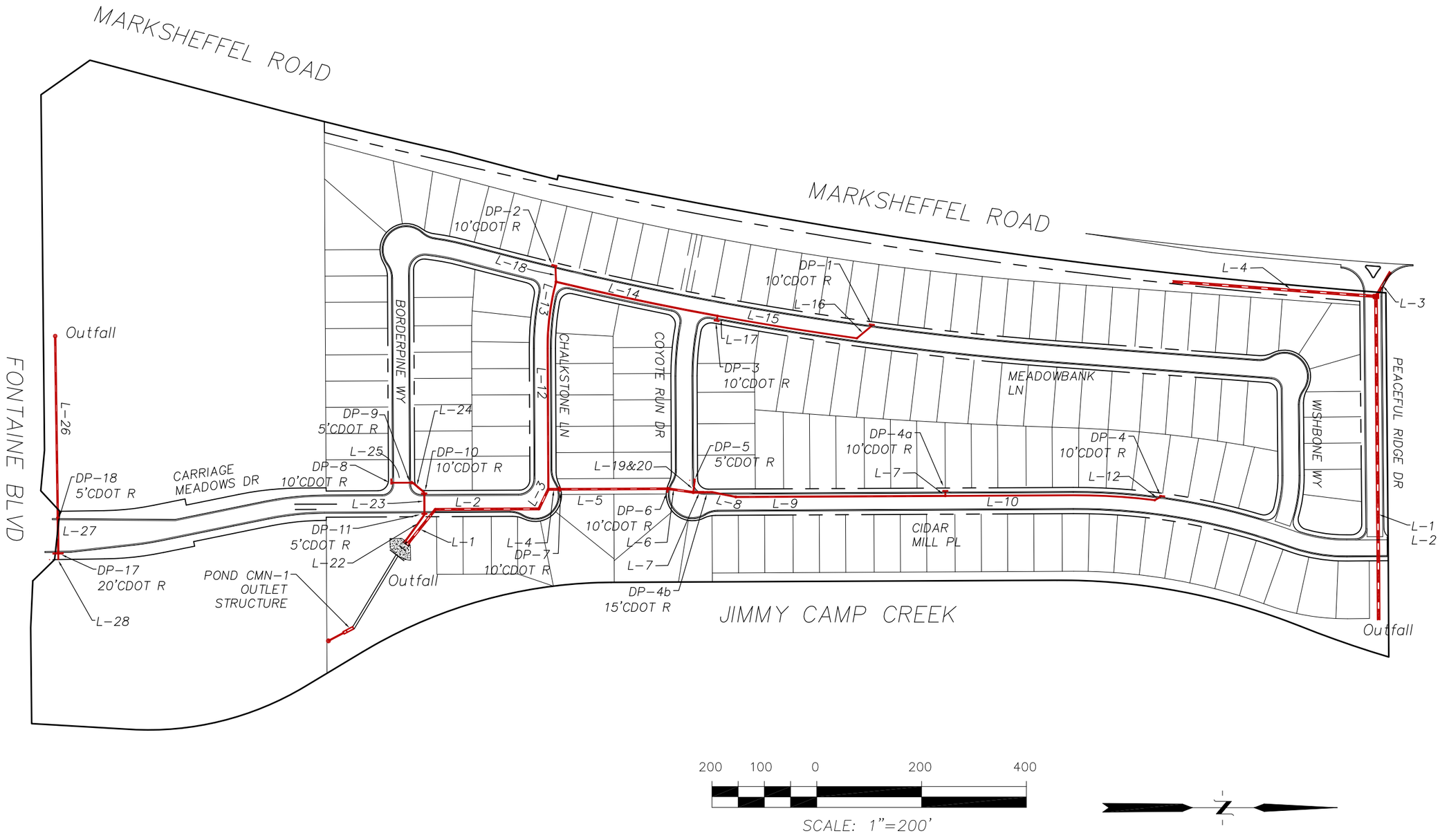
Compute by:	Known Q
Known Q (cfs)	= 65.00

Highlighted

Depth (ft)	= 0.74
Q (cfs)	= 65.00
Area (sqft)	= 16.06
Velocity (ft/s)	= 4.05
Wetted Perim (ft)	= 25.55
Crit Depth, Yc (ft)	= 0.70
Top Width (ft)	= 25.40
EGL (ft)	= 0.99



APPENDIX D – STORM SEWER SCHEMATIC & HDR FDR excerpts



P:\100\100.002\Drainage\100.002-StmSchematic.dwg Nov 02, 2017 - 6:20pm

CORE ENGINEERING GROUP

15004 1ST AVENUE S.
BURNSVILLE, MN 55306
PH: 719.570.1100
CONTACT: RICHARD L. SCHINDLER, P.E.
EMAIL: Rich@ceg1.com

CARRIAGE MEADOWS NORTH
FILING NO. 1
STORM DRAIN SCHEMATIC PLAN

DATE:	JOB NO:
DEC, 2017	100.002
SCALE: H: 1"=200' V:	FIGURE NO: 1

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	1	47.87	42 c	71.9	5706.00	5706.37	0.514	5708.55	5708.56	0.18	5708.73	End
2	2	47.53	42 c	202.2	5706.47	5708.27	0.890	5709.25	5710.38	n/a	5710.38 j	1
3	3	43.68	42 c	39.2	5708.40	5708.70	0.765	5711.02	5710.90	0.37	5711.27	2
4	4	25.18	42 c	22.0	5709.30	5709.50	0.913	5711.77	5711.75	0.23	5711.98	3
5	5	22.19	36 c	213.6	5710.00	5711.50	0.702	5712.06	5713.00	n/a	5713.00 j	4
6	6	17.47	36 c	36.0	5711.60	5711.90	0.830	5713.52	5713.44	0.35	5713.79	5
7	7	15.72	36 c	34.2	5712.20	5712.44	0.701	5714.07	5714.04	0.26	5714.30	6
8	8	11.28	24 c	54.3	5713.94	5714.32	0.699	5715.05	5715.52	0.52	5716.03	7
9	9	11.96	24 c	402.1	5714.32	5717.14	0.701	5716.32	5718.37	n/a	5718.37 j	8
10	10	7.59	18 c	399.8	5717.64	5720.42	0.695	5718.72	5721.50	0.48	5721.98	9
11	11	7.60	18 c	13.8	5720.52	5720.62	0.724	5722.18*	5722.25*	0.29	5722.54	10
12	12	14.10	24 c	271.8	5710.80	5713.62	1.038	5711.93	5714.95	n/a	5714.95	3
13	13	14.29	24 c	123.5	5713.72	5715.01	1.044	5715.26	5716.35	n/a	5716.35 j	12
14	14	9.69	24 c	312.2	5715.01	5717.33	0.743	5716.73	5718.47	n/a	5718.47 j	13
15	15	6.78	18 c	271.5	5717.93	5719.95	0.744	5718.90	5720.94	0.00	5720.94	14
16	16	6.81	18 c	35.4	5720.05	5720.31	0.735	5721.18	5721.31	n/a	5721.31 j	15
17	17	3.50	18 c	9.9	5718.03	5718.14	1.111	5718.94	5718.86	0.00	5718.86	14
18	18	5.57	18 c	31.7	5715.51	5715.77	0.822	5716.83	5716.85	0.00	5716.85	13
19	19	2.28	18 c	14.9	5713.40	5713.55	1.006	5714.12	5714.13	n/a	5714.13 j	6
20	20	2.29	18 c	7.6	5713.65	5713.73	1.060	5714.31	5714.31	0.00	5714.31	19
21	21	4.85	18 c	9.7	5717.74	5717.84	1.027	5718.79	5718.74	0.00	5718.74	9
22	22	15.36	24 c	62.0	5706.00	5707.40	2.261	5708.00	5708.79	n/a	5708.79 j	End
23	23	13.95	24 c	32.6	5707.50	5707.80	0.931	5709.16	5709.13	n/a	5709.13 j	22
24	24	11.56	24 c	29.9	5708.29	5708.47	0.603	5709.53	5709.68	0.00	5709.68	23
25	25	8.41	18 c	37.9	5708.97	5709.20	0.606	5710.09	5710.32	0.00	5710.32	24
26	26	19.20	30 c	348.0	5702.00	5703.74	0.500	5706.38*	5707.14*	0.12	5707.26	End
27	27	16.90	30 c	65.0	5703.74	5704.07	0.507	5707.32*	5707.43*	0.09	5707.52	26
28	28	5.30	18 c	50.0	5705.07	5705.34	0.540	5707.56*	5707.69*	0.14	5707.83	27

5-yr storm sewer-Carriage | Number of lines: 28 | Run Date: 11-02-2017

NOTES: c = cir; e = ellip; b = box; Return period = 5 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	1	87.35	42 c	71.9	5706.00	5706.37	0.515	5709.12	5709.72	0.26	5709.99	End
2	2	87.35	42 c	202.2	5706.47	5708.27	0.890	5710.02	5711.20	0.32	5711.52	1
3	3	87.35	42 c	39.2	5708.40	5708.70	0.765	5711.84	5712.09	0.52	5712.61	2
4	4	63.12	42 c	22.0	5709.30	5709.50	0.909	5713.25*	5713.34*	0.67	5714.01	3
5	5	52.22	36 c	213.6	5710.00	5711.50	0.702	5714.01*	5715.32*	0.25	5715.57	4
6	6	41.72	36 c	36.0	5711.60	5711.90	0.833	5715.88*	5716.02*	0.16	5716.18	5
7	7	35.82	36 c	34.2	5712.20	5712.44	0.701	5716.32*	5716.42*	0.16	5716.58	6
8	8	18.32	24 c	54.3	5713.94	5714.32	0.699	5716.58*	5716.94*	0.11	5717.04	7
9	9	18.32	24 c	402.1	5714.32	5717.14	0.701	5717.04*	5719.68*	0.16	5719.84	8
10	10	9.02	18 c	399.8	5717.64	5720.42	0.695	5719.96*	5722.91*	0.08	5723.00	9
11	11	9.02	18 c	13.8	5720.52	5720.62	0.724	5723.00*	5723.10*	0.41	5723.50	10
12	12	24.23	24 c	271.8	5710.80	5713.62	1.038	5712.99*	5716.11*	0.09	5716.21	3
13	13	24.23	24 c	123.5	5713.72	5715.01	1.044	5716.21*	5717.62*	0.37	5717.99	12
14	14	14.73	24 c	312.2	5715.01	5717.33	0.743	5718.58*	5719.90*	0.10	5720.00	13
15	15	8.63	18 c	271.5	5717.93	5719.95	0.744	5720.00*	5721.84*	0.11	5721.95	14
16	16	8.63	18 c	35.4	5720.05	5720.31	0.735	5721.95*	5722.19*	0.07	5722.26	15
17	17	6.10	18 c	9.9	5718.03	5718.14	1.111	5720.16*	5720.19*	0.04	5720.23	14
18	18	9.50	18 c	31.7	5715.51	5715.77	0.822	5718.47*	5718.73*	0.09	5718.82	13
19	19	5.90	18 c	14.9	5713.40	5713.55	1.006	5716.55*	5716.60*	0.05	5716.65	6
20	20	5.90	18 c	7.6	5713.65	5713.73	1.060	5716.65*	5716.67*	0.03	5716.71	19
21	21	9.30	18 c	9.7	5717.74	5717.84	1.027	5719.94*	5720.02*	0.09	5720.10	9
22	22	42.42	24 c	62.0	5706.00	5707.40	2.258	5708.00*	5710.18*	0.85	5711.03	End
23	23	40.30	24 c	32.6	5707.50	5707.80	0.919	5711.31*	5712.35*	0.77	5713.11	22
24	24	25.60	24 c	29.9	5708.29	5708.47	0.603	5714.64*	5715.02*	0.21	5715.23	23
25	25	16.30	18 c	37.9	5708.97	5709.20	0.606	5715.23*	5716.14*	0.00	5716.14	24
26	26	37.10	30 c	348.0	5702.00	5703.74	0.500	5704.04*	5707.18*	0.44	5707.62	End
27	27	32.20	30 c	65.0	5703.74	5704.07	0.507	5707.84*	5708.24*	0.33	5708.57	26
28	28	10.00	18 c	50.0	5705.07	5705.34	0.540	5708.74*	5709.20*	0.50	5709.70	27

100-yr storm sewer-Carriage | Number of lines: 28 | Run Date: 11-02-2017

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; *Surcharged (HGL above crown).

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp line No
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1		2.12	0.00	0.00	2.12	MH	0.0	0.00	0.00	0.00	0.00	Sag	2.00	0.080	0.050	0.013	0.00	0.00	0.00	0.00	0.00	Off
2		5.97	0.00	0.00	5.97	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
3		6.41	0.00	0.00	6.41	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
4	DP-7	5.20	0.00	5.20	0.00	Genr	0.0	0.00	0.00	0.00	0.00	Sag	2.00	0.080	0.050	0.013	0.50	8.80	0.50	8.80	0.00	Off
5	DP-6	5.05	0.00	5.05	0.00	Genr	0.0	0.00	0.00	0.00	0.00	Sag	2.00	0.080	0.050	0.013	0.50	8.80	0.50	8.80	0.00	Off
6		0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.00	Off
7	DP-4b	4.94	0.80	5.73	0.00	Genr	6.0	6.00	0.00	0.00	0.00	Sag	2.00	0.050	0.050	0.013	0.50	10.00	0.50	10.00	0.00	Off
8		0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.00	Off
9		0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.00	Off
10		0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.00	Off
11	DP-4	7.60	0.00	6.15	1.45	Genr	0.0	0.00	0.00	0.00	0.00	0.007	2.00	0.050	0.050	0.013	0.43	8.62	0.43	8.62	0.00	21
12		0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.00	Off
13		0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.00	Off
14		0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.00	Off
15		0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.00	Off
16	DP-1	6.81	0.00	6.81	0.00	Curb	6.0	6.00	0.00	0.00	0.00	Sag	2.00	0.080	0.050	0.013	0.51	9.10	0.62	9.10	2.00	Off
17	DP-3	3.50	0.00	3.50	0.00	Curb	6.0	6.00	0.00	0.00	0.00	Sag	2.00	0.080	0.050	0.013	0.35	5.82	0.46	5.82	2.00	Off
18	DP-2	5.57	0.00	5.57	0.00	Curb	6.0	6.00	0.00	0.00	0.00	Sag	2.00	0.080	0.050	0.013	0.46	7.95	0.56	7.95	2.00	Off
19		0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.00	Off
20	DP-5	2.29	0.00	2.29	0.00	Genr	6.0	6.00	0.00	0.00	0.00	Sag	2.00	0.080	0.050	0.013	0.50	8.80	0.50	8.80	0.00	Off
21	DP-4a	4.85	1.45	5.50	0.80	Genr	6.0	6.00	0.00	0.00	0.00	0.007	2.00	0.080	0.050	0.013	0.45	7.80	0.45	7.80	0.00	7
22	DP-11	2.12	0.00	2.12	0.00	Genr	6.0	6.00	0.00	0.00	0.00	Sag	2.00	0.080	0.050	0.013	0.50	8.80	0.50	8.80	0.00	Off

5-yr storm sewer-Carriage | Number of lines: 28 | Run Date: 11-02-2017

NOTES: Inlet N-Values = 0.016 ; Intensity = 39.98 / (Inlet time + 10.00) ^ 0.76; Return period = 5 Yrs. ; * Indicates Known Q added

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp line No
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
23	DP-10	3.07	0.00	3.07	0.00	Curb	6.0	6.00	0.00	0.00	0.00	Sag	2.00	0.080	0.050	0.013	0.33	5.33	0.43	5.33	2.00	22
24	DP-9	5.23	0.00	5.23	0.00	Curb	6.0	6.00	0.00	0.00	0.00	Sag	2.00	0.080	0.050	0.013	0.44	7.62	0.55	7.62	2.00	Off
25	DP-8	8.41	0.00	7.41	0.00	Curb	6.0	6.00	0.00	0.00	0.00	Sag	2.00	0.080	0.050	0.013	0.54	9.63	0.65	9.63	2.00	Off
26	DP-18	2.30*	0.00	2.30	0.00	Curb	6.0	5.00	0.00	0.00	0.00	Sag	2.00	0.063	0.020	0.013	0.32	11.83	0.40	11.83	2.00	Off
27	DP-17	11.60*	0.00	11.60	0.00	Curb	6.0	14.00	0.00	0.00	0.00	Sag	2.00	0.063	0.020	0.013	0.51	21.11	0.59	21.11	2.00	Off
28	DP-17a	5.30*	0.00	5.30	0.00	Genr	0.0	0.00	0.00	0.00	0.00	Sag	2.00	0.063	0.020	0.013	0.50	20.70	0.50	20.70	0.00	Off

5-yr storm sewer-Carriage | Number of lines: 28 | Run Date: 11-02-2017

NOTES: Inlet N-Values = 0.016 ; Intensity = 39.98 / (Inlet time + 10.00) ^ 0.76; Return period = 5 Yrs. ; * Indicates Known Q added

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp line No
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1		3.78	0.00	0.00	3.78	MH	0.0	0.00	0.00	0.00	0.00	Sag	2.00	0.080	0.050	0.013	0.00	0.00	0.00	0.00	0.00	Off
2		10.63	0.00	0.00	10.63	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.00	Off
3		11.40	0.00	0.00	11.40	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.00	Off
4	DP-7	10.90*	0.00	10.90	0.00	Genr	0.0	0.00	0.00	0.00	0.00	Sag	2.00	0.080	0.050	0.013	0.50	8.80	0.50	8.80	0.00	Off
5	DP-6	10.50*	0.00	10.50	0.00	Genr	0.0	0.00	0.00	0.00	0.00	Sag	2.00	0.080	0.050	0.013	0.50	8.80	0.50	8.80	0.00	Off
6		0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.00	Off
7	DP-4b	17.50*	0.00	17.50	0.00	Genr	6.0	6.00	0.00	0.00	0.00	Sag	2.00	0.050	0.050	0.013	0.50	10.00	0.50	10.00	0.00	Off
8		0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.00	Off
9		0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.00	Off
10		0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.00	Off
11	DP-4	9.02*	0.00	9.02	0.00	Genr	0.0	0.00	0.00	0.00	0.00	0.007	2.00	0.050	0.050	0.013	0.46	9.20	0.46	9.20	0.00	21
12		0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.00	Off
13		0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.00	Off
14		0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.00	Off
15		0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.00	Off
16	DP-1	8.63*	0.00	8.63	0.00	Curb	6.0	6.00	0.00	0.00	0.00	Sag	2.00	0.080	0.050	0.013	0.59	10.66	0.70	10.66	2.00	Off
17	DP-3	6.10*	0.00	6.10	0.00	Curb	6.0	6.00	0.00	0.00	0.00	Sag	2.00	0.080	0.050	0.013	0.48	8.45	0.59	8.45	2.00	Off
18	DP-2	9.50*	0.00	9.50	0.00	Curb	6.0	6.00	0.00	0.00	0.00	Sag	2.00	0.080	0.050	0.013	0.63	11.37	0.73	11.37	2.00	Off
19		0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.00	Off
20	DP-5	5.90*	0.00	5.90	0.00	Genr	6.0	6.00	0.00	0.00	0.00	Sag	2.00	0.080	0.050	0.013	0.50	8.80	0.50	8.80	0.00	Off
21	DP-4a	9.30*	0.00	9.30	0.00	Genr	6.0	6.00	0.00	0.00	0.00	0.007	2.00	0.080	0.050	0.013	0.51	9.08	0.51	9.08	0.00	7
22	DP-11	4.20*	0.00	2.12	2.08	Genr	6.0	6.00	0.00	0.00	0.00	Sag	2.00	0.080	0.050	0.013	0.50	8.80	0.50	8.80	0.00	Off

100-yr storm sewer-Carriage | Number of lines: 28 | Run Date: 11-02-2017

NOTES: Inlet N-Values = 0.016 ; Intensity = 71.16 / (Inlet time + 10.00) ^ 0.76; Return period = 100 Yrs. ; * Indicates Known Q added

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp line No
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
23	DP-10	14.70*	0.00	14.70	0.00	Curb	6.0	6.00	0.00	0.00	0.00	Sag	2.00	0.080	0.050	0.013	0.82	15.23	0.93	15.23	2.00	22
24	DP-9	9.30*	0.00	9.30	0.00	Curb	6.0	6.00	0.00	0.00	0.00	Sag	2.00	0.080	0.050	0.013	0.62	11.21	0.73	11.21	2.00	Off
25	DP-8	16.30*	0.00	16.30	0.00	Curb	6.0	6.00	0.00	0.00	0.00	Sag	2.00	0.080	0.050	0.013	0.80	14.84	0.91	14.84	2.00	Off
26	DP-18	4.90*	0.00	4.90	0.00	Curb	6.0	5.00	0.00	0.00	0.00	Sag	2.00	0.063	0.020	0.013	0.48	19.63	0.56	19.63	2.00	Off
27	DP-17	22.20*	0.00	22.20	0.00	Curb	6.0	14.00	0.00	0.00	0.00	Sag	2.00	0.063	0.020	0.013	0.74	32.62	0.82	32.62	2.00	Off
28	DP-17a	10.20*	0.00	10.00	0.20	Genr	0.0	0.00	0.00	0.00	0.00	Sag	2.00	0.063	0.020	0.013	0.50	20.70	0.50	20.70	0.00	Off

100-yr storm sewer-Carriage | Number of lines: 28 | Run Date: 11-02-2017

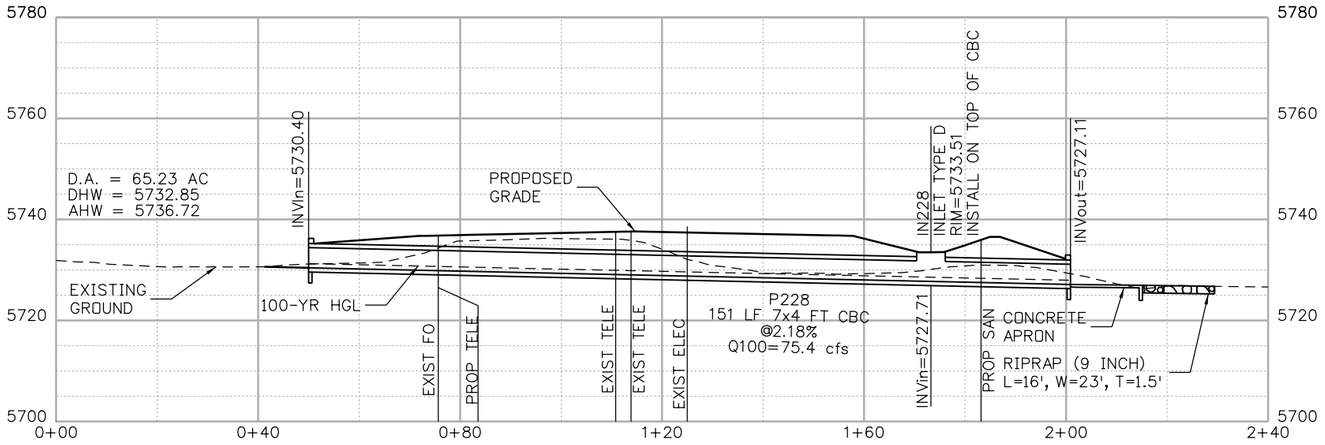
NOTES: Inlet N-Values = 0.016 ; Intensity = 71.16 / (Inlet time + 10.00) ^ 0.76; Return period = 100 Yrs. ; * Indicates Known Q added

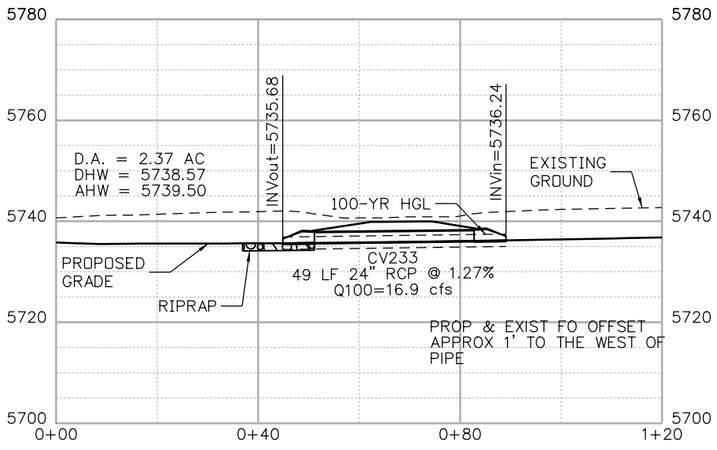
Storm Sewer Summary Report

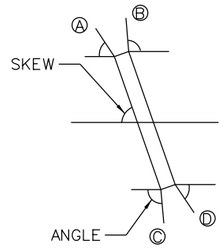
Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1		179.5	60 c	56.0	5716.00	5716.25	0.446	5719.78	5720.38	1.00	5721.38	End
2		179.5	60 c	740.0	5716.25	5719.60	0.453	5721.74*	5725.26*	1.17	5726.43	1
3		104.1	48 c	96.0	5721.00	5729.32	8.664	5726.66	5732.34	n/a	5732.34	2
4		75.40	48 c	438.0	5720.60	5722.83	0.509	5727.17*	5728.38*	0.56	5728.94	2
5	Ex 4'x7' CBC	75.40	48 x 84 b	18.0	5723.31	5723.70	2.167	5729.15*	5729.16*	0.01	5729.17	4
6	Ex. 4x7 CBC	75.40	48 x 84 b	68.0	5723.70	5725.18	2.176	5729.17*	5729.19*	0.07	5729.26	5

Project File: peaceful-storm-relocation.stm | Number of lines: 6 | Run Date: 12-01-2017

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; *Surcharged (HGL above crown).







NOTES:

1. INSTALL CULVERT APRON AND TOE WALL PER M-601-20.

2. WINGWALLS PER M-601-20.
   SKEW=85 DEGREES, M=5.33', K=1'
   Ⓐ L=24', ANGLE=30
   Ⓑ L=24', ANGLE=30
   Ⓒ L=18', ANGLE=70
   Ⓓ L=18', ANGLE=50

COLORADO LICENSED
ELIZABETH A. STATEN
38974
09/01/2015
PROFESSIONAL ENGINEER

Print Date: 8/31/2015		Sheet Revisions			As Constructed
File Name: South-Marksheffel_HYDR_Profile012.dgn		Date:	Comments	Init.	No Revisions:
Horiz. Scale: 1:30 Vert. Scale: As Noted					Revised:
Unit Information Unit Leader Initials					Void:
FDR					

EL PASO COUNTY COLORADO

PPRTA

MARKSHEFFEL ROAD
DRAINAGE PROFILE
224+00.00 TO 238+00.00

Designer: E. STATEN	Structure Numbers		Project No./Code ....
Detailer: A. QUINTANA			....
Sheet Subset: DRAINAGE	Subset Sheets: 7 of 20		D-62

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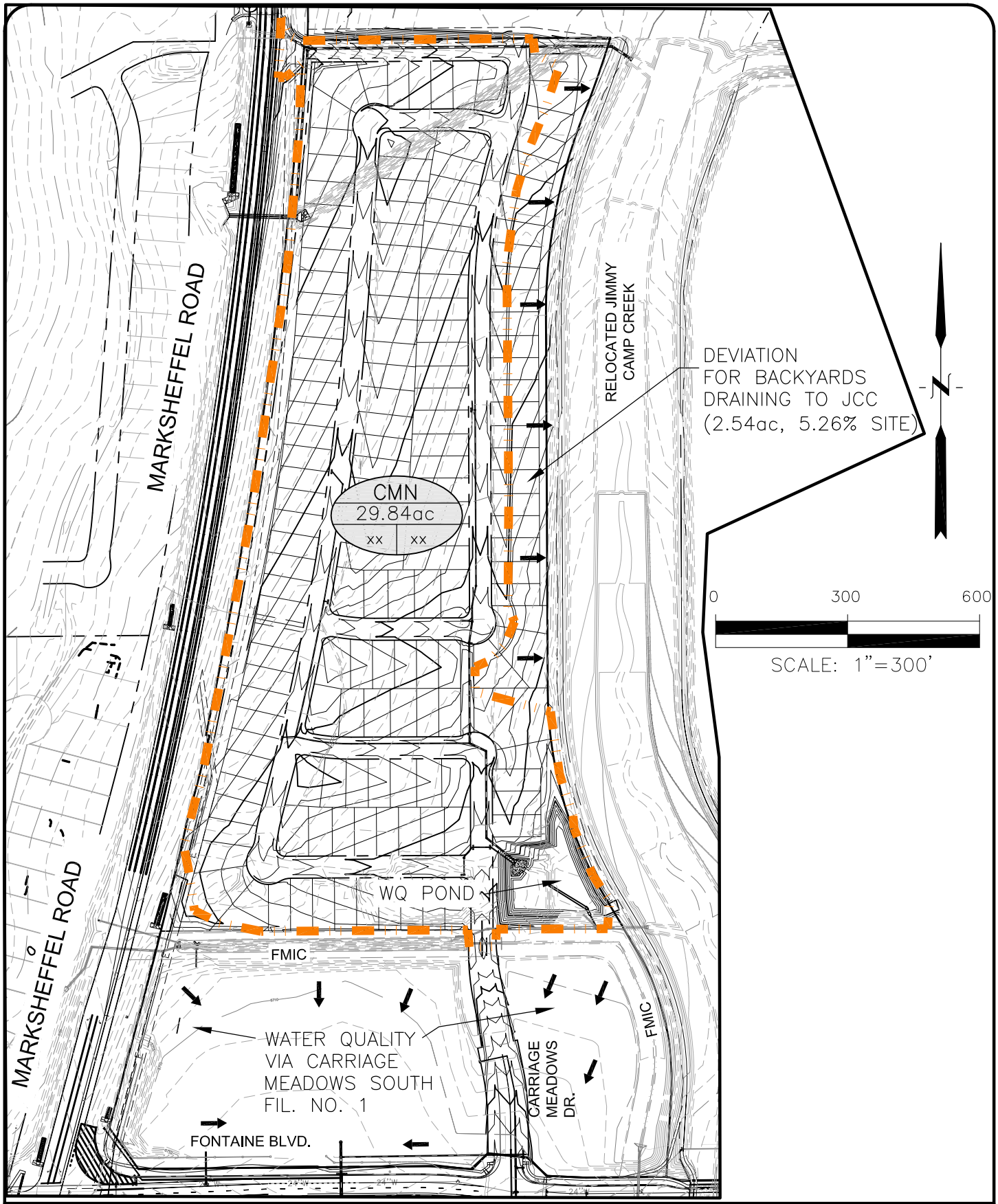
Basin ID	Area (ac)	5 -Year		100- Year	
		C	Q (cfs)	C	Q (cfs)
470L	0.23	0.90	0.97	0.95	2.11
469L	60.3	0.25	11.8	0.35	35.9
448R	0.62	0.90	2.30	0.95	5.01
448L	164	0.26	47.4	0.35	140
438R	0.68	0.90	2.68	0.95	5.83
422R	0.34	0.90	0.81	0.95	1.77
405L	3.05	0.90	5.59	0.95	12.2
404L	206	0.26	44.1	0.36	132
403R	0.20	0.90	0.81	0.95	1.77
403L	0.36	0.90	1.51	0.95	3.28
394L	0.18	0.90	0.77	0.95	1.67
377L	0.50	0.90	1.98	0.95	4.30
376R	15.47	0.43	5.79	0.52	14.4
376L	82.3	0.26	25.4	0.36	75.1
ZONE 3					
256L	0.77	0.90	2.46	0.95	6.97
256R	0.77	0.90	2.46	0.95	6.97
247L	0.96	0.90	2.41	0.95	6.83
246R	1.01	0.90	2.54	0.95	7.19
229R	0.31	0.90	0.99	0.95	2.81
226L	65.2	0.28	19.7	0.38	72.6
212L	1.55	0.90	2.65	0.95	7.48
212R	1.55	0.90	2.65	0.95	7.48
210L	125	0.31	55.4	0.43	205
208R	0.44	0.90	1.33	0.95	3.77
206L	0.74	0.90	1.99	0.95	5.63
205L	2.87	0.25	1.23	0.35	4.61
178L	79.9	0.34	23.4	0.46	87.1
178R	3.32	0.90	4.51	0.95	12.8
152L	2.49	0.90	3.05	0.95	8.68
152R	2.53	0.90	3.10	0.95	8.82
151R	39.3	0.42	12.2	0.56	44.4
150L	124	0.25	16.5	0.35	64.2
148L	0.41	0.90	0.92	0.95	2.62
148R	0.55	0.90	1.05	0.95	2.96
ZONE 4					
125R	1.08	0.90	2.06	0.95	5.82
103L	4.65	0.90	4.69	0.95	13.5
103R	0.57	0.90	1.09	0.95	3.07
92L	0.53	0.90	1.01	0.95	2.85
92R	0.58	0.90	1.09	0.95	3.07
70L	1.72	0.90	2.43	0.95	6.86
70R	0.27	0.90	0.68	0.95	1.92

3.3.2 Colorado Regional Regression

As mentioned in the Drainage Design Criteria section of this report the Regional Regression Equations were utilized instead of the SCS method. Using the SCS (TR-55) method for the same basin yields a Q_5 = 0.00 cfs and Q_{100} = 21.2 cfs. This is a significantly lower estimate than the

APPENDIX E – DETENTION ANALYSIS



CORE
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EMAIL: Rich@ceg1.com

CARRIAGE MEADOWS NORTH FILING NO. 1
WATER QUALITY TRIBUTARY AREA

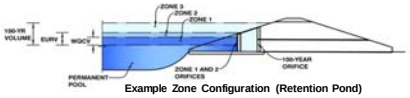
SCALE:	DATE:	FIGURE NO.
NTS	DECEMBER, 2017	1

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Carriage Meadows North Filing No. 1

Basin ID: Pond 1



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	29.84	acres
Watershed Length =	2,000	ft
Watershed Slope =	0.010	ft/ft
Watershed Imperviousness =	52.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.527	acre-feet
Excess Urban Runoff Volume (EURV) =	1.473	acre-feet
2-yr Runoff Volume (P1 = 1.16 in.) =	1.354	acre-feet
5-yr Runoff Volume (P1 = 1.44 in.) =	1.961	acre-feet
10-yr Runoff Volume (P1 = 1.68 in.) =	2.505	acre-feet
25-yr Runoff Volume (P1 = 1.92 in.) =	3.387	acre-feet
50-yr Runoff Volume (P1 = 2.16 in.) =	4.058	acre-feet
100-yr Runoff Volume (P1 = 2.42 in.) =	4.896	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	1.270	acre-feet
Approximate 5-yr Detention Volume =	1.848	acre-feet
Approximate 10-yr Detention Volume =	2.107	acre-feet
Approximate 25-yr Detention Volume =	2.274	acre-feet
Approximate 50-yr Detention Volume =	2.354	acre-feet
Approximate 100-yr Detention Volume =	2.663	acre-feet

Optional User Override 1-hr Precipitation

1.16	inches
1.44	inches
1.68	inches
1.92	inches
2.16	inches
2.42	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.527	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.946	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.190	acre-feet
Total Detention Basin Volume =	2.663	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

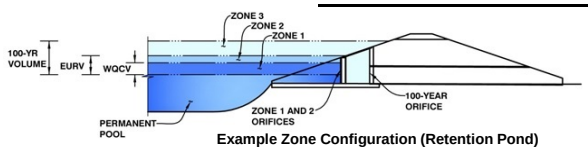
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	20	0.000		
5704.33	--	0.33	--	--	--	50	0.001	11	0.000
5705	--	1.00	--	--	--	431	0.010	168	0.004
5706	--	2.00	--	--	--	21,153	0.486	10,754	0.247
5707	--	3.00	--	--	--	24,200	0.556	33,641	0.772
5708	--	4.00	--	--	--	27,416	0.629	59,449	1.365
5709	--	5.00	--	--	--	30,763	0.706	88,538	2.033
5710	--	6.00	--	--	--	33,875	0.778	120,857	2.775
5711	--	7.00	--	--	--	37,112	0.852	156,351	3.589
5712	--	8.00	--	--	--	40,700	0.934	195,257	4.482

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Carriage Meadows North Filing No. 1

Basin ID: Pond 1



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.55	0.527	Orifice Plate
Zone 2 (EURV)	4.17	0.946	Rectangular Orifice
Zone 3 (100-year)	5.86	1.190	Weir&Pipe (Restrict)
		2.663	Total

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.250E-02	ft^2
Depth at top of Zone using Orifice Plate =	2.55	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	10.50	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	1.80	sq. inches (diameter = 1-1/2 inches)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.90	1.80					
Orifice Area (sq. inches)	1.80	1.80	1.80					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.55	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	4.17	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	6.00	N/A	inches
Vertical Orifice Width =	7.92		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.33	N/A	ft^2
Vertical Orifice Centroid =	0.25	N/A	feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.20	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Slope =	6.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	6.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.20	N/A	feet
Over Flow Weir Slope Length =	6.08	N/A	feet
Grate Open Area / 100-yr Orifice Area =	6.74	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	17.03	N/A	ft^2
Overflow Grate Open Area w/ Debris =	8.52	N/A	ft^2

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	18.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	2.53	N/A	ft^2
Outlet Orifice Centroid =	0.83	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.09	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	21.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.92	feet
Stage at Top of Freeboard =	7.92	feet
Basin Area at Top of Freeboard =	0.93	acres

Routed Hydrograph Results

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.16	1.44	1.68	1.92	2.16	2.42	0.00
Calculated Runoff Volume (acre-ft) =	0.527	1.473	1.354	1.961	2.505	3.387	4.058	4.896	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.526	1.472	1.354	1.960	2.504	3.387	4.058	4.895	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.09	0.24	0.57	0.76	1.00	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.3	2.6	7.1	17.1	22.6	29.8	0.0
Peak Inflow Q (cfs) =	6.8	18.9	17.4	25.1	32.0	43.1	51.5	61.8	#N/A
Peak Outflow Q (cfs) =	0.2	1.9	1.7	3.1	8.0	17.7	25.3	27.3	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.2	1.1	1.0	1.1	0.9	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.0	0.3	0.9	1.3	1.4	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	38	49	48	49	48	46	44	42	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**40**	52	51	54	53	53	52	51	#N/A
Maximum Ponding Depth (ft) =	2.46	3.79	3.63	4.39	4.79	5.19	5.41	5.86	#N/A
Area at Maximum Ponding Depth (acres) =	0.52	0.61	0.60	0.66	0.69	0.72	0.74	0.77	#N/A
Maximum Volume Stored (acre-ft) =	0.482	1.228	1.137	1.616	1.886	2.161	2.328	2.659	#N/A

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Designer: Richard Schindler
Company: Core Engineering Group
Date: January 11, 2018
Project: Carriage Meadows North Filing No. 1 FDR - Pond CMN-1 forebay design
Location:

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 52.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.520

C) Contributing Watershed Area — Area = 29.840 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = ____ in

E) Design Concept (Select EURV when also designing for flood control)

Choose One
- (●) Water Quality Capture Volume (WQCV)
- ( ) Excess Urban Runoff Volume (EURV)

F) Design Volume (WQCV) Based on 40-hour Drain Time
($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)
V_{DESIGN} = 0.527 ac-ft

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$)
$V_{DESIGN\ OTHER}$ = ____ ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)
$V_{DESIGN\ USER}$ = ____ ac-ft

I) Predominant Watershed NRCS Soil Group

Choose One
- ( ) A
- ( ) B
- ( ) C / D

WQCV selected. Soil group not required.

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$
EURV = ____ ac-f t

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.)
L : W = 2.0 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes
(Horizontal distance per unit vertical, 4:1 or flatter preferred)
Z = 0.25 ft / ft **TOO STEEP (< 3)**

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations:
wall in forebay

Design Procedure Form: Extended Detention Basin (EDB)

Designer: Richard Schindler
Company: Core Engineering Group
Date: January 11, 2018
Project: Carriage Meadows North Filing No. 1 FDR - Pond CMN-1 forebay design
Location:

5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.016 ac-ft
B) Actual Forebay Volume	V_F = 0.025 ac-ft
C) Forebay Depth (D_F = 18 inch maximum)	D_F = 18.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 61.10 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 1.22 cfs
E) Forebay Discharge Design	Choose One: ○ Berm With Pipe ◉ Wall with Rect. Notch ○ Wall with V-Notch Weir — (flow too small for berm w/ pipe)
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = 6.0 in
6. Trickle Channel	
A) Type of Trickle Channel	Choose One: ◉ Concrete ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 56 sq ft
C) Outlet Type	Choose One: ◉ Orifice Plate ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 1.50 inches
E) Total Outlet Area	A_{ot} = 26.85 square inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer: Richard Schindler
Company: Core Engineering Group
Date: January 12, 2018
Project: Carriage Meadows North Filing No. 1 FDR - Pond CMN-1 forebay design
Location:

8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 4 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 67.0 cu ft
C) Initial Surcharge Provided Above Micropool	V_s= 18.7 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 896 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.)	*Other (Please describe below)*
	stainless steel well screen
Other (Y/N): Y	
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio = 0.6
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 1494 sq. in. Based on type 'Other' screen ratio
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 2.5 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 58 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 25.8 inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer: Richard Schindler
Company: Core Engineering Group
Date: January 11, 2018
Project: Carriage Meadows North Filing No. 1 FDR - Pond CMN-1 forebay design
Location:

10. Overflow Embankment A) Describe embankment protection for 100-year and greater overtopping: B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	
11. Vegetation	Choose One ○ Irrigated ○ Not Irrigated
12. Access A) Describe Sediment Removal Procedures	

Notes:

Weir Report

Hydraflow Express by Intelisolve | Thursday, Nov 2 2017, 6:22 PM

Pond CMN-1 forebay weir (wq=6.7cfs)

Rectangular Weir

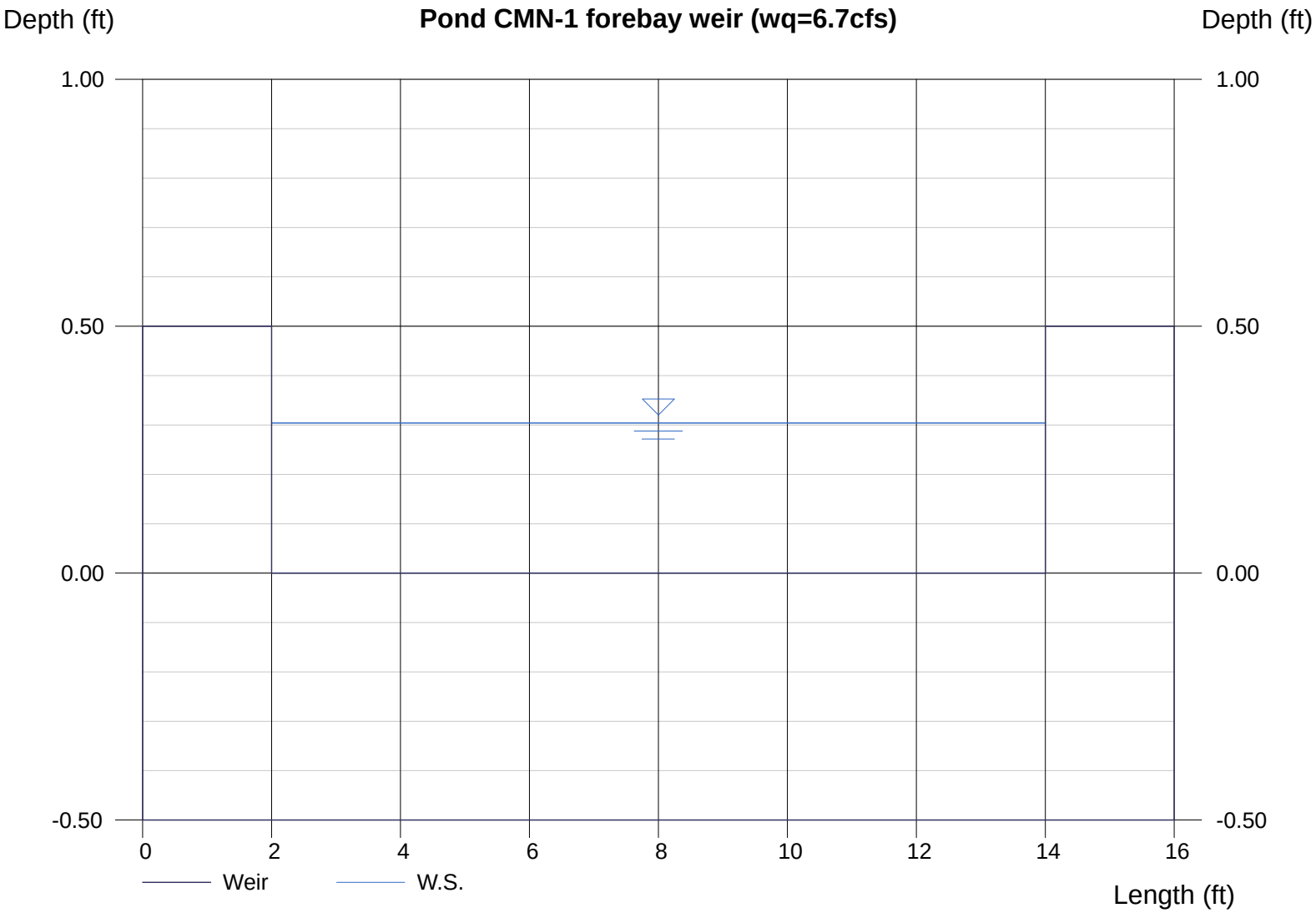
Crest	=	Sharp
Bottom Length (ft)	=	12.00
Total Depth (ft)	=	0.50

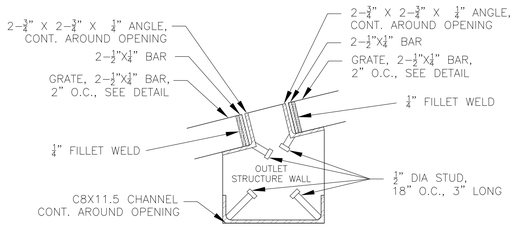
Calculations

Weir Coeff. Cw	=	3.33
Compute by:		Known Q
Known Q (cfs)	=	6.70

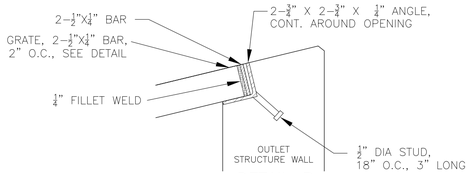
Highlighted

Depth (ft)	=	0.30
Q (cfs)	=	6.700
Area (sqft)	=	3.65
Velocity (ft/s)	=	1.84
Top Width (ft)	=	12.00



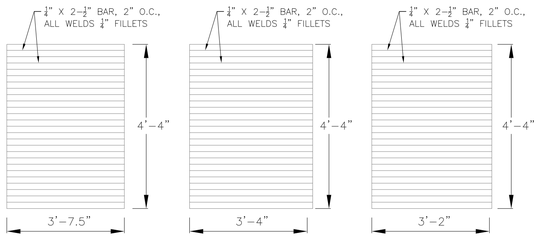


DETAIL A
NO SCALE



DETAIL B
NO SCALE

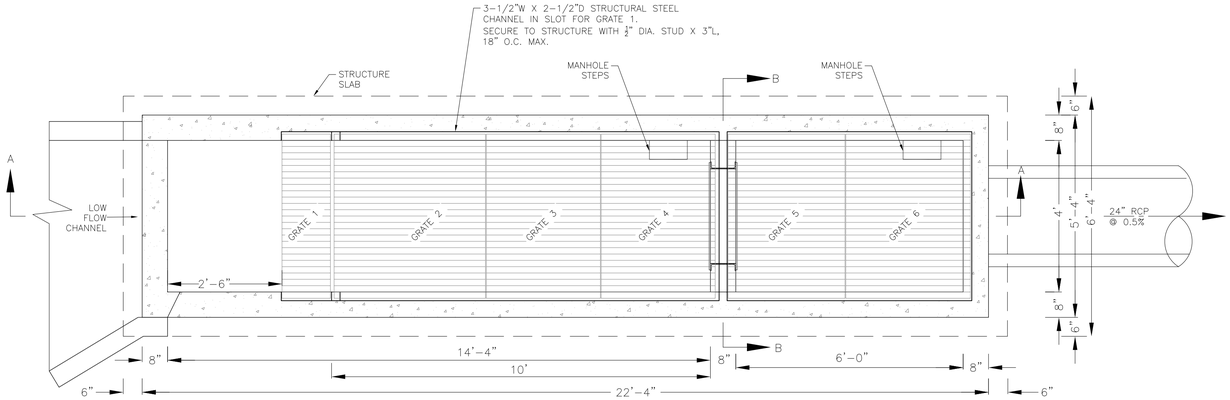
NOTE:
AFTER CONCRETE STRUCTURE HAS BEEN POURED
ALL GRATE DIMENSIONS SHALL BE FIELD VERIFIED
PRIOR TO GRATE CONSTRUCTION



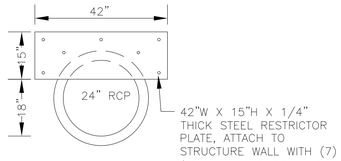
GRATE 1,2,3
NO SCALE

GRATE 4,5
NO SCALE

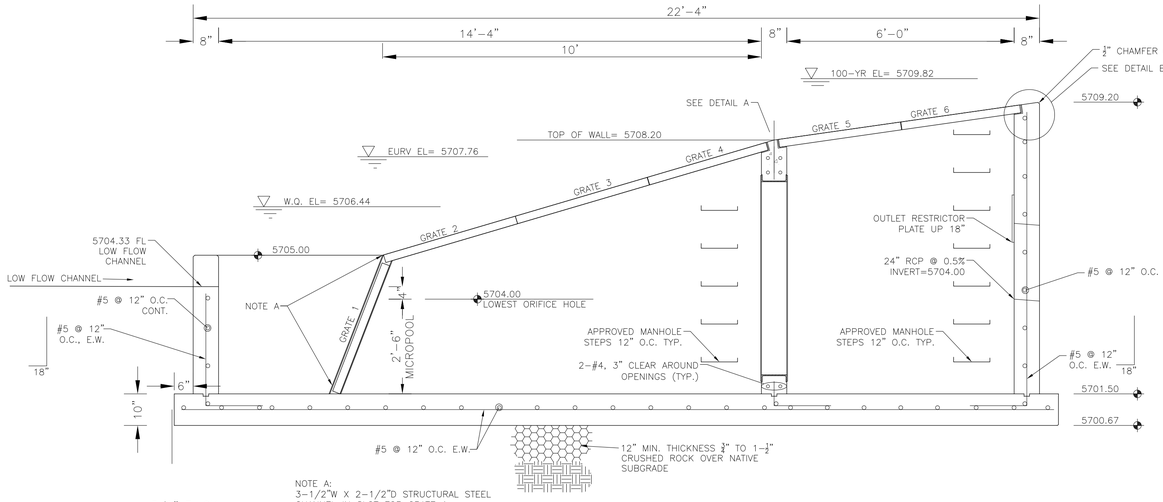
GRATE 6
NO SCALE



OUTLET STRUCTURE DETAIL – PLAN VIEW
NO SCALE

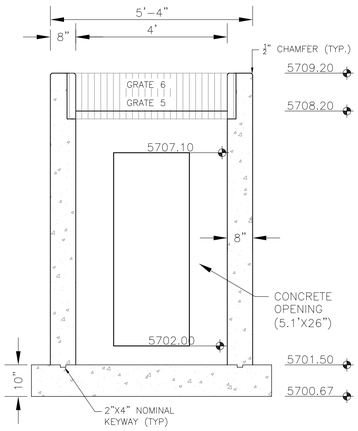


OUTLET RESTRICTOR PLATE
NO SCALE



NOTE A:
3–1/2"W X 2–1/2"D STRUCTURAL STEEL CHANNEL IN SLOT FOR GRATE 1.
SECURE TO STRUCTURE WITH ½" DIA. STUD X 3"L, 18" O.C. MAX.

OUTLET STRUCTURE DETAIL – SECTION A–A
NO SCALE



OUTLET STRUCTURE DETAIL – SECTION B–B
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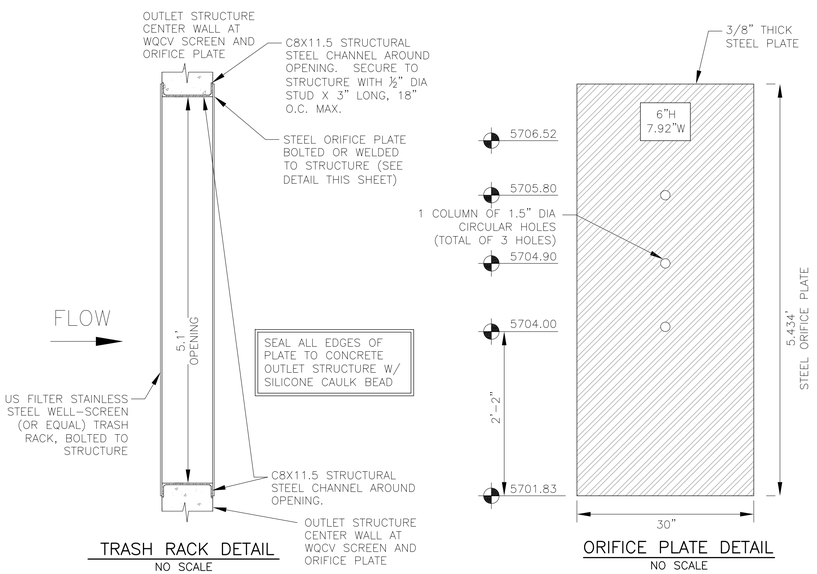


TRASH RACK DETAIL
NO SCALE

ORIFICE PLATE DETAIL
NO SCALE

OUTLET STRUCTURE, FOREBAY, AND DRAIN CHANNEL NOTES:

1. PRIOR TO CONSTRUCTION, CONTRACTOR SHALL PROVIDE SHOP DRAWINGS FOR ALL COMPONENTS OF THE OUTLET STRUCTURE.
2. GRADE 60 REINFORCING STEEL REQUIRED. SEE TABLE FOR THE MINIMUM LAP SPLICE LENGTH FOR REINFORCING BARS. ALL REINFORCING STEEL SHALL HAVE A TWO–INCH MINIMUM CLEARANCE FROM EDGE OF CONCRETE, UNLESS OTHERWISE NOTED.

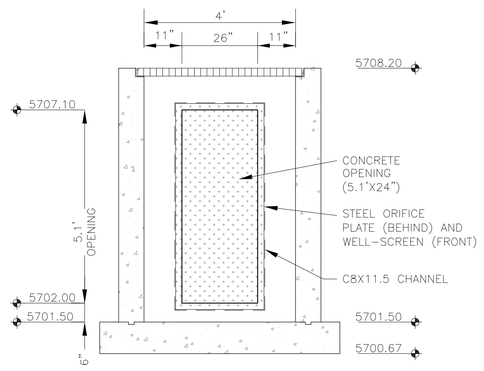
BAR SIZE	#4	#5	#6
MIN. SPLICE LENGTH	1'–3"	1'–7"	2'–0"

3. CONCRETE FOR THE OUTLET STRUCTURE AND FOREBAY SHALL BE CDOT CLASS D CONCRETE.
4. CONCRETE FOR DRAIN CHANNELS SHALL BE CDOT CLASS B CONCRETE
5. EXPANSION JOINT MATERIAL SHALL MEET AASHTO SPECIFICATION M–213. EXPANSION JOINT MATERIAL SHALL BE ½" THICK, SHALL EXTEND THE FULL DEPTH OF CONTACT SURFACE AND THE JOINT SHALL BE SEALED, REFER TO DETAILS.
6. ALL EXPOSED CONCRETE CORNERS SHALL HAVE A ¾" CHAMFER UNLESS OTHERWISE NOTED.
7. SUBGRADE TO BE 12" THICK CLEAN FILL COMPACTED TO 95% STANDARD PROCTOR DENSITY PER ASTM M698 UNDER STRUCTURE.
8. REFER TO SHEET XX FOR PRESEDIMENTATION/FOREBAY DESIGN.
9. ENGINEER SHALL BE NOTIFIED PRIOR TO BEGINNING CONSTRUCITON OF OUTLET STRUCTURE TO SCHEDULE OBSERVATION VISITS FOR STRUCTURES.

WQCV WELL–SCREEN NOTES:

1. Well–Screen shall be stainless steel and attached by stainless steel bolts along edge of the mounting frame.

2. WQCV Well Screen
- Type of Screen: Stainless steel #93 Vee Wire (Johnson Vee Wire (tm) Stainless Steel Screen or equivalent with 60% open area)
- Screen slot opening dimension: 0.139" (Screen #93 Vee Wire Slot Opening)
- Type and Size of Support Rod: TE 0.074"X0.50"
- Spacing of Support Rod (O.C.): 1.0 Inch
- Total Screen Thickness: 0.655"
- Carbon Steel Holding Frame Type: 3/4" x 1.0" angle



OUTLET STRUCTURE DETAIL – SECTION B–B
NO SCALE

CORE ENGINEERING GROUP
15004 1ST AVENUE S.
BURNSVILLE, MN 55306
PH: 719.570.1100
CONTACT: RICHARD L. SCHINDLER, P.E.
EMAIL: rlschindler@ceg1.com

NO. | DESCRIPTION | DATE

PREPARED FOR:
LORSON, LLC
212 N. WAHSATCH AVENUE, SUITE 301
COLORADO SPRINGS, COLORADO 80903
(719) 635–3200
CONTACT: JEFF MARK

PROJECT:
CARRIAGE MEADOWS
NORTH FIL. NO. 1
FONTAINE BLVD–CARRIAGE MEADOWS DR
COLORADO SPRINGS, COLORADO

DRAWN: RLS
DESIGNED: RLS
CHECKED: RLS

POND CMN-1 (DISTRICT)
FULL SPECTRUM
OUTLET STRUCTURE DETAILS

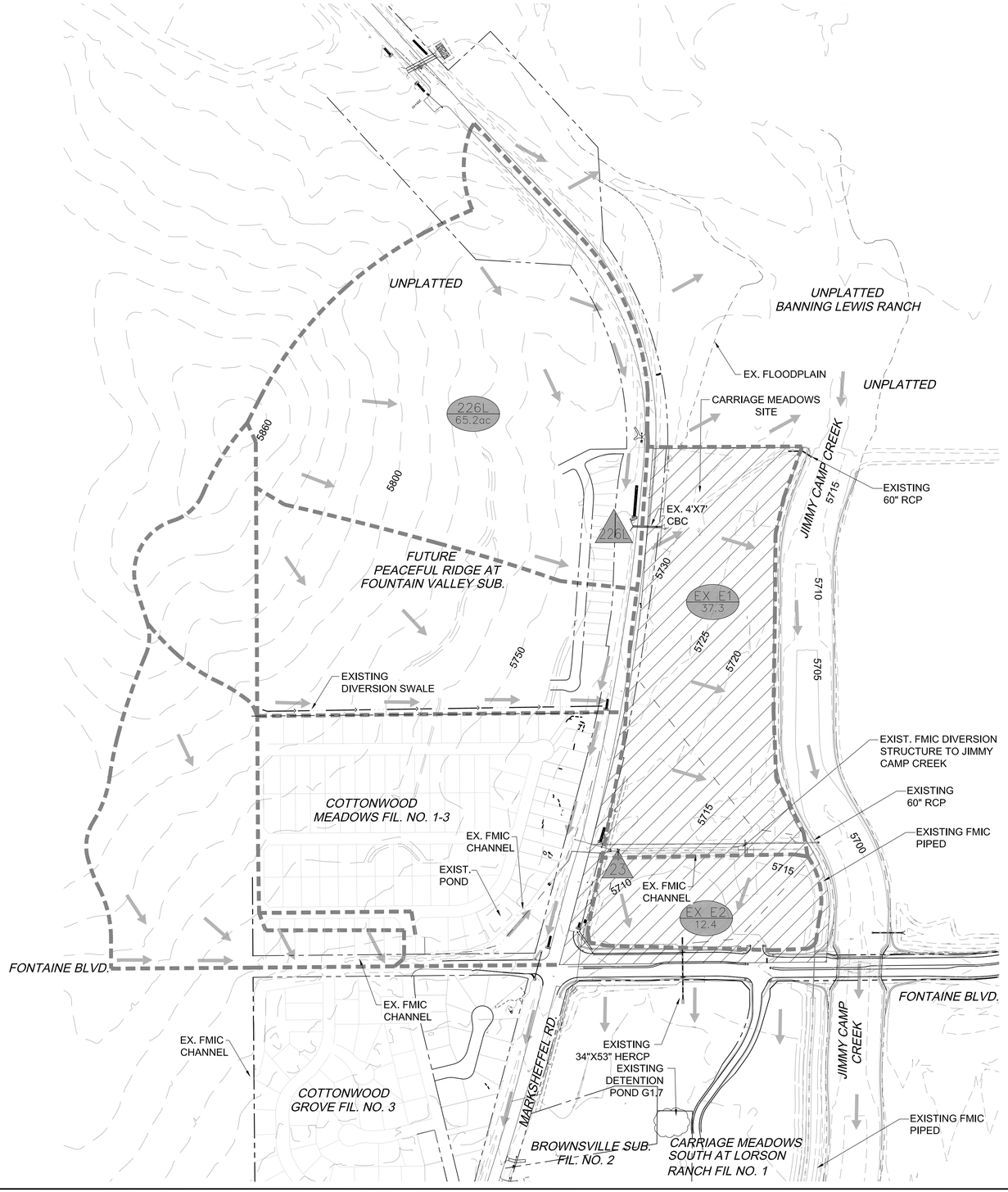
DATE:
DECEMBER, 2017

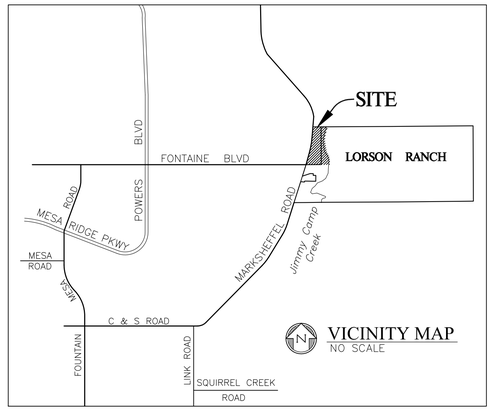
PROJECT NO.
100.002

SHEET NUMBER
C9.3

TOTAL SHEETS: 9

MAP POCKET





RUNOFF SUMMARY TABLE

BASIN	DRAINAGE AREA	RUNOFF 5 YR (CFS)	RUNOFF 100 YR (CFS)	COMMENTS
EX-E1	37.3	20.0	112.0	
EX-E2	12.4	7.0	39.1	
226L	65.2	20	73	

DESIGN POINT SUMMARY TABLE

DESIGN POINT	RUNOFF 5 YR (CFS)	RUNOFF 100 YR (CFS)	COMMENTS
226L	20.0	73.0	from HDR's FDR
23	113	214	from Font/Old Glory/Mark. FDR

LEGEND

BASIN / ACRES — BASIN ID, BASIN AREA

— DESIGN POINT

TC (TIME OF CONCENTRATION LINE)

MAJOR BASIN

GRAPHIC SCALE

300 0 150 300

1 inch = 300 ft.

CORE ENGINEERING GROUP
15004 1ST AVENUE S.
BURNSVILLE, MN 55306
PH: 719.570.1100
CONTACT: RICHARD L. SCHINDLER, P.E.
EMAIL: Rich@ceg1.com

NO.	DESCRIPTION	DATE
1	X	X

PREPARED FOR:
LORSON LLC
212 N. WAHSATCH AVE., SUITE 301
COLORADO SPRINGS, COLORADO 80903
(719) 635-2200
CONTACT: JEFF MARK

PROJECT:
CARRIAGE MEADOWS NORTH FILING NO. 1
LORSON RANCH
EL PASO COUNTY, COLORADO

DRAWN: LJA
DESIGNED: RLS
CHECKED: RLS

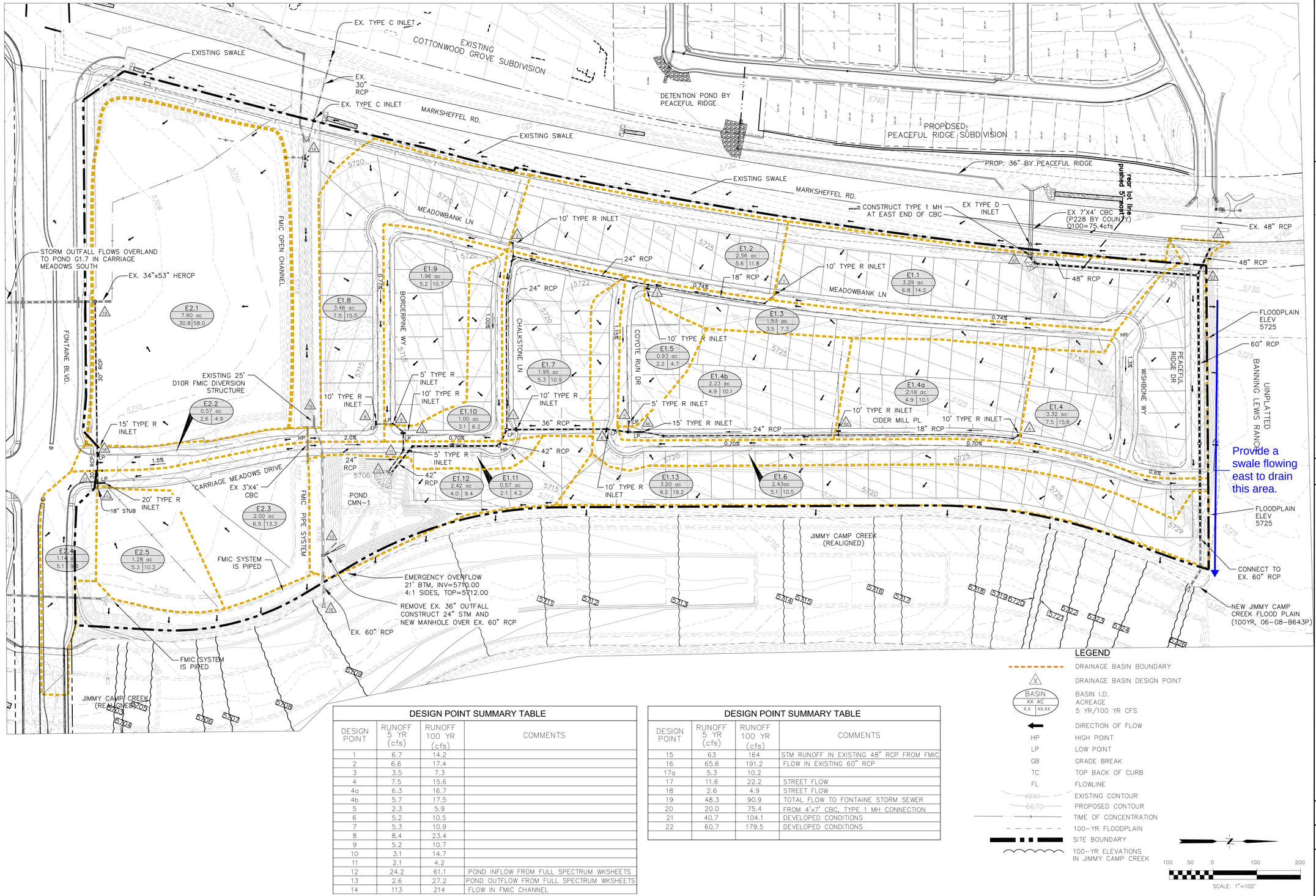
EXISTING CONDITIONS DRAINGE MAP

DATE
JANUARY, 2018

PROJECT NO.
100.002

SHEET NUMBER
1

TOTAL SHEETS: 2



DESIGN POINT SUMMARY TABLE

DESIGN POINT	RUNOFF 5 YR (cfs)	RUNOFF 100 YR (cfs)	COMMENTS
1	6.7	14.2	
2	6.6	17.4	
3	3.5	7.3	
4	7.5	15.6	
4a	6.3	16.7	
4b	5.7	17.5	
5	2.3	5.9	
6	5.2	10.5	
7	5.3	10.9	
8	8.4	23.4	
9	5.2	10.7	
10	3.1	14.7	
11	2.1	4.2	
12	24.2	61.1	POND INFLOW FROM FULL SPECTRUM WKSHEETS
13	2.6	27.2	POND OUTFLOW FROM FULL SPECTRUM WKSHEETS
14	113	214	FLOW IN FMIC CHANNEL

DESIGN POINT SUMMARY TABLE

DESIGN POINT	RUNOFF 5 YR (cfs)	RUNOFF 100 YR (cfs)	COMMENTS
15	63	164	STM RUNOFF IN EXISTING 48" RCP FROM FMIC
16	65.6	191.2	FLOW IN EXISTING 60" RCP
17a	5.3	10.2	
17	11.6	22.2	STREET FLOW
18	2.6	4.9	STREET FLOW
19	48.3	90.9	TOTAL FLOW TO FONTAINE STORM SEWER
20	20.0	75.4	FROM 4'x7' CBC, TYPE 1 MH CONNECTION
21	40.7	104.1	DEVELOPED CONDITIONS
22	60.7	179.5	DEVELOPED CONDITIONS

LEGEND

- DRAINAGE BASIN BOUNDARY
- DRAINAGE BASIN DESIGN POINT
- BASIN I.D. / ACREAGE / 5 YR/100 YR CFS
- DIRECTION OF FLOW
- HP — HIGH POINT
- LP — LOW POINT
- GB — GRADE BREAK
- TC — TOP BACK OF CURB
- FL — FLOWLINE
- 6690 — EXISTING CONTOUR
- 6670 — PROPOSED CONTOUR
- TIME OF CONCENTRATION
- 100-YR FLOODPLAIN
- SITE BOUNDARY
- 100-YR ELEVATIONS IN JIMMY CAMP CREEK

100 50 0 100 200

SCALE: 1"=100'

CORE ENGINEERING GROUP
15004 1ST AVENUE S
BURNSVILLE, MN 55306
PH: 952.890.6100
CONTACT: RICHARD L. SCHINDLER, P.E.
EMAIL: Rich@ceg1.com

PREPARED FOR: LORSON, LLC
212 N. WAHSATCH AVE., SUITE 300
COLORADO SPRINGS, COLORADO 80903
(719) 635-3200

NO.	DESCRIPTION	DATE

PROJECT: CARRIAGE MEADOWS FILING NO. 1
LORSON RANCH
EL PASO COUNTY, COLORADO

DRAWN: RLS
DESIGNED: RLS
CHECKED: RLS

CARRIAGE MEADOWS NORTH FIL NO. 1 DEVELOPED CONDITIONS DRAINAGE PLAN

DATE: JANUARY, 2018

PROJECT NO. 100.002

SHEET NUMBER 2

TOTAL SHEETS: 2

Markup Summary

dsdrice (3)

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Checkmark: Unchecked
Author: dsdrice
Date: 2/27/2018 3:10:54 PM
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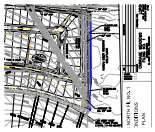

Subject: Arrow
Page Label: 81
Lock: Unlocked
Status:
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Author: dsdrice
Date: 2/27/2018 9:22:21 PM
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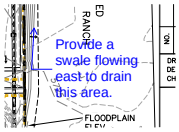
show swale



Subject: Callout
Page Label: 81
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Checkmark: Unchecked
Author: dsdrice
Date: 2/27/2018 9:22:31 PM
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Provide a swale flowing east to drain this area.

RSchindler (2)

Subject: Text Box
Page Label: 29
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: RSchindler
Date: 11/2/2017 6:15:16 AM
Color:

SITE

Subject: Polygonal Line
Page Label: 29
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: RSchindler
Date: 1/12/2018 6:26:07 AM
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