EPC STORMWATER REVIEW COMMENTS IN ORANGE BOXES WITH BLACK TEXT

FINAL DRAINAGE REPORT

FOR

CROSSROADS NORTH

EARLY GRADING

CITY OF COLORADO SPRINGS

EL PASO COUNTY, COLORADO

SEPTEMBER 2023

Prepared for:

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(719) 475-7621

Prepared by:

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Project #18-006
PCD Project #EGP-23-001

SP207

FINAL DRAINAGE REPORT FOR
CROSSROADS NORTH EARLY GRADING
CITY OF COLORADO SPRINGS
EL PASO COUNTY COLORADO

DRAINAGE PLAN STATEMENTS

ENGINEER'S STATEMENT

This report and plan for the early grading drainage design of Crossroads North was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said drainage report and plan has been prepared in accordance with the City of Colorado Springs Drainage Criteria Manual and is in conformity with the master plan of the drainage basin. I understand that the City of Colorado Springs does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

COLORADO REGISTERED
VIRGIL A. SANCHEZ
37160
09-14-23
PROFESSIONAL ENGINEER

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

DEVELOPER'S STATEMENT

Colorado Springs Equities LLC., hereby certifies that the early grading drainage facilities for Crossroads North shall be constructed according to the design presented in this report. I understand that the City of Colorado Springs does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that are submitted to the City of Colorado Springs pursuant to Section 7.7.906 of the City Code; and cannot, on behalf of Crossroads North, guarantee that the early grading drainage design review will absolve Colorado Springs Equities LLC., and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

BY: _____ DATE: 9-15-2023

TITLE: Developer

ADDRESS: Colorado Springs Equities LLC
90 S. Cascade, Suite 1500
Colorado Springs, CO 80903

CITY OF COLORADO SPRINGS
Filed in accordance with Section 7.7.906 of the Code of the City of Colorado Springs} 2001, as amended,

BY: _____ DATE: _____
For the City Engineer

CONDITIONS:

FINAL DRAINAGE REPORT FOR
CROSSROADS NORTH EARLY GRADING
CITY OF COLORADO SPRINGS
EL PASO COUNTY COLORADO

DRAINAGE PLAN STATEMENTS

ENGINEERS STATEMENT

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

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

DEVELOPER'S STATEMENT

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

BY: _____

TITLE: MANAGER _____ DATE: 9-15-2023

ADDRESS: Colorado Springs Equities LLC
90 S. Cascade, Suite 1500
Colorado Springs, CO 80903

EL PASO COUNTY'S STATEMENT

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

BY: _____ DATE: _____

Joshua Palmer, P.E.
County Engineer / ECM Administrator

CONDITIONS:

FINAL DRAINAGE REPORT FOR
CROSSROADS NORTH EARLY GRADING
CITY OF COLORADO SPRINGS
EL PASO COUNTY COLORADO

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APPENDIX

FINAL DRAINAGE REPORT FOR
CROSSROADS NORTH EARLY GRADING
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PURPOSE

This document is intended to serve as the Final Drainage Report for Crossroads North's Early Grading. This phase consists of overlot grading, retaining wall installation, and typical permanent control measure practices (PCM's) associated with an early grading plan. The purpose of this document is to identify and analyze the onsite drainage patterns during this phase, and to ensure that post development runoff is routed through the site safely and in a manner that satisfies the requirements set forth by the El Paso County and City of Colorado Springs Drainage Criteria Manual. The purpose of the overlot grading is to balance the earthworks and to prepare the site for future development. A final drainage report with site plan and final grading will be provided as each lot develops. The parcel is currently zoned by El Paso County for commercial regional, industrial, and light industrial as CR, M, and I-2, respectively.

GENERAL LOCATION AND DESCRIPTION

Crossroads North is located northeast of Highway 24 and Highway 94, in a portion of the south half of Section 8 and the northeast quarter of Section 8, Township 14 South, Range 65 West of the 6th Principal Meridian, within unincorporated El Paso County, Colorado. The site is bound on the south by Colorado Highway 94, to the north by Colorado Highway 24 and Marksheffel Road, and to the east by Marksheffel Road. Drainage flows from this site are tributary to the Jimmy Camp Creek Drainage Basin and Peterson Field Drainage Basin.

Crossroads North consists of approximately 44.34 acres within unincorporated El Paso County and is presently undeveloped. Improvements proposed for early grading are overlot grading to balance the earthworks, prepare the site for future development, provide temporary sediment basins, surface roughing and temporary mulching and seeding. As a part of the Crossroads North development, approximately 19 acres of property owned by the City of Colorado Springs along Highway 94 will also be partially graded. The total disturbance of the entire project is approximately 65 acres. Existing vegetation is sparse, consisting of native grasses. Existing site terrain generally slopes from north to southwest, and north to southeast, at grade rates that vary between 2% and 9%.

Land use for Crossroads North is currently listed as AG (Grazing Land). The total disturbance of the entire project is approximately 65 acres. A request for approval of early grading plans has been submitted with this Final Drainage Report and Preliminary Plan.

Six (6) temporary sediment basins will be provided for the proposed overlot grading. Five (5) of the temporary sediment basins will tie into the existing swale provided along Marksheffel Road and will eventually outfall into the existing extended detention basin provided at the southeast corner of the site. The one (1) temporary sediment basin at the southwest corner of the site will outfall to the existing 48" storm system at the northeast corner of Highway 24 and Highway 94. Temporary sediments basins have been sized per the Mile High Flood District (MHFD) Drainage Criteria manual (SB-5 and SB-6 details). The early grading (GEC) and MHFD detail SB-5 and SB-6 will accompany this submittal. Temporary sediment basins (TSB 3, 4, 5 and 6) have been oversized to prepare the site for future development and future detention ponds and to balance the earthwork on site. A final drainage report with site plan, final

hydraulic design (including storm sewer), associated calculations and final grading will be provided as each lot develops.

JIMMY CAMP CREEK DBPS & MARKSHEFFEL ROAD FINAL DRAINAGE REPORT

Excerpts of these two reports are include in the appendix of this report. The DBPS "Future Conditions Planning Information" map delineates this property as "Remaining areas with no detailed development plan". The "Future Conditions Land Use Map" delineates this site as "Low-Med Single Family Res, 4-8 Du/Ac, 40-50% percent impervious, and a Curve Number as 75-87". Since the proposed site will utilize the DBPS recommended Full Spectrum Detention method, the DBPS land use assumptions do not change the project's release rates. Excerpts from the Marksheffel Road Final Drainage Report (MRFD) is provided in the appendix to show and verify the drainage calculations for the existing facilities in Marksheffel Road and Highway 94. This report uses this data to compare the design flows in the existing system with the proposed early grading and erosion control flows for this development.

WETLANDS

There are no apparent wetlands within the boundary of this project.

CHANNEL IMPROVEMENTS

The proposed project is not adjacent to Jimmy Camp Creek or any other significant drainageway. No channel improvements are necessary as a part of this project.

SOILS

Soils for this project are delineated by the map in the appendix as Blakeland Loamy Sand (8) and have been characterized as Hydrologic Soil Types "A". Soils in the study area are shown as mapped by S.C.S. in the "Soils Survey of El Paso County Area". See Appendix for soils report.

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual and where applicable the Urban Storm Drainage Criteria Manual. The Rational Method was used to estimate storm water runoff anticipated from design storms with 5-year and 100-year recurrence intervals. Basins were analyzed and delineated (see Existing Conditions Map & Proposed Conditions Map in the Appendix) in order to determine areas and C coefficients. Overland flow and channelized flow paths were analyzed for each sub-basin in order to determine times of concentration. Table 6-6 Volume 1 of DCM was used for corresponding runoff coefficients.

HYDRAULIC CALCULATIONS

Hydraulic calculations were estimated using the methods described in the City of Colorado Springs Storm Drainage Design Criteria Manual (DCM) along with the Urban Drainage and Flood Control District (UDFCD) manual. UD-Inlet v4.05 from UDFCD was used to calculate street and inlet capacities. Manning's Equation was used for hydraulic analysis of diversion swales and the determine the sizing of existing storm sewer facilities. The pertinent data sheets are included in the appendix of this report.

FLOODPLAIN STATEMENT

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel Nos. 08041C0756G, 08041C0758G and 08041C0754G revised December 7, 2018. No portion of this site is located within the 100-year floodplain. See Appendix.

DRAINAGE CRITERIA

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

FOUR STEP PROCESS

Step1 Employ Runoff Reduction Practices – Runoff will be reduced through the use of temporary sediment ponds and in the interim condition until the ground has been stabilized with vegetation.

Step 2 Stabilize Drainageways –The site is several miles upstream of the Jimmy Camp Creek or Sand Creek Drainageway. Crossroads North's Early Grading proposes six (6) Temporary Sediment Basins, will capture site runoff and slowly release it to allow time for settling of sediment prior to discharge to the existing two systems at the southwest and southeast corners of the site. The developed flows from the onsite temporary sediment basins discharge less than historic 5 year and 100-year flows into the existing systems. These sediment basins are designed with respect to the UDFCD detail SB-5 and SB-6 guidelines for this particular sedimentation facility for the entire site and, therefore, we do not anticipate having negative effects on these downstream drainageways.

Step 3 Provide Water Quality Capture Volume (WQCV) – Six (6) Temporary Sediment Basin facilities are proposed and have been adequately sized to provide sedimentation collection from the site and maintain existing water quality levels.

Step 4 Consider Need for Industrial and Commercial Permanent Control Measure (PCM) – This submittal provides an early grading and erosion control plan with appropriate **PCMs** in place. The proposed project will use silt fence, vehicle tracking control pads, straw bale barriers, sediment basins, erosion control blanketing, inlet protection, mulching and reseeding, and other **PCM's** to mitigate the potential for erosion across the site. Specialized **PCM's** shall be considered with the final condition Final Drainage Report (and subsequent, individual lot reports) due to the nature of the proposed commercial uses.

EXISTING DRAINAGE CONDITIONS

There are major basin divides which occur within the Crossroads North (Hillcrest Acres Subdivision). The major basin divide between the Sand Creek and Jimmy Camp Creek watersheds is formed by US Highway 24 that borders the northwest boundary of the subdivision. The major basin divide between the Jimmy Camp Creek and the Peterson Field basin runs near the southwest corner of the site. Most of the land within the Hillcrest Acres subdivision discharges to the Marksheffel Road right-of-way. The City property along Highway 94 drains to the Hwy 94 right-of-way and concentrates at either the intersection of Hwy 94/24 or the intersection at Hwy 94 and Marksheffel Road.

Refer to the drainage basin descriptions below as well as the Existing Drainage Map located within the Appendix of this report for detailed descriptions of historic drainage patterns.

Detailed Drainage Discussion

Design Point 1

Basin 664R consists of approximately 1.09 acres of the eastern half of existing Marksheffel Road and a portion of Highway 24 located to the north and east of the site. The basin consists of an asphalt paved roadway surface, curb and gutter and a raised concrete median. Runoff from the basin is collected and conveyed within the roadway and 6" vertical curb and gutter to an existing public 5' Type R inlet (**IN664**) located at **Design Point 1** (Q5=5.1 Q100=9.1 cfs). Runoff collected by the inlet (**IN664**) (Q5=2.7 Q100=3.4 cfs) is conveyed within a public 24" storm sewer (**PR664**) that discharges to an existing 5'wide trapezoidal swale located within the Marksheffel Road ROW. An existing riprap pad is located at the terminus of the storm sewer and existing riprap check dams have been installed below **DP1** to aid in damping discharge and preventing erosion. Runoff bypassing the inlet continues south within the curb and gutter to downstream infrastructure **Design Point 5**.

Design Point 2

Basin 662L consists of approximately 1.21 acres of existing western half of Marksheffel Road and a portion of Highway 24 located to the north and east of the site. The basin consists of an asphalt paved roadway surface and curb and gutter. Runoff from the basin (Q5=5.6, Q100=10.0 cfs) is collected and conveyed within the western 6" vertical curb and gutter and pavement to a 5' Type R inlet (**IN662**) located at **Design Point 2**. Runoff collected by the inlet (**IN662**) (Q5=3.0 Q100=3.8 cfs) is conveyed within a public 24" storm sewer (**PR662**) that discharges within the Marksheffel Road ROW 5' wide swale. An existing riprap pad is located at the terminus of the storm sewer. Runoff bypassing the inlet continues south within the curb and gutter to downstream infrastructure **Design Point 3**.

Design Point 3

Basin 661L consists of approximately 0.07 acres of the western half of Marksheffel Road located to the north and east of the site. The basin consists of an asphalt paved roadway surface and existing curb and gutter. Runoff from the basin (Q5=0.3, Q100=0.6 cfs) is collected and conveyed within the western 6" vertical curb and gutter and pavement to a 5' Type R inlet (**IN661**) located at **Design Point 3**. Runoff from **Basin 661L** combines with flow by from **IN662** at peak flow rates of 2.9 and 6.7 cfs in the 5 year and 100-year events respectively. Runoff collected by the inlet (**IN661**) (Q5=1.9, Q100=3.2 cfs) is conveyed within a public 18" storm sewer (**PR661**) that discharges within the Marksheffel Road ROW 5' swale. An existing riprap pad is located at the terminus of the storm sewer. Runoff bypassing the inlet continues south within the curb and gutter to downstream infrastructure **Design Point 7**.

Design Point 4

Basin A consists of approximately 4.67 acres within public right of way, north of the site which occurs as a result of the relocation of Marksheffel Road. This area is currently undeveloped and is covered in sparse prairie grasses and vegetation. The assumptions in the **MDDP** were conservative and with re-examination of this site, it was determined the length of overland flow for the existing condition would be 300 feet (non-urban land use) instead of the 100 feet stated in the **MDDP** Existing Conditions Drainage Calculations Rational sheet, hence an increased time of concentration leading to a lower flow rate. Runoff from the basin (Q5=1.1, Q100=7.8 cfs) drains northwest to the southeast where it combines with the up-gradient roadway discharge from **DP's 1-3** within the existing Marksheffel Road ROW existing swale at **Design Point 4**. The combined runoff at **DP4** has been calculated to reach peak flow rates of 5.3 and 13.6 cfs in the 5 year and 100-year storm events respectively. The runoff continues south into **Basin B**.

Design Point 5

Basin 654R consists of approximately 1.62 acres of existing Marksheffel Road, located to the east of the site. This basin consists of an asphalt paved roadway surface and existing curb and gutter. Runoff from the basin (Q5=7.1, Q100=12.8 cfs) drains from the west across the street onto the east side gutter, and then flows south until it combines with flow by of **IN664** is collected by an existing Type R 5' inlet

(**IN654**: Q5=3.8, Q100=5.0 cfs). Runoff collected through this inlet (**IN654)** will be conveyed within a 24" public storm sewer (**PR654**) across to the western side of the road where it will discharge into the existing Marksheffel Road ROW swale. The combined flows for the 5 year and 100-year events that reach the **Design Point 5** are Q5=9.4 and Q100=18.2 cfs. An existing riprap pad is located at the terminus of the storm sewer. Runoff bypassing the inlet continues south within the curb and gutter to downstream infrastructure **Design Point 7**.

Design Point 6

Basin B consists of 3.64 undeveloped acres, where a majority of the area is in Lots 19, 20, and the 5' swale on the west side of Marksheffel Road. Currently the basin consists of undeveloped land covered by sparse prairie grasses and vegetation. **Basin B** is situated in the northeast corner of the proposed site. Runoff produced within **Basin B** is anticipated to reach peak runoff rates of Q5=0.8 and Q100=6.1 cfs and will flow south towards **Design Point 6**, where it combines with runoff of **DP4** and **PR654**. The combined flows for the 5 year and 100-year events in this basin are 7.8 and 21.3 cfs, respectively. Runoff from this design point continues to flow south to **Design Point 9**.

Design Point 7

Basin 646R consists of approximately 0.75 acres of the east side of existing Marksheffel Road, located to the east of the site. This basin consists of an asphalt paved roadway surface and existing curb and gutter. Runoff from the basin (Q5=3.5, Q100=6.2 cfs) drains from the crown of the road down to the east side gutter and combines with **FBIN661** and **FBIN654** and is collected by an existing Type R 5' inlet **IN646** at the design point (Q5=3.4, Q100=4.7 cfs). Runoff collected through this inlet will be conveyed to the western side of the road by entering a 24" public storm sewer **PR646** where it will discharge into the existing onsite swale. The total combined 5 year and 100-year flows at **Design Point 7** are 8.1 and 18.5 cfs, respectively. An existing riprap pad is located at the terminus of the storm sewer. Runoff bypassing the inlet continues south within the curb and gutter to downstream infrastructure **Design Point 14**.

Design Point 8

Basins C, D and **F** consist of approximately 2.51, 2.10 and 1.0 acres, respectively, of existing U.S. Highway 24 located to the northwest of the site. These basins consist of an asphalt paved roadway, and a grass-lined swale on the east side of U.S. Highway 24. Runoff from the three basins (**Basin C**: Q5=5.0, Q100=10.2 cfs; **Basin D**: Q5=3.7, Q100=8.8; **Basin F**: Q5=1.5, Q100=3.9) are conveyed south in the swale towards **Design Point 22.** The combined flowrates at **Design Point 8** are Q5=7.2, Q100=16.2 cfs in the 5 year and 100-year events, respectively. CDOT will repair this ditch so that flows do not enter the site. In the interim the proposed early grading will provide a grading berm until CDOT can properly repair the ditch.

Design Point 9

Basin E consists of approximately 10.82 acres of Lots 17, 18, and 19 located on the north side of the site. Currently the basin consists of undeveloped land covered by sparse prairie grasses and vegetation. Runoff from the basin (Q5=2.2, Q100=15.9 cfs) combines with runoff from **DP6** and **PR646** in the 5' Marksheffel Road ROW swale. The combined runoff at **DP9** has been calculated to reach peak flow rates of 10.9 and 36.2 cfs in the 5 and 100-year storm events, respectively. Runoff from this design point continues to flow south.

Design Point 10

Basin H consists of approximately 15.03 acres of Lots 13, 14, and 15, along the west side of the site. This undeveloped basin is sparse prairie grasses and vegetation. Runoff from the basin (Q5=3.0, Q100=22.1 cfs) drains from the south to north until it collecting in a localized depression area. The effects from temporary ponding were not considered in hydrologic analysis. Runoff continues east, where it enters **Basin G**.

Design Point 11

Basin G consists of approximately 8.99 acres of Lots 15, 16, and 18 located near the center of the site. This basin consists of undeveloped land covered by sparse prairie grasses and vegetation. The assumptions in the **MDDP** were conservative and with re-examination of this site (visual examination), it was determined **Basin F** runoff will continue south along the swale. **Basin G** (Q5=1.9, Q100=13.9 cfs) drains west to east where it collects with flow from **DP10** in the existing Marksheffel Road ROW swale. The combined flow at **DP11** has been calculated to reach peak flow rates of 3.6 and 26.6 cfs in the 5 year and 100-year storm events, respectively. Runoff from this design point continues to flow south to **Design Point 13**.

Design Point 12

Basin 641L consists of approximately 1.58 acres of the west side of Marksheffel Road, located east of the site. This basin is mainly comprised of an asphalt paved roadway surface and existing curb and gutter. Runoff from the basin (Q5=5.8, Q100=10.4 cfs) is directed to a 5' Type R existing inlet at the design point (**IN640:**Q5=2.9, Q100=3.8 cfs). Runoff collected by this inlet is conveyed to an existing swale via a public 24" storm sewer, **PR640**. An existing riprap pad is located at the terminus of the storm sewer. Runoff bypassing the inlet continues south within the curb and gutter to downstream infrastructure **Design Point 18**.

Design Point 13

Basin I consists of approximately 4.22 acres of Lots 12 and 16, located along the east side of the site. This undeveloped basin is covered by sparse prairie grasses and vegetation, and a portion of a dirt road. Runoff from the basin (Q5=1.0, Q100=7.0 cfs) drains from the southern side of the basin, flows northeast and combines with flows from **DP9, DP11,** and **PR640**. An existing private 36" culvert (**PR639**) directs runoff under the Air Lane Drive entrance. The combined flow for the 5 year and 100-year events at the **Design Point 13** is 15.5 and 67.4 cfs, respectively. Flow from here will continue to head south in an existing swale into the next basin.

Design Point 14

Basin 637R consists of approximately 0.91 acres of the eastern side of Marksheffel Road, located to the east of the site. This basin consists of a roadway surface and curb and gutter. Runoff from the basin (Q5=3.1, Q100=5.5 cfs) drains from the median on the west side into the east side gutter which flows south and combines with **FBIN646** at **Design Point 14** with 5 year and 100-year runoff of 6.0 and 14.8 cfs, and is collected by an existing Type R 5' inlet (**IN636**: Q5=3.0, Q100=4.3 cfs). Runoff collected through this inlet is conveyed to the western side of the road through an existing public 24"storm sewer (**PR636**) where it will discharge into the existing Marksheffel Road ROW swale. An existing riprap pad is located at the terminus of the storm sewer. Runoff bypassing the inlet continues south within the curb and gutter to downstream infrastructure **Design Point 17**.

Design Point 15

Basin J consists of approximately 2.88 acres of Lots 10, 11, and 12, on the east side of the site. This undeveloped basin is covered by sparse prairie grasses and vegetation, a portion of a dirt road, and a swale on the west side of the road. Runoff from the basin (Q5=0.7, Q100=5.3 cfs) drains from the western side of the basin, and then flows east until it combines with flows from **DP13** and **PR636**. The combined flow for the 5 year and 100-year events at **DP15** are 16.4 and 68.3 cfs, respectively. This flow continues south within an existing swale on the west side of the road.

Design Point 16

Basin J1 consists of approximately 2.67 acres of Lots 10 and 11, and a portion of the swale on the located on the southeast side of the site. This undeveloped basin is comprised of sparse prairie grasses and vegetation, and a portion of the existing swale on the west of the road. Runoff from the basin (Q5=0.6, Q100=4.3 cfs) drains from the western side of the basin, and then flows southeast until it combines with flows from **DP15**. The combined flow for the 5 year and 100-year events at the design point are 15.2 and 64.6 cfs, respectively. This flow will collect in an existing Type C area inlet and will continue south-

southwest through an existing 24" public storm sewer, **PRE2 (**Q5=15.2, Q100=64.6 cfs), into an existing extended detention basin. An existing rip rap rundown is provided to prevent erosion.

Design Point 17

Basin 631R consists of approximately 0.56 acres of the existing eastern side of Marksheffel Road, located to the southeast of the site. This basin consists of an asphalt paved roadway surface and existing curb and gutter. Runoff from the basin (Q5=2.4, Q100=4.2 cfs) drains from the median on the west side into the east side gutter, then flows south and combines with **FBIN636** at 5 year and 100-year peak runoffs of 4.1 and 11.9 cfs, and is collected by an existing Type R 5' inlet at the design point (**IN630A**: Q5=2.6, Q100=4.1 cfs). Runoff collected through this inlet is conveyed to the western side of the road through an existing public 24" storm sewer (**PR630A**) where it will discharge into existing public 24" storm sewer (**PR630B**), which then discharges into the existing water quality pond. An existing riprap pad is located at the terminus of the storm sewer. Runoff bypassing the inlet will wrap around the curb return and continue south and east to the downstream infrastructure to an existing inlet along HWY 94.

Design Point 18

Basin 632L consists of approximately 1.21 acres of the existing western side of Marksheffel Road, located to the southeast of the site. This basin consists of an asphalt paved roadway surface and existing curb and gutter. Runoff from the basin (Q5=4.5, Q100=8.1 cfs) drains from the median on the east side into the west side gutter, then flows south combining with **FBIN640** at rates of Q5=5.8 and Q100=11.6 cfs until it is collected by an existing Type R 15' inlet at the design point (**IN630B**: Q5=5.8, Q100=10.3 cfs). Runoff collected through this inlet is conveyed west through an existing public 24" storm sewer (**PR630B: Q5=8.9, Q100=15.2 cfs**), where it discharges into the existing extended detention basin. An existing riprap pad is located at the terminus of the storm sewer. Runoff bypassing the inlet will wrap around the curb return and continue south and west to the downstream infrastructure to **Design Point 19**.

Design Point 19

Basin L consists of approximately 0.35 acres of the existing western side of Marksheffel Road, on the southeast side of the site, which curves and turns into U.S. Highway 94, located to the south of the site. This basin consists of an asphalt paved roadway surface with an existing curb and gutter along a portion of the road. Runoff from the basin (Q5=1.6, Q100=2.9 cfs) drains from the median on the south side into the north side gutter, and then drains east. It combines with **FBIN630B** at rates of 1.6 and 4.9 cfs in the 5 year and 100-year events, and is then collected by an existing public 12" plastic corrugated pipe (**PRE1:** Q5=1.6, Q100=4.9 cfs) at **DP19** (Q5=1.6, Q100=4.9 cfs). The collected flows are then conveyed north to an existing water quality detention pond 630. An existing riprap pad is located at the terminus of the plastic storm sewer. In the event any runoff will bypass this flared-end section, the runoff will bypass the curb and gutter and outfall into an existing water quality detention pond 630.

Design Point 20

Basin K consists of approximately 3.33 acres of Lot 11 public right of way on the south side of the site. This undeveloped basin is comprised of sparse prairie grasses and vegetation. Runoff from the basin (Q5=0.8, Q100=5.9 cfs) drains from the northern side of the basin to the south until it combines with flows from **PR630B, PRE1** and **PRE2** in the existing extended detention basin at the southeastern end of the site**.** A rip rap pad is located at the terminus of the outlet structure. The combined flow for the 5 year and 100-year events at the **Design Point 20** is 21.0 and 77.8 cfs, respectively. From here the flow will continue to drain west. These flows will be routed through the outlet structure as designed in the **MRFD**. The flows calculated at **DP20** (Q5=21.0 cfs, Q100=77.8 cfs) are less than the flows calculated in the **MRFD** (Q5=35.98 cfs, Q100=97.97 cfs).

Design Point 21

Basin M consists of approximately 13.93 acres of Lots 9, 10, 16 and public right of way, and is located on the south side of the site. This undeveloped basin is comprised primarily of sparse prairie grasses and vegetation. Runoff from the basin (Q5=3.0, Q100=22.2 cfs) drains from the northern side of the basin

to the south until it combines with flows from **DP20. Basin N** consists of approximately 0.71 acres of the existing northern side of U.S. Highway 94, located to the south of the site. This basin consists of an asphalt paved roadway surface and existing grassy swale on the north side of the road. Runoff from this basin (Q5=3.3, Q100=5.9 cfs) drains from the median on the south side into the aforementioned swale to the north, and then flows east until it combines with flows from **Basin M** and **DP20 (PRE5,** (Q5=21.0 cfs, Q100=77.8 cfs)). Combined flows at **DP21** for the 5 year and 100-year events are 24.1 and 93.3 cfs, respectively. From here, the combined flows drain offsite to the south through an existing 42" CMP storm sewer (**E3:** Q5=24.1, Q100=93.3 cfs), which discharges into a broad, natural swale.

Design Point 22

Basin O consists of approximately 11.52 acres of Lots 9, 13, 16 and public right of way, and is located on the southwestern side of the site. This undeveloped basin is comprised primarily of sparse prairie grasses and vegetation, with a 31' wide dirt road running through it. Runoff from the basin (Q5=2.3, Q100=17.0 cfs) drains from the northeast side of the basin to the southwest until it runs into a localized depression. **Basin P** has a similar land description as the aforementioned basin, except it is approximately 9.17 acres in size, contains a portion of the grassy swale on the eastern side of U.S. Highway 24, and is comprised of Lot 6, 14, and public right of way. Runoff from this basin (Q5=1.6, Q100=11.9 cfs) drains from north to south, and also drains into the depression. **Basin Q** consists of approximately 1.41 acres of existing U.S. Highway 94, and is located on the southwestern side of the site. This basin is comprised of an asphalt paved roadway surface. Runoff from this basin (Q5=6.6, Q100=11.8 cfs) also drains into the depression. These flows combine with **DP8** for the 5 year and 100-year storms at Design **Point 22** are 11.8 and 42.9 cfs, respectively. This flow then exits the site through an existing public 48" corrugated metal pipe (**E4:** Q5=11.8, Q100=42.9 cfs).

PROPOSED DRAINAGE CHARACTERISTICS

General Concept Drainage Discussion

Improvements proposed for early grading are overlot grading to balance the earthworks, prepare the site for future development, provide temporary sediment basins, surface roughing and temporary mulching and seeding. The outlet structures of the proposed FSD ponds will release runoff to the existing public 42" and 48" CMP public storm sewers located at the southeast and southwest corners of the site, respectively. A visual inspection of these existing structures shall be made before use. The existing public 42" storm sewer connects to a proposed storm sewer system on the adjacent property, where it eventually reaches Jimmy Camp Creek. The concept storm system is proposed with the Reagan Ranch master development. An excerpt map of the MDDP for this development is included in the Appendix to show the general storm system location. The 48" CMP ties into an existing public storm sewer system which will route the remaining treated runoff to Sand Creek. For more information of drainage basins, existing and proposed structures refer to the Proposed Drainage Map located within the Appendix of this report.

Detailed Drainage Discussion

discuss WQ for final design. where will flows be routed and by which pond will they be treated?

Design Point 1

Basin 664R consists of approximately 1.09 acres of the eastern half of existing Marksheffel Road and a portion of Highway 24 located to the north and east of the site. The basin consists of an asphalt paved roadway surface, curb and gutter and a raised concrete median. Runoff from the basin is collected and conveyed within the roadway and 6" vertical curb and gutter to an existing public 5' Type R inlet (**IN664**) located at **Design Point 1** (Q5=5.1 Q100=9.1 cfs). Runoff collected by the inlet (Q5=2.7 Q100=3.4 cfs) is conveyed within a public 24" storm sewer (**PR664**) that discharges to an existing 5'wide trapezoidal swale located within the Marksheffel Road ROW. An existing riprap pad is located at the terminus of the storm sewer and existing riprap check dams have been installed below **DP1** to aid in damping discharge and preventing erosion. Runoff bypassing the inlet continues south within the curb and gutter to downstream infrastructure **Design Point 5**.

Design Point 2

Basin 662L consists of approximately 1.21 acres of existing western half of Marksheffel Road and a portion of Highway 24 located to the north and east of the site. The basin consists of an asphalt paved roadway surface and curb and gutter. Runoff from the basin (Q5=5.6, Q100=10.0 cfs) is collected and conveyed within the western 6" vertical curb and gutter and pavement to a 5' Type R inlet (**IN662**) located at **Design Point 2**. Runoff collected by the inlet (Q5=3.0 Q100=3.8 cfs) is conveyed within a public 24" storm sewer (**PR662**) that discharges within the Marksheffel Road ROW existing swale. An existing riprap pad is located at the terminus of the storm sewer. Runoff bypassing the inlet continues south within the curb and gutter to downstream infrastructure.

Design Point 3

Basin 661L consists of approximately 0.07 acres of the western half of Marksheffel Road located to the north and east of the site. The basin consists of an asphalt paved roadway surface and existing curb and gutter. Runoff from the basin (Q5=0.3, Q100=0.6 cfs) is collected and conveyed within the western 6" vertical curb and gutter and pavement to a 5' Type R inlet (**IN661**) located at **Design Point 3**. Runoff from **Basin 661L** combines with flow by from **IN662** at peak flow rates of 2.9 and 6.7 cfs in the 5 year and 100-year events respectively. Runoff collected by the inlet (Q5=1.9, Q100=3.2 cfs) is conveyed within a public 18" storm sewer (**PR661**) that discharges within the Marksheffel Road ROW existing swale. An existing riprap pad is located at the terminus of the storm sewer. Runoff bypassing the inlet continues south within the curb and gutter to downstream infrastructure.

Design Point 4

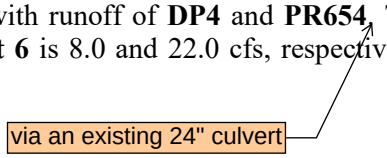
Basin A consists of approximately 4.67 acres within public right of way, north of the site which occurs as a result of the relocation of Marksheffel Road. This area is currently undeveloped and is covered in sparse prairie grasses and vegetation. Runoff from the basin (Q5=1.1, Q100=7.8 cfs) drains northwest to the southeast where it combines with the up-gradient roadway discharge from **DP's 1-3** within the existing Marksheffel Road ROW existing swale at **Design Point 4**. The combined runoff at **DP4** has been calculated to reach peak flow rates of 5.3 and 13.6 cfs in the 5 year and 100-year storm events respectively. The runoff continues south into **Basin B**.

Design Point 5

Basin 654R consists of approximately 1.62 acres of existing Marksheffel Road, located to the east of the site. This basin consists of an asphalt paved roadway surface and existing curb and gutter. Runoff from the basin (Q5=7.1, Q100=12.8 cfs) drains from the west across the street onto the east side gutter, and then flows south until it combines with flow by of **IN664** is collected by an existing Type R 5' inlet (**IN654**: Q5=3.8, Q100=5.0 cfs). Runoff collected through this inlet will be conveyed within a 24" public storm sewer (**PR654**) across to the western side of the road where it will discharge into the existing 5' wide Marksheffel Road ROW swale. The combined flows for the 5 year and 100-year events that reach the **Design Point 5** are Q5=9.4 and Q100=18.2 cfs. An existing riprap pad is located at the terminus of the storm sewer. Runoff bypassing the inlet continues south within the curb and gutter to downstream infrastructure.

Design Point 6

Basin B and **Basin D** consists of 2.92 and 1.13 undeveloped acres, where a majority of the area is in Lots 20 and an existing swale on the west side of Marksheffel Road. Currently the basins consist of undeveloped land covered by sparse prairie grasses and vegetation. **Basin B** and **Basin D** are situated in the northeast corner of the proposed site. Runoff produced within **Basin B** and **Basin D** are anticipated to reach peak runoff rates of Q5=0.7 and Q100=5.0 cfs and Q5=0.5 and Q100=3.4 cfs, respectively. This runoff will flow south towards **Design Point 6**, where it combines with runoff of **DP4** and **PR654**. The combined flows for the 5 year and 100-year events for **Design Point 6** is 8.0 and 22.0 cfs, respectively. Runoff from this design point continues to flow south.



Design Point 7

Basin 646R consists of approximately 0.75 acres of the east side of existing Marksheffel Road, located to the east of the site. This basin consists of an asphalt paved roadway surface and existing curb and gutter. Runoff from the basin (Q5=3.5, Q100=6.2 cfs) drains from the crown of the road down to the east side gutter and combines with **FBIN661** and **FBIN654** and is collected by an existing Type R 5' inlet **IN646** at the design point (Q5=3.4, Q100=4.7 cfs). Runoff collected through this inlet will be conveyed to the western side of the road by entering a 24" public storm sewer **PR646** where it will discharge into the existing onsite swale. The total combined 5 year and 100-year flows at **Design Point 7** is 8.1 and 18.5 cfs, respectively. An existing riprap pad is located at the terminus of the storm sewer. Runoff bypassing the inlet continues south within the curb and gutter to downstream infrastructure.

Design Point 8

Basins C consist of approximately 2.51 acres of existing U.S. Highway 24 located to the northwest of the site. This basin consists of asphalt paved roadway, and a grass-lined swale on the east side of U.S. Highway 24. Runoff from **Basin C** Q5=8.2, Q100=10.8 cfs is conveyed south in the swale towards **Design Point 22.** The flowrates at **Design Point 8** are Q5=5.2, Q100=10.8 cfs in the 5 year and 100-year events. CDOT will repair this ditch so that flows do not enter the site. In the interim the proposed early grading will provide a grading berm until CDOT can properly repair the ditch.

Design Point 9

Basins F consist of approximately 2.57 acres of partial Lots 18 and 19 located to the northeast of the site. This basin consists of early overlot grading to balance the earthworks and prepare the site for future development. Runoff from **Basin F** Q5=1.5, Q100=8.4 cfs is conveyed south to a temporary sediment basin at **Design Point 9.** The flows from **Temporary Sediment Basin 1 (TSB1)** will discharge through a 6" PVC storm sewer into the existing Marksheffel Road ROW swale.

Design Point 10

Basins E consist of approximately 9.53 acres of partial Lots 15, 18 and 19 located to the northeast of the site. This basin consists of early overlot grading to balance the earthworks and prepare the site for future development. Runoff from **Basin E** Q5=3.9, Q100=21.5 cfs is conveyed south to a temporary sediment basin at **Design Point 10.** The flows from **Temporary Sediment Basin 2 (TSB2)** will discharge through a 6" PVC storm sewer into the existing Marksheffel Road ROW swale.

Design Point 11

Basin G consists of approximately 1.62 acres located on the northeast side of the site. Currently the basin consists of a small part of Lots 16, 17 and the 5' swale on the west side of Marksheffel Road. Runoff from the basin (Q5=0.6, Q100=3.7 cfs) combines with runoff from **DP6, DP9, DP10** and **PR646** in the existing Marksheffel Road ROW swale. The combined runoff at **Design Point 11** has been calculated to reach peak flow rates of 12.7 and 42.9 cfs in the 5 and 100-year storm events, respectively. Runoff from this design point continues to flow south.

Design Point 12

Basins H consist of approximately 11.25 acres of Lots 13, 14 and part of Lot 15 located to the west of the site. This basin consists of early overlot grading to balance the earthworks and prepare the site for future development. Runoff from **Basin H** Q5=4.5, Q100=24.4 cfs is conveyed south to a temporary sediment basin at **Design Point 12.** The flows from **Temporary Sediment Basin 3 (TSB3)** will discharge through a 6" PVC storm sewer into the existing Marksheffel Road ROW swale.

Design Point 13

Basins F1 consist of approximately 12.10 acres of Lots 12, 16 and part of Lot 17 located to the east of the site. This basin consists of early overlot grading to balance the earthworks and prepare the site for future development. Runoff from **Basin F1** Q5=4.7, Q100=25.8 cfs is conveyed south to a temporary sediment

basin at **Design Point 13.** The flows from **Temporary Sediment Basin 4 (TSB4)** will discharge through a 6" PVC storm sewer into the existing Marksheffel Road ROW swale.

Design Point 14

Basin 641L consists of approximately 1.58 acres of the west side of Marksheffel Road, located east of the site. This basin is mainly comprised of an asphalt paved roadway surface and existing curb and gutter. Runoff from the basin (Q5=5.8, Q100=10.4 cfs) is directed to a 5' Type R existing inlet at the design point (**IN640:**Q5=2.9, Q100=3.8 cfs). Runoff collected by this inlet is conveyed to the existing swale via a public 24" storm sewer, **PR640**. An existing riprap pad is located at the terminus of the storm sewer. Runoff bypassing the inlet continues south within the curb and gutter to downstream infrastructure.

Design Point 15

Basin J consists of approximately 1.13 acres located on the northeast side of the site. Currently the basin consists of a small part of Lots 16, 12 and the 5' swale on the west side of Marksheffel Road. Runoff from the basin (Q5=0.5, Q100=2.9 cfs) combines with runoff from **DP11, DP12, DP13** and **PR640** in the existing Marksheffel Road ROW swale. The combined runoff at **Design Point 15** has been calculated to reach peak flow rates of 18.5 and 72.0 cfs in the 5 and 100-year storm events, respectively. Runoff from this design point continues to flow south.

Design Point 16

Basin 637R consists of approximately 0.91 acres of the eastern side of Marksheffel Road, located to the east of the site. This basin consists of a roadway surface and curb and gutter. Runoff from the basin (Q5=3.1, Q100=5.5 cfs) drains from the median on the west side into the east side gutter which flows south and combines with **FBIN646** at **Design Point 16** with 5 year and 100-year runoff of 6.0 and 14.8 cfs, and is collected by an existing Type R 5' inlet (**IN636**: Q5=3.0, Q100=4.3 cfs). Runoff collected through this inlet is conveyed to the western side of the road through an existing public 24"storm sewer (**PR636**) where it will discharge into the existing Marksheffel Road ROW swale. An existing riprap pad is located at the terminus of the storm sewer. Runoff bypassing the inlet continues south within the curb and gutter to downstream infrastructure.

Design Point 17

Basin J1 consists of approximately 1.14 acres located on the east side of the site. Currently the basin consists of a small part of Lots 11 and the 5' swale on the west side of Marksheffel Road. Runoff from the basin (Q5=0.5, Q100=2.7 cfs) combines with runoff from **DP15** and **PR636** in the existing Marksheffel Road ROW swale. The combined runoff at **Design Point 17** has been calculated to reach peak flow rates of 19.5 and 71.8 cfs in the 5 and 100-year storm events, respectively. Runoff from this design point continues to flow south.

Design Point 18

Basin K consists of approximately 11.16 acres of Lots 16 and part of Lot 9 located to the southwest of the site. This basin consists of early overlot grading to balance the earthworks and prepare the site for future development. Runoff from **Basin K** Q5=4.8, Q100=26.0 cfs is conveyed south to a temporary sediment basin at **Design Point 18.** The flows from **Temporary Sediment Basin 5 (TSB5)** will discharge through a 6" PVC storm sewer to an existing 48" CMP public storm sewer located at the southwest corner of the site, **Design Point 26**.

Design Point 19

Basins I consist of approximately 13.13 acres of Lots 10 and part of Lot 9 located to the southeast of the site. This basin consists of early overlot grading to balance the earthworks and prepare the site for future development. Runoff from **Basin I** Q5=5.2, Q100=28.6 cfs is conveyed south to a temporary sediment basin at **Design Point 19.** The flows from **Temporary Sediment Basin 6 (TSB6)** will discharge through a 6" PVC storm sewer into the existing Marksheffel Road ROW swale.

Design Point 20

Basin 631R consists of approximately 0.56 acres of the existing eastern side of Marksheffel Road, located to the southeast of the site. This basin consists of an asphalt paved roadway surface and existing curb and gutter. Runoff from the basin (Q5=2.4, Q100=4.2 cfs) drains from the median on the west side into the east side gutter, then flows south and combines with **FBIN636** at 5 year and 100-year peak runoffs of 4.1 and 11.9 cfs, and is collected by an existing Type R 5' inlet at the design point (**IN630A**: Q5=2.6, Q100=4.1 cfs). Runoff collected through this inlet is conveyed to the western side of the road through an existing public 24" storm sewer (**PR630A**) where it will discharge into existing public 24" storm sewer (**PR630B**), which then discharges into the existing water quality pond. An existing riprap pad is located at the terminus of the storm sewer. Runoff bypassing the inlet continues south within the curb and gutter to downstream infrastructure.

Design Point 21

Basin 632L consists of approximately 1.21 acres of the existing western side of Marksheffel Road, located to the southeast of the site. This basin consists of an asphalt paved roadway surface and existing curb and gutter. Runoff from the basin (Q5=4.5, Q100=8.1 cfs) drains from the median on the east side into the west side gutter, then flows south combining with **FBIN640** at rates of Q5=5.8 and Q100=11.6 cfs until it is collected by an existing Type R 15' inlet at the design point (**IN630B**: Q5=5.8, Q100=10.3 cfs). Runoff collected through this inlet is conveyed west through an existing public 24" storm sewer (**PR630B: Q5=8.9, Q100=15.2 cfs**), where it discharges into the existing extended detention basin. An existing riprap pad is located at the terminus of the storm sewer. Runoff bypassing the inlet continues south within the curb and gutter to downstream infrastructure.

Design Point 22

Basin L consists of approximately 1.11 acres of a portion of Lots 11, and a portion of the existing 5' swale on the west of the road. Runoff from the basin (Q5=0.4, Q100=2.5 cfs) drains south and combines with flows from **DP17**. The combined flow for the 5 year and 100-year events at the **Design Point 22** are 18.3 and 67.6 cfs, respectively. This flow will collect in an existing Type C area inlet and will continue south-southwest through an existing 24" public storm sewer, **PRE2 (**Q5=18.3, Q100=67.6 cfs), into an existing extended detention basin. An existing rip rap rundown is provided to prevent erosion.

Design Point 23

Basin N consists of approximately 0.35 acres of the existing western side of Marksheffel Road, on the southeast side of the site, which curves and turns into U.S. Highway 94, located to the south of the site. This basin consists of an asphalt paved roadway surface with an existing curb and gutter along a portion of the road. Runoff from the basin (Q5=1.6, Q100=2.9 cfs) drains from the median on the south side into the north side gutter, and then drains east. It combines with **FBIN630B** at rates of 1.6 and 4.9 cfs in the 5 year and 100-year events, and is then collected by an existing public 12" plastic corrugated pipe (**PRE1:** Q5=1.6, Q100=5.0 cfs). The collected flows are then conveyed north to an extended detention basin. An existing riprap pad is located at the terminus of the plastic storm sewer. Runoff bypassing the inlet continues east within the curb and gutter to downstream infrastructure.

Design Point 24

Basin L1 consists of approximately 2.24 acres of public right of way on the south side of the site. This undeveloped basin is comprised of sparse prairie grasses and vegetation. Runoff from the basin (Q5=0.7, Q100=5.2 cfs) drains from the northern side of the basin to the south until it combines with flows from **PR630B, PRE1** and **PRE2** in the existing extended detention basin at the southeastern end of the site**.** An existing riprap pad is located at the terminus of the outlet structure. The combined flow for the 5 year and 100-year events at the **Design Point 24** is 24.1 and 80.1 cfs, respectively. From here the flow will continue to drain west. These flows will be routed through the outlet structure as designed in the **MRFD**. The flows calculated at **DP24** (Q5=24.1 cfs, Q100=80.1 cfs) are less than the flows calculated in the

MRFD (Q5=35.98 cfs, Q100=97.97 cfs). From visual inspection, the existing water quality and detention pond is functioning as intended.

Design Point 25

Basin L2 consists of approximately 7.05 acres of public right of way, and is located on the south side of the site. This undeveloped basin is comprised primarily of sparse prairie grasses and vegetation. Runoff from the basin (Q5=1.9, Q100=14.1 cfs) drains from the northern side of the basin to the south until it combines with flows from **DP24. Basin O** consists of approximately 0.72 acres of the existing northern side of U.S. Highway 94, located to the south of the site. This basin consists of an asphalt paved roadway surface and existing grassy swale on the north side of the road. Runoff from this basin (Q5=3.4, Q100=6.0 cfs) drains from the median on the south side into the aforementioned swale to the north, and then flows east until it combines with flows from **Basin L2** and **DP24**. The combined flows at **DP25** for the 5 year and 100-year events are 26.2 and 86.5 cfs, respectively. From here, the combined flows drain offsite to the south through an existing 42" CMP storm sewer (**E3:** Q5=26.2, Q100=86.5 cfs), which discharges into a broad, natural swale. The existing 42" CMP has capacity to carry the peak flow of 86.5 cfs. The proposed flows calculated at **DP25** (Q5=26.2 cfs, Q100=86.5 cfs) are less than the existing flows calculated in this report (Q5=24.1 cfs, Q100=93.3 cfs), see appendix existing rational calculations and existing conditions drainage map.

Design Point 26

Basin M consists of approximately 11.24 acres of public right of way, and is located on the southwestern side of the site. This undeveloped basin is comprised primarily of sparse prairie grasses and vegetation, with a 31' wide dirt road running through it. Runoff from the basin (Q5=7.0, Q100=28.7 cfs) drains from the northeast side of the basin to the southwest until it runs into a localized depression. **Basin P** consists of approximately 1.41 acres of existing U.S. Highway 94, and is located on the southwestern side of the site. This basin is comprised of an asphalt paved roadway surface. Runoff from this basin (Q5=6.5, Q100=11.7 cfs) also drains into the depression. These flows combine with **DP8** and **DP18** for the 5 year and 100-year storms at **Design Point 26** are 13.5 and 45.9 cfs, respectively. This flow then exits the site through an existing public 48" corrugated metal pipe (**E4:** Q5=13.5, Q100=45.9 cfs). The existing 48" CMP pipe has the capacity to carry the peak flow of 45.9 cfs.

EROSION CONTROL

It is the policy of El Paso County that a grading and erosion control plan be submitted with the drainage report. Proposed silt fence, vehicle traffic control, reseeding and mulching, straw bale barriers, and temporary sediment basins are proposed as a few of the erosion control measures.

DRAINAGE & BRIDGE FEES

Crossroads North subdivision lays within the Jimmy Camp Creek and Peterson Field Drainage Basins. Crossroads North will be platted in one or multiple phases or final plats. Crossroads North will be a re-plat of Hillcrest Acres, originally platted in 1960. The County Drainage Fee program did not exist in 1960, therefore drainage and bridge fees will be required to be paid upon platting and at the time the MDDP for the site is approved

CONSTRUCTION COST OPINION

The construction cost associated with the early grading are for earth moving, proposed silt fence, vehicle traffic control, reseeding and mulching, straw bale barriers, and temporary sediment basins. Assurances will be posted with the submittal early grading plan (GEC).

TEMPORARY SEDIMENT POND SUMMARY

A total of six proposed private temporary sediment basins have been designed per the Mile High Flood District (MHFD) Drainage Criteria manual (SB-5 and SB-6 details). The six temporary sediment basins are summarized below.

Temporary Sediment Pond Table

TSB	Upstream Drainage Basin	Required Volume (cubic-feet)	Provided Volume (cubic-feet)
1	F	7,841	16,117
2	E	27,007	40,511
3	H	31,799	68,825
4	F1	34,848	130,680
5	K	31,799	95,832
6	I	37,897	40,511.

SUMMARY

Development of Crossroads North will not adversely affect the surrounding development. The proposed early grading will adequately convey, detain and route runoff from the onsite & offsite flows to existing facilities. All drainage facilities described herein and shown on the included Proposed Drainage Map (See Appendix) are subject to change upon the MDDP being approved for the site. The final drainage report is only for the early grading. Care will be taken to accommodate overland emergency flow routes on site and temporary drainage conditions.

REFERENCES

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

2.) "Urban Storm Drainage Criteria Manual"

3.) Web Soil Survey, USDA NRCS Soils Map https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

4.) FEMA flood Map Service Center, Federal Emergency Management Agency https://msc.fema.gov/portal/home

5.) "Master Development Drainage Plan Preliminary and Final Drainage Report Hillcrest Acres Subdivision Parts Depot, El Paso County", last revised February 9, 2017, by Kiowa Engineering Corporation

6.) "Jimmy Camp Creek - Drainage Basin Planning Study Development of Alternatives & Design of Selected Plan Report" dated March 9, 2015 by Kiowa Engineering Corporation.

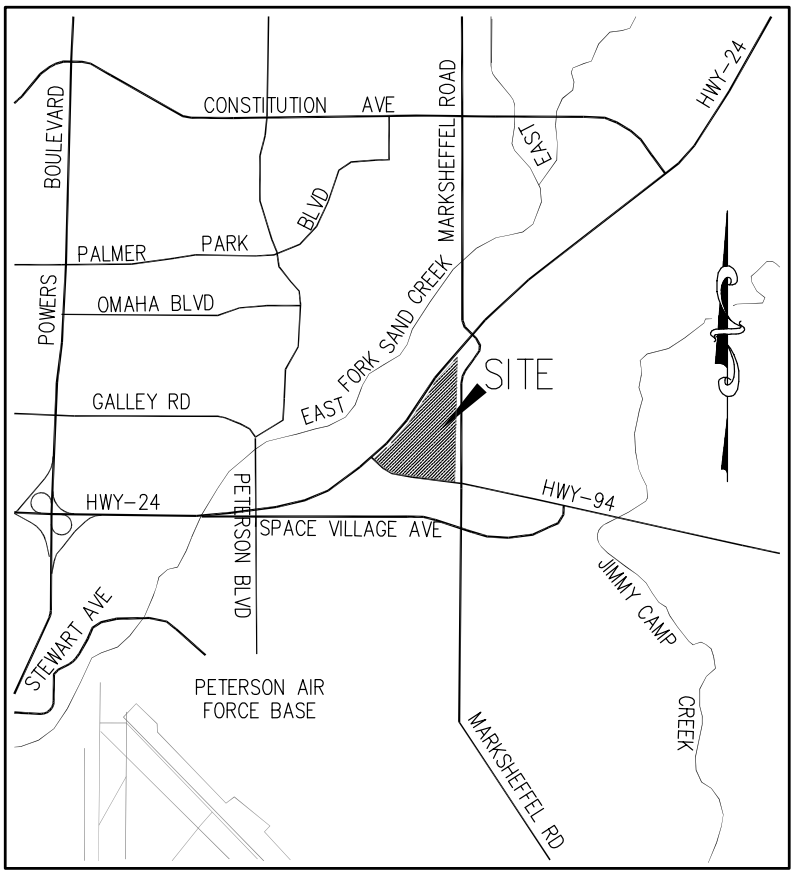
7.) "Marksheffel Road South, Link Road to US-24, Final Drainage Report" dated January 2017 by HDR Engineering.

8.) "Master Development Drainage Report for Reagan Ranch & Final Drainage Report for High Plains at Reagan Ranch" dated February 2021 by Matrix Design Group.

Comments for this review are preliminary in nature. Revise to provide pond bmp sheets on the next submittal.

APPENDIX

VICINITY MAP



VICINITY MAP

N.T.S.

SOILS MAP

Soil Map—El Paso County Area, Colorado
(CROSSROADS)

Map Scale: 1:6,730 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 300 600 1200 1800

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 18, Jun 5, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

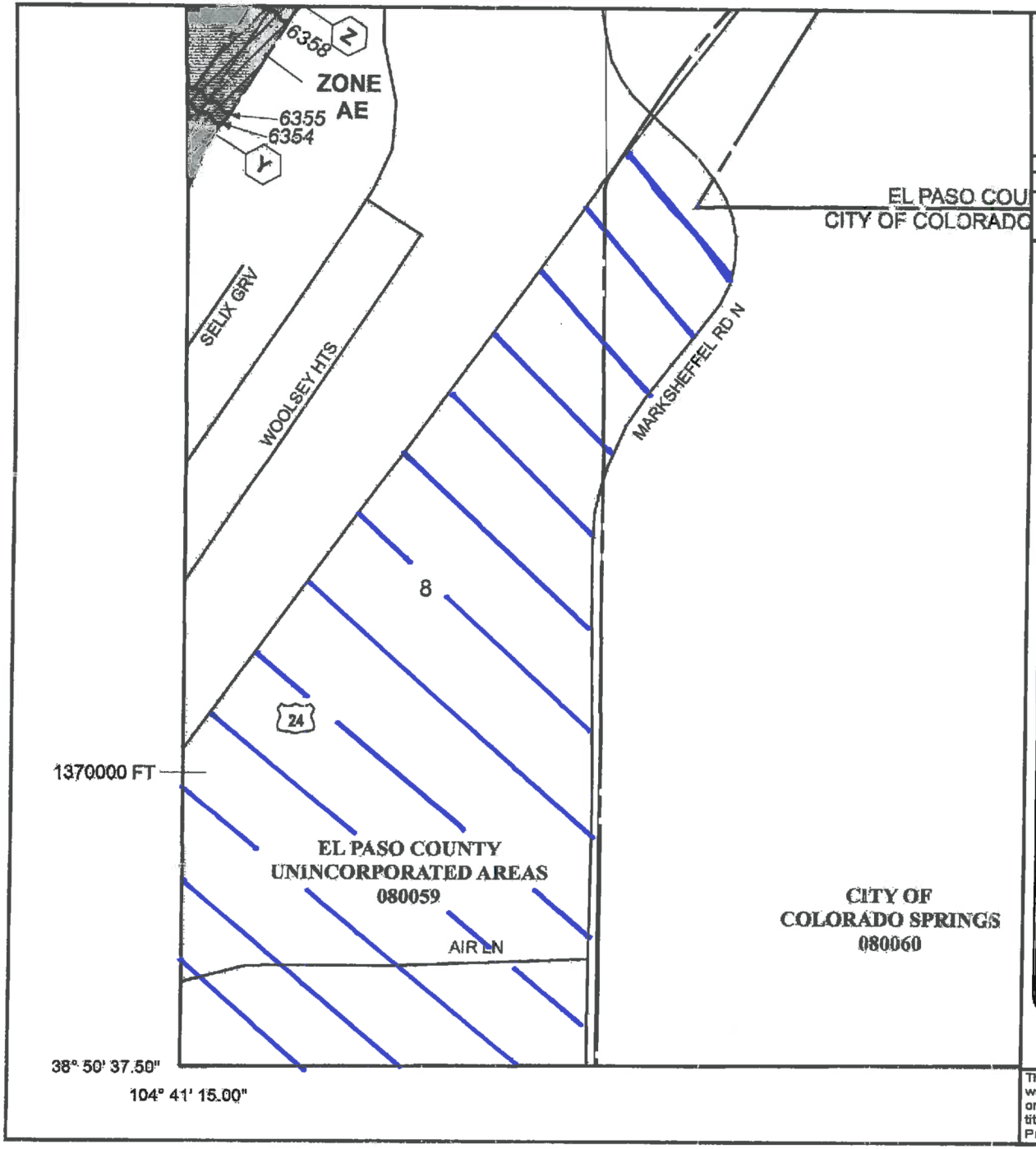
Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	95.2	100.0%
Totals for Area of Interest		**95.2**	**100.0%**

FIRM PANELS



MAP SCALE 1" = 500'

0 500 1000 FEET

NFIP

PANEL 0756G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 756 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0756	G
EL PASO COUNTY	080059	0756	G

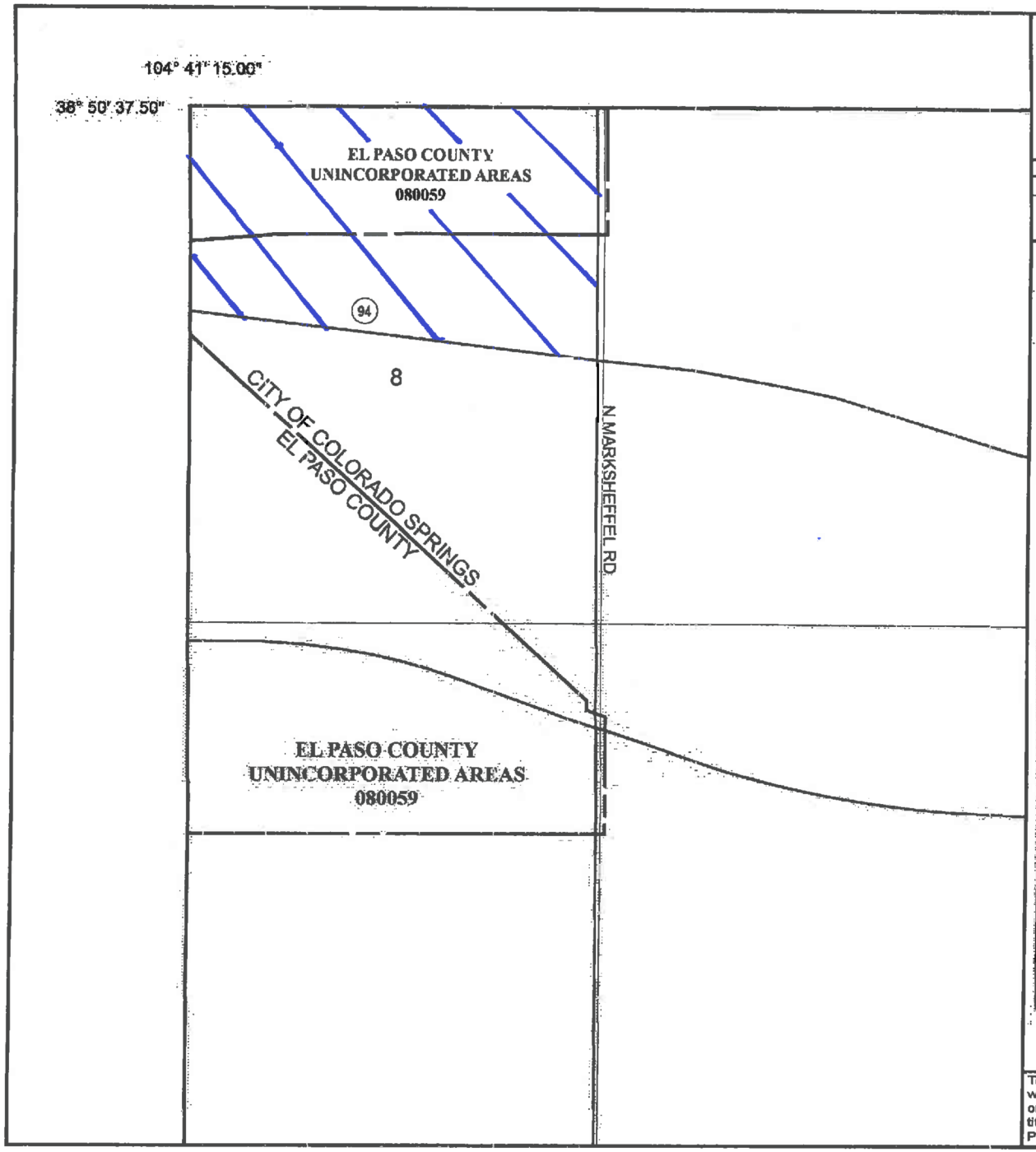
Notice: This map was reissued on 05/15/2020 to make a correction. This version replaces any previous versions. See the Notice-to-User Letter that accompanied this correction for details.

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0756G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency



MAP SCALE 1" = 500'

0 500 1000 FEET

NFIP

PANEL 0758G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 758 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0758	G
EL PASO COUNTY	080059	0758	G

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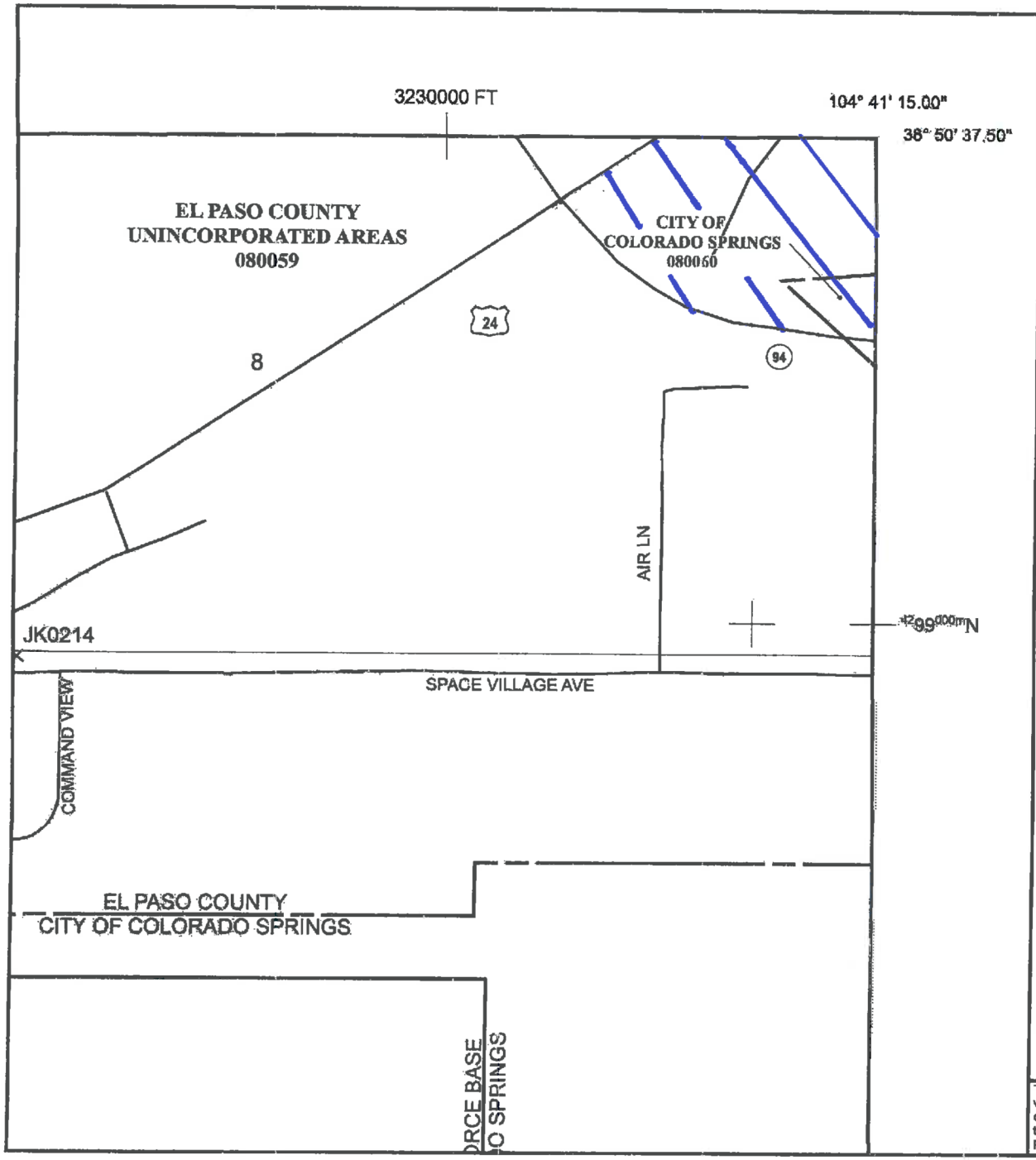
MAP NUMBER
08041C0758G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency



MAP SCALE 1" = 500'

0 500 1000 FEET

NFIP

PANEL 0754G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 754 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0754	G
EL PASO COUNTY	080059	0754	G

Notice: This map was released on 05/15/2020 to make a correction. This version replaces any previous versions. See the Notice-to-User Letter that accompanied this correction for details.

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0754G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

HYDROLOGIC CALCULATIONS

CROSSROADS NORTH
GEC-EXISTING CONDITIONS DRAINAGE CALCULATIONS
(Area Runoff Coefficient Summary)

			STREETS/DEVELOPED			*DEVELOPED LOTS*			*UNDEVELOPED/LANDSCAPE*			*RUNOFF COEFFICIENT*	
BASIN	**TOTAL AREA** *(SF)*	**TOTAL AREA** *(Acres)*	**AREA** *(Acres)*	**C_5**	**C_{100}**	**AREA** *(Acres)*	**C_5**	**C_{100}**	**AREA** *(Acres)*	**C_5**	**C_{100}**	**C_5**	**C_{100}**
A	**203381.3256**	4.67	0.00	0.90	0.96	0.00	0.59	0.70	4.67	0.08	0.35	**0.08**	**0.35**
B	**158516.3618**	3.64	0.00	0.90	0.96	0.00	0.30	0.50	3.64	0.08	0.35	**0.08**	**0.35**
C	**109239.8277**	2.51	1.59	0.90	0.96	0.00	0.30	0.50	0.92	0.08	0.35	**0.60**	**0.74**
D	**91440.6938**	2.10	0.91	0.90	0.96	0.00	0.30	0.50	1.19	0.08	0.35	**0.43**	**0.61**
E	**471391.0309**	10.82	0.00	0.90	0.96	0.00	0.30	0.50	10.82	0.08	0.35	**0.08**	**0.35**
F	**43435.2924**	1.00	0.31	0.90	0.96	0.00	0.30	0.50	0.69	0.08	0.35	**0.34**	**0.54**
G	**391802.4147**	8.99	0.00	0.90	0.96	0.00	0.30	0.50	8.99	0.08	0.35	**0.08**	**0.35**
H	**654546.7604**	15.03	0.00	0.90	0.96	0.00	0.30	0.50	15.03	0.08	0.35	**0.08**	**0.35**
I	**183810.6797**	4.22	0.00	0.90	0.96	0.00	0.30	0.50	4.22	0.08	0.35	**0.08**	**0.35**
J	**125261.6321**	2.88	0.00	0.90	0.96	0.00	0.45	0.59	2.88	0.08	0.35	**0.08**	**0.35**
J1	**116434.8196**	2.67	0.00	0.90	0.96	0.00	0.45	0.59	2.67	0.08	0.35	**0.08**	**0.35**
K	**145033.8974**	3.33	0.00	0.90	0.96	0.00	0.45	0.59	3.33	0.08	0.35	**0.08**	**0.35**
L	**15414.997**	0.35	0.35	0.90	0.96	0.00	0.45	0.59	0.00	0.08	0.35	**0.90**	**0.96**
M	**606580.5543**	13.93	0.00	0.90	0.96	0.00	0.45	0.59	13.93	0.08	0.35	**0.08**	**0.35**
N	**31084.7798**	0.71	0.71	0.90	0.96	0.00	0.45	0.59	0.00	0.08	0.35	**0.90**	**0.96**
O	**501674.7436**	11.52	0.00	0.90	0.96	0.00	0.45	0.59	11.52	0.08	0.35	**0.08**	**0.35**
P	**399360.1957**	9.17	0.00	0.90	0.96	0.00	0.45	0.59	9.17	0.08	0.35	**0.08**	**0.35**
Q	**61495.5769**	1.41	1.41	0.90	0.96	0.00	0.45	0.59	0.00	0.08	0.35	**0.90**	**0.96**
631R	***N/A***	*0.56*	*0.56*	*0.90*	*0.96*	*0.00*	*0.45*	*0.59*	*0.00*	*0.08*	*0.35*	***0.90***	***0.96***
632L	***N/A***	*1.21*	*1.21*	*0.90*	*0.96*	*0.00*	*0.45*	*0.59*	*0.00*	*0.08*	*0.35*	***0.90***	***0.96***
637R	***N/A***	*0.91*	*0.91*	*0.90*	*0.96*	*0.00*	*0.45*	*0.59*	*0.00*	*0.09*	*0.36*	***0.90***	***0.96***
641L	***N/A***	*1.58*	*1.58*	*0.90*	*0.96*	*0.00*	*0.45*	*0.59*	*0.00*	*0.09*	*0.36*	***0.90***	***0.96***
646R	***N/A***	*0.75*	*0.75*	*0.90*	*0.96*	*0.00*	*0.42*	*0.57*	*0.00*	*0.09*	*0.36*	***0.90***	***0.96***
654R	***N/A***	*1.62*	*1.62*	*0.90*	*0.96*	*0.00*	*0.39*	*0.55*	*0.00*	*0.09*	*0.36*	***0.90***	***0.96***
661L	***N/A***	*0.07*	*0.07*	*0.90*	*0.96*	*0.00*	*0.36*	*0.53*	*0.00*	*0.09*	*0.36*	***0.90***	***0.96***
662L	***N/A***	*1.21*	*1.21*	*0.90*	*0.96*	*0.00*	*0.33*	*0.51*	*0.00*	*0.09*	*0.36*	***0.90***	***0.96***
664R	***N/A***	*1.09*	*1.09*	*0.90*	*0.96*	*0.00*	*0.30*	*0.49*	*0.00*	*0.09*	*0.36*	***0.90***	***0.96***

Italized values taken from Marksheffel FDR

Calculated by: GT
Date: 3/24/2023
Checked by: VAS

CROSSROADS NORTH
GEC-EXISTING CONDITIONS DRAINAGE CALCULATIONS
(Area Drainage Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*STREET / CHANNEL FLOW*				*Time of Travel (T_t)*		*INTENSITY **		*TOTAL FLOWS*	
BASIN	**AREA TOTAL**	**C_5**	**C_{100}**	**C_5**	**Length**	**Height**	**T_C**	**Length**	**Slope**	**Velocity**	**T_t**	**TOTAL**	**CHECK**	**I_5**	**I_{100}**	**Q_5**	**Q_{100}**
	(Acres)	*From DCM Table 5-1*			*(ft)*	*(ft)*	*(min)*	*(ft)*	*(%)*	*(fps)*	*(min)*	*(min)*	*(min)*	*(in/hr)*	*(in/hr)*	*(c.f.s.)*	*(c.f.s.)*
A	4.67	0.08	0.35	0.08	300	28	15.3	591	2.9%	1.2	8.3	23.6	15.0	2.8	4.8	**1.1**	**7.8**
B	3.64	0.08	0.35	0.08	300	19	17.3	657	7.0%	1.9	5.9	23.3	15.3	2.9	4.8	**0.8**	**6.1**
C	2.51	0.60	0.74	0.90	100	2.0	2.9	883	2.1%	1.0	14.5	17.4	15.5	3.3	5.5	**5.0**	**10.2**
D	2.10	0.43	0.61	0.90	100	2	2.9	600	3.7%	1.3	7.5	10.3	13.9	4.1	6.8	**3.7**	**8.8**
E	10.82	0.08	0.35	0.08	300	26	15.6	1121	3.7%	1.3	13.9	29.5	17.9	2.5	4.2	**2.2**	**15.9**
F	1.00	0.34	0.54	0.90	100	2	2.9	285	1.4%	0.8	5.7	8.6	12.1	4.4	7.3	**1.5**	**3.9**
G	8.99	0.08	0.35	0.08	300	23	16.3	809	3.2%	1.3	10.8	27.1	16.2	2.6	4.4	**1.9**	**13.9**
H	15.03	0.08	0.35	0.08	300	8	23.1	495	3.2%	1.3	6.6	29.6	14.4	2.5	4.2	**3.0**	**22.1**
I	4.22	0.08	0.35	0.08	300	14	19.2	438	4.8%	1.5	4.8	24.0	14.1	2.8	4.7	**1.0**	**7.0**
J	2.88	0.08	0.35	0.08	300	25	15.8	303	3.9%	1.4	3.7	19.5	13.4	3.1	5.2	**0.7**	**5.3**
J1	2.67	0.08	0.35	0.08	300	19	17.3	729	4.4%	1.5	8.3	25.6	15.7	2.7	4.6	**0.6**	**4.3**
K	3.33	0.08	0.35	0.08	300	22	16.5	478	6.7%	1.8	4.4	20.9	14.3	3.0	5.1	**0.8**	**5.9**
L	0.35	0.90	0.96	0.90	30	0.5	1.7	0	0.0%	0.0	0.0	5.0	5.0	5.2	8.7	**1.6**	**2.9**
M	13.93	0.08	0.35	0.08	300	16	18.4	754	6.1%	1.7	7.3	25.6	15.9	2.7	4.6	**3.0**	**22.2**
N	0.71	0.90	0.96	0.90	25	0.5	1.4	0	0.0%	0.0	0.0	5.0	5.0	5.2	8.7	**3.3**	**5.9**
O	11.52	0.08	0.35	0.08	300	14	19.2	917	4.7%	1.5	10.1	29.3	16.8	2.5	4.2	**2.3**	**17.0**
P	9.17	0.08	0.35	0.08	300	6	25.4	944	4.6%	1.5	10.5	35.9	16.9	2.2	3.7	**1.6**	**11.9**
Q	1.41	0.90	0.96	0.90	90	1.8	2.7	0	0.0%	0.0	0.0	5.0	5.0	5.2	8.7	**6.6**	**11.8**
631R	*0.56*	*0.90*	*0.96*	0.90	30	0.1	3.4	200	1.8%	0.9	3.5	6.9	9.8	4.7	7.9	**2.4**	**4.2**
632L	*1.21*	*0.90*	*0.96*	0.90	53	3.0	1.5	1000	1.8%	0.9	17.7	19.2	9.8	4.2	7.0	**4.5**	**8.1**
637R	*0.91*	*0.90*	*0.96*	0.90	77	3.0	2.0	900	0.5%	1.4	10.6	12.6	16.2	3.8	6.3	**3.1**	**5.5**
641L	*1.58*	*0.90*	*0.96*	0.90	47	1.0	1.9	1500	2.3%	3.0	8.2	10.2	13.0	4.1	6.9	**5.8**	**10.4**
646R	*0.75*	*0.90*	*0.96*	0.90	41	1.0	1.7	78	1.8%	2.7	0.5	5.0	5.0	5.2	8.7	**3.5**	**6.2**
654R	*1.62*	*0.90*	*0.96*	0.90	91	5.0	2.0	1000	4.3%	4.1	4.0	6.0	16.1	4.9	8.2	**7.1**	**12.8**
661L	*0.07*	*0.90*	*0.96*	0.90	82	3.0	2.1	100	2.7%	3.3	0.5	5.0	5.0	5.2	8.7	**0.3**	**0.6**
662L	*1.21*	*0.90*	*0.96*	0.90	75	3.0	2.0	800	4.6%	4.3	3.1	5.1	14.9	5.1	8.6	**5.6**	**10.0**
664R	*1.09*	*0.90*	*0.96*	0.90	78	3.0	2.1	600	5.3%	4.6	2.2	5.0	5.0	5.2	8.7	**5.1**	**9.1**

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

Italized values taken from Marksheffel FDR

Calculated by: GT

Date: 3/24/2023

Checked by: VAS

CROSSROADS NORTH
GEC-EXISTING CONDITIONS DRAINAGE CALCULATIONS
(Basin Routing Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*PIPE / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*		
DESIGN POINT	**CONTRIBUTING BASINS/PIPES**	**CA_5**	**CA_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*	COMMENTS
1	**664R**	0.98	1.05									5.0	5.2	8.7	***5.1***	***9.1***	EX 5' CDOT TYPE R AG INLET
				Basin 664R Tc was used													
2	**662L**	1.09	1.16									5.1	5.1	8.6	***5.6***	***10.0***	EX 5' CDOT TYPE R AG INLET
				Basin 662L Tc was used													
3	**FBIN662, 661L**	0.57	0.79				5.1	50	2.7%	3.3	0.3	5.3	5.1	8.5	***2.9***	***6.7***	EX 5' CDOT TYPE R AG INLET
				Basin 662L Tc was used													
4	**PR664, PR662, PR661, A**	1.85	2.84									23.6	2.8	4.8	***5.3***	***13.6***	EX 5' BTM EARTH TRAP CHANNEL
				Basin A Tc was used													
5	**FBIN664, 654R**	1.92	2.21									6.0	4.9	8.2	***9.4***	***18.2***	EX 5' CDOT TYPE R AG INLET
				Basin 654R Tc was used													
6	**DP4, PR654, B**	2.92	4.72				23.6	535	4.9%	3.3	2.7	26.3	2.7	4.5	***7.8***	***21.3***	EX 5' BTM EARTH TRAP CHANNEL
				Design Point 4 Tc was used													
7	**FBIN661, FBIN654, 646R**	2.01	2.73				6.0	800	2.0%	2.8	4.7	10.7	4.0	6.8	***8.1***	***18.5***	EX 5' CDOT TYPE R AG INLET
				Basin 654R Tc was used													
8	**C, D, F**	2.75	3.67				17.4	1290	2.1%	2.2	9.9	27.3	2.6	4.4	***7.2***	***16.2***	EX 5' BTM EARTH TRAP CHANNEL
				Basin C Tc was used													
9	**DP6, E, PR646**	4.63	9.21				26.3	793	1.8%	2.0	6.6	32.8	2.3	3.9	***10.9***	***36.2***	EX 5' BTM EARTH TRAP CHANNEL
				Design Point 6 Tc was used													
10	**H**	1.20	5.26									29.6	2.5	4.2	***3.0***	***22.1***	LOCALIZED LOWPOINT
				Basin H Tc was used													
11	**G, DP10**	1.92	8.41				29.6	730	1.4%	0.8	14.9	44.5	1.9	3.2	***3.6***	***26.6***	EX 5' BTM EARTH TRAP CHANNEL
				Design Point 9 Tc was used													
12	**641L**	1.42	1.52									10.2	4.1	6.9	***5.8***	***10.4***	EX 5' CDOT TYPE R AG INLET
				Basin 641L Tc was used													

CROSSROADS NORTH
GEC-EXISTING CONDITIONS DRAINAGE CALCULATIONS
(Basin Routing Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*PIPE / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*		
DESIGN POINT	**CONTRIBUTING BASINS/PIPES**	**CA_5**	**CA_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*	COMMENTS
13	**DP9, DP11, PR640, I**	7.60	19.64				32.8	547	0.7%	1.3	7.3	40.1	2.0	3.4	***15.5***	***67.4***	EX 36" CULVERT
				Design Point 9 Tc was used													
14	**FBIN646, 637R**	1.98	2.91				10.7	871	0.5%	1.4	10.3	21.0	3.0	5.1	***6.0***	***14.8***	EX 5' CDOT TYPE R AG INLET
				Design Pt 7 Tc was used													
15	**DP13, J, PR636**	8.53	21.20				40.1	296	0.5%	1.4	3.5	43.6	1.9	3.2	***16.4***	***68.3***	EX 5' BTM EARTH TRAP CHANNEL
				Design Pt 13 Tc was used													
16	**DP15, J1**	8.75	22.14				43.6	550	1.2%	1.6	5.6	49.2	1.7	2.9	***15.2***	***64.6***	EX CDOT TYPE C AREA INLET W/RIPRAP BYPASS RUNDOWN AND 24" RCP
				Design Pt 15 Tc was used													
17	**FBIN636, 631R**	1.49	2.60				21.0	650	1.5%	2.4	4.5	25.4	2.7	4.6	***4.1***	***11.9***	EX 5' CDOT TYPE R AG INLET
				Design Point 14 Tc was used													
18	**FBIN640, 632L**	1.80	2.13				10.2	986	1.1%	2.1	8.0	18.1	3.2	5.4	***5.8***	***11.6***	EX 15' CDOT TYPE R AG INLET
				Design Pt 12 Tc was used													
19	**FBIN630B, L**	0.32	0.57									5.0	5.2	8.7	***1.6***	***4.9***	EX 12" PLASTIC CORR PIPE
				Basin L Tc was used													
20	**PRE1, PRE2, PR630B, K**	12.08	26.66									49.2	1.7	2.9	***21.0***	***77.8***	EX WQ POND
				Design Pt 16 was used													
21	**PRE5, M, N**	13.83	31.98									49.2	1.7	2.9	***24.1***	***93.3***	EX 42" RCP
				Design Point 20 Tc was used													
22	**O, P, Q, DP8**	5.68	12.27				27.3	1884	3.1%	2.7	11.8	39.1	2.1	3.5	***11.8***	***42.9***	EX 48" CMP
				Design Point 8 Tc was used													

CROSSROADS NORTH
GEC-EXISTING CONDITIONS DRAINAGE CALCULATIONS
(Storm Sewer Routing Summary)

PIPE RUN	*Contributing Pipes/Design Points/Struct*	*Equivalent CA_5*	*Equivalent CA_{100}*	*Maximum T_C*	*Intensity**		*Flow*	
					I_5	*I_{100}*	*Q_5*	*Q_{100}*
664	**IN664R**	0.52	0.39	5.0	5.2	8.7	**2.7**	**3.4**
662	**IN662L**	0.58	0.44	5.1	5.1	8.6	**3.0**	**3.8**
661	**IN661L**	0.37	0.38	5.3	5.1	8.5	**1.9**	**3.2**
654	**IN654**	0.78	0.61	6.0	4.9	8.2	**3.8**	**5.0**
646	**IN646**	0.84	0.69	10.7	4.0	6.8	**3.4**	**4.7**
640	**IN640**	0.71	0.55	10.2	4.1	6.9	**2.9**	**3.8**
636	**IN636**	0.99	0.85	21.0	3.0	5.1	**3.0**	**4.3**
630A	**IN630A**	0.95	0.90	25.4	2.7	4.6	**2.6**	**4.1**
630B	**IN630B, IN630A**	2.75	2.79	18.1	3.2	5.4	**8.9**	**15.2**
E1	**DP19**	0.32	0.57	5.0	5.2	8.7	**1.6**	**4.9**
E2	**INDP16**	8.75	22.14	49.2	1.7	2.9	**15.2**	**64.6**
E3	**DP21**	13.83	31.98	49.2	1.7	2.9	**24.1**	**93.3**
E4	**DP22**	5.68	12.27	39.1	2.1	3.5	**11.8**	**42.9**
E5	**DP20**	12.08	26.42	49.2	1.7	2.9	**21.0**	**77.1**

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

Calculated by: GT

DP - Design Point

FB- Flow By from Design Point

Date: 3/24/2023

EX - Existing Design Point

IN- Inlet

Checked by: VAS

CROSSROADS NORTH
GEC-PROPOSED CONDITIONS DRAINAGE CALCULATIONS
(Area Runoff Coefficient Summary)

			STREETS/DEVELOPED			*DEVELOPED LOTS/OVERLOT GRADE*			*UNDEVELOPED/LANDSCAPE*			*RUNOFF COEFFICIENT*	
BASIN	**TOTAL AREA** *(SF)*	**TOTAL AREA** *(Acres)*	**AREA** *(Acres)*	C_5	C_{100}	**AREA** *(Acres)*	C_5	C_{100}	**AREA** *(Acres)*	C_5	C_{100}	C_5	C_{100}
A	**203519**	4.67	0.00	0.90	0.96	0.00	0.12	0.39	4.67	0.08	0.35	**0.08**	**0.35**
B	**127250**	2.92	0.00	0.90	0.96	0.27	0.12	0.39	2.65	0.08	0.35	**0.08**	**0.35**
C	**109332**	2.51	1.59	0.90	0.96	0.00	0.12	0.39	0.92	0.08	0.35	**0.60**	**0.74**
D	**49197**	1.13	0.00	0.90	0.96	0.00	0.12	0.39	1.13	0.08	0.35	**0.08**	**0.35**
E	**415316**	9.53	0.00	0.90	0.96	9.53	0.12	0.39	0.00	0.08	0.35	**0.12**	**0.39**
F	**112146**	2.57	0.00	0.90	0.96	2.57	0.12	0.39	0.00	0.08	0.35	**0.12**	**0.39**
F1	**527158**	12.10	0.00	0.90	0.96	12.10	0.12	0.39	0.00	0.08	0.35	**0.12**	**0.39**
G	**70439**	1.62	0.00	0.90	0.96	0.76	0.12	0.39	0.86	0.08	0.35	**0.10**	**0.37**
H	**489911**	11.25	0.00	0.90	0.96	11.25	0.12	0.39	0.00	0.08	0.35	**0.12**	**0.39**
I	**572019**	13.13	0.00	0.90	0.96	13.13	0.12	0.39	0.00	0.08	0.35	**0.12**	**0.39**
J	**49015**	1.13	0.00	0.90	0.96	0.53	0.12	0.39	0.60	0.08	0.35	**0.10**	**0.37**
J1	**49759**	1.14	0.00	0.90	0.96	0.77	0.12	0.39	0.37	0.08	0.35	**0.11**	**0.38**
K	**486179**	11.16	0.00	0.90	0.96	11.16	0.12	0.39	0.00	0.08	0.35	**0.12**	**0.39**
L	**48142**	1.11	0.00	0.90	0.96	0.34	0.12	0.39	0.77	0.08	0.35	**0.09**	**0.36**
L1	**97566**	2.24	0.00	0.90	0.96	0.14	0.12	0.39	2.10	0.08	0.35	**0.08**	**0.35**
L2	**307202**	7.05	0.00	0.90	0.96	0.01	0.12	0.39	7.04	0.08	0.35	**0.08**	**0.35**
M	**489476**	11.24	1.23	0.90	0.96	0.00	0.12	0.39	10.01	0.08	0.35	**0.17**	**0.42**
N	**15430**	0.35	0.35	0.90	0.96	0.00	0.12	0.39	0.00	0.08	0.35	**0.90**	**0.96**
O	**31380**	0.72	0.72	0.90	0.96	0.00	0.12	0.39	0.00	0.08	0.35	**0.90**	**0.96**
P	**61207**	1.41	1.41	0.90	0.96	0.00	0.12	0.39	0.00	0.08	0.35	**0.90**	**0.96**
631R	***N/A***	*0.56*	*0.56*	*0.90*	*0.96*	*0.00*	*0.45*	*0.59*	*0.00*	*0.08*	*0.35*	***0.90***	***0.96***
632L	***N/A***	*1.21*	*1.21*	*0.90*	*0.96*	*0.00*	*0.45*	*0.59*	*0.00*	*0.08*	*0.35*	***0.90***	***0.96***
637R	***N/A***	*0.91*	*0.91*	*0.90*	*0.96*	*0.00*	*0.45*	*0.59*	*0.00*	*0.09*	*0.36*	***0.90***	***0.96***
641L	***N/A***	*1.58*	*1.58*	*0.90*	*0.96*	*0.00*	*0.45*	*0.59*	*0.00*	*0.09*	*0.36*	***0.90***	***0.96***
646R	***N/A***	*0.75*	*0.75*	*0.90*	*0.96*	*0.00*	*0.42*	*0.57*	*0.00*	*0.09*	*0.36*	***0.90***	***0.96***
654R	***N/A***	*1.62*	*1.62*	*0.90*	*0.96*	*0.00*	*0.39*	*0.55*	*0.00*	*0.09*	*0.36*	***0.90***	***0.96***
661L	***N/A***	*0.07*	*0.07*	*0.90*	*0.96*	*0.00*	*0.36*	*0.53*	*0.00*	*0.09*	*0.36*	***0.90***	***0.96***
662L	***N/A***	*1.21*	*1.21*	*0.90*	*0.96*	*0.00*	*0.33*	*0.51*	*0.00*	*0.09*	*0.36*	***0.90***	***0.96***
664R	***N/A***	*1.09*	*1.09*	*0.90*	*0.96*	*0.00*	*0.30*	*0.49*	*0.00*	*0.09*	*0.36*	***0.90***	***0.96***

Italized values taken from Marksheffel FDR

Calculated by: GT
Date: 3/29/2023
Checked by: VAS

CROSSROADS NORTH
GEC-PROPOSED CONDITIONS DRAINAGE CALCULATIONS
(Area Drainage Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*STREET / CHANNEL FLOW*				*Time of Travel (T_t)*		*INTENSITY **		*TOTAL FLOWS*	
BASIN	**AREA TOTAL**	**C_5**	**C_{100}**	**C_5**	**Length**	**Height**	**T_C**	**Length**	**Slope**	**Velocity**	**T_t**	**TOTAL**	**CHECK**	**I_5**	**I_{100}**	**Q_5**	**Q_{100}**
	(Acres)	*From DCM Table 5-1*			*(ft)*	*(ft)*	*(min)*	*(ft)*	*(%)*	*(fps)*	*(min)*	*(min)*	*(min)*	*(in/hr)*	*(in/hr)*	*(c.f.s.)*	*(c.f.s.)*
A	4.67	0.08	0.35	0.08	300	28	15.3	591	2.9%	1.2	8.3	23.5	15.0	2.8	4.8	**1.1**	**7.8**
B	2.92	0.08	0.35	0.08	300	19	17.3	657	7.0%	1.9	5.9	23.2	15.3	2.9	4.8	**0.7**	**5.0**
C	2.51	0.60	0.74	0.90	100	2.0	2.9	883	2.1%	1.0	14.4	17.3	15.5	3.5	5.8	**5.2**	**10.8**
D	1.13	0.08	0.35	0.90	100	6	2.0	281	8.2%	2.0	2.3	5.0	12.1	5.2	8.7	**0.5**	**3.4**
E	9.53	0.12	0.39	0.12	100	16	7.1	941	3.0%	1.7	9.1	16.2	15.8	3.4	5.8	**3.9**	**21.5**
F	2.57	0.12	0.39	0.90	100	9	1.7	494	4.3%	2.1	4.0	5.7	13.3	5.0	8.3	**1.5**	**8.4**
F1	12.10	0.12	0.39	0.90	100	0.5	4.5	1309	2.5%	1.6	13.8	18.3	17.8	3.3	5.5	**4.7**	**25.8**
G	1.62	0.10	0.37	0.10	80	21	5.5	759	1.3%	1.7	7.5	13.0	14.7	3.7	6.3	**0.6**	**3.7**
H	11.25	0.12	0.39	0.12	100	9	8.6	1203	2.0%	1.4	14.2	22.7	17.2	3.3	5.6	**4.5**	**24.4**
I	13.13	0.12	0.39	0.12	100	2	14.1	1169	1.6%	1.3	15.4	29.5	17.1	3.3	5.6	**5.2**	**28.6**
J	1.13	0.10	0.37	0.10	50	9	4.9	536	1.3%	1.7	5.2	10.1	13.3	4.1	6.9	**0.5**	**2.9**
J1	1.14	0.11	0.38	0.11	100	6	9.9	375	2.4%	2.3	2.7	12.6	12.6	3.8	6.3	**0.5**	**2.7**
K	11.16	0.12	0.39	0.12	100	5	10.4	738	5.3%	2.3	5.4	15.8	14.7	3.6	6.0	**4.8**	**26.0**
L	1.11	0.09	0.36	0.09	75	16	5.7	528	1.1%	1.6	5.5	11.2	13.4	3.7	6.2	**0.4**	**2.5**
L1	2.24	0.08	0.35	0.08	100	6	10.2	190	8.4%	2.0	1.6	11.7	11.6	3.9	6.6	**0.7**	**5.2**
L2	7.05	0.08	0.35	0.08	100	9	8.9	1044	1.2%	0.8	22.3	31.2	16.4	3.4	5.7	**1.9**	**14.1**
M	11.24	0.17	0.42	0.17	100	4	10.6	569	4.7%	1.5	6.2	16.9	13.7	3.7	6.1	**7.0**	**28.7**
N	0.35	0.90	0.96	0.90	25	0.5	1.4	0	0.0%	0.0	0.0	5.0	10.1	5.2	8.7	**1.6**	**3.0**
O	0.72	0.90	0.96	0.90	25	0.5	1.4	0	0.0%	0.0	0.0	5.0	5.0	5.2	8.7	**3.4**	**6.0**
P	1.41	0.90	0.96	0.90	90	5	1.9	0	0.0%	0.0	0.0	5.0	10.5	5.2	8.7	**6.5**	**11.7**
631R	*0.56*	*0.90*	*0.96*	0.90	30	0.1	3.4	200	1.8%	0.9	3.5	6.9	9.8	4.7	7.9	**2.4**	**4.2**
632L	*1.21*	*0.90*	*0.96*	0.90	53	3.0	1.5	1000	1.8%	0.9	17.7	19.2	9.8	4.2	7.0	**4.5**	**8.1**
637R	*0.91*	*0.90*	*0.96*	0.90	77	3.0	2.0	900	0.5%	1.4	10.6	12.6	16.2	3.8	6.3	**3.1**	**5.5**
641L	*1.58*	*0.90*	*0.96*	0.90	47	1.0	1.9	1500	2.3%	3.0	8.2	10.2	13.0	4.1	6.9	**5.8**	**10.4**
646R	*0.75*	*0.90*	*0.96*	0.90	41	1.0	1.7	78	1.8%	2.7	0.5	2.2	5.0	5.2	8.7	**3.5**	**6.2**
654R	*1.62*	*0.90*	*0.96*	0.90	91	5.0	2.0	1000	4.3%	4.1	4.0	6.0	16.1	4.9	8.2	**7.1**	**12.8**
661L	*0.07*	*0.90*	*0.96*	0.90	82	3.0	2.1	100	2.7%	3.3	0.5	2.6	5.0	5.2	8.7	**0.3**	**0.6**
662L	*1.21*	*0.90*	*0.96*	0.90	75	3.0	2.0	800	4.6%	4.3	3.1	5.1	14.9	5.1	8.6	**5.6**	**10.0**
664R	*1.09*	*0.90*	*0.96*	0.90	78	3.0	2.1	600	5.3%	4.6	2.2	4.2	5.0	5.2	8.7	**5.1**	**9.1**

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

Italized values taken from Marksheffel FDR

Calculated by: GT

Date: 3/29/2023

Checked by: VAS

CROSSROADS NORTH
GEC-PROPOSED CONDITIONS DRAINAGE CALCULATIONS
(Basin Routing Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*PIPE / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*		
DESIGN POINT	**CONTRIBUTING BASINS/PIPES**	**CA_5**	**CA_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*	COMMENTS
1	**664R**	0.98	1.05									5.0	5.2	8.7	***5.1***	***9.1***	EX 5' CDOT TYPE R AG INLET
				Basin 664R Tc was used													
2	**662L**	1.09	1.16									5.1	5.1	8.6	***5.6***	***10.0***	EX 5' CDOT TYPE R AG INLET
				Basin 662L Tc was used													
3	**FBIN662, 661L**	0.57	0.79				5.1	50	2.7%	3.3	0.3	5.3	5.1	8.5	***2.9***	***6.7***	EX 5' CDOT TYPE R AG INLET
				Basin 662L Tc was used													
4	**PR664, PR662, PR661, A**	1.85	2.84									23.5	2.8	4.8	***5.3***	***13.6***	EX 5' BTM EARTH TRAP CHANNEL
				Avg DP3 and Basin A Tc was used													
5	**FBIN664, 654R**	1.92	2.21									6.0	4.9	8.2	***9.4***	***18.2***	EX 5' CDOT TYPE R AG INLET
				Basin 654R Tc was used													
6	**DP4, PR654, B, D**	2.97	4.88				23.5	535	4.9%	3.3	2.7	26.2	2.7	4.5	***8.0***	***22.0***	EX 5' BTM EARTH TRAP CHANNEL
				DP4 Tc was used													
7	**FBIN661, FBIN654, 646R**	2.01	2.73				6.0	800	2.0%	2.8	4.7	10.7	4.0	6.8	***8.1***	***18.5***	EX 5' CDOT TYPE R AG INLET
				Basin 654R Tc was used													
8	**C**	1.50	1.85									15.5	3.5	5.8	***5.2***	***10.8***	EX BTM EARTH TRAP CHANNEL IN CDOT ROW
				Basin C Tc was used													
9	**F**	0.31	1.00									5.7	5.0	8.3	***1.5***	***8.4***	TEMP SEDIMENT BASIN OUTFALL TO MARKSHEFFEL EX 5' BTM EARTH TRAP CHANNEL
				Basin F Tc was used													
10	**E**	1.14	3.72									15.8	3.4	5.8	***3.9***	***21.5***	TEMP SEDIMENT BASIN OUTFALL TO MARKSHEFFEL EX 5' BTM EARTH TRAP CHANNEL
				Basin E Tc was used													
11	**DP6, DP9, DP10, G, PR646**	5.42	10.89				26.2	793	1.8%	2.0	6.6	32.8	2.3	3.9	***12.7***	***42.9***	EX 5' BTM EARTH TRAP CHANNEL
				DP6 Tc was used													
12	**H**	1.35	4.39									17.2	3.3	5.6	***4.5***	***24.4***	TEMP SEDIMENT BASIN OUTFALL TO MARKSHEFFEL EX 5' BTM EARTH TRAP CHANNEL
				Basin H Tc was used													
13	**F1**	1.45	4.72									18.3	3.2	5.4	***4.7***	***25.5***	TEMP SEDIMENT BASIN OUTFALL TO MARKSHEFFEL EX 5' BTM EARTH TRAP CHANNEL
				Basin F1 Tc was used													
14	**641L**	1.42	1.52									10.2	4.1	6.9	***5.8***	***10.4***	EX 5' CDOT TYPE R AG INLET
				Basin 641L Tc was used													

CROSSROADS NORTH
GEC-PROPOSED CONDITIONS DRAINAGE CALCULATIONS
(Basin Routing Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*PIPE / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*		
DESIGN POINT	**CONTRIBUTING BASINS/PIPES**	**CA_5**	**CA_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*	COMMENTS
15	**DP11, DP12, DP13, J, PR640**	9.04	20.97				32.8	547	0.7%	1.3	7.3	40.0	2.0	3.4	***18.5***	***72.0***	EX 36" CULVERT
				Design Pt 11 Tc was used													
16	**FBIN646, 637R**	1.98	2.91				10.7	871	0.5%	1.4	10.3	21.0	3.0	5.1	***6.0***	***14.8***	EX 5' CDOT TYPE R AG INLET
				Design Pt 7 Tc was used													
17	**DP15, J1, PR636**	10.16	22.25				40.0	296	0.5%	1.4	3.5	43.5	1.9	3.2	***19.5***	***71.8***	EX 5' BTM EARTH TRAP CHANNEL OUTFALL TO MARKSHEFFEL
				Design Pt 15 Tc was used													
18	**K**	1.34	4.35									14.7	3.6	6.0	***4.8***	***26.0***	TEMP SEDIMENT BASIN OUTFALL TO HWY 94 CDOT ROW
				Basin K Tc was used													
19	**I**	1.58	5.12									17.1	3.3	5.6	***5.2***	***28.6***	TEMP SEDIMENT BASIN OUTFALL TO MARKSHEFFEL EX 5' BTM EARTH TRAP CHANNEL
				Basin I Tc was used													
20	**FBIN636, 631R**	1.49	2.60				21.0	650	1.5%	2.4	4.5	25.4	2.7	4.6	***4.1***	***11.9***	EX 5' CDOT TYPE R AG INLET
				Design Point 16 Tc was used													
21	**FBIN640, 632L**	1.80	2.13				10.2	986	1.1%	2.1	8.0	18.1	3.2	5.4	***5.8***	***11.6***	EX 15' CDOT TYPE R AG INLET
				Design Pt 14 Tc was used													
22	**DP17, L**	10.26	22.65				43.5	550	2.0%	2.1	4.3	47.9	1.8	3.0	***18.3***	***67.6***	EX CDOT TYPE C AREA INLET
				Design Point 17 Tc was used													
23	**N, FBIN630B**	0.32	0.57									5.0	5.2	8.7	***1.6***	***5.0***	EX 12" PLASTIC CORR PIPE
				Design Point 21 Tc was used													
24	**L1, PR630B, PRE1,PRE2**	13.51	26.80									47.9	1.8	3.0	***24.1***	***80.1***	EX WQ POND
				Design Point 22 Tc was used													
25	**L2, O, PRE5**	14.72	28.95									47.9	1.8	3.0	***26.2***	***86.5***	EX 42" RCP
				Design Point 24 Tc was used													
26	**M, P,DP8, DP18**	6.02	12.23				15.5	3096	3.0%	2.6	19.9	35.3	2.2	3.8	***13.5***	***45.9***	EX 48" CMP
				Design Point 8 was used													

CROSSROADS NORTH
GEC-PROPOSED CONDITIONS DRAINAGE CALCULATIONS
(Storm Sewer Routing Summary)

PIPE RUN	*Contributing Pipes/Design Points/Struct*	*Equivalent CA_5*	*Equivalent CA_{100}*	*Maximum T_C*	*Intensity**		*Flow*	
					I_5	*I_{100}*	*Q_5*	*Q_{100}*
664	**IN664R**	0.52	0.39	5.0	5.2	8.7	**2.7**	**3.4**
662	**IN662L**	0.58	0.44	5.1	5.1	8.6	**3.0**	**3.8**
661	**IN661L**	0.37	0.38	5.3	5.1	8.5	**1.9**	**3.2**
654	**IN654**	0.78	0.61	6.0	4.9	8.2	**3.8**	**5.0**
646	**IN646**	0.84	0.69	10.7	4.0	6.8	**3.4**	**4.7**
640	**IN641**	0.71	0.55	10.2	4.1	6.9	**2.9**	**3.8**
636	**IN636**	0.99	0.85	21.0	3.0	5.1	**3.0**	**4.3**
630A	**IN630A**	0.95	0.90	25.4	2.7	4.6	**2.6**	**4.1**
630B	**IN630A, IN630B**	2.75	2.79	18.1	3.2	5.4	**8.9**	**15.2**
E1	**DP23**	0.32	0.57	5.0	5.2	8.7	**1.6**	**5.0**
E2	**INDP22**	10.26	22.65	47.9	1.8	3.0	**18.3**	**67.6**
E3	**DP25**	14.72	28.95	47.9	1.8	3.0	**26.2**	**86.5**
E4	**DP26**	6.02	12.23	35.3	2.2	3.8	**13.5**	**45.9**
E5	**WQ POND**	13.51	25.79	47.9	1.8	3.0	**24.1**	**77.1**

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

Calculated by: GT

DP - Design Point

FB- Flow By from Design Point

Date: 9/30/2022

EX - Existing Design Point

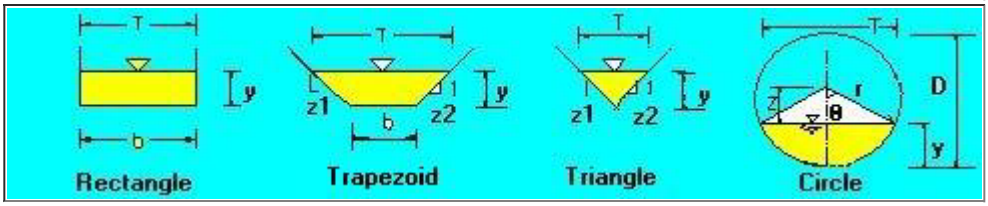
IN- Inlet

Checked by: VAS

HYDRAULIC CALCULATIONS

The open channel flow calculator

Select Channel Type: Triangle



Velocity(V)&Discharge(Q)

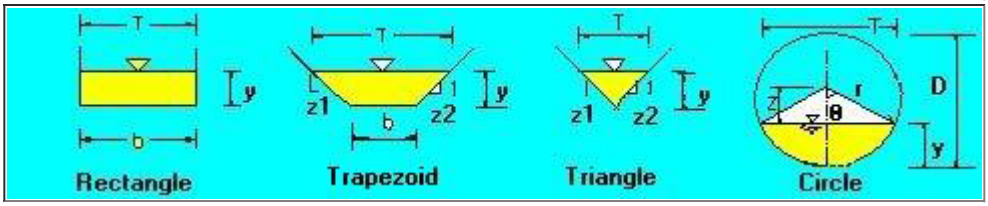
Select unit system: Feet(ft)

Channel slope: .01 ft/ft	Water depth(y): 1.02 ft	Bottom W(b) 0 ft
Flow velocity 3.7183 ft/s	LeftSlope (z_1): 4 to 1 (H:V)	RightSlope (z_2): 4 to 1 (H:V)
Flow discharge 15.4742 ft^3/s	Input n value 0.025 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 8.41 ft	Flow area 4.16 ft^2	Top width(T) 8.16 ft
Specific energy 1.23 ft	Froude number 0.92	Flow status Subcritical flow
Critical depth 0.99 ft	Critical slope 0.0117 ft/ft	Velocity head 0.21 ft

EX MARKSHEFFEL SWALE
SEC A-A Q5=15.2 cfs

The open channel flow calculator

Select Channel Type: Triangle



Velocity(V)&Discharge(Q)

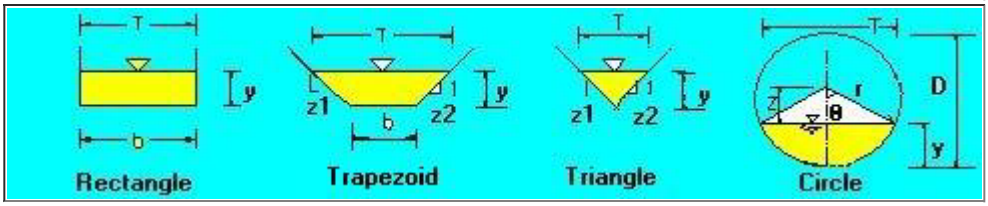
Select unit system: Feet(ft)

Channel slope: .01 ft/ft	Water depth(y): 1.75 ft	Bottom W(b) 0 ft
Flow velocity 5.3289 ft/s	LeftSlope (z_1): 4 to 1 (H:V)	RightSlope (z_2): 4 to 1 (H:V)
Flow discharge 65.2796 ft^3/s	Input n value 0.025 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 14.43 ft	Flow area 12.25 ft^2	Top width(T) 14 ft
Specific energy 2.19 ft	Froude number 1	Flow status Critical flow
Critical depth 1.75 ft	Critical slope 0.0099 ft/ft	Velocity head 0.44 ft

EX MARKSHEFFEL SWALE
SEC A-A Q100=64.4 cfs

The open channel flow calculator

Select Channel Type: Trapezoid



Velocity(V)&Discharge(Q)

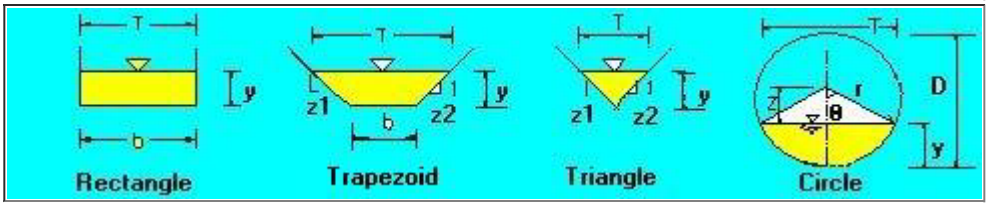
Select unit system: Feet(ft)

Channel slope: .01 ft/ft	Water depth(y): 0.43 ft	Bottom W(b) 14 ft
Flow velocity 2.8397 ft/s	LeftSlope (z_1): 14 to 1 (H:V)	RightSlope (z_2): 14 to 1 (H:V)
Flow discharge 24.4455 ft^3/s	Input n value 0.025 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 26.07 ft	Flow area 8.61 ft^2	Top width(T) 26.04 ft
Specific energy 0.56 ft	Froude number 0.87	Flow status Subcritical flow
Critical depth 0.4 ft	Critical slope 0.0133 ft/ft	Velocity head 0.13 ft

EX HWY 94 SWALE
SEC B-B Q5=24.1 cfs

The open channel flow calculator

Select Channel Type: Trapezoid



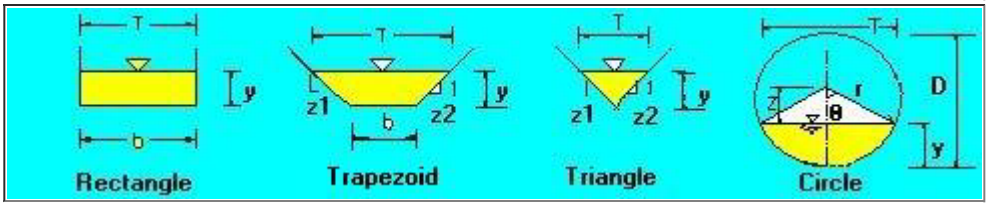
Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: .01 ft/ft	Water depth(y): 0.87 ft	Bottom W(b) 14 ft
Flow velocity 4.1945 ft/s	LeftSlope (z_1): 14 to 1 (H:V)	RightSlope (z_2): 14 to 1 (H:V)
Flow discharge 95.5373 ft^3/s	Input n value 0.025 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 38.42 ft	Flow area 22.78 ft^2	Top width(T) 38.36 ft
Specific energy 1.14 ft	Froude number 0.96	Flow status Subcritical flow
Critical depth 0.85 ft	Critical slope 0.0108 ft/ft	Velocity head 0.27 ft

EX HWY 94 SWALE
SEC B-B Q100=93.3 cfs

The open channel flow calculator

Select Channel Type: Triangle



Velocity(V)&Discharge(Q)

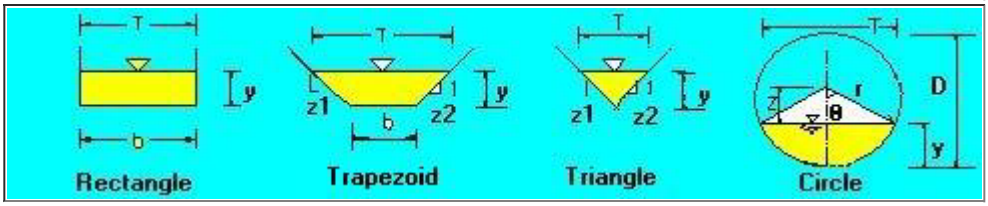
Select unit system: Feet(ft)

Channel slope: .02 ft/ft	Water depth(y): 0.9 ft	Bottom W(b) 0 ft
Flow velocity 4.766 ft/s	LeftSlope (z_1): 3 to 1 (H:V)	RightSlope (z_2): 3 to 1 (H:V)
Flow discharge 11.5813 ft^3/s	Input n value 0.025 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 5.69 ft	Flow area 2.43 ft^2	Top width(T) 5.4 ft
Specific energy 1.25 ft	Froude number 1.25	Flow status Supercritical flow
Critical depth 0.99 ft	Critical slope 0.0122 ft/ft	Velocity head 0.35 ft

EX HWY 24 SWALE
SEC C-C Q5=11.8 cfs

The open channel flow calculator

Select Channel Type: Triangle



Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: .02 ft/ft	Water depth(y): 1.47 ft	Bottom W(b) 0 ft
Flow velocity 6.61 ft/s	LeftSlope (z_1): 3 to 1 (H:V)	RightSlope (z_2): 3 to 1 (H:V)
Flow discharge 42.8505 ft^3/s	Input n value 0.025 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 9.3 ft	Flow area 6.48 ft^2	Top width(T) 8.82 ft
Specific energy 2.15 ft	Froude number 1.36	Flow status Supercritical flow
Critical depth 1.67 ft	Critical slope 0.0103 ft/ft	Velocity head 0.68 ft

EX HWY 24 SWALE
SEC C-C Q100=42.9 cfs

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Printable Title

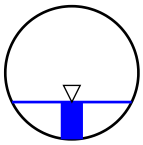
Printable Subtitle

Inputs

Pipe diameter, d_0	3.0	ft
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	0.0185	rise/run
Relative flow depth, y/d_0	0.28	fraction

Results

Flow depth, y	0.8400	ft
Flow area, a	1.6202	ft^2
Pipe area, a0	7.0688	ft^2
Relative area, a/a0	22.9208	%
Wetted perimeter, P_w	3.3456	ft
Hydraulic radius, R_h	0.4843	ft
Top width, T	2.6940	ft
Velocity, v	9.5873	ft/sec
Velocity head, h_v	0.6193	psi
Froude number, F	2.18	
Average shear stress (tractive force), tau	0.5593	psf
Flow, Q (See notes)	15.5329	cfs
Full flow, Q0	90.7133	cfs
Ratio to full flow, Q/Q0	17.1231	%



Notes:

This is the flow and depth inside an *infinitely long* pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

EX 36" CULVERT AIR LANE
Q5=15.5 cfs

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Printable Title

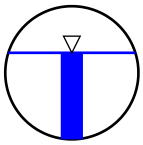
Printable Subtitle

Inputs

Pipe diameter, d_0	3.0	ft
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	0.0185	rise/run
Relative flow depth, y/d_0	0.65	fraction

Results

Flow depth, y	1.9500	ft
Flow area, a	4.8639	ft^2
Pipe area, a0	7.0688	ft^2
Relative area, a/a0	68.8081	%
Wetted perimeter, P_w	5.6265	ft
Hydraulic radius, R_h	0.8644	ft
Top width, T	2.8618	ft
Velocity, v	14.1078	ft/sec
Velocity head, h_v	1.3410	psi
Froude number, F	1.91	
Average shear stress (tractive force), tau	0.9984	psf
Flow, Q (See notes)	68.6163	cfs
Full flow, Q0	90.7133	cfs
Ratio to full flow, Q/Q0	75.6408	%



Notes:

This is the flow and depth inside an *infinitely long* pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

EX 36" CULVERT AIR LANE
Q100=67.4 cfs

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Printable Title

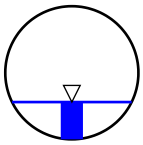
Printable Subtitle

Inputs

Pipe diameter, d_0	3.5	ft
Manning roughness, n	0.022	
Pressure slope (possibly ? equal to pipe slope), S_0	0.069	rise/run
Relative flow depth, y/d_0	28	%

Results

Flow depth, y	0.9800	ft
Flow area, a	2.2053	ft^2
Pipe area, a0	9.6214	ft^2
Relative area, a/a0	22.9208	%
Wetted perimeter, P_w	3.9032	ft
Hydraulic radius, R_h	0.5650	ft
Top width, T	3.1430	ft
Velocity, v	12.1251	ft/sec
Velocity head, h_v	2.2849	ft H2O
Froude number, F	2.56	
Average shear stress (tractive force), tau	2.4338	psf
Flow, Q (See notes)	26.7385	cfs
Full flow, Q0	156.1547	cfs
Ratio to full flow, Q/Q0	17.1231	%



Notes:

This is the flow and depth inside an *infinitely long* pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

EXISTING 42" CMP AT DP25 Q5= 26.2 cfs

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Printable Title

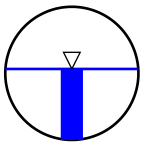
Printable Subtitle

Inputs

Pipe diameter, d_0	3.5	ft
Manning roughness, n	0.022	
Pressure slope (possibly ? equal to pipe slope), S_0	0.069	rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	53.3	%

Results

Flow, Q (See notes)	86.8889	cfs
Velocity, v	16.6630	ft/sec
Velocity head, h_v	4.3153	ft H2O
Flow area	5.2147	ft^2
Wetted perimeter	5.7290	ft
Hydraulic radius	0.9102	ft
Top width, T	3.4924	ft
Froude number, F	2.41	
Average shear stress (tractive force), tau	3.9209	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

EXISTING 42" CMP AT DP25 Q100= 86.5 cfs

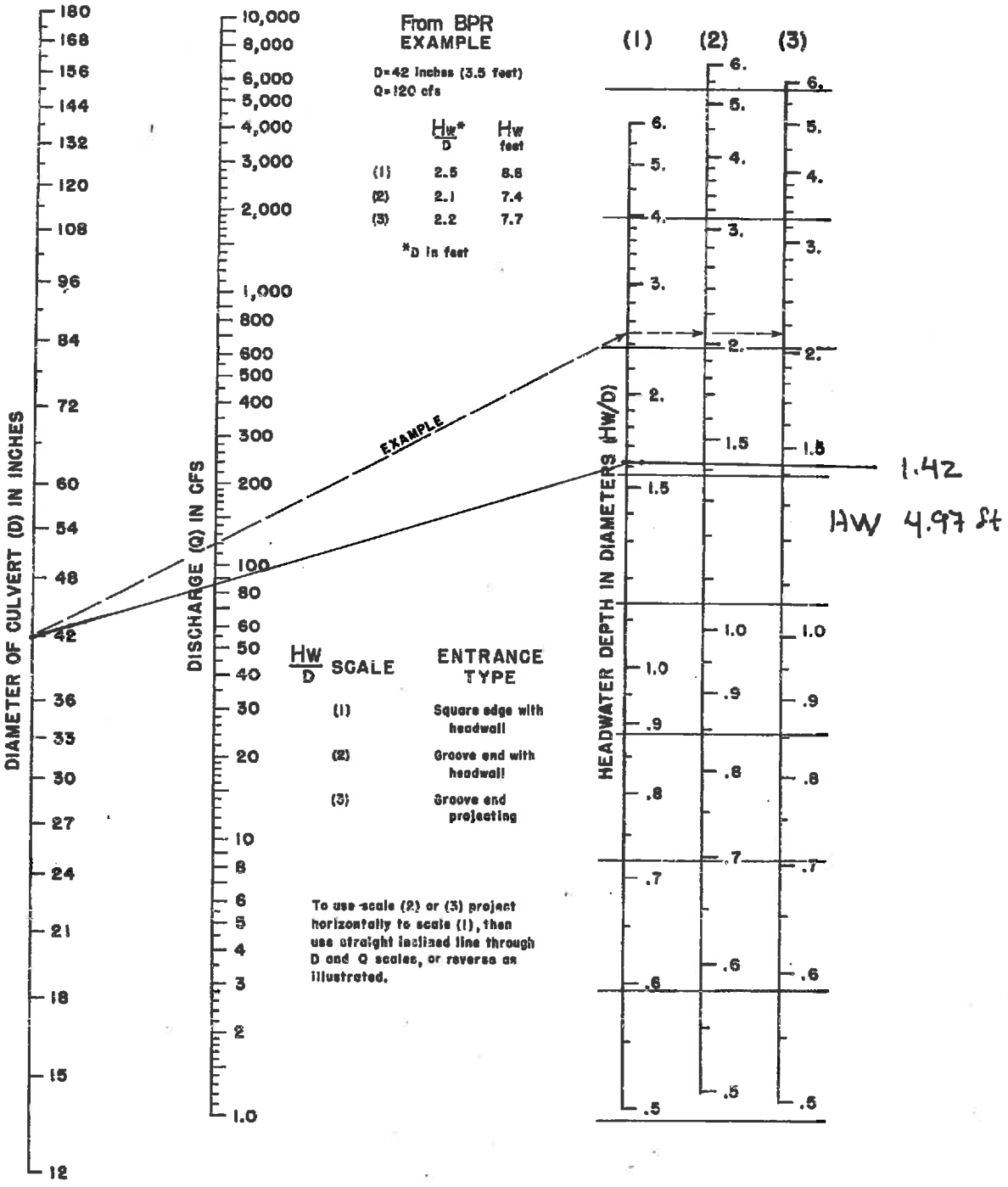


Figure CU-9—Inlet Control Nomograph—Example

DP 25 Ex 42" CMP $Q_{100} = 86.5$ cfs

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Printable Title

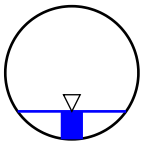
Printable Subtitle

Inputs

Pipe diameter, d_0	4	ft
Manning roughness, n	0.022	
Pressure slope (possibly ? equal to pipe slope), S_0	0.0316	rise/run
Relative flow depth, y/d_0	21	%

Results

Flow depth, y	0.8400	ft
Flow area, a	1.9184	ft^2
Pipe area, a0	12.5668	ft^2
Relative area, a/a0	15.2658	%
Wetted perimeter, P_w	3.8083	ft
Hydraulic radius, R_h	0.5037	ft
Top width, T	3.2585	ft
Velocity, v	7.6012	ft/sec
Velocity head, h_v	0.8980	ft H2O
Froude number, F	1.75	
Average shear stress (tractive force), tau	0.9938	psf
Flow, Q (See notes)	14.5817	cfs
Full flow, Q0	150.8757	cfs
Ratio to full flow, Q/Q0	9.6647	%



Notes:

This is the flow and depth inside an *infinitely long* pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

EXISTING 48" CMP AT DP26 Q5= 13.5 cfs

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Printable Title

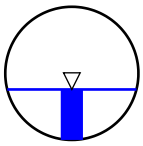
Printable Subtitle

Inputs

Pipe diameter, d_0	4	ft
Manning roughness, n	0.022	
Pressure slope (possibly ? equal to pipe slope), S_0	0.0316	rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	37.9	%

Results

Flow, Q (See notes)	46.0371	cfs
Velocity, v	10.5440	ft/sec
Velocity head, h_v	1.7278	ft H2O
Flow area	4.3664	ft^2
Wetted perimeter	5.3055	ft
Hydraulic radius	0.8230	ft
Top width, T	3.8811	ft
Froude number, F	1.75	
Average shear stress (tractive force), tau	1.6235	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

EXISTING 48" CMP AT DP26 Q100= 45.9 cfs

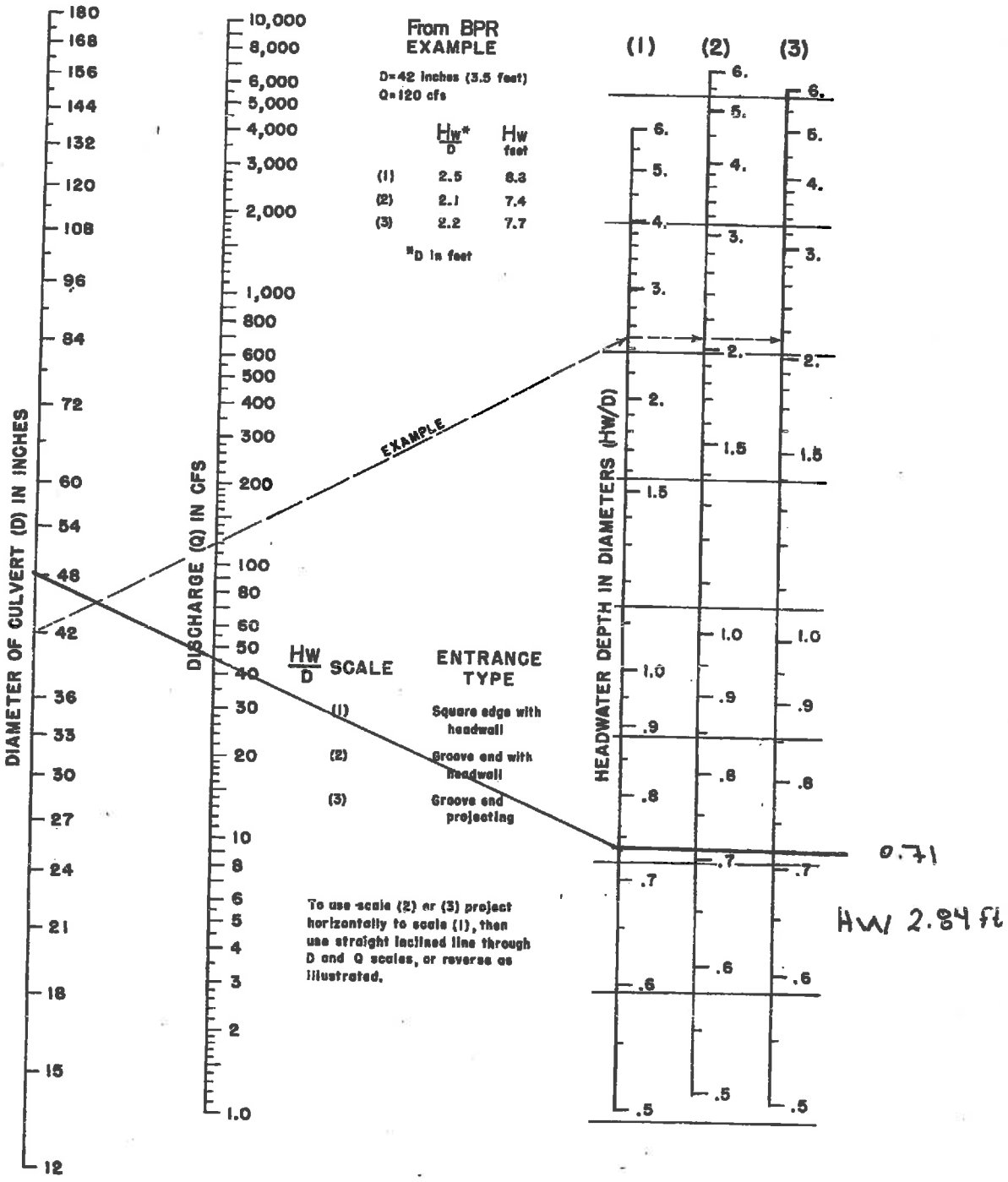
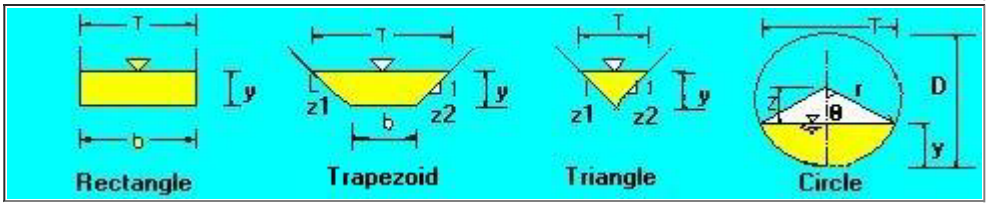


Figure CU-9—Inlet Control Nomograph—Example

DP 26 Ex 48" CMP Q_{100} = 45.9 cfs

The open channel flow calculator

Select Channel Type: Triangle



Velocity(V)&Discharge(Q)

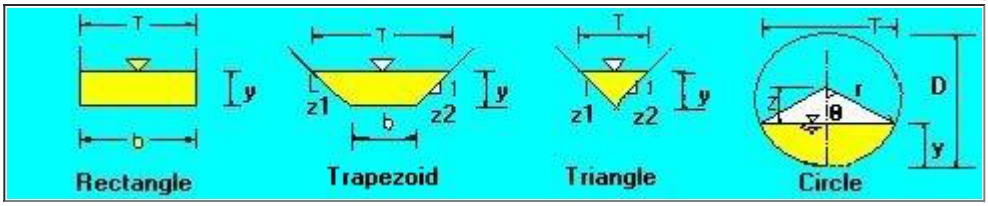
Select unit system: Feet(ft)

Channel slope: .0256 ft/ft	Water depth(y): 0.6 ft	Bottom W(b) 0 ft
Flow velocity 4.1767 ft/s	LeftSlope (z_1): 4 to 1 (H:V)	RightSlope (z_2): 4 to 1 (H:V)
Flow discharge 6.0145 ft^3/s	Input n value 0.025 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 4.95 ft	Flow area 1.44 ft^2	Top width(T) 4.8 ft
Specific energy 0.87 ft	Froude number 1.34	Flow status Supercritical flow
Critical depth 0.68 ft	Critical slope 0.0136 ft/ft	Velocity head 0.27 ft

PROP SEC A-A
Q5=4.7 cfs

The open channel flow calculator

Select Channel Type: Triangle



Velocity(V)&Discharge(Q)

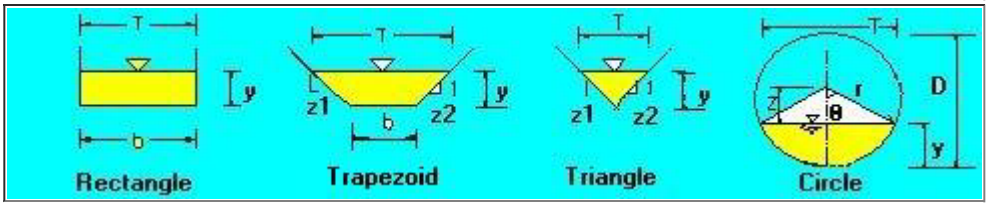
Select unit system: Feet(ft)

Channel slope: .0256 ft/ft	Water depth(y): 1.04 ft	Bottom W(b) 0 ft
Flow velocity 6.0269 ft/s	LeftSlope (z_1): 4 to 1 (H:V)	RightSlope (z_2): 4 to 1 (H:V)
Flow discharge 26.0746 ft^3/s	Input n value 0.025 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 8.58 ft	Flow area 4.33 ft^2	Top width(T) 8.32 ft
Specific energy 1.6 ft	Froude number 1.47	Flow status Supercritical flow
Critical depth 1.22 ft	Critical slope 0.0112 ft/ft	Velocity head 0.56 ft

PROP SEC A-A
Q100=25.5 cfs

The open channel flow calculator

Select Channel Type: Trapezoid



Velocity(V)&Discharge(Q)

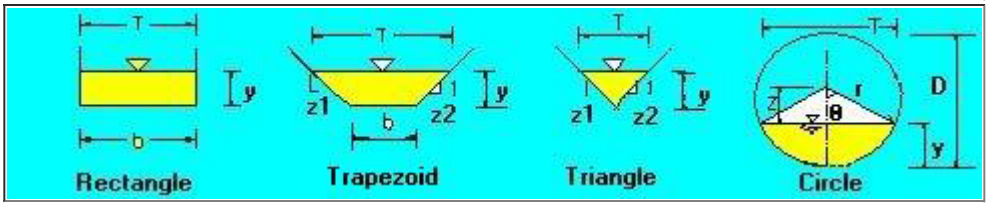
Select unit system: Feet(ft)

Channel slope: .0227 ft/ft	Water depth(y): 0.28 ft	Bottom W(b) 4 ft
Flow velocity 3.3348 ft/s	LeftSlope (z_1): 4 to 1 (H:V)	RightSlope (z_2): 4 to 1 (H:V)
Flow discharge 4.7808 ft^3/s	Input n value 0.025 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 6.31 ft	Flow area 1.43 ft^2	Top width(T) 6.24 ft
Specific energy 0.45 ft	Froude number 1.23	Flow status Supercritical flow
Critical depth 0.32 ft	Critical slope 0.0145 ft/ft	Velocity head 0.17 ft

PROP SEC B-B
Q5=4.5 cfs

The open channel flow calculator

Select Channel Type: Trapezoid



Velocity(V)&Discharge(Q)

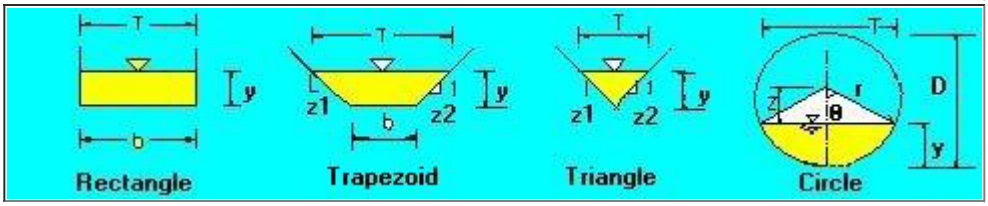
Select unit system: Feet(ft)

Channel slope: .0227 ft/ft	Water depth(y): 0.68 ft	Bottom W(b) 4 ft
Flow velocity 5.4568 ft/s	LeftSlope (z_1): 4 to 1 (H:V)	RightSlope (z_2): 4 to 1 (H:V)
Flow discharge 24.9355 ft^3/s	Input n value 0.025 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 9.61 ft	Flow area 4.57 ft^2	Top width(T) 9.44 ft
Specific energy 1.14 ft	Froude number 1.38	Flow status Supercritical flow
Critical depth 0.81 ft	Critical slope 0.0113 ft/ft	Velocity head 0.46 ft

PROP SEC B-B
Q100=24.4 cfs

The open channel flow calculator

Select Channel Type: Triangle



Velocity(V)&Discharge(Q)

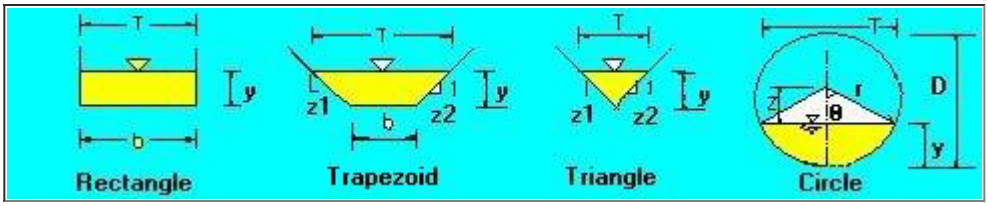
Select unit system: Feet(ft)

Channel slope: .01 ft/ft	Water depth(y): 0.68 ft	Bottom W(b) 0 ft
Flow velocity 2.8376 ft/s	LeftSlope (z_1): 4 to 1 (H:V)	RightSlope (z_2): 4 to 1 (H:V)
Flow discharge 5.2485 ft^3/s	Input n value 0.025 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 5.61 ft	Flow area 1.85 ft^2	Top width(T) 5.44 ft
Specific energy 0.81 ft	Froude number 0.86	Flow status Subcritical flow
Critical depth 0.64 ft	Critical slope 0.0138 ft/ft	Velocity head 0.13 ft

PROP SEC C-C
Q5=5.2 cfs

The open channel flow calculator

Select Channel Type: Triangle



Velocity(V)&Discharge(Q)

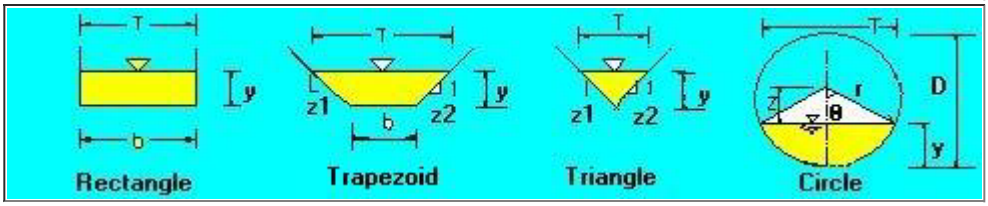
Select unit system: Feet(ft)

Channel slope: .01 ft/ft	Water depth(y): 1.29 ft	Bottom W(b) 0 ft
Flow velocity 4.3485 ft/s	LeftSlope (z1): 4 to 1 (H:V)	RightSlope (z2): 4 to 1 (H:V)
Flow discharge 28.9455 ft^3/s	Input n value 0.025 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 10.64 ft	Flow area 6.66 ft^2	Top width(T) 10.32 ft
Specific energy 1.58 ft	Froude number 0.95	Flow status Subcritical flow
Critical depth 1.27 ft	Critical slope 0.0109 ft/ft	Velocity head 0.29 ft

PROP SEC C-C
Q100=28.6 cfs

The open channel flow calculator

Select Channel Type: Triangle



Velocity(V)&Discharge(Q)

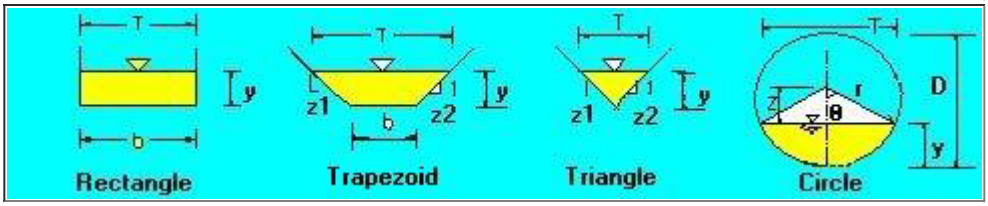
Select unit system: Feet(ft)

Channel slope: .01 ft/ft	Water depth(y): 0.68 ft	Bottom W(b) 0 ft
Flow velocity 2.8376 ft/s	LeftSlope (z_1): 4 to 1 (H:V)	RightSlope (z_2): 4 to 1 (H:V)
Flow discharge 5.2485 ft^3/s	Input n value 0.025 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 5.61 ft	Flow area 1.85 ft^2	Top width(T) 5.44 ft
Specific energy 0.81 ft	Froude number 0.86	Flow status Subcritical flow
Critical depth 0.64 ft	Critical slope 0.0138 ft/ft	Velocity head 0.13 ft

PROP SEC D-D
Q5=5.2 cfs

The open channel flow calculator

Select Channel Type: Triangle



Velocity(V)&Discharge(Q)

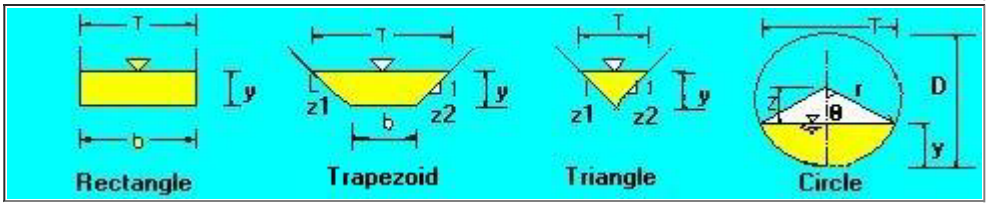
Select unit system: Feet(ft)

Channel slope: .01 ft/ft	Water depth(y): 1.29 ft	Bottom W(b) 0 ft
Flow velocity 4.3485 ft/s	LeftSlope (z_1): 4 to 1 (H:V)	RightSlope (z_2): 4 to 1 (H:V)
Flow discharge 28.9455 ft^3/s	Input n value 0.025 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 10.64 ft	Flow area 6.66 ft^2	Top width(T) 10.32 ft
Specific energy 1.58 ft	Froude number 0.95	Flow status Subcritical flow
Critical depth 1.27 ft	Critical slope 0.0109 ft/ft	Velocity head 0.29 ft

PROP SEC D-D
Q100=28.6 cfs

The open channel flow calculator

Select Channel Type: Triangle



Velocity(V)&Discharge(Q)

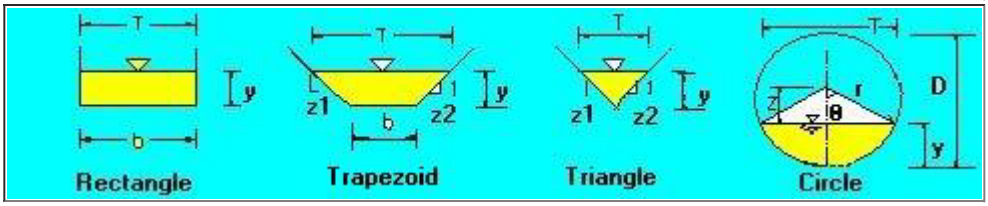
Select unit system: Feet(ft)

Channel slope: .03 ft/ft	Water depth(y): 0.54 ft	Bottom W(b) 0 ft
Flow velocity 4.2148 ft/s	LeftSlope (z_1): 4 to 1 (H:V)	RightSlope (z_2): 4 to 1 (H:V)
Flow discharge 4.9161 ft^3/s	Input n value 0.025 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 4.45 ft	Flow area 1.17 ft^2	Top width(T) 4.32 ft
Specific energy 0.82 ft	Froude number 1.43	Flow status Supercritical flow
Critical depth 0.62 ft	Critical slope 0.014 ft/ft	Velocity head 0.28 ft

PROP SEC E-E
Q5=4.8 cfs

The open channel flow calculator

Select Channel Type: Triangle



Velocity(V)&Discharge(Q)

Select unit system: Feet(ft)

Channel slope: .03 ft/ft	Water depth(y): 1.01 ft	Bottom W(b) 0 ft
Flow velocity 6.3982 ft/s	LeftSlope (z1): 4 to 1 (H:V)	RightSlope (z2): 4 to 1 (H:V)
Flow discharge 26.1072 ft^3/s	Input n value 0.025 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 8.33 ft	Flow area 4.08 ft^2	Top width(T) 8.08 ft
Specific energy 1.65 ft	Froude number 1.59	Flow status Supercritical flow
Critical depth 1.22 ft	Critical slope 0.0112 ft/ft	Velocity head 0.64 ft

PROP SEC E-E
Q100=26.0 cfs

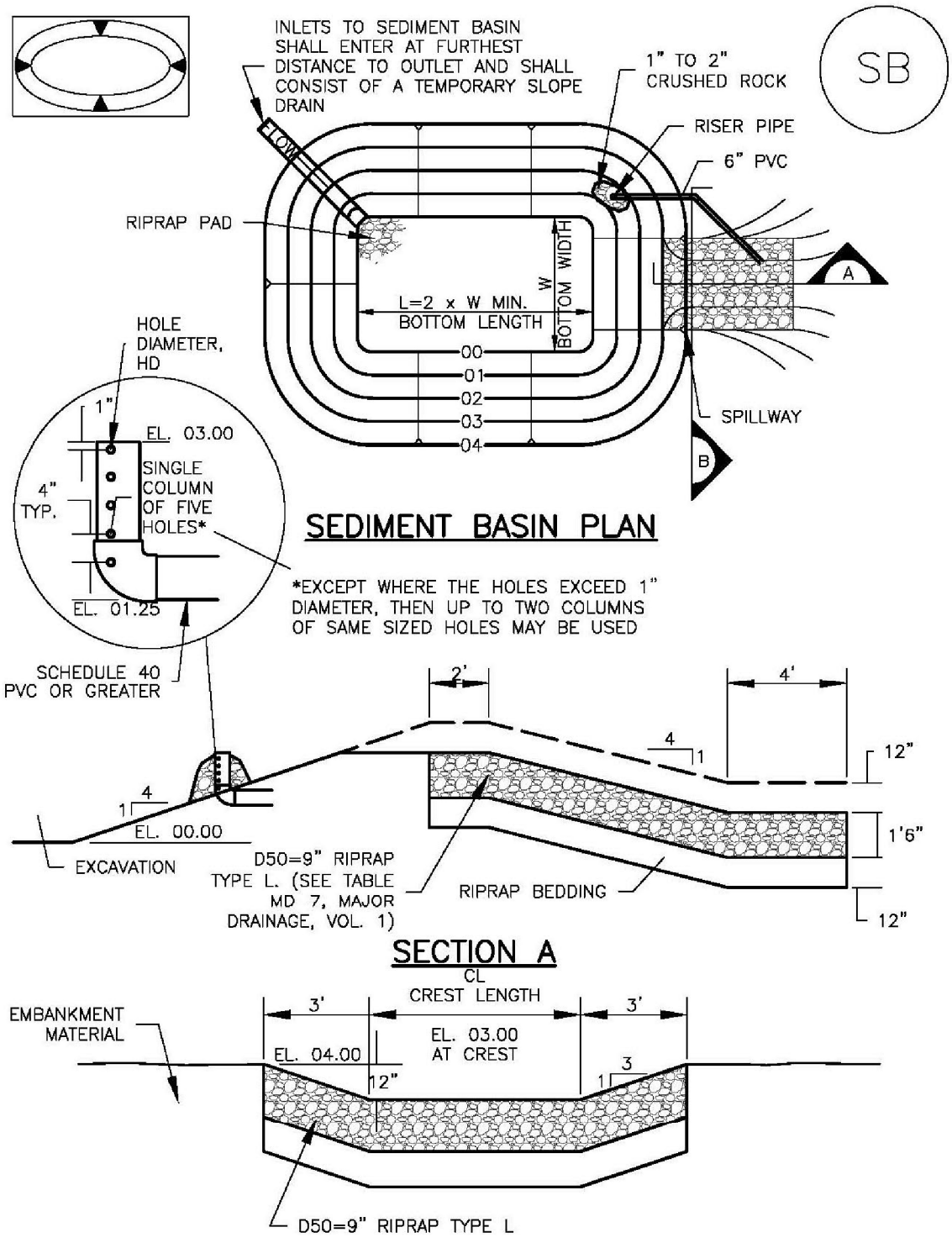

INLETS TO SEDIMENT BASIN SHALL ENTER AT FURTHEST DISTANCE TO OUTLET AND SHALL CONSIST OF A TEMPORARY SLOPE DRAIN
FLOW
1" TO 2" CRUSHED ROCK
SB
RISER PIPE
6" PVC
RIPRAP PAD
W BOTTOM WIDTH
L=2 x W MIN. BOTTOM LENGTH
00
01
02
03
04
A
B
SPILLWAY
HOLE DIAMETER, HD
1"
EL. 03.00
4" TYP.
SINGLE COLUMN OF FIVE HOLES*
EL. 01.25
SCHEDULE 40 PVC OR GREATER
SEDIMENT BASIN PLAN
*EXCEPT WHERE THE HOLES EXCEED 1" DIAMETER, THEN UP TO TWO COLUMNS OF SAME SIZED HOLES MAY BE USED
2'
4'
4
1
12"
4
1
EL. 00.00
1'6"
EXCAVATION
D50=9" RIPRAP TYPE L. (SEE TABLE MD 7, MAJOR DRAINAGE, VOL. 1)
RIPRAP BEDDING
12"
SECTION A
CL
CREST LENGTH
3'
3'
EMBANKMENT MATERIAL
EL. 04.00
EL. 03.00 AT CREST
12"
3
1
D50=9" RIPRAP TYPE L

TABLE SB–1. SIZING INFORMATION FOR STANDARD SEDIMENT BASIN			
Upstream Drainage Area (rounded to nearest acre), (ac)	Basin Bottom Width (W), (ft)	Spillway Crest Length (CL), (ft)	Hole Diameter (HD), (in)
1	12 ½	2	9/32
2	21	3	13/16
3	28	5	½
4	33 ½	6	9/16
5	38 ½	8	21/32
6	43	9	21/32
7	47 ¼	11	25/32
8	51	12	27/32
9	55	13	⅞
10	58 ¼	15	15/16
11	61	16	31/32
12	64	18	1
13	67 ½	19	1 1/16
14	70 ½	21	1 ⅛
15	73 ¼	22	1 3/16

SEDIMENT BASIN INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - –LOCATION OF SEDIMENT BASIN.
   - –TYPE OF BASIN (STANDARD BASIN OR NONSTANDARD BASIN).
   - –FOR STANDARD BASIN, BOTTOM WIDTH W, CREST LENGTH CL, AND HOLE DIAMETER, HD.
   - –FOR NONSTANDARD BASIN, SEE CONSTRUCTION DRAWINGS FOR DESIGN OF BASIN INCLUDING RISER HEIGHT H, NUMBER OF COLUMNS N, HOLE DIAMETER HD AND PIPE DIAMETER D.

2. FOR STANDARD BASIN, BOTTOM DIMENSION MAY BE MODIFIED AS LONG AS BOTTOM AREA IS NOT REDUCED.

3. SEDIMENT BASINS SHALL BE INSTALLED PRIOR TO ANY OTHER LAND–DISTURBING ACTIVITY THAT RELIES ON ON BASINS AS AS A STORMWATER CONTROL.

4. EMBANKMENT MATERIAL SHALL CONSIST OF SOIL FREE OF DEBRIS, ORGANIC MATERIAL, AND ROCKS OR CONCRETE GREATER THAN 3 INCHES AND SHALL HAVE A MINIMUM OF 15 PERCENT BY WEIGHT PASSING THE NO. 200 SIEVE.

5. EMBANKMENT MATERIAL SHALL BE COMPACTED TO AT LEAST 95 PERCENT OF MAXIMUM DENSITY IN ACCORDANCE WITH ASTM D698.

6. PIPE SCH 40 OR GREATER SHALL BE USED.

7. THE DETAILS SHOWN ON THESE SHEETS PERTAIN TO STANDARD SEDIMENT BASIN(S) FOR DRAINAGE AREAS LESS THAN 15 ACRES. SEE CONSTRUCTION DRAWINGS FOR EMBANKMENT, STORAGE VOLUME, SPILLWAY, OUTLET, AND OUTLET PROTECTION DETAILS FOR ANY SEDIMENT BASIN(S) THAT HAVE BEEN INDIVIDUALLY DESIGNED FOR DRAINAGE AREAS LARGER THAN 15 ACRES.

MARKSHEFFEL ROAD FINAL DRAINAGE REPORT EXCERPTS

Final Drainage Report

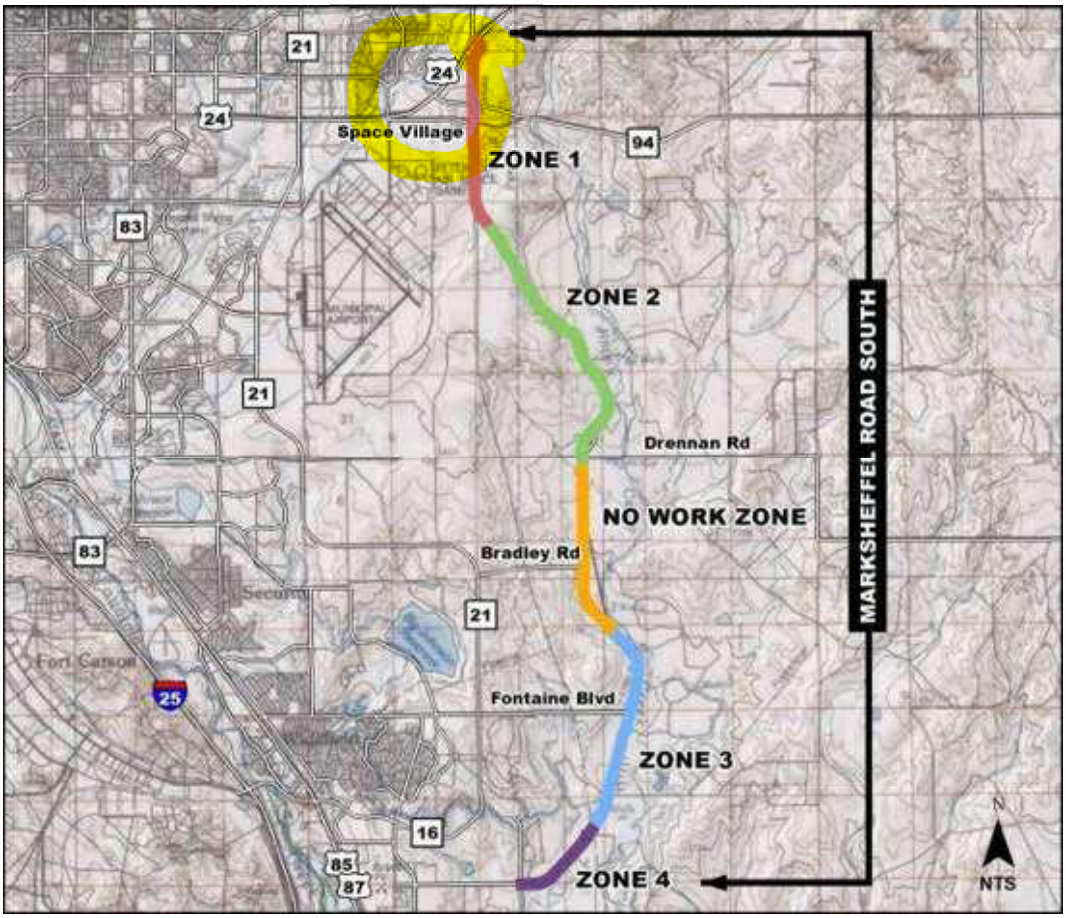
Marksheffel Road South

Link Road to US-24

El Paso County, CO

January 2017

Figure 1 - Vicinity Map



The site is located in multiple townships, ranges and sections as shown in table 1 below.

Table 1: Township Range and Section

Township	Range	Section
14 South	65 West	8, 9, 16, 17, 20, 21, 27, 28, 33, 24
15 South	65 West	10, 15, 22, 27, 28

The majority of the project is located within the Jimmy Camp Creek Drainage Basin and runoff from the surrounding area drains east towards Jimmy Camp Creek crossing Marksheffel Road through a number of culverts. The West Fork of Jimmy Camp Creek flows on the west side of Marksheffel following the roadway down to Link Road where it crosses Marksheffel and connects with the main branch of Jimmy Camp Creek. A portion of the project is also located within the Peterson Field Drainage Basin, which receives the majority of Zone 1 runoff.

The offsite topography is rolling plains with mostly undeveloped lands. Generally, the land slopes from north to south and west to east across the project roadway.

are less than the WQCV event. The overall goal of the project is to detain the WQCV along the entire roadway pavement. The required WQCV will be in areas located within the El Paso County & City of Colorado Springs MS4 Permit Boundary, which is within the City boundary and the El Paso County Urbanized Area. Treatment will be provided as possible outside of these boundaries, though it is not required.

Per the City of Colorado Springs Drainage Criteria Manual Vol 2, "Stormwater Quality Policies, Procedures and Best Management Practices," November 1, 2002 approved BMP's - Sand Filters and Extended Detention Basins will be used to provide Water Quality Capture Volume for the project to satisfy the MS4 Permit requirements.

2.4 Floodplain Criteria

See Appendix 11 for all applicable Floodplain Criteria.

3.0 HYDROLOGY

3.1 Precipitation

Design rainfall for this project was determined by using the National Oceanic and Atmospheric Administration (NOAA) Precipitation Frequency Data Server, which delivers the NOAA Atlas 14 precipitation frequency estimates. A single location along Marksheffel Road was chosen to represent the entire project. Estimated rainfall depths for the design durations were obtained from this NOAA webtool. Rainfall intensities for the 1-hour 5 and 100-year events are 1.30 and 2.76-inches per hour respectively. Design rainfall uses NOAA Atlas 14 Volume III, which provides the most up to date information available. See Appendix 3 for further design details.

3.2 Drainage Basins

This project is segmented into four zones for design. The most southern zone, Zone 4 is Sta. 70+83.78 to Sta. 128+00, Zone 3 is Sta. 128+00 to 282+30.48, Zone 2 is 376+00 to Sta. 554+00, and the most northern zone is Zone 1 and is Sta. 554+00 to 670+73.68.

On the East side of Marksheffel is Jimmy Camp Creek, which is an identified and studied floodplain (Zone AE). Jimmy Camp Creek does not cross the Marksheffel Road, but stays to the east and south of the roadway. On the west side of the road an identified unstudied floodplain (Zone A) which crosses the road at Sta. 256+00. Several tributaries to Jimmy Camp Creek do cross the road in Zone 3. At the south end of the project in Zone 4, near Link Road, on the northwest side of Marksheffel Road is the Jimmy Camp Creek West Tributary. This tributary is an identified studied floodplain (Zone AE) which crosses the roadway in multiple locations

On the north portion of this project most of the offsite drainage flows from north to south and crosses east across Marksheffel Road north of Space Village Road, then flows to the southwest through the culvert crossing at Sta. 563+20. From that point, all the off site drainage flows from west to east crossing Marksheffel and following natural drainage paths to Jimmy Camp Creek. The on-site flows will be conveyed in curb and gutter section north of Space Village Road. South of Space Village Road the runoff follows the grade of the road draining into roadside ditches.

In Zone 3, the Farmers Mutual irrigation ditch is located at Sta. 212+00 north of Fontaine Boulevard. Both irrigation and storm flows are collected on the west and piped across Marksheffel Road to the irrigation ditch that continues east.

The majority of flow from Fontaine Boulevard to the south contributes to the Jimmy Camp Creek West Tributary. This basin is 3.98 square miles and crosses Marksheffel Road at Sta. 103+00, 91+00, and 71+00. From there flows converge with the main branch of Jimmy Camp Creek. The West Tributary is a FEMA Zone AE studied floodplain with base flood elevations determined. The roadway and drainage work within this floodplain has been reduced to adding shoulders, and replacing culverts to match the existing culverts. The crown of the roadway is limited to matching the existing roadway crown in order to not impact the floodplain elevations.

Pavement basins are not discussed in the narrative, but are included within the rational method calculations.

3.2.1 ZONE 1

This northern portion of the project drains easterly across Marksheffel Road and South to a multi-cell box culvert at Station 563+20 where the runoff flows back across Marksheffel and onto Peterson Air Force Base.

Basin 640L contains 50.0-acres between Air Lane and US-24 west of Marksheffel Road. Historically the runoff in this area was conveyed west across Marksheffel at Sta. 650+26 through an 18-inch CMP and at Sta. 642+80 through an 18-inch CMP. It is proposed to drain the basin south at Air Lane through a 48-inch RCP, where the runoff enters Basin 631L.

Basin 631L contains 18.1-acres between SH-94 and Air Lane. Currently the basin drains south across SH-94 through an existing 42-inch RCP. In the proposed condition, runoff from Basin 640L and 631L will enter an extended detention basin that provides some detention and water quality. From the pond runoff will drain south to Basin 618L through the existing 42-inch RCP.

Basin 618L contains 38.4-acres between Air Lane and Space Village Road west of Marksheffel Road. This runoff flows southwest and currently crosses diagonally through the intersection with Space Village Road through an existing 18-inch CMP. It is proposed to treat this runoff in an extended detention basin that does not provide for detention and to drain it south across Space Village Road in a 5 x 2-foot CBC, then west across Marksheffel Road through double 45 x 29-inch ERCPs. From there runoff enters Basin 552R.

Basin 608L contains 21.4-acres between Sta. 608+00 and Space Village Road. This runoff flows west to east and crosses Marksheffel Road at the proposed double 45 x 29-inch ERCPs which also carries runoff from the north. From there runoff enters into Basin 552R.

Basin 575L contains 106.1-acres. This runoff flows to the south with flows staying on the west side of Marksheffel Road. Flows from this basin cross the Peterson Air Force Base Access Road near Sta. 574+00 through an existing 24-inch RCP and a proposed 60” x 38” ERCP. From there flows travel to the south into Basin 563L.

existing runoff along historic drainage patterns. Offsite runoff is not being increased as part of this project. It will be the responsibility of future developers to detain flows that result from an increase in runoff from change in land use.

Roadway basins were primarily delineated for water quality determination. Ditches capacities were primarily confirmed using offsite flows and were sized for maintenance concerns.

The results of the basin hydrology are shown in the tables below.

3.3.1 Rational Method

The Rational Basin hydrology is shown below in Table 5. This table includes both the on-site roadway basins and the offsite basins. The Basin IDs generally represent the roadway station each basin outlets to, and the L and R indicate the basin in on the left or right side of the Marksheffel centerline. The basins are listed from the north end of the project to the south generally following the drainage patterns of the project.

Table 5: Basins (Rational Method)

Basin ID	Area (ac)	5 -Year		100- Year	
		C	Q (cfs)	C	Q (cfs)
Zone 1					
664R	1.09	0.90	4.54	0.95	9.87
662L	1.21	0.90	4.79	0.95	10.4
661L	0.07	0.90	0.29	0.95	0.63
654L	1.62	0.90	6.04	0.95	13.1
646R	0.75	0.90	2.63	0.95	5.70
641L	1.58	0.90	4.48	0.95	9.72
640L	50.0	0.25	20.6	0.35	60.0
637R	0.91	0.90	2.22	0.95	4.82
631R	0.56	0.90	2.22	0.95	4.83
632L	1.21	0.90	3.96	0.95	8.61
631L	18.1	0.29	9.95	0.39	27.3
618R	1.41	0.90	4.61	0.95	10.0
618L	38.4	0.27	14.7	0.37	42.1
617R	17.53	0.25	9.55	0.35	27.55
608R	1.12	0.90	3.28	0.95	7.13
608L	21.4	0.28	10.0	0.38	28.2
575L	106	0.27	29.4	0.37	85.8
563R	4.84	0.90	8.45	0.95	18.4
563L	11.7	0.25	4.87	0.35	14.2
Zone 2					
553R	0.80	0.90	2.44	0.95	5.31
553L	0.26	0.90	1.01	0.95	2.20
552R	662	0.27	99.3	0.37	302
547R	0.33	0.90	1.17	0.95	2.53
534R	0.37	0.90	1.38	0.95	3.01
534L	15.5	0.29	7.09	0.39	19.8
498L	1.61	0.90	2.96	0.95	6.43
485L	0.33	0.90	1.38	0.95	3.01
484R	2.64	0.90	4.61	0.95	10.1
484L	142	0.26	44.0	.036	129.5
480L	0.17	0.90	0.68	0.95	1.48

calculated by either the Rational Method or the USGS Regional Regression methodology. A small number of culverts were upsized based on a need for additional capacity to meet current design criteria. Culverts that have been upsized outlet to Jimmy Camp Creek and the runoff follows historic drainage patterns, any increased conveyance through the upsized pipe is not expected to have adverse downstream impacts. The minimum 100-year velocity is 3.71 fps. See Appendix 9 for calculations.

Table 7 lists the proposed culverts through the project corridor.

Table 7: Culvert Design

Culvert ID	Existing Size	Proposed Size	100 Year Flow (cfs)	100 Year Headwater	Allowable Headwater	100 Year Velocity (fps)
Zone 1						
CV639	-	42”	75.4	6337.4	6338.3	9.41
SH-94	42”	-	77.4	6323.2	6325.0	20.51
CV617		2-24”	27.55	6282.6	6284.72	6.17
CV616	-	2-45x29	127	6284.8	8285.0	9.29
CV614	-	18”	15.21	6285.6	6285.8	8.82
CV603	-	18”	3.94	6284.7	6286.4	7.95
CV594	-	18”	8.17	6255.2	6256.8	6.57
CV592	-	18”	9.38	6256.1	6257.4	10.00
CV575	-	60” x 38”	85.75	6203.8	6204.6	17.48
CV563	2-7'x3'	2-7x3 CBC	349	6187.2	6187.7	15.13
Zone 2						
CV533	36"	36"	19.8	6159.3	6163.0	15.00
CV490	-	18"	6.06	6073.5	6075.8	7.08
CV483	36”	2-36"	129	6063.8	6064.7	13.75
CV468	36"	36"	38.0	6033.2	6038.0	12.43
CV447	72”	72"	140	5989.0	5995.9	12.29
CV404	48"	54”	134	5908.8	5909.7	10.37
Zone 3						
CV255	-	18”	6.83	5759.1	5760.0	10.06
CV233	-	24”	16.9	5738.6	5739.5	8.11
CV228	72”	7x4 CBC	75.4	5732.9	5736.7	12.73
CV195	-	18"	9.87	5700.9	5703.0	6.76
CV194	-	18"	10.1	5699.8	5701.8	6.77
CV192	-	18”	10.5	5697.8	5699.8	6.84
CV178L		2-36”	87.1	5688.9	5690.19	8.03
CV177R	24”	2-24”	28.6	5687.56	5689.14	6.27
CV177	-	2-36”	87.06	5688.43	5688.7	8.63
CV168	-	2-24”	33.60	5683.18	5683.94	6.75
CV152	18”	18”	8.68	5674.0	5675.2	6.02
CV150	-	6x2 CBC	119	5676.3	5676.3	9.90
Zone 4						
CV125	-	24”	8.55	5652.54	5654.11	6.01
CV121	-	24”	9.59	5649.44	5650.77	6.23
CV117	-	24”	11.16	5646.58	5647.78	6.36
CV112	-	18”	1.67	5640.75	5643.25	4.21
CV109	-	18”	2.31	5638.7	5641.2	4.18
CV102	24”	24”	Replaced in kind to not impact floodplain			

Culvert ID	Existing Size	Proposed Size	100 Year Flow (cfs)	100 Year Headwater	Allowable Headwater	100 Year Velocity (fps)
CV92	24”	30” x 19”	Replaced in kind to not impact floodplain			

4.1.1 Hydraulic Variance

The existing 42-inch culvert at SH-94 has a velocity greater than 18-fps. This is due to the steepness of the culvert, re-routing of the storm system, and ROW limitations that limit what can be detained at that location. A stilling basin has been designed for the outlet of this culvert to counteract the scour forces caused by such high velocities.

Utility impacts caused a set of ditch modifications that included a set of bumpouts for access to the utility manholes along the a few sections of the corridor. These bulbouts block the roadside ditch and 24-inch RCPs. These culverts do not have to convey the full 100-year event, but may overtop the bumpouts during large events.

4.2 Storm Pipes

Inlets and storm pipes are used to route water from the curb and gutter section in Zone 1 to the adjacent ditch on the left side of the roadway. In Zone 2 and 3 grate inlets are used in the ditches to route on-site flow from the ditches to crossing culverts where the runoff will follow historic drainage patterns. In Zone 2 Inlets are placed in the ditches and shall follow ditch criteria requirements. In Table 8 and 9, the inlet location and storm system information is summarized.

For the InRoads calculations located in Appendix 7 of this report the Q_5 is only provided for the inlets listed in Table 8 below. This was done because these inlets are in the only curb and gutter section of the project and the Q_5 was analyzed for spread criteria. In other locations the Q_{100} criteria superseded the Q_5 HW/D criteria.

Table 8: Storm System Design

Inlet ID	Inlet Type	Inlet Size (ft)	Pipe Size	5-Year				100-Year			
				Flow (cfs)	Flow Depth (ft)	Spread (ft)	Pipe Velocity (fps)	Flow (cfs)	Flow Depth (ft)	Spread (ft)	Pipe Velocity (fps)
ZONE 1											
IN664	Type R	5	24”	4.54	0.21	14.82	4.20	9.87	0.25	20.1	4.56
IN662	Type R	5	24"	4.79	0.30	8.81	7.59	10.4	0.38	12.5	8.44
IN661	Type R	5	18"	3.11	0.26	8.95	5.05	8.22	0.33	14.4	6.35
IN654	Type R	5	24"	10.5	0.45	7.70	3.76	26.57	0.62	11.1	4.36
IN646	Type R	5	24”	10.4	0.48	17.7	4.50	27.8	0.65	26.0	5.31
IN640	Type R	5	24”	4.48	0.38	12.5	6.98	9.72	0.47	17.2	7.85
IN636	Type R	5	18”	2.22	0.23	14.8	3.45	4.68	0.27	22.1	3.72
IN630A	Type R	5	24"	2.22	0.23	4.92	4.70	4.83	0.28	7.78	5.31
IN630B	Type R	5	24"	3.96	0.27	7.03	3.24	8.61	0.33	10.3	3.54
IN620	Type R	5	18”	4.61	0.28	7.89	2.62	10.00	0.35	11.36	2.89

Table 9: Grate Inlet Table

Inlet ID	Inlet Type	Pipe Size	100-Year		
			Flow (cfs)	Ponding Depth (ft)	Pipe Velocity (fps)
IN592	Type C	18”	Nuisance Flows		
IN533	Type D	36”	3.01	0.71	15.00
IN468B	Type D	36”	5.93	0.34	12.43
IN468	Type D	36”	2.11	0.52	12.43
IN447	Type D	72”	5.01	0.75	12.29
IN403	Type D	18”	1.77	0.15	1.00
IN206	Type C	24”	5.63	0.47	3.85
IN228	Type D	7x4 CBC	2.81	0.64	12.58
IN257	Type D	18”	14.16	0.61	10.55

4.2.1 Hydraulic Variance

P403 in Zone 3 has a velocity below 2.5-fps. This pipe has been steepened as far as is advisable to help increase velocity and reduce sedimentation within the pipe. The site limitations including roadway cover and existing ground limit further steepening of this pipe.

4.3 Curb & Gutter

A curb and gutter section will be located in Zone 1 from Space Village Avenue to US-24 to minimize ROW impacts and coordination with the Colorado Springs Utilities SDS pump station site. See Appendix 8 for calculations.

Table 10: Curb & Gutter Design

Curb & Gutter ID	Slope (ft/ft)	5-yr Discharge (cfs)	Gutter Depth (ft)	Spread (ft)	100-yr Discharge (cfs)	Normal Depth (ft)	Velocity (fps)
664R	0.053	4.54	0.27	7.30	9.87	0.33	7.96
662L	0.046	4.79	0.28	7.78	10.41	0.34	9.60
661L	0.027	0.29	0.12	1.47	0.63	0.16	4.09
654R	0.043	6.04	0.30	8.86	13.136	0.37	7.76
646R	0.018	2.63	0.27	7.28	5.7	0.33	4.63
641L	0.005	4.48	0.37	12.54	9.72	0.46	3.14
637R	0.005	2.22	0.30	9.18	4.82	0.38	2.69
632L	0.005	3.96	0.36	11.89	8.61	0.45	3.06
631R	0.005	2.22	0.30	9.18	4.83	0.38	2.69
618R	0.018	4.61	0.31	9.57	10.01	0.39	5.20

4.4 Ditches

Ditches will be used to convey on-site flow for a majority of the project as they do currently. Ditches will be trapezoidal with a 5-foot flat bottom and 3:1 back slopes and 4:1 fore slopes where possible. The ditches break at cross culverts where runoff will follow historic drainage patterns. Ditch design requirements are addressed in Section 2.1 of this report.

Table 11 below summarizes the ditches and their corresponding attributes. Calculations for ditch sizes can be viewed in Appendix 8.

Table 11: Ditch Design

Ditch ID	Range	Channel Slope (ft/ft)	5-yr Discharge (cfs)	Normal Depth (ft)	Velocity (fps)	100-yr Discharge (cfs)	Normal Depth (ft)	Velocity (fps)
ZONE 1								
641L	Sta. 640+00 to 655+00	0.005	14.49	0.78	2.39	33.79	1.21	3.04
632L	Sta. 630+00 to 640+00	0.013	30.82	0.9	4.18	80.68	1.46	5.44
618L *	Sta. 630+00 to 640+00	0.044	4.61	0.23	3.52	77.42	1.06	8.39
608L	Sta. 618+00 to 631+00	0.013	4.61	0.32	2.35	28.19	0.86	4.07
608R	Sta. 608+00 to 618+00	0.013	3.28	0.26	2.1	7.13	0.41	2.7
575L	Sta. 608+00 to 618+00	0.013	29.38	0.88	4.12	85.75	1.51	5.53
563R	Sta. 575+00 to 608+00	0.026	8.45	0.37	3.61	18.44	0.57	4.6
ZONE 2								
553L	Sta. 575+00 to 608+00	0.02	1.01	0.12	1.59	2.2	0.19	2.1
C 575L	Sta. 568+50 to 573+23	0.014	-	-	-	85.75	1.37	12.48
553R	Sta. 553+00 to 559+00	0.02	2.44	0.2	2.18	5.31	0.31	2.84
547R	Sta. 552+00 to 563+00	0.024	1.17	0.12	1.78	2.53	0.19	2.35
534L	Sta. 547+00 to 552+00	0.014	7.09	0.4	2.76	19.8	0.7	3.78
534R	Sta. 533+50 to 542+00	0.019	1.38	0.14	1.75	3.01	0.23	2.31
498L	Sta. 533+50 to 550+00	0.018	2.96	0.23	2.25	6.43	0.35	2.92
485L	Sta. 498+50 to 534+00	0.033	1.38	0.12	2.09	3.01	0.19	2.76
484R	Sta. 484+00 to 491+00	0.019	4.61	0.29	2.66	10.06	0.45	3.43
480L	Sta. 480+00 to 484+00	0.007	0.68	0.13	0.99	1.48	0.2	1.3
470R	Sta. 484+00 to 534+00	0.025	2.73	0.2	2.44	5.93	0.31	3.17
470L	Sta. 470+00 to 484+00	0.025	0.97	0.11	1.68	2.11	0.17	2.23
448L	Sta. 469+00 to 474+00	0.021	47.35	1	5.6	5.01	0.29	2.83
448R	Sta. 448+00 to 455+00	0.021	2.3	0.19	2.17	5.01	0.29	2.83
438R	Sta. 447+60 to 469+00	0.019	2.68	0.21	2.22	5.83	0.33	2.88
422R	Sta. 438+00 to 448+00	0.012	0.81	0.12	1.25	1.77	0.19	1.65
405L	Sta. 422+00 to 430+00	0.023	5.59	0.3	3.02	12.15	0.47	3.88
403L	Sta. 404+00 to 444+00	0.02	1.51	0.15	1.84	3.28	0.23	2.42
403R	Sta. 398+60 to 403+00	0.02	0.81	0.1	1.47	1.77	0.16	1.95
394L	Sta. 398+60 to 404+00	0.013	0.77	0.11	1.26	1.67	0.18	1.66
377L	Sta. 394+20 to 398+60	0.017	1.98	0.18	1.92	4.3	0.29	2.51
376R	Sta. 376+40 to 381+00	0.031	5.79	0.29	3.38	14.42	0.48	4.54
ZONE 3								
A 256L	Sta 256+30 to 264+29	0.009	2.46	0.25	1.68	6.97	0.25	2.36
A 256R	Sta 256+30 to 264+30	0.009	2.46	0.25	1.68	6.97	0.25	2.36
A 247L	Sta. 246+00 to 256+30	0.019	2.41	0.51	2.67	6.83	0.51	3.46
A 246R	Sta. 246+00 to 256+30	0.019	2.54	0.52	2.7	7.19	0.52	3.5
A 226L *	Sta. 226+00 to 246+00	0.023	19.69	0.61	4.49	72.59	0.61	6.51
A 229R	Sta. 229+00 to 232+00	0.0095	0.99	0.14	1.25	2.81	0.14	1.79
A 210L *	Sta. 210+60 to 226+00	0.0258	25.06	0.65	4.82	92.09	0.65	6.89
A 212R	Sta. 212+00 to 229+00	0.0083	2.65	0.27	1.68	7.48	0.27	2.35
A 208R	Sta. 207+60 to 212+00	0.01	1.33	0.17	1.41	3.77	0.17	2.01
A 206L	Sta. 205+00 to 212+00	0.01	1.99	0.21	1.62	5.63	0.21	2.29
A 178L	Sta. 179+00 to 205+00	0.012	23.38	0.8	3.75	87.06	0.8	5.39
A 178R**	Sta. 200+00 to 205+00					12.81	1.35	3.53
A 178R	Sta. 178+00 to 207+00	0.01	4.51	0.34	2.13	12.81	0.34	2.95
A 152L	Sta. 152+00 to 178+00	0.0053	3.05	0.33	1.52	8.68	0.33	2.1
A 152R	Sta. 152+00 to 178+00	0.0052	3.1	0.33	1.51	8.82	0.33	2.1
ZONE 4								
A 125R	Sta. 124+50 to 137+50	0.01	2.06	0.22	1.64	5.82	0.22	2.31
A 103L**	Sta 130+00 to 140+00	0.0075				13.47	1.45	3.21
A 103L	Sta. 103+00 to148+00	0.088	4.69	0.36	2.07	13.47	0.36	2.86
A 130L**	Sta 103+00 to 148+00	0.01				129.7	1.88	12.6
A 92L	Sta. 92+00 to 103+00	0.0073	1.01	0.16	1.15	2.85	0.16	1.65

Ditch ID	Range	Channel Slope (ft/ft)	5-yr Discharge (cfs)	Normal Depth (ft)	Velocity (fps)	100-yr Discharge (cfs)	Normal Depth (ft)	Velocity (fps)
A 92R	Sta. 92+00 to 103+00	0.0071	1.09	0.17	1.17	3.07	0.17	1.68

* Turf Reinforcement matt required due to high velocities.
** Ditch Section is triangular.

There is one concrete lined ditch located in Zone 2 of the project downstream of the culvert at the Peterson Air Force Base. This ditch is rectangular with a 5-foot bottom width and a depth of 1.5 feet. This was done to accommodate ROW limitation in the area and to receive the high velocities from CV575. The minimum ditch slope was used to compute capacity. See C 575L for design information.

There is also a concrete lined ditch at the south end of Zone 3 at Station 130+00 Left. The ditch has been narrowed significantly at this location for a turning lane at the future Mesa Ridge Parkway, and a utility access road.

4.2.1 Ditch Variance

Ditches 618L, 226L, and 210L shall be protected with turf reinforcement due to higher velocities for the 100-YR flow.

Utility impacts caused a set of ditch modifications that included a set of bumpouts for access to the utility manholes along the a few sections of the corridor. These bulbouts block the roadside ditch and 24-inch RCPs. These culverts do not have to convey the full 100-year event, but may overtop the bumpouts during large events.

4.5 Detention

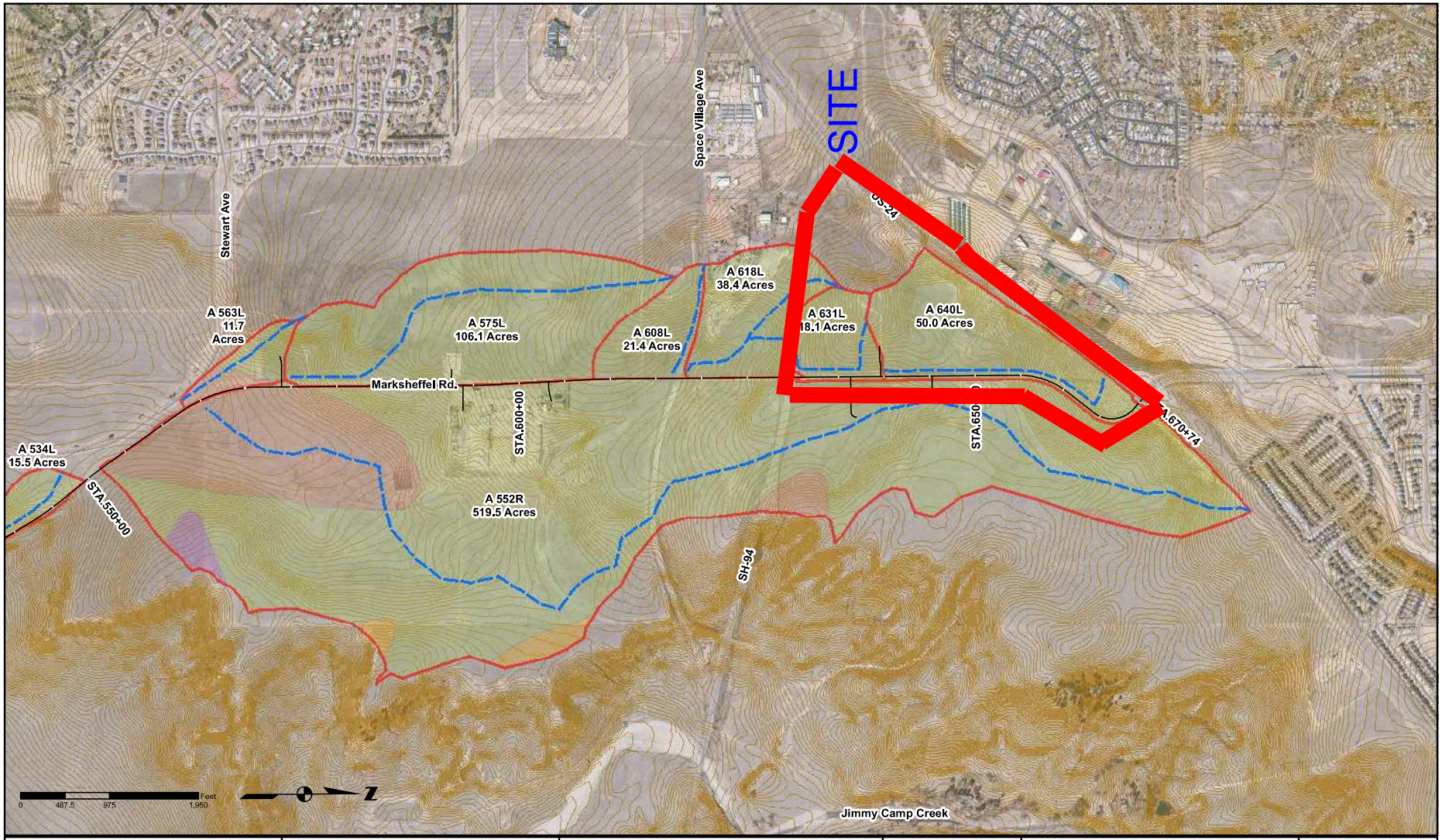
There are two extended detention basins on the project that provide detention in addition to water quality treatment. Pond 630 provides detention to the capacity of the existing 42” CMP that crosses SH-94. Pond 380 provides detention to the capacity of the existing 24” CMP that crosses Drennan on the east side of Marksheffel. See the Water Quality section for further discussion and Appendix 11 for Extended Detention Basin calculations. Table 12 provides the detention design results for these ponds.

Table 12: Detention Design

Pond ID	10-year			100-year		
	Q_{in} (cfs)	Q_{out} (cfs)	Storage Volume (ac-ft)	Q_{in} (cfs)	Q_{out} (cfs)	Storage Volume (ac-ft)
Pond 380	9.14	6.81	0.23	27.11	6.81	1.56
Pond 630	-	-	-	90.41	77.05	0.88

5.0 WATER QUALITY

This section outlines the Treatment BMPs used to fulfill the MS4 Permit requirements on the project. Sand Filters and Extended Detention Ponds were used to provide WQCV on the project. These are approved Treatment BMP’s as outlined in the El Paso County and City of Colorado Spring Drainage Design Manual which references Urban Drainage and Flood Control District Criteria.



Print Date: 10/23/2014	Basin Boundary	Hydrologic Soils Group A	As Constructed	MARKSHEFFEL ROAD DRAINAGE BASIN	Project No./Code
File Name: Basins_BL_20141009.mxd	Flowpath	Hydrologic Soils Group B	No Revisions:		
Horiz. Scale: Vert. Scale: None	Water	Hydrologic Soils Group C	Revised:	Designer: E. Staten / Detailer: M.Johnson / Sheet Subset: BASIN	Structure Numbers
Unit Information Unit Leader Initials		Hydrologic Soils Group D	Void:	Subset Sheets: 3 of 3	Sheet Number 3
HDR Engineering, Inc. PARSONS BRINCKERHOFF			EL PASO COUNTY COLORADO / PPRTA		

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

Corridor / Design Package: Marksheffel

System Name:

Computed: MAJ Date: 6/28/2014

Checked: Date:

Design Storm: 5-yr

	LOCATION	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME		
			AREA DESIGN (name)	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C.A. (AC)	I IN / HR	Q (CFS)	t_c (MIN)	SUM (C*A) (AC)	I (IN / HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
	ZONE 1																				
1	Sta. 664+00 to Sta. 670+00		664R	1.09	0.90	5.02	0.98	4.63	4.54				4.54						180	6.70	0.45
2	Sta. 662+50 to Sta. 670+00		662L	1.21	0.90	6.19	1.09	4.38	4.79	6.19	1.09	4.38	4.79						50	6.70	0.12
3	Sta. 661+60 to Sta. 662+50		661L	0.07	0.90	5.00	0.06	4.63	0.29	6.31	2.14	4.38	9.36						750	6.70	1.87
4	Sta. 646+00 to Sta. 654+00		646R	0.75	0.90	8.25	0.68	3.89	2.63	8.25	2.81	3.89	10.94						560	6.70	1.39
5	Sta. 640+00 to Sta. 655+00		641L	1.58	0.90	12.99	1.43	3.14	4.48	12.99	4.24	3.14	13.30								
6	Sta. 640+00 to Sta. 644+50		640L	50.02	0.25	46.61	12.51	1.65	20.63	46.61	16.74	1.65	27.62						930	5.98	2.59
7	Sta. 637+00 to Sta. 646+00		637R	0.91	0.90	16.24	0.82	2.71	2.22	49.20	17.56	1.57	27.57						770	5.98	2.15
8	Sta. 631+00 to Sta. 637+00		631R	0.56	0.90	6.51	0.51	4.38	2.22	51.35	18.07	1.52	27.46						300	5.98	0.84
9	Sta. 630+00 to Sta. 640+00		632L	1.21	0.90	9.82	1.09	3.64	3.96	52.19	19.16	1.50	28.74						300	5.98	0.84
10	Sta. 631+00 to Sta. 640+00	SH-94 Pond Entrance	631L	18.14	0.29	37.54	5.32	1.87	9.95	53.02	24.48	1.47	35.98						1300	5.98	3.62
		SH-94 Pond Exit								76.99	24.48	1.15	28.15								
11	Sta. 618+00 to Sta. 631+00	Space Village Pond Entrance	618L	38.41	0.27	56.19	10.51	1.40	14.71	82.61	34.98	1.11	38.83						160	6.11	0.44
12	Sta. 608+00 to Sta. 618+00	CV 616	608L	21.42	0.28	45.51	6.01	1.67	10.04	83.05	41.00	1.10	45.09								
13	Sta. 575+00 to Sta. 608+00		575L	106.11	0.27	92.38	28.52	1.03	29.38												
14	Sta. 563+00 to Sta. 608+00		563R	4.84	0.90	34.21	4.36	1.94	8.45												
15	Sta. 563+00 to Sta. 574+50		563L	11.66	0.25	45.65	2.92	1.67	4.87												
	ZONE 2																				
16	Sta. 552+00 to Sta 563+00		553R	0.80	0.90	10.30	0.72	3.39	2.44												
17	Sta. 553+00 to Sta. 559+00		553L	0.26	0.90	6.01	0.23	4.38	1.01												
18	Sta. 552+00 to Sta. 670+00		552R	662.21	0.27	366.65	176.32	0.56	99.27												
19	Sta. 547+00 to Sta. 552+00		547R	0.33	0.90	8.79	0.30	3.89	1.17												
20	Sta. 533+50 to Sta. 542+00		534R	0.37	0.90	7.79	0.33	4.13	1.38												
21	Sta. 533+50 to Sta. 550+00		534L	15.52	0.29	49.91	4.52	1.57	7.09												
22	Sta. 498+50 to Sta. 534+00		498L	1.61	0.90	30.86	1.45	2.04	2.96												
23	Sta. 484+00 to Sta. 491+00		485L	0.33	0.90	5.52	0.30	4.63	1.38												
24	Sta. 484+00 to Sta. 534+00		484R	2.64	0.90	34.79	2.38	1.94	4.61												
25	Sta. 484+00 to Sta. 534+00		484L	141.71	0.26	72.35	36.69	1.20	44.03												
26	Sta. 480+00 to Sta. 484+00		480L	0.17	0.90	6.53	0.16	4.38	0.68												
27	Sta. 470+00 to Sta. 484+00		470R	0.93	0.90	11.47	0.84	3.26	2.73												
28	Sta. 469+00 to Sta. 474+00		470L	0.23	0.90	5.22	0.21	4.63	0.97												
29	Sta. 469+00 to Sta. 484+00		469L	60.30	0.25	124.04	15.34	0.77	11.81												
30	Sta. 448+00 to Sta. 455+00		448R	0.62	0.90	7.52	0.56	4.13	2.30												
31	Sta. 447+60 to Sta. 469+00		448L	164.16	0.26	80.62	41.91	1.13	47.35												
32	Sta. 438+00 to Sta. 448+00		438R	0.68	0.90	6.97	0.61	4.38	2.68												
33	Sta. 422+00 to Sta. 430+00		422R	0.34	0.90	17.19	0.31	2.66	0.81												
34	Sta. 404+00 to Sta 444+00		405L	3.05	0.90	30.85	2.74	2.04	5.59												
35	Sta. 398+60 to Sta. 403+00		403R	0.20	0.90	5.00	0.18	4.63	0.81												
36	Sta. 398+60 to Sta. 404+00		403L	0.36	0.90	5.19	0.33	4.63	1.51												
37	Sta. 398+60 to Sta. 447+00		404L	206.24	0.26	116.90	53.78	0.82	44.10												
38	Sta. 394+20 to Sta. 398+60		394L	0.18	0.90	5.00	0.17	4.63	0.77												
39	Sta. 376+40 to Sta. 381+00		377L	0.50	0.90	6.35	0.45	4.38	1.98												
40	Sta. 376+40 to Sta. 398+60		376R	15.47	0.35	49.14	5.36	1.57	8.41												
41	Sta. 376+40 to Sta. 398+60		376L	82.29	0.26	71.69	21.02	1.21	25.43												

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

Corridor / Design Package: Marksheffel
System Name:

Computed: MAJ Date: 6/28/2014
Checked: Date:

Design Storm: 100-yr

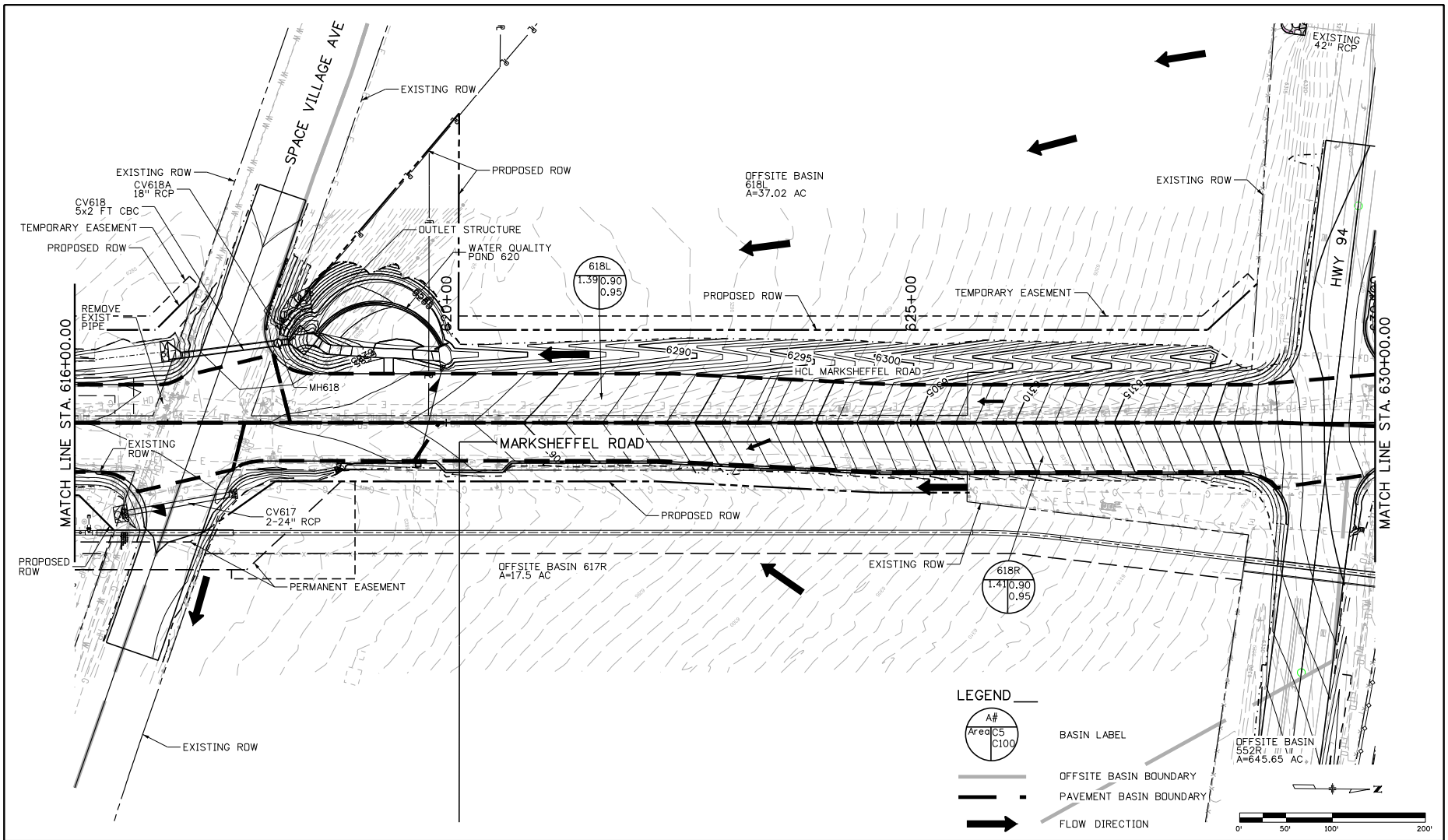
	LOCATION	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME		
			AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C.A. (AC)	I IN / HR	Q (CFS)	t_c (MIN)	SUM (C*A) (AC)	I (IN / HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
	Zone 1																				
1	Sta. 664+00 to Sta. 670+00		664R	1.09	0.95	5.02	1.04	9.53	9.87				9.87						180	6.70	0.45
2	Sta. 662+50 to Sta. 670+00		662L	1.21	0.95	6.19	1.15	9.02	10.41	6.19	1.15	9.02	10.41						50	6.70	0.12
3	Sta. 661+60 to Sta. 662+50		661L	0.07	0.95	5.00	0.07	9.53	0.63	6.31	2.25	9.02	20.34						750	6.70	1.87
4	Sta. 646+00 to Sta. 654+00		646R	0.75	0.95	8.25	0.71	8.00	5.70	8.25	2.97	8.00	23.74						560	6.70	1.39
5	Sta. 640+00 to Sta. 655+00		641L	1.58	0.95	12.99	1.51	6.46	9.72	12.99	4.47	6.46	28.89								
6	Sta. 640+00 to Sta. 644+50		640L	50.02	0.35	46.61	17.51	3.43	60.05	46.61	21.98	3.43	75.39						930	5.98	2.59
7	Sta. 637+00 to Sta. 646+00		637R	0.91	0.95	16.24	0.86	5.57	4.82	49.20	22.84	3.29	75.16						770	5.98	2.15
8	Sta. 631+00 to Sta. 637+00		631R	0.56	0.95	6.51	0.54	9.02	4.83	51.35	23.38	3.19	74.58						300	5.98	0.84
9	Sta. 630+00 to Sta. 640+00		632L	1.21	0.95	9.82	1.15	7.49	8.61	52.19	24.53	3.14	77.02						300	5.98	0.84
10	Sta. 631+00 to Sta. 640+00	SH-94 Pond Entrance	631L	18.14	0.39	37.54	7.08	3.86	27.31	53.02	31.60	3.10	97.97						1300	5.98	3.62
		SH-94 Pond Exit								76.99	31.60	2.45	77.42								
11	Sta. 618+00 to Sta. 631+00	Space Village Pond Entrance	618L	38.41	0.37	56.19	14.28	2.95	42.12	82.61	45.88	2.38	109.20						160	6.11	0.44
12	Sta. 608+00 to Sta. 618+00	CV 616	608L	21.42	0.38	45.51	8.10	3.48	28.19	83.05	53.98	2.36	127.40								
13	Sta. 575+00 to Sta. 608+00		575L	106.11	0.37	92.38	38.98	2.20	85.75												
14	Sta. 563+00 to Sta. 608+00		563R	4.84	0.95	34.21	4.60	4.01	18.44												
15	Sta. 563+00 to Sta. 574+50		563L	11.66	0.35	45.65	4.08	3.48	14.20												
	ZONE 2																				
16	Sta. 552+00 to Sta 563+00		553R	0.80	0.95	10.30	0.76	6.98	5.31												
17	Sta. 553+00 to Sta. 559+00		553L	0.26	0.95	6.01	0.24	9.02	2.20												
18	Sta. 552+00 to Sta. 670+00		552R	662.21	0.37	366.65	241.71	1.25	302.14												
19	Sta. 547+00 to Sta. 552+00		547R	0.33	0.95	8.79	0.32	8.00	2.53												
20	Sta. 533+50 to Sta. 542+00		534R	0.37	0.95	7.79	0.35	8.51	3.01												
21	Sta. 533+50 to Sta. 550+00		534L	15.52	0.39	49.91	6.02	3.29	19.80												
22	Sta. 498+50 to Sta. 534+00		498L	1.61	0.95	30.86	1.53	4.20	6.43												
23	Sta. 484+00 to Sta. 491+00		485L	0.33	0.95	5.52	0.32	9.53	3.01												
24	Sta. 484+00 to Sta. 534+00		484R	2.64	0.95	34.79	2.51	4.01	10.06												
25	Sta. 484+00 to Sta. 534+00		484L	141.71	0.36	72.35	50.77	2.55	129.45												
26	Sta. 480+00 to Sta. 484+00		480L	0.17	0.95	6.53	0.16	9.02	1.48												
27	Sta. 470+00 to Sta. 484+00		470R	0.93	0.95	11.47	0.88	6.72	5.93												
28	Sta. 469+00 to Sta. 474+00		470L	0.23	0.95	5.22	0.22	9.53	2.11												
29	Sta. 469+00 to Sta. 484+00		469L	60.30	0.35	124.04	21.35	1.68	35.87												
30	Sta. 448+00 to Sta. 455+00		448R	0.62	0.95	7.52	0.59	8.51	5.01												
31	Sta. 447+60 to Sta. 469+00		448L	164.16	0.35	80.62	58.26	2.41	140.39												
32	Sta. 438+00 to Sta. 448+00		438R	0.68	0.95	6.97	0.65	9.02	5.83												
33	Sta. 422+00 to Sta. 430+00		422R	0.34	0.95	17.19	0.32	5.47	1.77												
34	Sta. 404+00 to Sta 444+00		405L	3.05	0.95	30.85	2.89	4.20	12.15												
35	Sta. 398+60 to Sta. 403+00		403R	0.20	0.95	5.00	0.19	9.53	1.77												
36	Sta. 398+60 to Sta. 404+00		403L	0.36	0.95	5.19	0.34	9.53	3.28												
37	Sta. 398+60 to Sta. 447+00		404L	206.24	0.36	116.90	74.23	1.78	132.13												
38	Sta. 394+20 to Sta. 398+60		394L	0.18	0.95	5.00	0.18	9.53	1.67												
39	Sta. 376+40 to Sta. 381+00		377L	0.50	0.95	6.35	0.48	9.02	4.30												
40	Sta. 376+40 to Sta. 398+60		376R	15.47	0.44	49.14	6.79	3.29	22.34												
41	Sta. 376+40 to Sta. 398+60		376L	82.29	0.36	71.69	29.21	2.57	75.08												

(1) Basin Description linked to C-Value Sheet
(2) Basin Design Point
(3) Enter the Basin Name from C Value Sheet
(4) Basin Area linked to C-Value Sheet
(5) Composite C linked to C-Value Sheet
(6) Time of Concentration linked to C-Value Sheet

(7) =Column 4 x Column 5
(8) =28.5*P/(10+Column 6)^0.786
(9) =Column 7 x Column 8
(10) =Column 6 + Column 21
(11) Add the Basin Areas (7) to get the combined basin AC
(12) =28.5*P/(10+Column 10)^0.786

(13) Sum of Qs
(14) Additonal Street Overland Flow
(15) Additonal Street Overland Flow
(16) Design Pipe Flow
(17) Pipe Slope
(18) Pipe Size

(19) Additional Flow Length
(20) Velocity
(21) =Column 19 / Column 20 / 60



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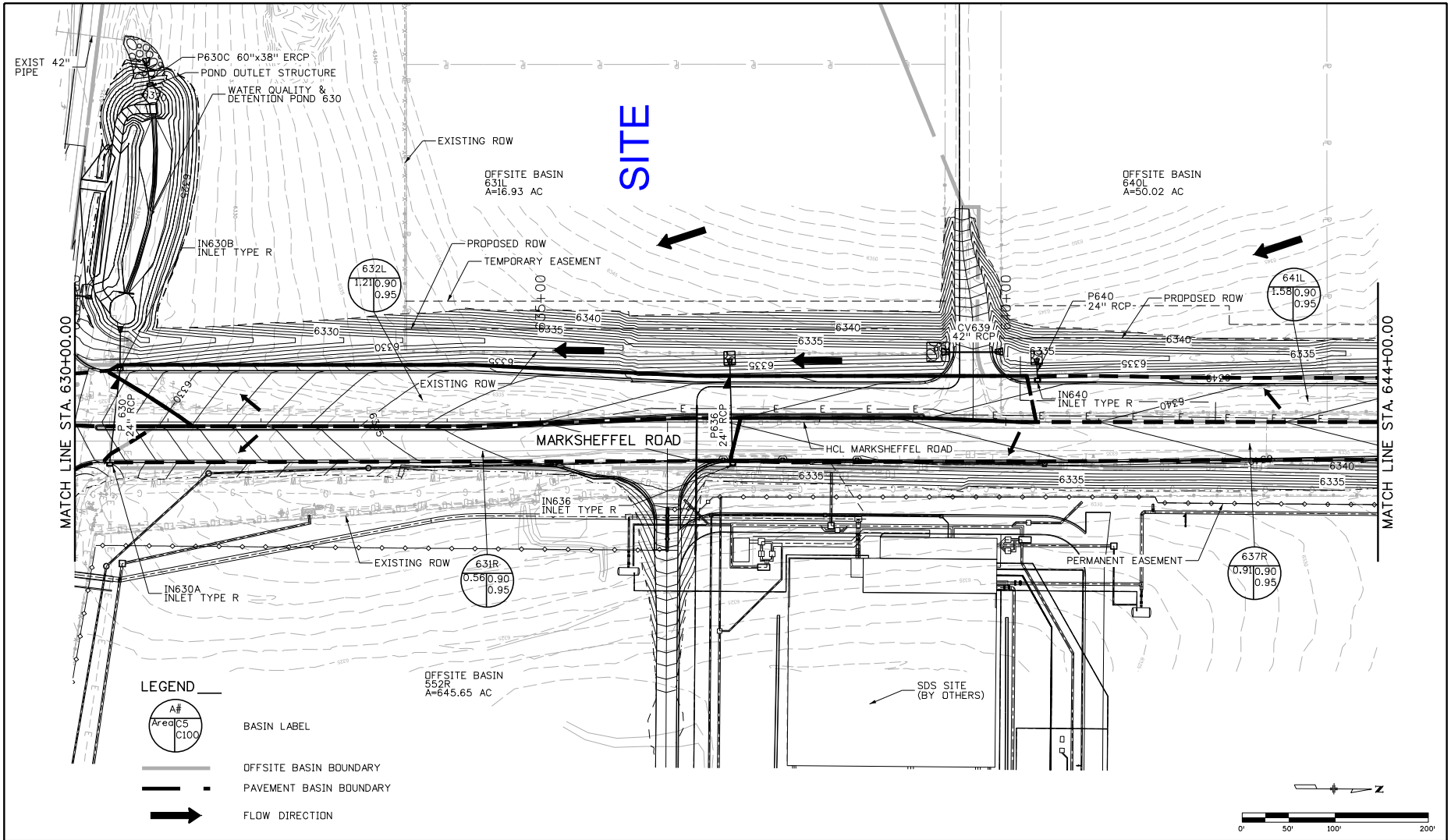
Horiz. Scale: 1:100 Vert. Scale: As Noted						Revised:	Designer: E. STATEN / Detailer: D. MADDOCK / Structure Numbers	....
Unit Information Unit Leader Initials						Void:	Sheet Subset: BASINS / Subset Sheets:33 of 36	33
HDR PARSONS BRINCKERHOFF	0000							



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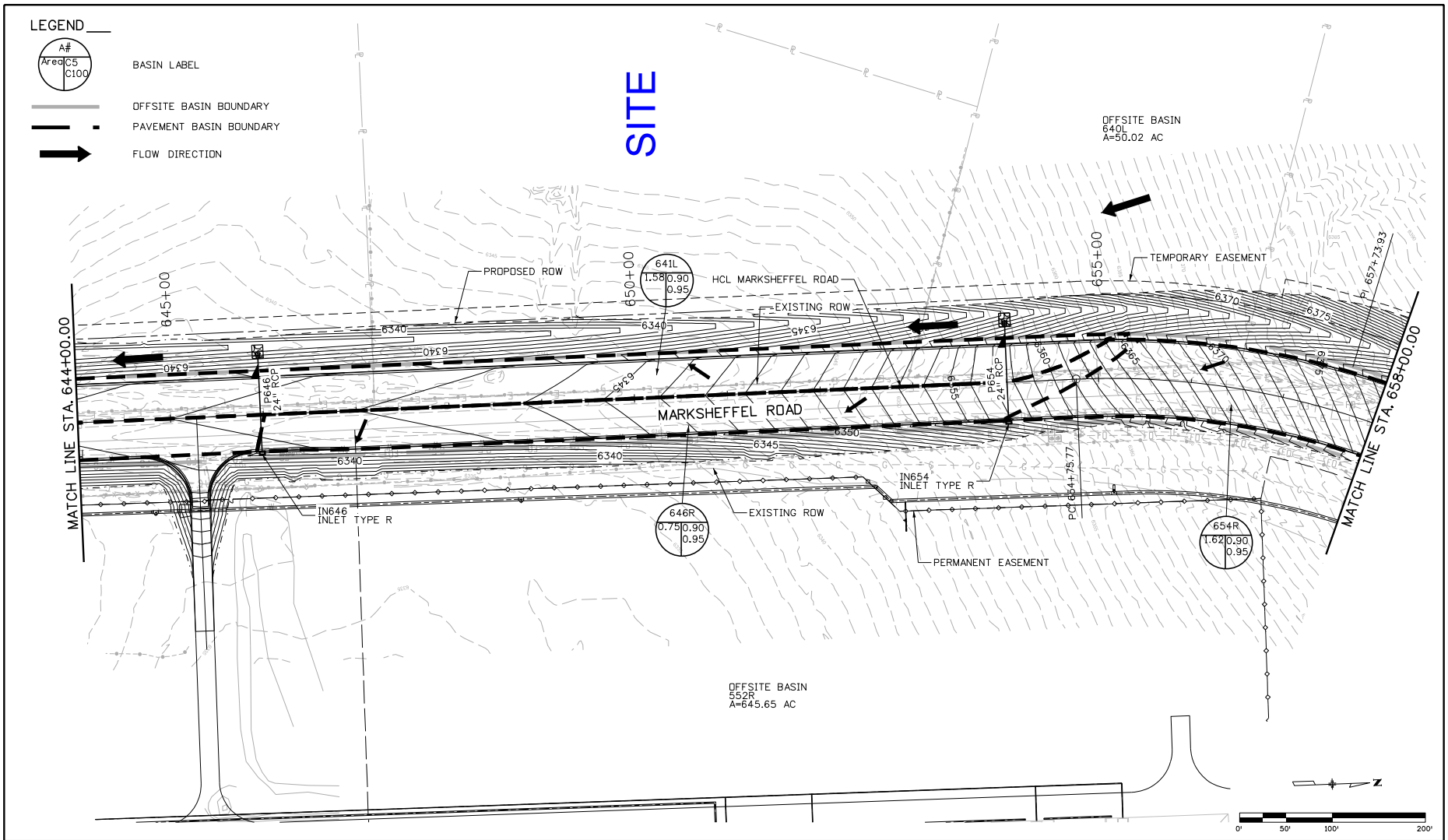
Unit Information Unit Leader Initials				Void:	Detailer: D. MADDOCK	
HDR PARSONS BRINCKERHOFF					Sheet Subset: BASINS Subset Sheets:34 of 36	34

EL PASO COUNTY COLORADO

PPRTA

ABALES 12:53:13 PM c:\pwworking\cmo\d0266572\North-Marksheffel_BASINS_Plan041.dgn



Print Date: 12/8/2016		Sheet Revisions			El Paso County Colorado	As Constructed	MARKSHEFFEL ROAD DRAINAGE BASINS PLAN 644+00.00 TO 658+00.00	Project No./Code
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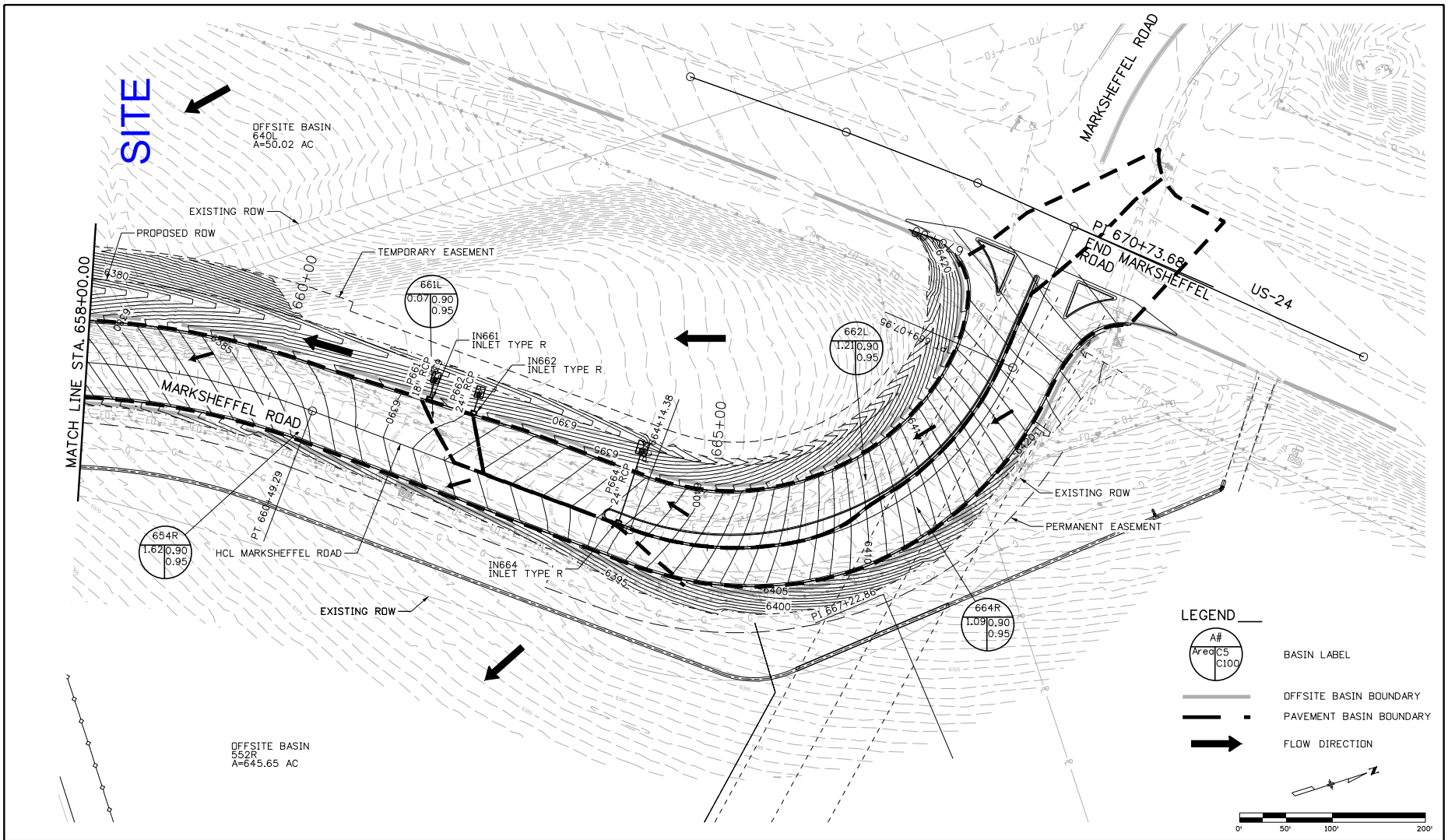
Horiz. Scale: 1:100 Vert. Scale: As Noted						Revised:	Designer: E. STATEN / Detailer: D. MADDOCK / Structure Numbers	....
Unit Information Unit Leader Initials						Void:	Sheet Subset: BASINS / Subset Sheets:35 of 36	35
HDR PARSONS BRINCKERHOFF	0000							



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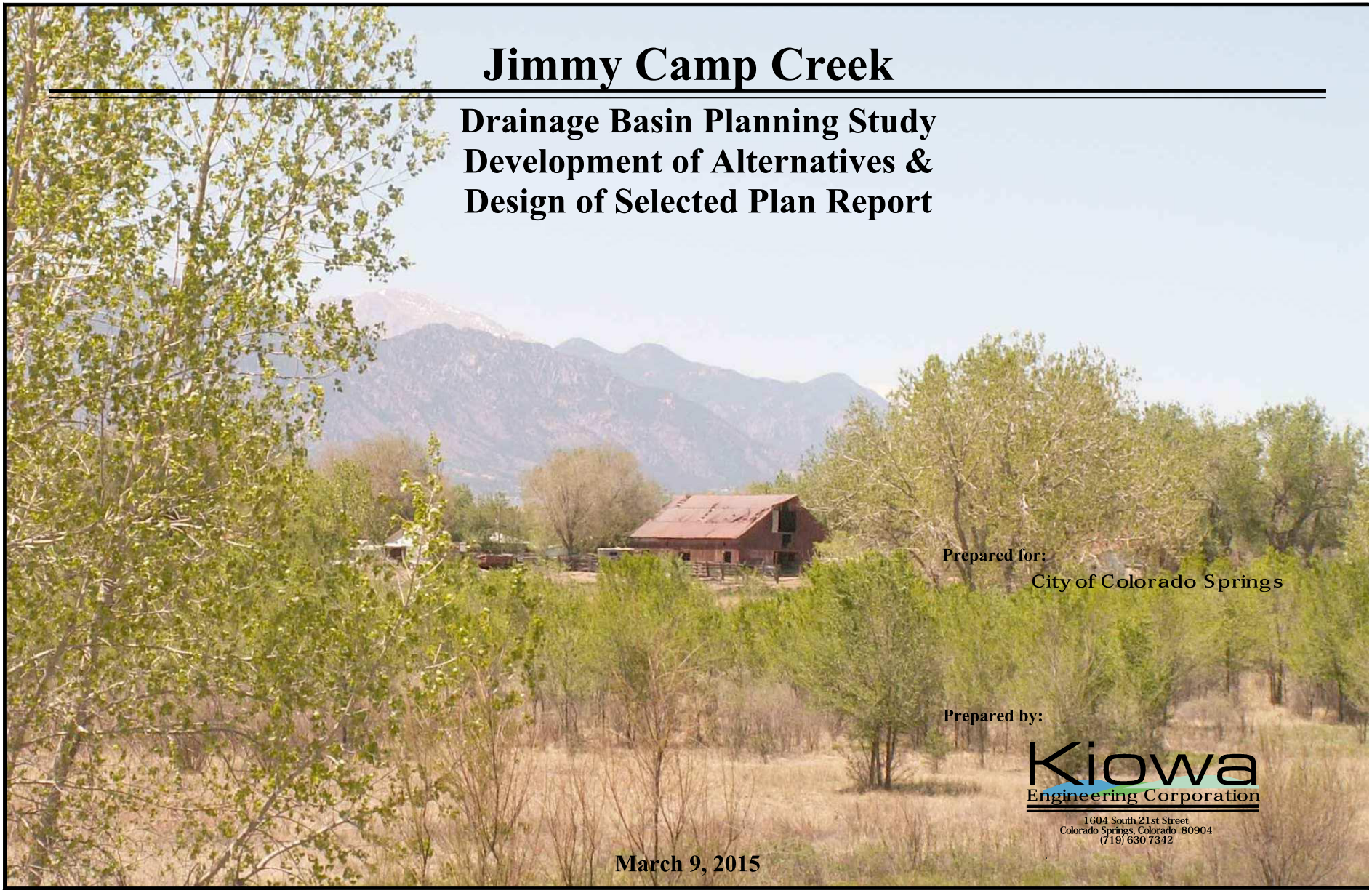
Unit Information Unit Leader Initials					Void:	Subset Sheets:36 of 36	36
HDR PARSONS BRINCKERHOFF					EL PASO COUNTY COLORADO	PPRTA	

JIMMY CAMP CREEK DRAINAGE REPORT EXCERPTS



Jimmy Camp Creek

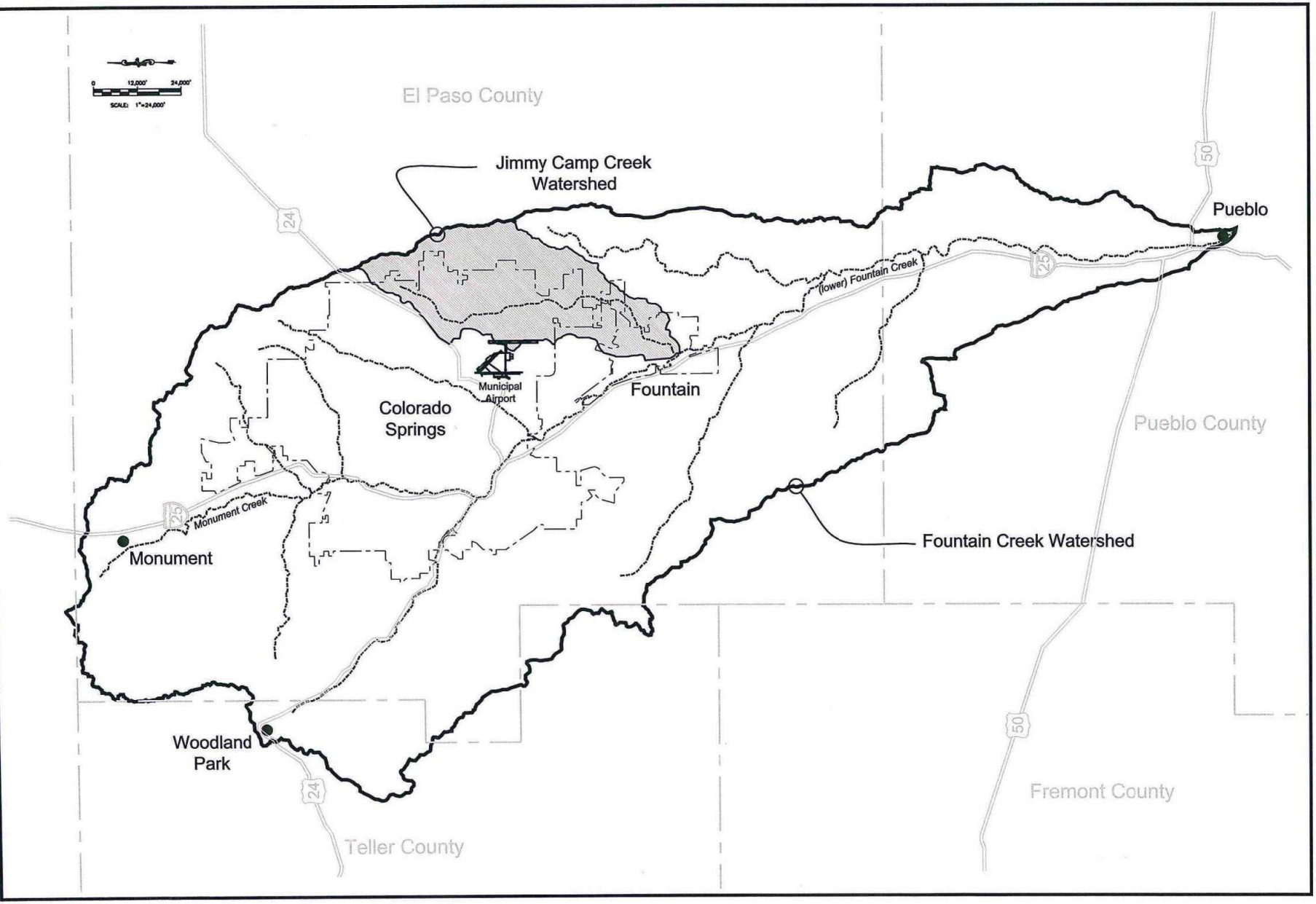
Drainage Basin Planning Study
Development of Alternatives &
Design of Selected Plan Report

Prepared for:
City of Colorado Springs

Prepared by:

Kiowa
Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342

March 9, 2015



Kiowa Engineering Corporation
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Colorado Springs, Colorado 80904
(719) 630-7342

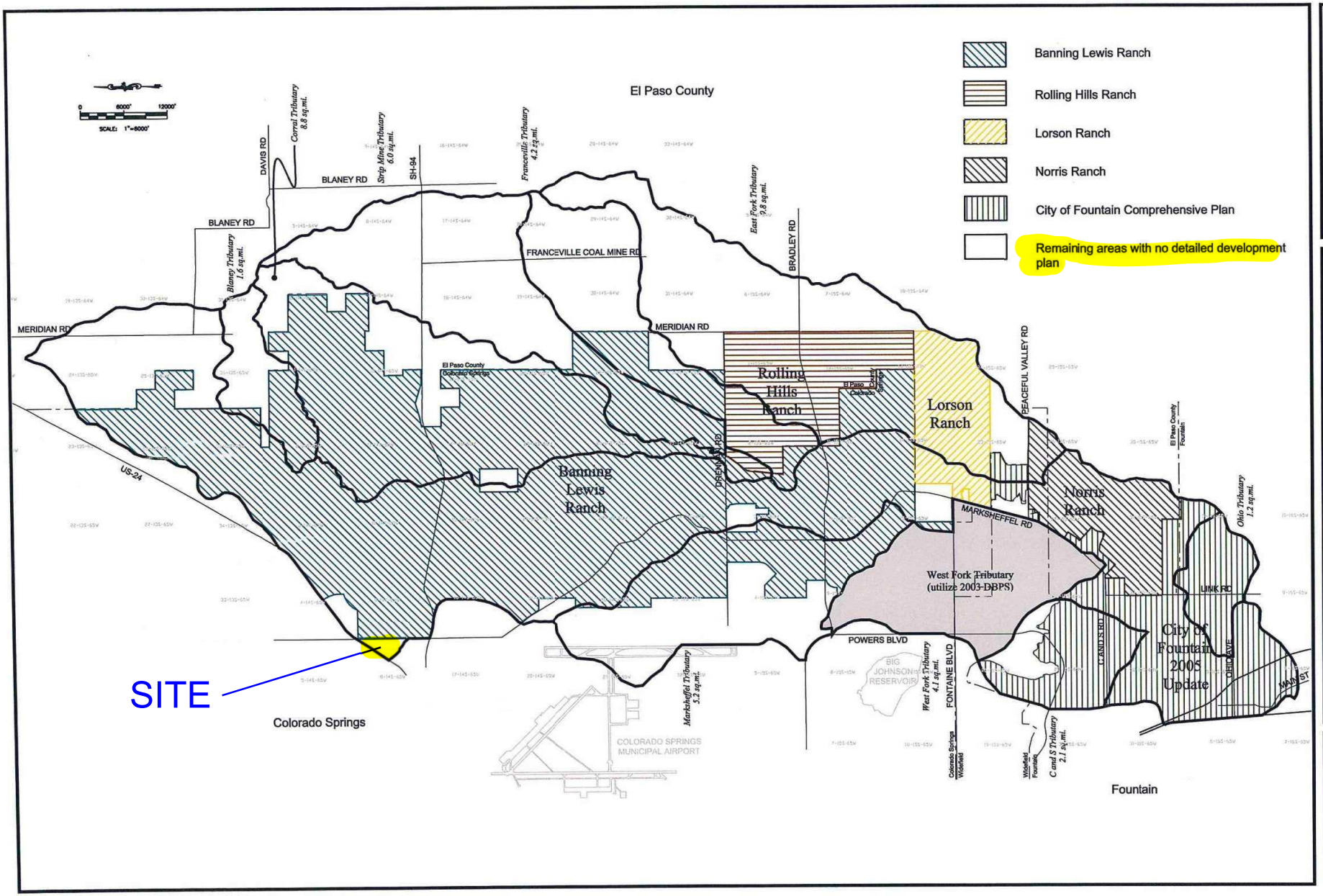
JIMMY CAMP CREEK WATERSHED DRAINAGE BASIN PLANNING STUDY

VICINITY MAP

CITY OF COLORADO SPRINGS

Project No.:	14006
Date:	OCT 2014
Design:	
Drawn:	BJW
Check:	
Revisions:	

I-1

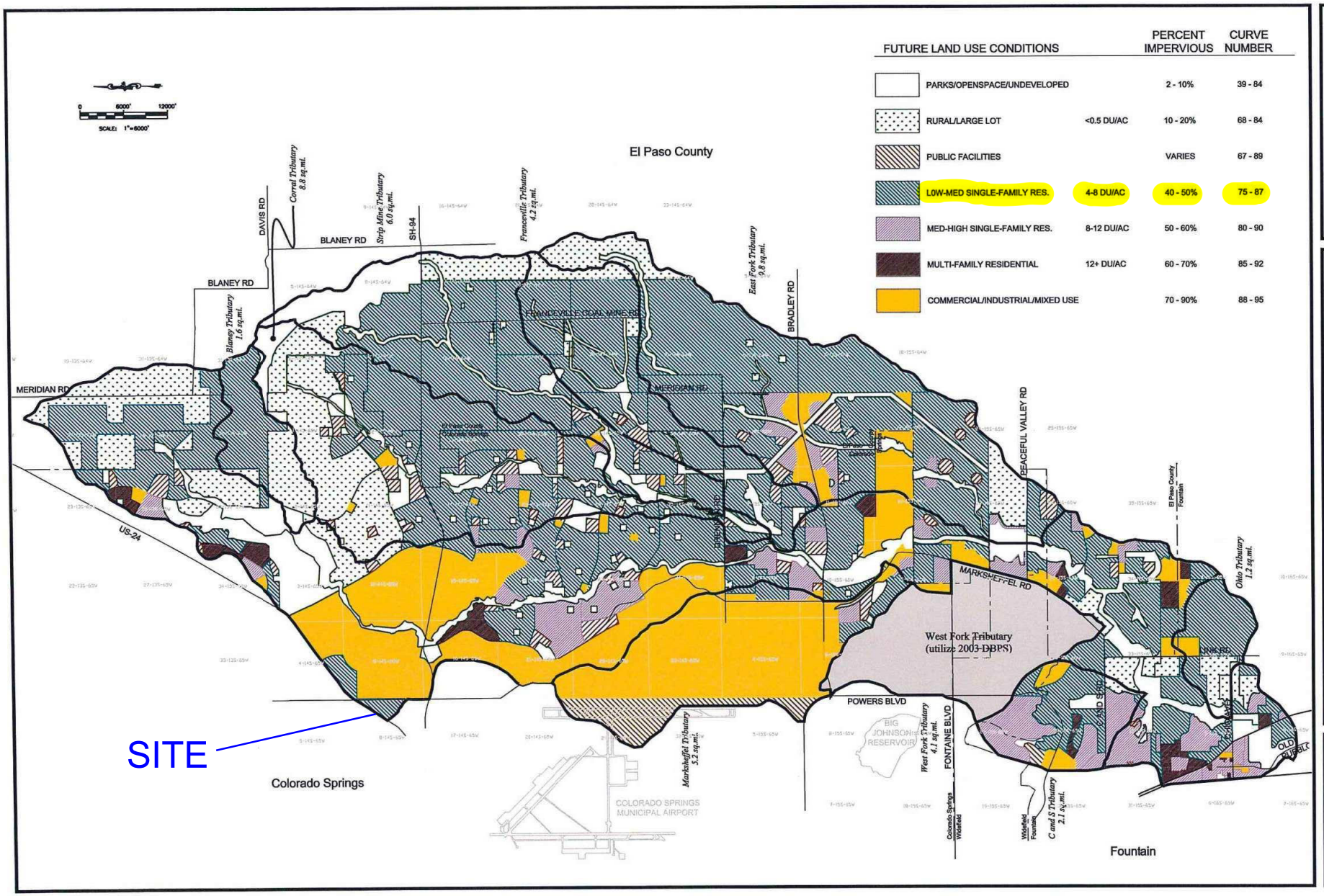


Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342

JIMMY CAMP CREEK WATERSHED
DRAINAGE BASIN PLANNING STUDY
FUTURE CONDITIONS PLANNING INFORMATION
, CITY OF COLORADO SPRINGS

Project No.:	14008
Date:	OCT 2014
Design:	
Drawn:	BJW
Check:	
Revisions:	

II-2



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Colorado Springs, Colorado 80904
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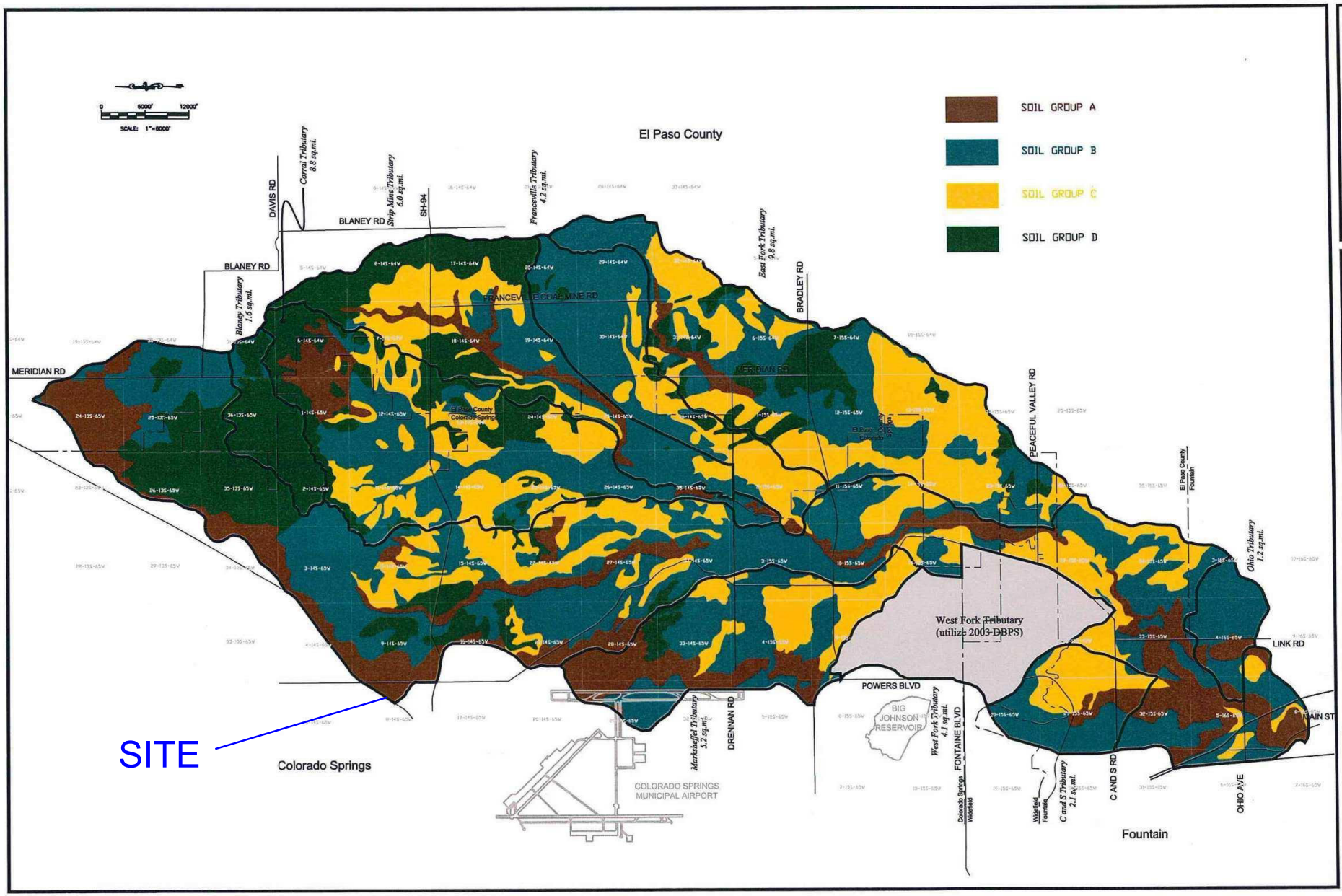
JIMMY CAMP CREEK WATERSHED
DRAINAGE BASIN PLANNING STUDY
FUTURE CONDITIONS LAND USE MAP
CITY OF COLORADO SPRINGS

Project No.:	1408
Date:	OCT 2014
Design:	
Drawn:	BJW
Check:	
Revisions:	

II-3



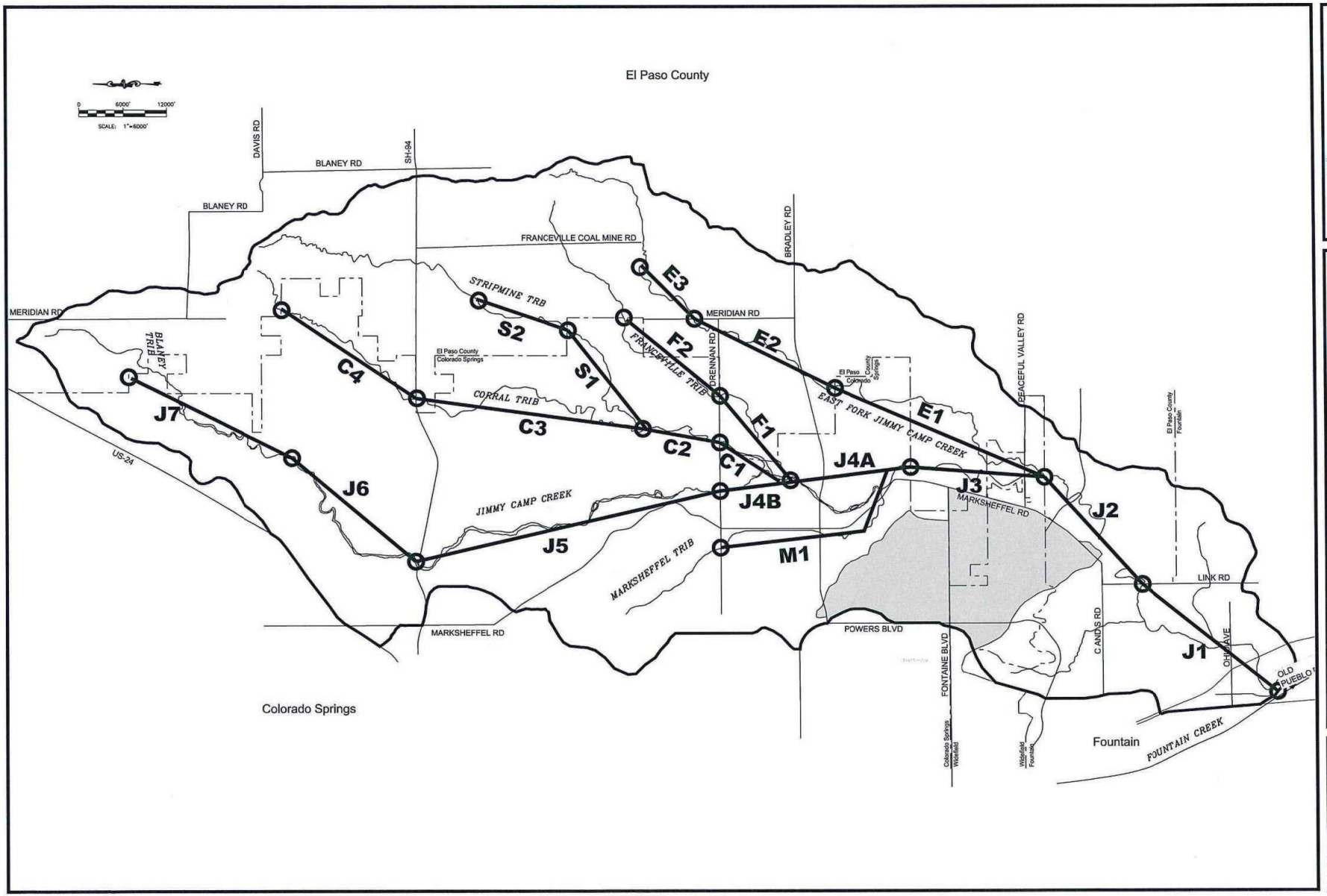
Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 6307342

JIMMY CAMP CREEK WATERSHED DRAINAGE BASIN PLANNING STUDY

SOILS MAP

CITY COLORADO SPRINGS

Project No.:	14008
Date:	OCT 2014
Design:	BJW
Drawn:	AFE
Check:	BJW
Revisions:	



Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719)630-7342

JIMMY CAMP CREEK WATERSHED
DRAINAGE BASIN PLANNING STUDY
MAJOR DRAINAGEWAY REACH DELINEATION
CITY OF COLORADO SPRINGS, COLORADO

Project No.:	14008
Date:	SEPT. 2014
Design:	
Drawn:	BJW
Check:	
Revisions:	

FIGURE
IV-1

EXHIBIT 1
Project No.: 14008
Date: APRIL 2015
Design: RHW
Drawn: DAK
Checked:
Revisions:
JIMMY CAMP CREEK WATERSHED
DRAINAGE BASIN PLANNING STUDY
SUBBASIN MAP
CITY OF COLORADO SPRINGS, COLORADO
Kiowa
Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719)630-7342
LEGEND
SUBBASIN ID
DESIGN POINT ID
ROUTING REACH ID
IRRIGATION DITCH
SUB-BASIN DIVIDE
WATERSHED DIVIDE
RECEIVING DRAINAGEWAY
SUB-DRAINAGEWAY
BLANEY RD
DAVIS RD
MERIDIAN RD
FRANCSVALE COAL MINE RD
PEACEFUL VALLEY RD
MARKSHEFFEL RD
LINK RD
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DORNAN DR
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US-24
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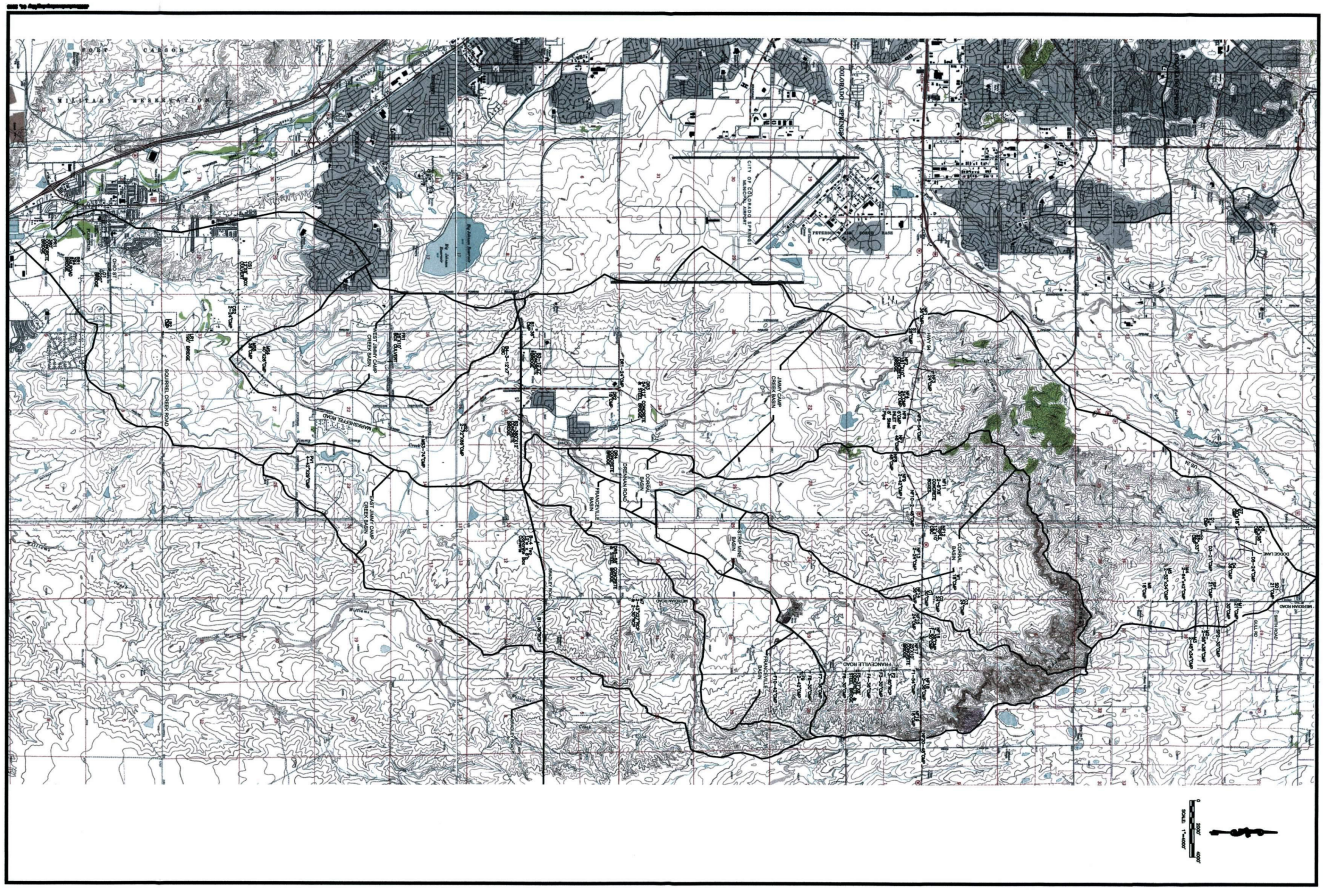
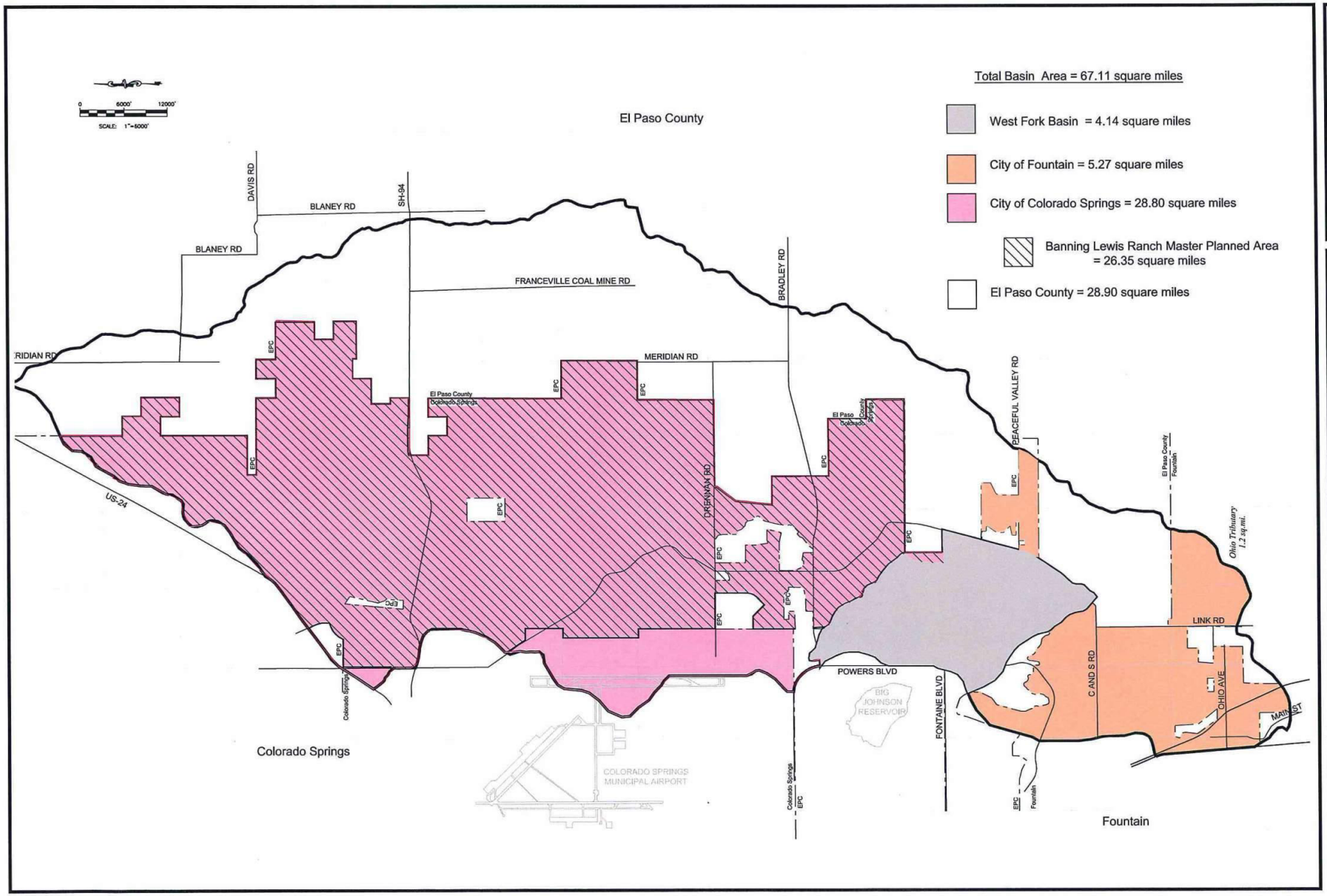


JIMMY CAMP CREEK WATERSHED
DRAINAGE BASIN PLANNING STUDY
STRUCTURE INVENTORY MAP
CITY OF FOUNTAIN, CITY OF COLORADO SPRINGS, EL PASO COUNTY

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342

Project No.:	06025
Date:	DECEMBER 2008
Design:	
Drawn:	EAK
Check:	
Revisions:	

SHEET 1 OF 4 SHEETS



Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342

JIMMY CAMP CREEK WATERSHED DRAINAGE BASIN PLANNING STUDY

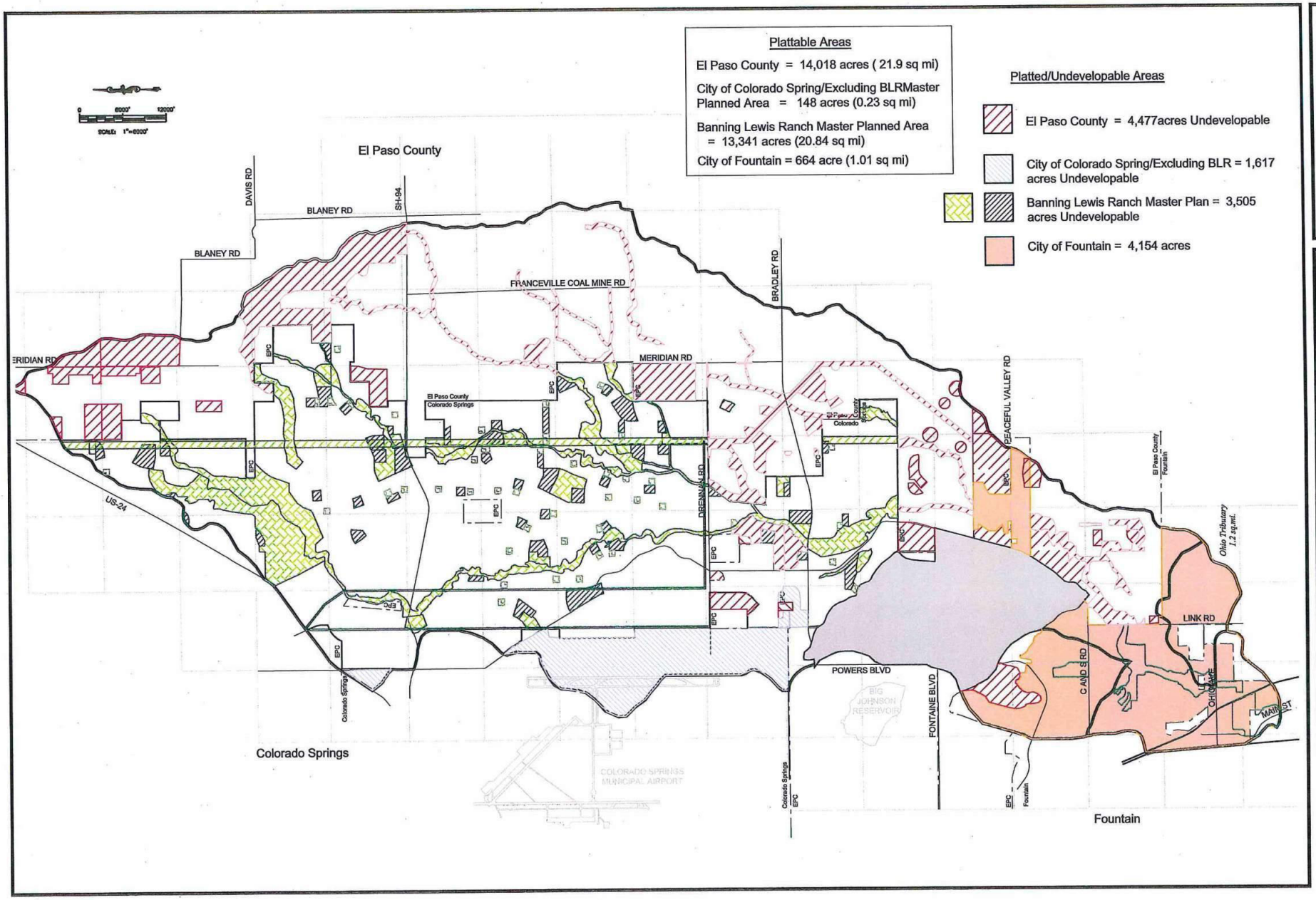
JURISDICTIONAL BOUNDARIES

CITY OF FOUNTAIN, CITY OF COLORADO SPRINGS, EL PASO COUNTY

Project No.:	14008
Date:	OCTOBER 2014
Design:	
Drawn:	EAK
Check:	
Revisions:	

FIGURE

Fig. VII-1



Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342

JIMMY CAMP CREEK WATERSHED
DRAINAGE BASIN PLANNING STUDY
PLATTABLE ACREAGE
CITY OF FOUNTAIN, CITY OF COLORADO SPRINGS, EL PASO COUNTY

Project No.:	14008
Date:	OCTOBER 2014
Design:	
Drawn:	EAK
Check:	
Revisions:	

FIGURE

Fig VII-2

REAGAN RANCH MDDP EXCERPTS

SHEET No. 3

811 Know what's Below. Call before you dig.

CROSSROADS NORTH SITE

LEGEND

- EXISTING BASIN BOUNDARY
- EXISTING EASEMENT
- PROPOSED BASIN BOUNDARY
- EXISTING CONTOUR
- PROPOSED CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING STORM DRAIN PIPE
- FLOWLINE
- PROPOSED PROPERTY LINE
- PROPOSED HIGH PLAINS AT REAGAN RANCH
- PROPOSED FLOW DIRECTION
- PROPOSED INTERIM DRAINAGE SWALE

X-X — DESIGN POINT

BASIN (Q5 / Q100) / AREA — SUB BASIN DESIGNATION; 5-YEAR STORM EVENT PEAK FLOW (CFS); 100-YEAR STORM EVENT PEAK FLOW (CFS); SUB BASIN AREA (AC.)

NOTE: SUB-BASINS B1-B6 WILL BE DEVELOPED IN A FUTURE PHASE.

N

GRAPHIC SCALE
(IN FEET)
1 inch = 100 ft.

PER THE SDD DRAINAGE REPORT FOR THE FACILITY IN THIS SUB-BASIN THE ONSITE DETENTION POND CAPTURES ALL OF THE UPSTREAM FLOWS AND DISCHARGES VIA INFILTRATION, THEREFORE, NONE OF THESE FLOWS ARE DISCHARGED ACROSS HWY 94 TO THE REAGAN RANCH PROPERTY.

REAGAN RANCH MDDP
Proposed Conditions - Sub-basin Summary

Basin	Area	Q5	Q100
	acres	cfs	cfs
OS-2	18.14	2.72	18.31
OS-3	135.71	11.02	74.05
OS-4	19.16	4.00	26.85
N28	3.94	0.81	5.43
A1	9.57	18.69	34.12
A2	2.06	7.16	13.08
A3	4.20	15.22	27.78
A4	1.85	7.72	14.09
A5	2.72	11.08	20.22
A6	1.18	4.90	8.94
A7	5.95	16.57	31.12
A8	3.33	3.27	9.65
A9	1.37	0.70	3.81
B1	2.72	10.55	19.26
B2	2.40	9.19	16.77
B3	0.37	1.53	2.80
B4	0.33	1.39	2.53
B5	2.40	7.29	13.30
B6	2.43	8.08	14.74
B7	0.61	2.47	4.50
B8	1.22	3.07	6.32
B9	1.20	5.02	9.16
B10	1.05	2.32	4.88
B11	1.42	0.85	4.66

REAGAN RANCH MDDP
Proposed Design Point Summary

Design Point	Sub-Basins	Total Area (ac.)	Q(5) (cfs)	Q(100) (cfs)	DP STRUCTURE
PETERSON FIELD BASIN Offsite and Upstream					
DP1	CB5 - CB8.1 & N28	4.72	3.3	9.8	30" CMP
DP3	OS-1 & OS-2 (Existing WQ Detention omitted)	68.16	19.4	72.8	42" CMP
PETERSON FIELD BASIN - AREA A					
6-A	A2-A6	12.01	40.3	73.5	
7-A Inflow	A1-A6 & A9 (Proposed Pond)	22.94	66.6	123.7	
7-A Outflow	A1-A6 & A9 (Pond A Post Detention)	22.94	0.8	19.9	30" RCP
8-A	A1-A9, MK-2, OS-1, OS-2 & MK-2 (WQ Pond 620 Discharge)	104.57	16.9	73.8	
9-A	A1-A9, MK-2, OS-1, OS-2 & OS-4 (EX DP 5)	123.73	17.7	81.4	
PETERSON FIELD BASIN - AREA B					
1-B	B1-B3	5.50	20.0	36.6	30" RCP
2-B	B4	0.33	1.4	2.5	42" RCP
3-B	B1-B4	5.83	24.1	44.1	42" RCP
4-B	B1-B6	10.66	38.5	70.2	60" RCP
5-B	B8+B10	2.27	5.6	11.7	24" RCP
6-B	B7-B10	2.88	7.9	15.9	30" RCP
7-B Inflow	B1-B11 (Pond B)	16.16	43.7	83.3	
7-B Outflow	Pond B Dischage	16.16	0.6	21.1	
8-B	B1-B8, B11, N-28	18.66	4.8	32.5	24" RCP

PIKES PEAK INVESTMENTS, LLC
COLORADO SPRINGS, COLORADO
REAGAN RANCH MDDP/FDR

PRELIMINARY DRAINAGE MAP

DESIGNED BY: JTS | SCALE: AS SHOWN | DATE: FEBRUARY 2021
DRAWN BY: DRG | CHECKED BY: BDB | PROJ. NO.: 207 | SHEET: 1 OF 11

PRELIMINARY
THIS DRAWING HAS NOT BEEN APPROVED BY GOVERNING AGENCIES AND IS SUBJECT TO CHANGE

FOR AUTOCAD DETAILS, C.F. MATRIX DESIGN GROUP, INC. PROJECT No. 19.224.008

Matrix

SHEET KEY

NO.	DATE	DESCRIPTION
		REVISIONS

COMPUTER FILE MANAGEMENT
FILE NAME: S:\19.224.008 Reagan Ranch\200 Drainage\201 Drainage Reports\MDDP\DWG\Reagan Ranch - DR-current.dwg
PLOT DATE: February 5, 2021 2:35:07 PM
Field Verification of Conditions and Utilities Location are to be Verified Prior to Construction.

REFERENCE DRAWINGS

c. The ***fully developed conditions*** for the site are as follows:

At this Master Development stage of design for the drainage, general locations of Design Points have been defined in order to size the trunk mains of the proposed storm system (see Appendix D for Storm Exhibit). Each of the proposed sub-basins will have their own internal storm systems that convey the flows to the Design Points mentioned in this report and will be outlined in each parcel's respective Final Drainage Report.

Design Point 1 (Q_5 = 3.3 cfs, Q_{100} = 9.8 cfs) (Sub-basins CB-5-CB8.1 and N-28 (SDS), Tributary Area: 4.72 Acres) represents the offsite runoff crossing Highway 94 at the existing triple 30" CMP culverts (Public CDOT). This drainage point has a tributary area of approximately 4.7 acres. The drainage area includes a portion of Marksheffel Road north of Highway 94 and the portion of the SDS property which is not captured by the existing SDS detention pond (private) (which provides 100 percent infiltration for its tributary drainage area and does not discharge to the Reagan Ranch development). After crossing Highway 94 this sub-basin drains eastward along the Highway 94 road ditch eventually entering Jimmy Camp Creek. This sub-basin and design point remain unchanged from predevelopment conditions.

Design Point 3 (Q_5 = 19.4 cfs, Q_{100} = 72.8 cfs) (Sub-basins OS-1 and OS-2, Tributary Area: 68.2 Acres) represents the offsite flows conveyed across Highway 94 towards the west side of the proposed project. These flows are conveyed across Highway 94 via a 42-inch CMP (Public CDOT). These flows appear to go through the Marksheffel Water Quality Pond (Public-Colorado Springs) located in the NW quadrant of the Marksheffel Road and Highway 94 intersection. This sub-basin and design point remain unchanged from predevelopment conditions.

Notes:

- **Analysis of the Proposed Basin areas is conceptual in nature. Greater detail than typical (including some preliminary storm sewer design) is provided in this MDDP in order to accommodate SWMM analysis of the various regions within the development for use in the City of Colorado Springs PCM Preliminary Detention Spreadsheet. Future FDRs for each phase of the site must define the specific storm sewer and drainage patterns. Basin Lettering (i.e. A, B, C, etc.) can be considered to indicate a rough idea of future phases and/or regions which would require on-site detention. Future FDRs must define the drainage within each phase/region.**

- **The first phase of the Reagan Ranch development which is planned for construction has been named "High Plains at Reagan Ranch" and consists of a small portion of region B and all of regions C and J. Street and inlet calculations for these three regions are included in the report. Similar calculations for the remaining regions will be submitted with future Final Drainage Reports as development progresses. An FDR will be submitted with the High Plains at Reagan Ranch Final Plat.**

- **For sub-basins within the single-family residential areas, runoff will sheet flow towards the adjacent streets. Once reaching the street these flows will be channelized into gutter flow for conveyance to downstream inlets.**

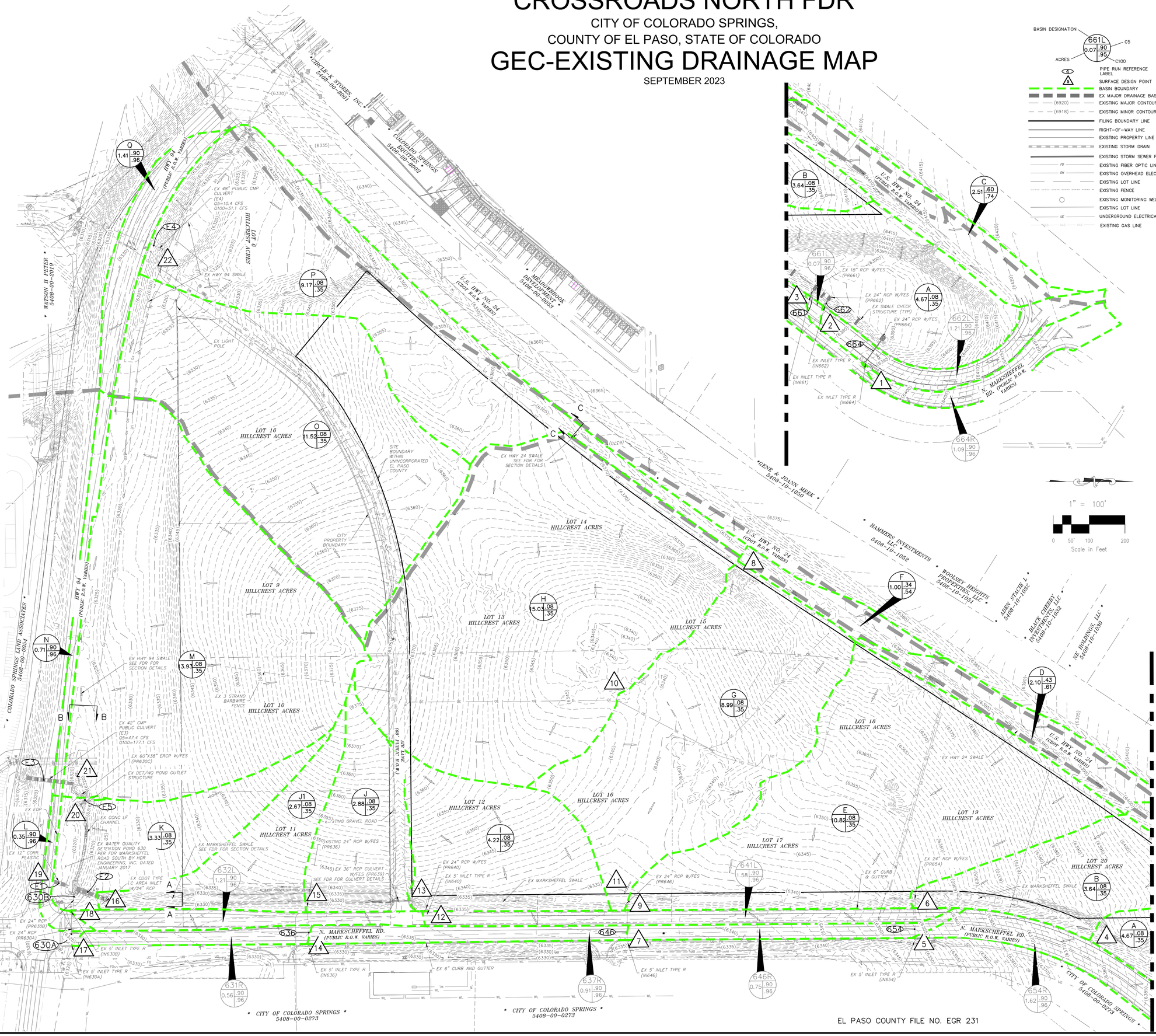
DRAINAGE MAPS

CROSSROADS NORTH FDR

CITY OF COLORADO SPRINGS,
COUNTY OF EL PASO, STATE OF COLORADO

GEC-EXISTING DRAINAGE MAP

SEPTEMBER 2023



LEGEND

BASIN DESIGNATION: 661L, 0.07 ACRES, .90, .95, C5, C100

- PIPE RUN REFERENCE LABEL
- SURFACE DESIGN POINT
- BASIN BOUNDARY
- EX MAJOR DRAINAGE BASIN BOUNDARY
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- FILING BOUNDARY LINE
- RIGHT-OF-WAY LINE
- EXISTING PROPERTY LINE
- EXISTING STORM DRAIN
- EXISTING STORM SEWER PIPE
- EXISTING FIBER OPTIC LINE
- EXISTING OVERHEAD ELECTRIC
- EXISTING LOT LINE
- EXISTING FENCE
- EXISTING MONITORING WELL
- EXISTING LOT LINE
- UNDERGROUND ELECTRICAL
- EXISTING GAS LINE
- EXISTING FLOW DIRECTION ARROW
- EMERGENCY OVERFLOW DIRECTION
- EXISTING RIPRAP TYP.
- EXISTING UTILITY POLE
- EX. IRRIGATION VALVE
- EX. STORM INLET
- EX. GAS TEST NODE
- EX. TRAFFIC SIGNAL CONTROL BOX
- EX. ELECTRIC VAULT
- EX. SANITARY MANHOLE
- EX. WATER VALVE
- EXISTING WATER WELL
- EXISTING MONITORING WELL
- EX. TELEPHONE VAULT
- EX. ELECTRIC VAULT
- EX. ELECTRIC PEDESTAL
- EX. ELECTRIC METER
- EX. ELECTRIC TRANSFORMER
- EX. TELEPHONE PEDESTAL
- EX. FIBER OPTIC MANHOLE
- EX. ELECTRIC PEDESTAL
- EX. WATER MARKER
- EX. GAS MARKER
- EX. FIBER OPTIC MARKER
- EX. ELECTRIC MANHOLE
- EX. CABLE TV MARKER
- EX. SHRUB/TREE
- EX. WATER YARD HYDRANT
- EX. STORM INLET
- EX. ELECTRIC BOX
- EX. FIRE HYDRANT
- EX. ELECTRIC MARKER
- EX. TRAFFIC SIGNAL
- PROP SANITARY & WATER MAINS

BASIN SUMMARY

BASIN	AREA (ACRES)	Q_5	Q_{100}
A	4.67	1.1	7.8
B	3.64	0.8	6.1
C	2.51	5.0	10.2
D	2.10	3.7	8.8
E	10.82	2.2	15.9
F	1.00	1.5	3.9
G	8.99	1.9	13.9
H	15.03	3.0	22.1
I	4.22	1.0	7.0
J	2.88	0.7	5.3
J1	2.67	0.6	4.3
K	3.33	0.8	5.9
L	0.35	1.6	2.9
M	13.93	3.0	22.2
N	0.71	3.3	5.9
O	11.52	2.3	17.0
P	9.17	1.6	11.9
Q	1.41	6.6	11.8
631R*	0.56	2.4	4.2
632L*	1.21	4.5	8.1
637R*	0.91	3.1	5.5
641L*	1.58	5.8	10.4
646R*	0.75	3.5	6.2
654R*	1.62	7.1	12.8
661L*	0.07	0.3	0.6
662L*	1.21	5.6	10.0
664R*	1.09	5.1	9.1

DESIGN POINT SUMMARY

DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
1	5.1	9.1	664R	EX 5' CDOT TYPE R AG INLET
2	5.6	10.0	662L	EX 5' CDOT TYPE R INLET
3	2.9	6.7	FBIN662, 661L	EX 5' CDOT TYPE R INLET
4	5.3	13.6	PR664, PR662, PR661, A	EX 5' BTM EARTH TRAP CHANNEL
5	9.4	18.2	FBIN664, 654R	EX 5' CDOT TYPE R INLET
6	7.8	21.3	DP4, PR654, B	EX 5' BTM EARTH TRAP CHANNEL
7	8.1	18.5	FBIN654, FBIN661, 646R	EX 5' CDOT TYPE R INLET
8	7.2	16.2	C, D, F	ENTERS PROPERTY FROM CDOT ROW
9	10.9	36.2	DP6, E, PR646	EX 5' BTM EARTH TRAP CHANNEL
10	3.0	22.1	H	LOCALIZED LOWPOINT
11	3.6	26.6	G, DP10	EX 5' BTM EARTH TRAP CHANEL
12	5.8	10.4	641L	EX 5' CDOT TYPE R INLET
13	15.5	67.4	DP9, DP11, PR640, I	EX 36" CULVERT
14	6.0	14.8	FBIN646, 637R	EX 5' CDOT TYPE R INLET
15	16.4	68.3	DP13, J, PR636	EX 5' BTM EARTH TRAP CHANNEL
16	15.2	64.4	DP15, J1	EX CDOT TYPE C AREA INLET W/ RIPRAP BYPASS RUNDOWN
17	4.1	11.9	FBIN836, 631R	EX 5' CDOT TYPE R INLET
18	5.8	11.6	FBIN640, 632L	EX 15" CDOT TYPE R INLET
19	1.6	4.9	FBIN630B, L	EX 12" PLASTIC CORUGATED PIPE
20	21.0	77.8	PR630B, PRE1, PRE2, K	EX W.Q. POND
21	24.1	93.3	PRE5, M, N	EX 42" CMP
22	11.8	42.9	O, P, Q	EX 48" CMP

STORM SEWER SUMMARY

PIPE RUN	Q_5	Q_{100}	PIPE SIZE	CONTRIBUTING PIPES/DP	TYPE
664	2.7	3.4	EX 24" RCP	IN664R	PUBLIC
662	3.0	3.8	EX 24" RCP	IN662L	PUBLIC
661	1.9	3.2	EX 18" RCP	IN661L	PUBLIC
654	3.8	5.0	EX 24" RCP	IN654	PUBLIC
646	3.4	4.7	EX 24" RCP	IN646	PUBLIC
640	2.9	3.8	EX 24" RCP	IN640	PUBLIC
636	3.0	4.3	EX 24" RCP	IN636	PUBLIC
630A	2.6	4.1	EX 24" RCP	IN630A	PUBLIC
630B	8.9	15.2	EX 24" RCP	IN630B,IN630A	PUBLIC
E1	1.6	4.9	EX. 12" CORR. PLASTIC	DP19	PUBLIC
E2	15.2	64.6	EX. 24" RCP	DP16	PUBLIC
E3	24.1	93.3	EX. 42" OR	DP21	PUBLIC
E4	11.8	42.9	EX 48" CMP	DP22	PUBLIC
E5	21.0	77.1	EX 60"x30" ERCP	DP20	PUBLIC

CROSSROADS NORTH FILING NO.1
EXISTING DRAINAGE MAP-GEC
DATE SUBMITTED: 09/06/23
SHEET 1 OF 1

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

EL PASO COUNTY FILE NO. EGR 231

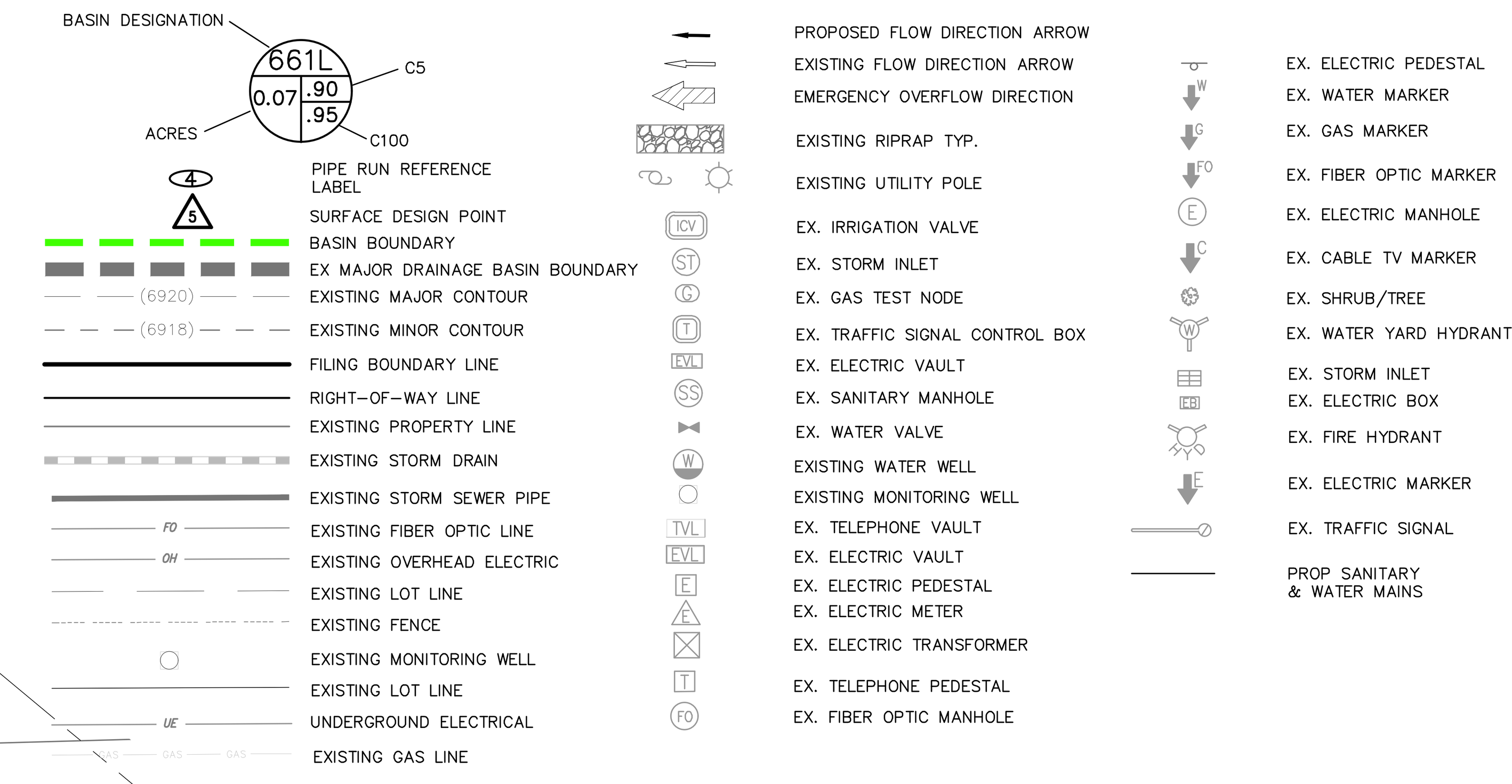
File: C:\18008A-Crossroads North Design\Crossroads Development Co\Drainage\Drainage Map\El Paso County\EXISTING DRAINAGE MAP-GEC.dwg Plotstamp: 9/7/2023 3:35 PM

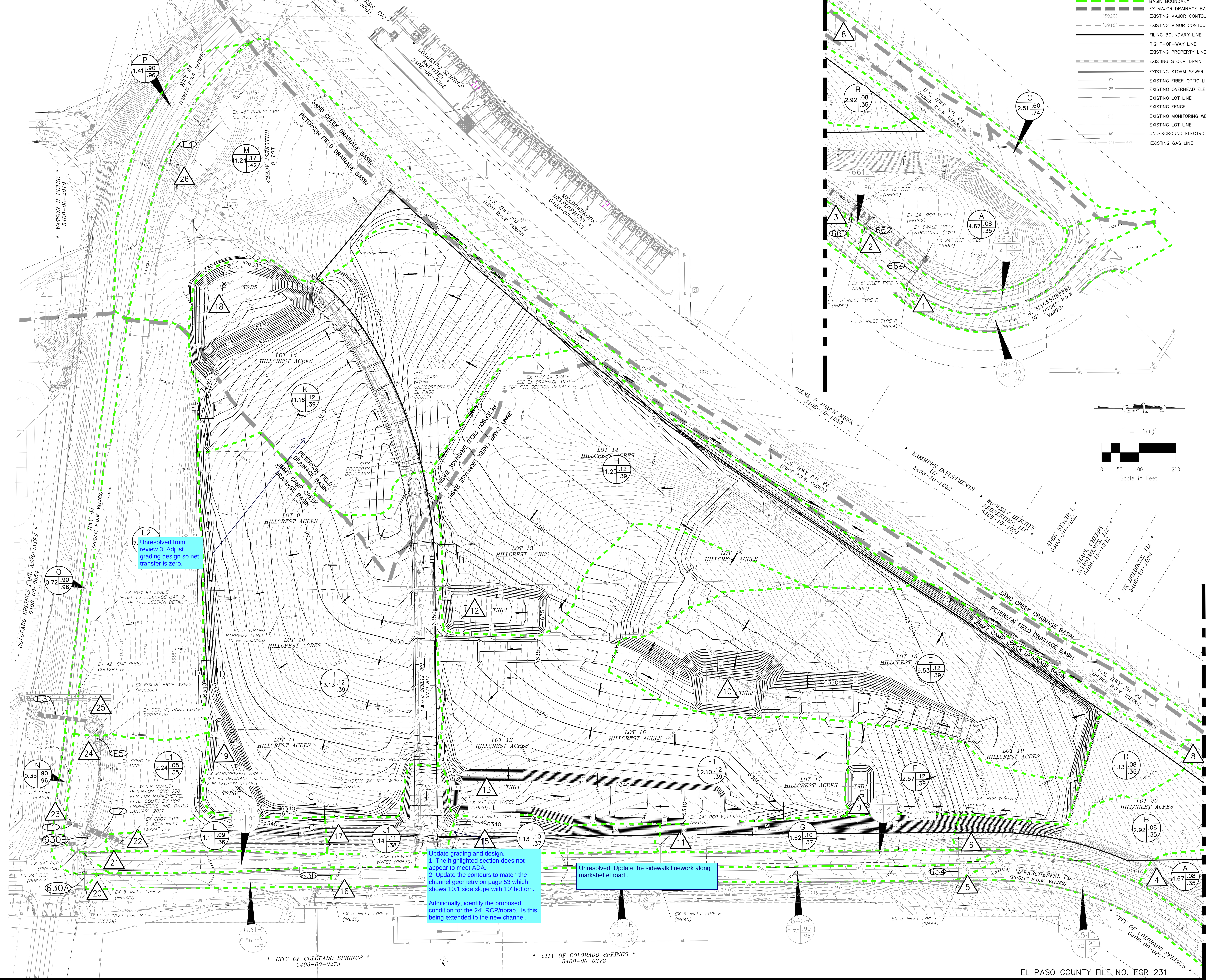
CROSSROADS NORTH FDR

CITY OF COLORADO SPRINGS,
COUNTY OF EL PASO, STATE OF COLORADO

GEC-PROPOSED DRAINAGE MAP

SEPTEMBER 2023





BASIN SUMMARY			
BASIN	AREA (ACRES)	Q_5	Q_{100}
A	4.67	1.1	7.8
B	2.92	0.7	5.0
C	2.51	5.2	10.8
D	1.13	0.5	3.4
E	9.53	3.9	21.5
F	2.57	1.5	8.4
F1	12.10	4.7	25.8
G	1.62	0.6	3.7
H	11.25	4.5	24.4
I	13.13	5.2	28.6
J	1.13	0.5	2.9
J1	1.14	0.5	2.7
K	11.16	4.8	26.0
L	1.11	0.4	2.5
L1	2.24	0.7	5.2
L2	7.05	1.9	14.1
M	11.24	7.0	28.7
N	0.35	1.6	3.0
O	0.72	3.4	6.0
P	1.41	6.5	11.7
631R*	0.56	2.4	4.2
632L*	1.21	4.5	8.1
637R*	0.91	3.1	5.5
641L*	1.58	5.8	10.4
646R*	0.75	3.5	6.2
654R*	1.62	7.1	12.8
661L*	0.07	0.3	0.6
662L*	1.21	5.6	10.0
664R*	1.09	5.1	9.1

DESIGN POINT SUMMARY				
DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
1	5.1	9.1	664R	EX 5' CDOT TYPE R AG INLET
2	5.6	10.0	662L	EX 5' CDOT TYPE R INLET
3	2.9	6.7	FBIN662, 661L	EX 5' CDOT TYPE R INLET
4	5.3	13.6	PR664, PR662, PR661, A	EX 5' BTM EARTH TRAP CHANNEL
5	9.4	18.2	FBIN664, 654R	EX 5' CDOT TYPE R INLET
6	8.0	22.0	DP4, PR654, B, D	EX 5' BTM EARTH TRAP CHANNEL
7	8.1	18.5	FBIN661, FBIN654, 646R	EX 5' CDOT TYPE R INLET
8	5.2	10.8	C	EX 5' BTM EARTH TRAP CHANNEL
9	1.5	8.4	F	TEMP SEDIMENT BASIN OUTFALL TO EX 5' BTM EARTH TRAP CHANNEL
10	3.9	21.5	E	TEMP SEDIMENT BASIN OUTFALL TO EX 5' BTM EARTH TRAP CHANNEL
11	12.7	42.9	DP6, DP9, DP10, G, PR646	EX 5' BTM EARTH TRAP CHANNEL
12	4.5	24.4	H	TEMP SEDIMENT BASIN OUTFALL TO EX 5' BTM EARTH TRAP CHANNEL
13	4.7	25.5	F1	TEMP SEDIMENT BASIN OUTFALL TO EX 5' BTM EARTH TRAP CHANNEL
14	5.8	10.4	641L	EX 5' CDOT TYPE R INLET
15	18.5	72.0	DP11, DP12, DP13, J, PR640	EX 36" CULVERT
16	6.0	14.8	FBIN646, 637R	EX 5' CDOT TYPE R INLET
17	19.5	71.8	DP15, J1, PR636	EX 5' BTM EARTH TRAP CHANNEL
18	4.8	26.0	K	TEMP SEDIMENT BASIN OUTFALL TO HWY 94 CDOT ROW
19	5.2	28.6	I	TEMP SEDIMENT BASIN OUTFALL TO EX 5' BTM EARTH TRAP CHANNEL
20	4.1	11.9	FBIN636, 631R	EX 5' CDOT TYPE R INLET
21	5.8	11.6	FBIN640, 632L	EX 15' CDOT TYPE R INLET
22	18.3	67.6	DP17, L	EX CDOT TYPE C AREA INLET W/ RIPRAP BYPASS RUNDOWN
23	1.6	5.0	N, FBIN630B	EX 12" PLASTIC CORR PIPE
24	24.1	80.1	L1, PR630B, PRE1, PRE2	EX W.Q. POND
25	26.2	86.5	L2, O, PRE5	EX 42" CMP
26	13.5	45.9	M, P, DP8 DP18	EX 48" CMP

STORM SEWER SUMMARY					
PIPE RUN	Q_5	Q_{100}	PIPE SIZE	CONTRIBUTING PIPES/DP	TYPE
664	2.7	3.4	EX 24" RCP	IN664R	PUBLIC
662	3.0	3.8	EX 24" RCP	IN662L	PUBLIC
661	1.9	3.2	EX 18" RCP	IN661L	PUBLIC
654	3.8	5.0	EX 24" RCP	IN654	PUBLIC
646	3.4	4.7	EX 24" RCP	IN646	PUBLIC
640	2.9	3.8	EX 24" RCP	IN640	PUBLIC
636	3.0	4.3	EX 24" RCP	IN636	PUBLIC
630A	2.6	4.1	EX 24" RCP	IN630A	PUBLIC
630B	8.9	15.2	EX 24" RCP	IN630B, IN630A	PUBLIC
E1	1.6	5.0	EX. 12" CORR. PLASTIC	DP23	PUBLIC
E2	18.3	67.6	EX. 24" RCP	INDP22	PUBLIC
E3	26.2	86.5	EX. 42" OR	DP25	PUBLIC
E4	13.5	45.9	EX 48" CMP	DP26	PUBLIC
E5	24.1	77.1	EX 30"x60" ERCP	WQ POND	PUBLIC

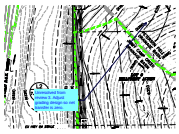
CROSSROADS NORTH FILING NO.1
PROPOSED DRAINAGE MAP–GEC
DATE SUBMITTED: 9/05/23
SHEET 1 OF 1

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

EL PASO COUNTY FILE NO. EGR 231

v4_Drainage Report_Comments.pdf Markup Summary

Callout (2)



Subject: Callout
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Date: 11/15/2023 4:25:37 PM
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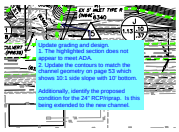
Unresolved from review 3. Adjust grading design so net transfer is zero.



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Date: 11/15/2023 4:27:21 PM
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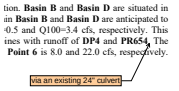
Update grading and design.
1. The highlighted section does not appear to meet ADA.
2. Update the contours to match the channel geometry on page 53 which shows 10:1 side slope with 10' bottom.

Additionally, identify the proposed condition for the 24" RCP/riprap. Is this being extended to the new channel.

Contractor (3)



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Page Label: 13
Author: dotprete
Date: 11/16/2023 4:40:51 PM
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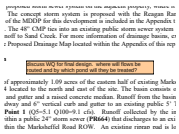
via an existing 24" culvert



Subject: Contractor
Page Label: 12
Author: dotprete
Date: 11/16/2023 4:40:41 PM
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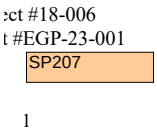
discuss WQ for final design. where will flows be routed and by which pond will they be treated?



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SP207

Stormwater Comments Color (1)

Subject: Stormwater Comments Color
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Author: dotprete
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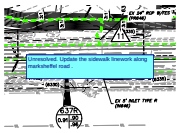
Text Box (2)



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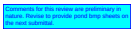
Unresolved. Update the sidewalk linework along marksheffel road .



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Author: lpackman
Date: 11/15/2023 4:30:10 PM
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Comments for this review are preliminary in nature. Revise to provide pond bmp sheets on the next submittal.