PRELIMINARY/ FINAL DRAINAGE REPORT FOR RIVERBEND CROSSING FILINGS NO. 1 AND 2

SEPTEMBER 2018

Prepared for:

Avatar Fountain, LP.
6800 Jericho Tpke., Suite 120W #204
Syosset, NY 11791

Prepared By:

CATAMOUNT ENGINEERING
PO BOX 221
Woodland Park, CO 80866
719-426-2124

PCD FILE NOS:
SP 187
SF 1843
SF 1844

PRELIMINARY/FINAL DRAINAGE REPORT FOR REIVERBEND CROSSING FILING NO. 1 AND 2

... applicable master plan

ADDED

Engineer's Statement:
The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according 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.

Certification Statement:
This report and plan for the preliminary and final drainage design for the RIVERBEND CROSSING was prepared by me (or under my direct supervision) in accordance with the provisions of City of Colorado Springs/El Paso County Drainage Criteria Manual Volumes 1 and 2 Drainage Design and Technical Criteria for the owners thereof. I understand that El Paso County does not and will not assume liability for drainage facilities designed by others.

_____ _____

David L. Mijares, Colorado PE #40510 Date
For and on behalf of Catamount Engineering

Developer's Statement:
I, the developer have read and will comply with all of the requirements specified in this drainage report and plan.

AVATAR FOUNTAN, LP. hereby certifies that the drainage facilities for RIVERBEND CROSSING shall be constructed according to the design presented in this report. I understand that El Paso County does not and will not assume liability for the drainage facilities designed and or certified by my engineer and that the El Paso County reviews drainage plans pursuant to Colorado Revised Statues, Title 30, Article 28; but cannot, on behalf of RIVERBEND CROSSING guarantee that final drainage design review will absolve AVATAR FOUNTAIN, LP. 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.

AVATAR FOUNTAIN, LP.
Business Name

By: Alan Toth

Title: Managing Partner

Address: 6800 Jericho Turnpike, Suite 120W #204

Syosset, NY 11791

El Paso County:
Filed in accordance with the requirements of the El Paso County land Development Code and the Drainage Criteria manual Volumes 1 and 2, and the El Paso County Engineering Criteria Manual, latest revision.

_____ _____

Jennifer Irvine, PE Date
County Engineer/ECM Administrator

Add a table of contents.

ADDED TOC

Conditions:

PRELIMINARY/FINAL DRAINAGE REPORT FOR REIVERBEND CROSSING FILING NO. 1 AND 2

PURPOSE

The purpose of this drainage report is to identify existing drainage patterns and establish outfall scenarios from the proposed development. The site is contained within the West Little Johnson Drainage Basin and outfalls directly to Fountain Creek. The parcel was previously studied in the Little Johnson/Security Creek Drainage Basin Planning Study prepared by Simons, Li and Associates, dated December 1987, and the Preliminary Drainage Report for Riverbend Crossing., prepared by Nolte and Associates, dated February 14, 2007. The Little Johnson Drainage Basin Planning Study identifies the parcel as direct flow into Fountain Creek and does not propose improvements to the adjacent reach. The overall Riverbend development consists of two overall projects, The Riverbend Crossing residential subdivision filings 1 and 2 to be developed in El Paso County; and the Riverbend Crossing Commons Development to be developed within City of Fountain. This report develops broad analysis of both El Paso County and Fountain development parcels and provides Final Drainage Report detail for the residential parcels.

GENERAL LOCATION AND DESCRIPTION

The Riverbend Crossing Developments are located within the NE ¼ of Section 14, Township 15 South and Range 66 West of the 6th principal meridian. The proposed commercial parcel contains approximately 10.69 acres to be developed within the City of Fountain incorporation limits. The existing commercial development is proposed to have the majority of buildings and infrastructure demolished and reconstruction of the site will incorporate access to the proposed commercial development.

The proposed residential developments contain approximately 52.0 acres of undeveloped land with approximately 10 acres located within the existing Fountain Creek 100-year floodplain. Improvements are proposed in the portions of the property identified as outside of the existing floodplain. Residential development is proposed to be completed in 2 filings. Filing No. 1 will contain 136 residential lots situated on approximately 36.5 acres within the easterly and southerly portions of the residential parcel. Filing No. 2 will contain 86 residential lots on approximately 15.5 acres. The 10 acres within the floodplain not proposed for development are contained within the boundary of Filing No. 1.

The overall development is bounded to the north and west by undeveloped land zoned A-5, to the east by U.S. Highway 85/87 and Southmoor Drive, and to the south by Fountain Creek. The easterly portions of the development contained within the City of Fountain incorporation limits are predominantly zoned commercial and the southerly and westerly portions of the development are zoned PUD. An RS-5000 zone is being sought with entitlement applications within the El Paso County portions.

Existing soils on the site consist of Limon clay (Hydrologic Group 'C'), Schamber-Razor complex (Hydrologic Group 'A'), and Nunn clay loam (Hydrologic Group 'C'). Soils have been identified

Include page numbers. Unresolved.

ADDED

as determined by the Natural Resources Conservation Service Web Soil Survey. Hydrologic Group 'C' soils have been used in hydrologic calculations.

The 10.69 acres contained within the commercial site contains existing structures, paved parking, and paved drive aisles with little existing vegetation. The 52.0 acre residential portion remains substantially ungraded and vegetated with native grasses and volunteer trees and shrubs within roadside ditches and established drainage swales.

The property contains an abandoned irrigation pond within the northern portion of the site that was historically supplied by two wells located within the commercial development. There is no active irrigation within the parcel currently. The parcel contains an abandoned sewer outfall crossing the site that previously served the commercial development. The abandoned sewer conveyed sewage to a lagoon system located within the Fountain Creek Floodplain. The lagoon was filled when central sewer became available to the commercial development from Security Sanitation District. No development is proposed in the location of the filled lagoon.

The existing commercial site sits 10-15 feet higher than the undeveloped residential portion of the parcels and runoff sheetflows predominantly at 1%-1.5% to the south and into Southmoor Drive. Flows are contained within the Southmoor Drive roadside ditch and conveyed southwest to Fountain Creek. The undeveloped portion of the Riverbend Crossing Developments falls flows predominantly to the south at an average slope of 1.5%

The majority of the site is located within Shaded Zone X (500-year) floodplain and the southern portion of the site is contained within a F.E.M.A. designated Zone AE (100-year) floodplain per FIRM panels 08041C0763G and 08041C0951 F, effective December 07, 2018. The F.E.M.A. Flood Insurance Rate Map has been provided. The portion of the site within the Zone AE floodplain will not be utilized for residential development.

A portion of the FIRM Panels were further modified by LOMR 17-08-0467P effective 1/15/2019. The LOMR modified floodplain affected by Security Creek and shows 100-YR flood being contained east of the centerline of Highway 85/87. LOMR revisions did not remove shaded zone X contained within the subject property.

EXISTING DRAINAGE

The parcels are located within the West Little Johnson Drainage Basin and are directly tributary to Fountain Creek within the reach. The Little Johnson/Security Creek Drainage Basin Planning Study identifies three separate sub-basins (75,76, and 77) within the parcel. The majority of the parcels are identified as within Shaded Zone X 500-year floodplain and the southerly portion of the property not proposed for development lies with Zone AE 100-yr floodplain and floodway. The effective firm panel is included in the appendix of the report. The West Little Johnson drainage basin contains approximately five square miles located in the semi-arid region of the high plains. Precipitation within the basin ranges from 14 to 16 inches per year with thunderstorms typical in the summer months.

The existing drainage patterns for the parcel were summarized in the "Preliminary Drainage Study Riverbend Crossing", prepared by Nolte and Associates, inc. dated 2/14/2007. No development within the parcel has been pursued since the Nolte analysis was completed and the existing drainage analysis has been accepted in this report. The northerly adjacent parcel has been developed for use as St. Dominic Catholic Church. Flows from the Church are collected on-site and conveyed to an existing full spectrum extended detention basin within the southwest corner of the church parcel. Outfall from the extended detention basin is piped to outfall to an existing swale within a drainage easement on agricultural property west of the Riverbend properties and does not enter the subject property. No other changes to surrounding properties are evident.

The report indicates the 3 sub-basins identified in the Drainage Basin Planning Study as sub-basins 75,76, and 77. The basins are direct flow basins directly tributary to Fountain Creek and traverse the site from north to south where they enter Fountain Creek.

Basin 77 represents the existing commercial center development northwest of proposed Riverbend Crossing Filings No. 1 and 2 and the southeasterly portion of the residential filings. Redevelopment of the commercial development within the City of Fountain is being concurrently pursued by the developer of both properties. Existing flows entering the residential portion at the southern limits of the commercial development were modeled as Q_5=25.99 cfs, Q_{100}=45.15 cfs in the Preliminary Drainage Report and are conveyed in a drainage swale to outfall within Fountain Creek. Total outfall to Fountain Creek from Basin 77 was Q_5=15.28 cfs, Q_{100}=31.70 cfs.

Basin 76 represents the central portion of the undeveloped parcel and the northwesterly portion of the existing commercial development and is directly tributary to Fountain Creek. The property north of Basin 76 is contained within the St. Dominic's Church Subdivision. Storm runoff from the St. Dominic's Church Subdivision is collected on-site and conveyed through a private detention pond prior to historic release east of the parcel. The Preliminary Drainage Report shows Q_5=6.89 cfs, Q_{100}=12.07 cfs entering the residential parcel from the northwest corner of the commercial development and exhibits Q_5=11.87 cfs, Q_{100}=28.05 cfs leaving the site and entering Fountain Creek.

west? REVISED TO WEST

Basin 75 contains the westerly portion of the proposed residential development. The preliminary drainage report indicates that Q_5=20.28 cfs, Q_{100}=45.99 cfs enter the west side of the parcel from the adjacent agricultural property. Topography does not indicate a channelized flow but rather overland flow from the west. The anticipated long term use for the adjacent parcel is to remain

agricultural. The foundation that owns the parcel is extending and irrigation ditch along the west boundary of the subject property to divert flows from the adjacent parcel south to Fountain Creek. An additional 15' setback is proposed in the residential development plan to allow for grading of a fill slope to convey flows south the Fountain Creek.

DEVELOPED DRAINAGE BASINS

The intent of the proposed development is to follow closely to historic drainage patterns while satisfying current El Paso County development and water quality criteria. The area of the site proposed for impervious development will be contained within the parking/private roadway section and private on-site storm sewer system conveying flows to a full spectrum detention basin and water quality facility within the southeast portion of the site prior to outfall to Fountain Creek.

Development of the site includes 225 residential lots, roadway and utility infrastructure to be constructed in 2 filings. Due to limited grade within the site necessitating flat roadway sections minimal drainage will be conveyed within the street roadway sections and drainage will primarily be conveyed is public storm drain systems conveying flows to outfall within a private extended detention basin. The private extended detention basin will be developed to accept developed runoff from the proposed redeveloped commercial center along the parcel's northeasterly boundary.

Flows generated within the proposed commercial center redevelopment will be conveyed within the commercial curb lines and private storm drain to be constructed along the southerly property boundary and outfall directly to the proposed shared extended detention basin.

Offsite Basins

Offsite flow (Historic sub-basin 75) generates runoff of Q_5=20.28 cfs, Q_{100}=45.99 cfs from the adjacent westerly agricultural parcel currently enter the property at an existing low point along the westerly boundary. Flows will be conveyed in a 10' wide constructed grass swale at 0.5% with 3:1 side slopes from the existing low point south approximately 300' to outfall within the adjacent reach of Fountain Creek. See calculations in the Appendix.

Historic Basins 76 and 77 have been remodeled in this report as either 'B' designated basins within the interior or 'C' basins representing the commercial development. 'B' designated basins will be conveyed within interior street, inlet, and storm sewer conveyance systems to the proposed full spectrum pond proposed with the development. 'C' designated basins will be conveyed in a separate storm sewer system developed in conjunction with commercial redevelopment to outfall to the shared on-site extended detention system. The detailed drainage plan for the commercial development is currently under review with the city of Fountain and a composite basin representing the commercial development is utilized in calculation for sizing the shared pond. Runoff from the commercial development will not directly enter the Riverbend Crossing residential development with the exception of storm sewer outfall directly to the pond.

Per review comments on the preliminary, the swale shall be located within a tract. TRACT IDENTIFIED.

Update narrative to discuss why no WQCV is provided for this basin. Per the recent ECM update 100% of the applicable development site must be captured for WQ with specific exclusions. Identify the specific criteria in ECM I.7.1.B which excludes Basin A from providing permanent WQCV.

DISCUSSION ADDED FOR JUSTIFICATION OF ECM I.7.1.B

'A Basins'

Basin A1 (1.30 Acres, Q_2=0.2 cfs, Q_5=0.6 cfs, Q_{10}=1.1 cfs, Q_{25}=1.8 cfs, Q_{50}=2.3 cfs, and Q_{100}=2.9 cfs) consists of the proposed diversion [illegible] the southern portion of the system boundary. Development will consist of a grass lined swale intended to divert offsite flows around Pond A1 to Kettle Creek.

'B Basins'

'B' designated basins consist of the majority of the residential development. Runoff from 'B' basins will primarily sheetflow to residential street sections, be collected in Type 'R' inlets and conveyed in public storm drainage systems to the extended detention basin.

This sentence does not apply to basin B17, and B18. A separate narrative for the basin description is required. ADDED SPECIFIC DISCUSSION FOR B17 & B18. DISCUSSED PVT STORM CONVEYANCE

The drainage map is not clear how runoff is conveyed to pipe design point 12. The map does not show an area inlet. ADDED DETAIL TO MAP.

BASIN	AREA	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Type R inlet
B1	1.70	2.1	3.8	5.2	7.0	8.5	10.3	10'
B2	1.33	2.0	3.2	4.3	5.8	7.0	8.5	5'
B3	2.29	2.9	4.0	5.2	7.0	8.5	10.3	10'
B4	1.26	1.8	2.8	3.8	5.1	6.2	7.5	5'
B5	3.57	4.8	6.8	9.1	12.0	14.4	17.4	15'
B6	1.67	2.1	2.9	3.8	5.1	6.2	7.5	5'
B7	3.79	4.0	5.7	7.7	9.9	11.9	14.2	10'
B8	0.33	0.5	0.7	0.9	1.1	1.3	1.6	5'
B9	3.19	4.3	5.9	7.6	9.5	11.3	13.2	10'
B10	2.15	3.0	4.0	5.2	6.5	7.6	9.0	10'
B11	4.41	6.0	8.2	10.6	13.2	15.7	18.4	15'
B12	3.74	5.1	7.0	9.0	11.3	13.3	15.6	10'
B13	1.96	2.6	3.5	4.6	5.7	6.7	7.9	DP-A1
B14	1.35	1.8	2.5	3.2	4.0	4.7	5.5	5'
B15	1.15	1.2	1.6	2.1	2.6	3.1	3.7	5'
B16	2.19	2.4	3.3	4.2	5.3	6.3	7.4	DP-A1
B17	0.87	1.2	1.7	2.2	2.7	3.2	3.7	AREA
B18	4.86	1.9	3.6	5.8	8.5	10.7	13.3	POND

The development contains roadways with minimum grades of 1.0%. Roadway conveyance at minimum grade of 1.0% is Q_5=8.5 cfs and Q_{100}=37 cfs exceeding individual basin runoff. Inlets were developed in sump locations throughout the development and flow-by is not anticipated. Inlet calculations for Basins B1 through B16 are provided in the appendix. Lots will be developed with side lot line swales directed to the streets. Lot templates for 'A' lot grading, 'B' lot grading, and a limited number of Walkout units will be provided in the final grading plan.

Basin B13 and Basin B16 are combined in the southerly knuckle at design Point A1. Combined flows at Design Point 1B of Q_5=6.3 cfs and Q_{100}=13.9 cfs are collected in a 20' sump inlet within the knuckle. Inlet calculation is provided in the appendix.

Is this a typo? If not, update the drainage map and proposed design points summary table to include design point 1B.

TYPO A1 IS DP #

'C Basins'

Basin C (11.25 Acres, Q_2=20.6 cfs, Q_5=26.3 cfs, Q_{10}=31.5 cfs, Q_{25}=37.3 cfs, Q_{50}=42.4 cfs, and Q_{100}=48.0 cfs) represents the combined flow generated within the commercial development. Runoff generated within the commercial development sheetflows within the proposed curb line and is collected within private inlets on-site and will be conveyed in a private storm sewer to outfall within the shared extended detention basin at Design Point P.

Update to reference the FDR for the commercial site within Fountain for the detailed drainage analysis. State whether or not the report is approved or under review at this time.

REFERENCE STATUS UPDATED.

Storm Sewer

Flows collected within 'B' designated basin inlets will be conveyed in a public storm sewer system located predominantly within the street ROW which outfalls to the private extended detention basin. Mannings equation calculations are provided in the appendix of this report. Hydraulic Grade Line Calculations will be developed upon development of initial review comments.

Unresolved. Revise sentence. Initial review has occurred. Include HGL calculations in the appendix.

HGL's ADDED MANNINGS REMOVED.

Pipe Design Point 1 (Q_5=5.4 cfs and Q_{100}=12.4) represents combined flows from basins B1 and B2 and will be conveyed in a public 24" RCP at a minimum grade of 0.5%.

Pipe Design Point 2 (Q_5=6.4 cfs and Q_{100}=14.6) represents combined flows from basins B3 and B4 and will be conveyed in a public 24" RCP at a minimum grade of 1.8%.

Pipe Design Point 3 (Q_5=14.9 cfs and Q_{100}=33.6) represents combined flows from basins B5 and B6 and Pipe Design Point 2. Combined flows will be conveyed in a public 30" RCP at a minimum grade of 0.65%.

Pipe Design Point 5 (Q_5=6.3 cfs and Q_{100}=15.5) represents combined flows from basins B7 and B8 and will be conveyed in a public 24" RCP at a minimum grade of 0.5%.

Pipe Design Point 6 (Q_5=15.8 cfs and Q_{100}=36.5) represents combined flows from basins B9 and B10 and Pipe Design Point 5. Combined flows will be conveyed in a public 30" RCP at a minimum grade of 0.66%.

Pipe Design Point 7 (Q_5=36.5 cfs and Q_{100}=82.5) represents combined flows from Pipe Design Points 6 and 11. Combined flows will be conveyed in a public 42" RCP at a minimum grade of 0.7%.

Pipe Design Point 8 (Q_5=15.2 cfs and Q_{100}=33.9) represents combined flows from basins B11 and B12 and will be conveyed in a public 30" RCP at a minimum grade of 0.70%.

Pipe Design Point 9 (Q_5=21.1 cfs and Q_{100}=46.9) represents combined flows from Basin B9 and Pipe Design Point 8. Combined flows will be conveyed in a public 36" RCP at a minimum grade of 0.50%.

Pipe Design Point 10 (Q_5=23.4 cfs and Q_{100}=52.1) represents combined flows from Pipe Design Point 9 and overland Design Point A1. Combined flows will be conveyed in a private 36" RCP pipe at a minimum grade of 0.065%.

Pipe Design Point 11 (Q_5=23.8 cfs and Q_{100}=53.0) represents combined flows from Pipe Design Point 10 and Basin B15. Combined flows will be conveyed in a private 36" RCP pipe at a minimum grade of 0.065%.

Pipe Design Point 4 (Q_5=53.0 cfs and Q_{100}=119.9) represents combined flows from Pipe Design Points 1,3. and 7. Combined flows will be conveyed in a private 48" RCP at a minimum grade of 0.75%.

Pipe Design Point 12 (Q_5=54.3 cfs and Q_{100}=122.6) represents combined flows from Pipe Design Points 41,3. and Basin B17. Combined flows will be conveyed in a private 48" RCP at a minimum grade of 0.75%.

EXTENDED DETENTION BASIN

Revise. Per the calculation provided EURV=3.71 ac-ft Revised and 100yr=6.17 ac-ft Revised

The parcel proposes to develop 54.90 acres within the West Little Johnson Drainage tributary to Fountain Creek requiring development of water quality treatment and detention per the criteria of the El Paso County Drainage Criteria Manual Volume 2. extended detention basin will be developed to provide water quality and full spec for both the Riverbend Crossing residential development Filings No. 1 and 2 and the Riverbend Crossing Commons Commercial development within the City of Fountain. The proposed Extended Detention Basin located in the southerly portion of the development has 54.90 tributary acres of development with an average imperviousness of 65.40%. Full spectrum pond development requires 1.170 acre-ft of water quality capture volume ponding to an elevation of 5685.95, an EURV volume of 2.542-acre ft, and a total volume of 6.1169 acre-ft ponding to an elevation of 5689.98 providing full spectrum detention including the 100-YR event.

Runoff generated within the site will be conveyed to the pond through storm sewer systems or as direct sheetflow. The storm sewer systems will outfall directly to 6" concrete forebays with baffle providing adequate protection at discharge point. The concrete forebays require a total volume of 1,525 cubic feet of volume (2% of the design WQCV). The forebay will be constructed of a concrete slab with sides conforming to the pond slopes and 1' wall with a 9" rectangular notch which outfalls to the proposed trickle channel at the downstream end.

The pond will be constructed with 4:1 minimum side slopes to be vegetated per the final landscape plan. A 4' wide by 6" deep concrete trickle channel with a 0.5% longitudinal slope will convey low flows across the pond bottom to the micropool/outlet structure. The trickle channel will outfall to a 17' long by 7' wide by 2.5' deep concrete micropool. The micropool will provide a surface area of 120 square feet and an initial surcharge volume of 80 cubic feet utilizing an 8" initial surcharge depth.

A portion of the pond is situated below the Base Flood Elevation of the 100-YR recurrence event within the adjacent portion of Fountain Creek, 5689.00. Excess volume exceeding the 100-YR event volume above the base flood elevation was incorporated into the pond to overcome backwater effects should the subdivision experience a 100-YR event concurrent with passage of maximum flood event within the adjacent reach of Fountain Creek.

The outlet structure will consist of a concrete box with orifice plate and screen providing water quality outlet and weir with trash rack for larger storm outfall. The pond will outfall through a private 30" RCP pipe system directly to Fountain Creek.

The emergency spillway will consist of a 60' weir along the southerly end of the pond at an elevation of 5691.00. The overflow area will consist of 12" depth of type VL soil riprap.

Outfall from the extended detention basin of Q_2=1.0 cfs, Q_5=2.6 cfs, Q_{10}=7.8 cfs, Q_{25}=18.2 cfs, Q_{50}=27.2 cfs, and Q_{100}=36.4 will be conveyed in a private 30" RCP. Combined flows at Design P-out is less than historic runoff from basins 75,76, and 77. Outfall from the onsite extended detention basin will be conveyed directly to Fountain Creek through the private 30" HDPE and full spectrum release will have no impacts on the Fountain Creek Drainage.

COST ESTIMATE

Public Improvements Non-reimbursable

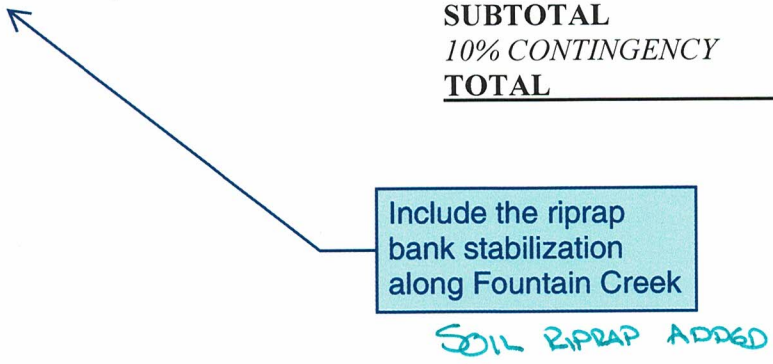
5' Type R Inlet	2 EA	@$	3,800/EA	$ 7,600
10' Type R Inlet	9 EA	@$	5,500/EA	$ 49,500
15' Type R Inlet	1 EA	@$	8,000/EA	$ 8,000
20' Type R Inlet	1 EA	@$	10,0000/EA	$ 10,000
Type I Manhole	11 EA	@$	4,000/EA	$ 40,000
18" RCP	213 LF	@$	45/LF	$ 9,585
24" RCP	2,102 LF	@$	55/LF	$ 115,610
30" RCP	1,411 LF	@$	68/LF	$ 95,948
42" RCP	152LF	@$	90/LF	$ 13,680
48" RCP	151 LF	@$	110/LF	$ 16,610

SUBTOTAL	**$ 366,533**
10% CONTINGENCY	*$ 36,653*
TOTAL	**$ 403,168**

Private Improvements Non-reimbursable

48" HDPE	552 LF	@$	85/LF	$ 46,920
WATER QUALITY POND	1 EA	@$	65,000/EA	$ 65,000

SUBTOTAL	**$ 111,920**
10% CONTINGENCY	*$ 11,192*
TOTAL	**$ 123,112**



DRAINAGE FEE CALCULATION

Riverbend Crossing Filing No. 1 contains 36.5 acres to be platted within the West Little Johnson Drainage Basin. Riverbend Crossing Filing No. 2 contains 15.5 acres to be platted within the West Little Johnson Drainage Basin. The 2018 fee for the West Little Johnson Drainage Basin (A miscellaneous Drainage Basin) is $1,133/ per impervious acre.

Filing No.1-36.547 total acres.

Use	Acres	Imperviousness
1/8 acre or less	23.45	65%
Open Space	13.09	7%
Composite Imperviousness:	44.2%	

36.547 acres X 44.2% X $1,133.00 = $18,311

Filing No.2-15.452 total acres.

Use	Acres	Imperviousness
1/8 acre or less	14.48	65%
Open Space	0.97	7%
Composite Imperviousness:	61.4%	

15.452 acres X 61.4% X $1,133.00 = $10,742

DRAINAGE METHODOLOGY

This drainage report was prepared in accordance to the criteria established in the City of Colorado Springs/El Paso County Drainage Criteria Manual Volumes 1 and 2, as revised May 2014.

The rational method for drainage basin study areas of less than 100 acres was utilized in the analysis. For the Rational Method, flows were calculated for the 2, 5, 10, 25, 50, and 100-year recurrence intervals. The average runoff coefficients, 'C' values, are taken from Table 6-6 and the Intensity-Duration-Frequency curves are taken from Figure 6-5 of the City Drainage Criteria Manual. Time of concentration for overland flow and storm drain or gutter flow are calculated per Section 3.2 of the City Drainage Criteria Manual. Calculations for the Rational Method are shown in the Appendix of this report.

Remove. ✓

Urban Drainage and Flood Control District methodology was utilized for determination of street capacity, inlet sizing, and extended detention basin design. UD-Inlet Version 4.05 was utilized in street capacity and inlet sizing calculations. UD-Culvert Version 3.05 was utilized in developing preliminary pipe sizing. Details and analysis of final storm drain conveyance and collection system will be developed in an addendum to the final drainage report submitted with Private Storm Sewer Plans for Fillmore Apartments Subdivision. Preliminary sizing calculations were provided in the appendix of this report. UD-Detention version 3.07 was utilized in development of extended detention basin and outfall. Calculations are included in the appendix of this report.

Since this report is associated with the final plats, final design must be provided with this report. Unresolved. PROVIDED

SUMMARY

Development of Riverbend Crossing Filings No. 1 and No. 2 will require that flows be treated for water quality and be detained to historic levels prior to release from the site. Site runoff and storm drain and appurtenances will not adversely affect the downstream and surrounding developments. This report is in general conformance with all previously approved reports which included this site. Facilities will be owned or maintained by the Riverbend Crossing Metropolitan District.

REFERENCES:

City of Colorado Springs Engineering Division Drainage Criteria Manual Volumes 1 and 2, revised May 2014

"Little Johnson/Security Creek Drainage Basin Planning Study" prepared by Simons, Li and Associates, Inc. dated December 1987.

"Preliminary Drainage Study Riverbend Crossing" prepared by Nolte and Associates, Inc." accepted February 2017.

"Preliminary/Final Drainage Report for St. Dominic's Church Subdivision", accepted October 2007.

Natural Resources Conservation Service Web Soil Survey

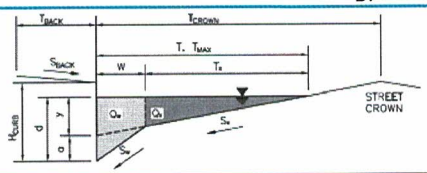
Version 4.05 Released March 2017

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

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

Project: Riverbend Crossing

Inlet ID: B1



For local road this is mainly back of sidewalk. Revise the manning's n. Unresolved

Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} = 7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} = 0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} = 0.020	0.012
Height of Curb at Gutter Flow Line	H_{CURB} = 6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} = 17.0	ft
Gutter Width	W = 2.00	ft
Street Transverse Slope	S_X = 0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W = 0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O = 0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} = 0.016	

14" gutter for Optional Type C curb Unresolved

16,17

	Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm (T_{MAX})	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm (d_{MAX})	5.1	7.8	inches

16,17

Check boxes are not applicable in SUMP conditions

MINOR STORM Allowable Capacity is based on Depth Criterion

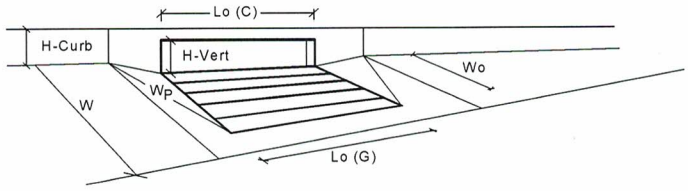
MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	SUMP	SUMP	cfs

16,17

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening	
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00 inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.5	7.8 inches
Grate Information			MINOR	MAJOR ☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A feet
Width of a Unit Grate		W_o =	N/A	N/A feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A
Curb Opening Information			MINOR	MAJOR
Length of a Unit Curb Opening		L_o (C) =	10.00	10.00 feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00 inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00 inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40 degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00 feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67
Low Head Performance Reduction (Calculated)			MINOR	MAJOR
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.29	0.48 ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.52	0.74
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.90	1.00
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A
			MINOR	MAJOR
Total Inlet Interception Capacity (assumes clogged condition)		Q_a =	**6.6**	**15.5** cfs
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	5.7	14.2 cfs

The inlet calculation for basin B7 indicates a 10' inlet. Revise the drainage map.
Unresolved. Check all the other inlets for consistency.

REVISED TO MATCH CALCULATIONS

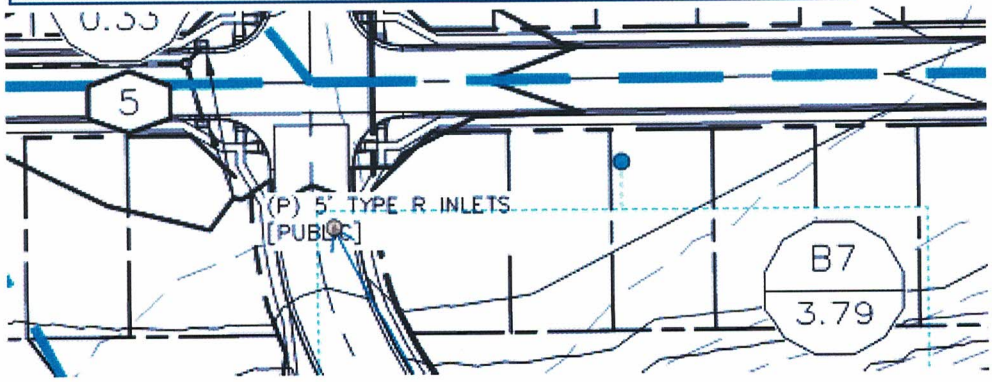
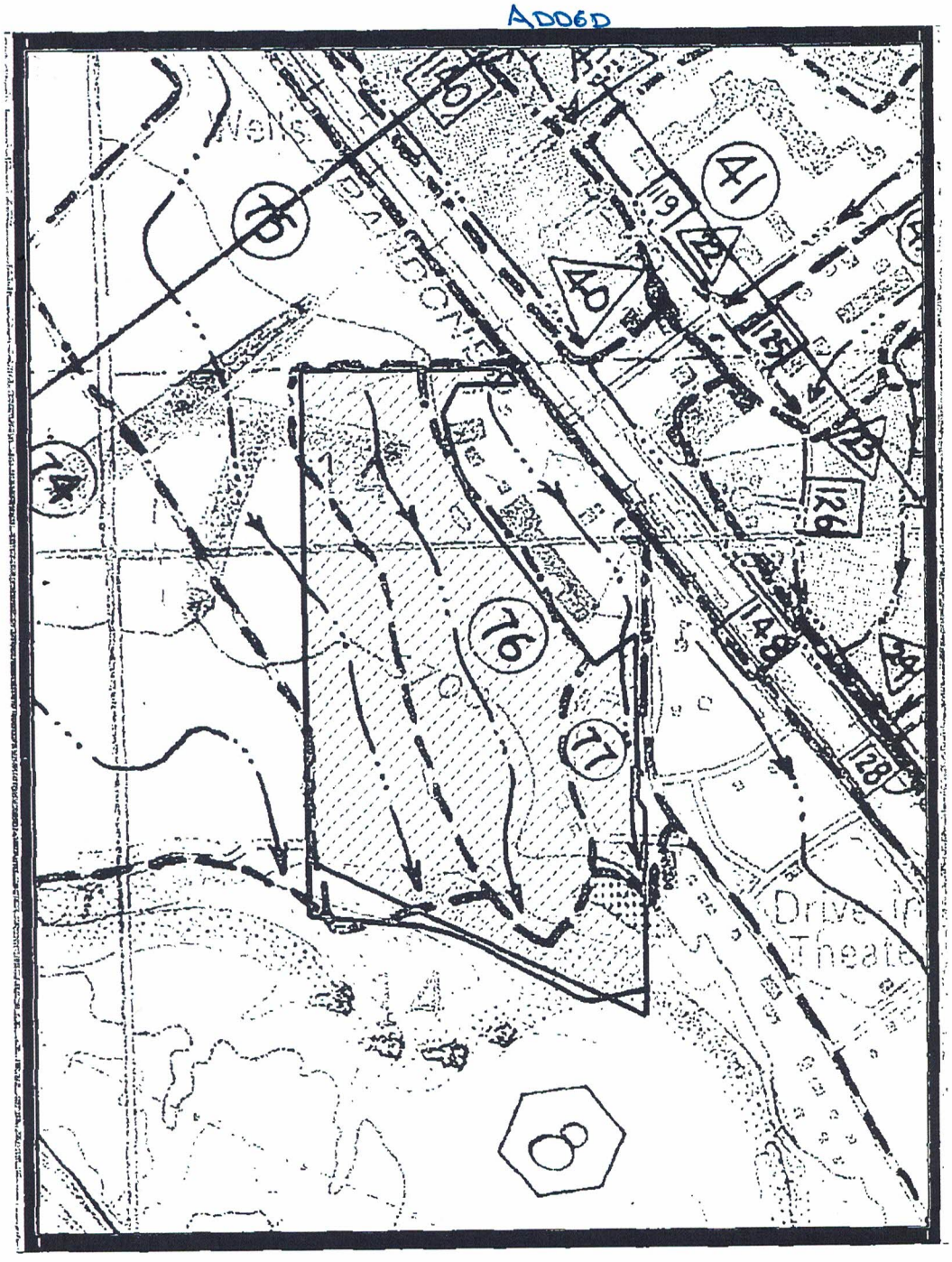
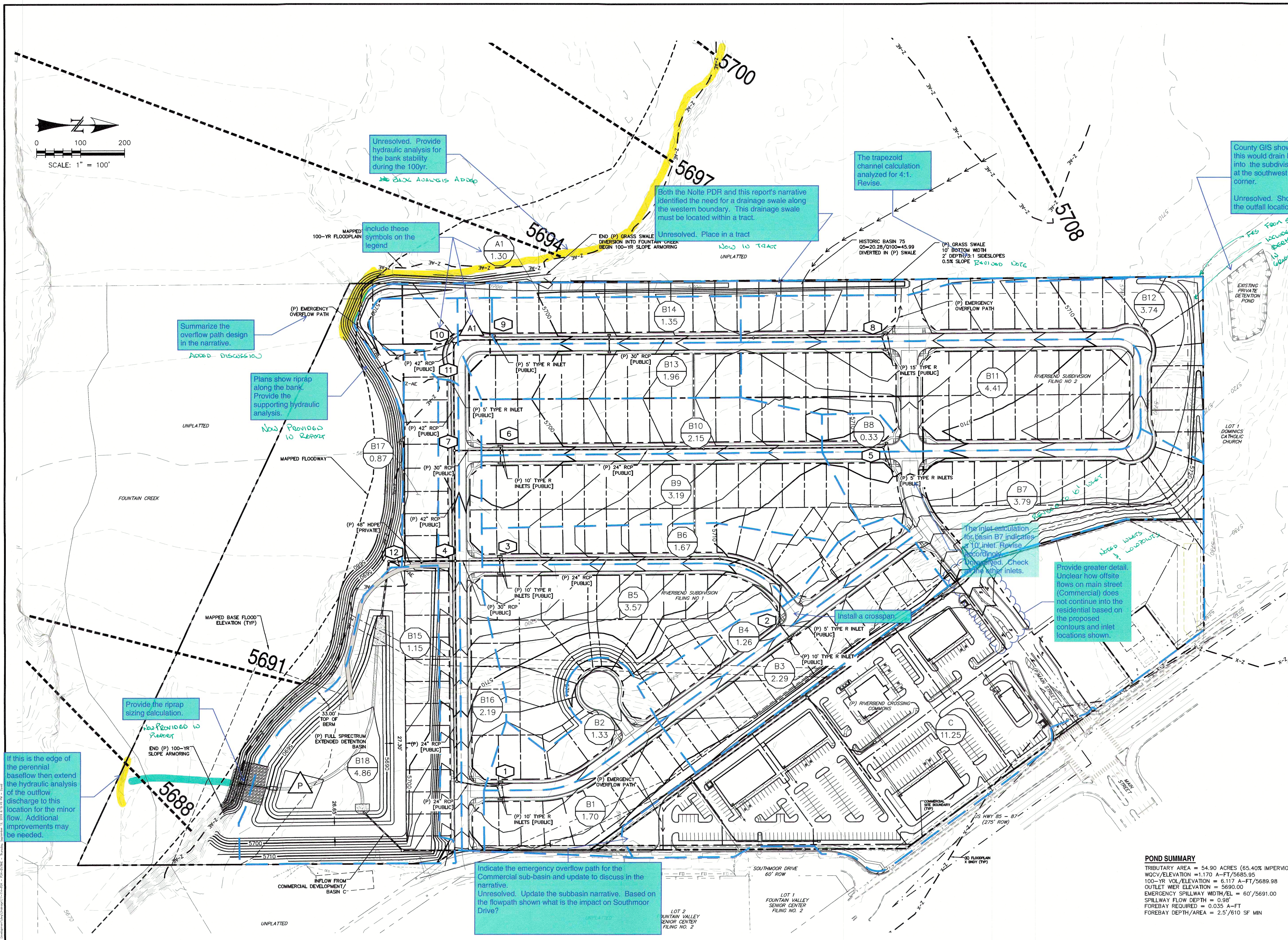


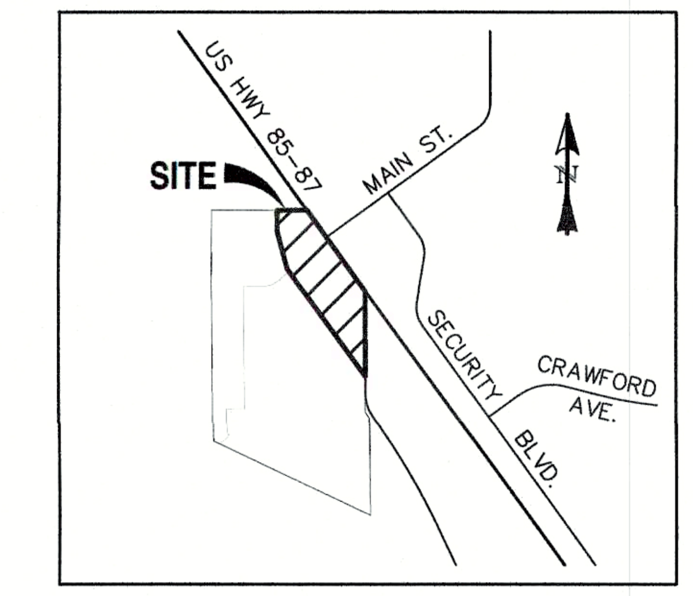
FIGURE A4 – Drainage Patterns as Depicted in the DBPS

Add a north arrow.

ADDED




SCALE: 1" = 100'
Unresolved. Provide hydraulic analysis for the bank stability during the 100yr.
include these symbols on the legend
Both the Nolte PDR and this report's narrative identified the need for a drainage swale along the western boundary. This drainage swale must be located within a tract.
Unresolved. Place in a tract.
The trapezoid channel calculation analyzed for 4:1. Revise.
County GIS shows this would drain back into the subdivision at the southwest corner.
Unresolved. Show the outfall location.
Summarize the overflow path design in the narrative.
Plans show riprap along the bank. Provide the supporting hydraulic analysis.
The inlet calculation for basin B7 indicates a 10' inlet. Revise accordingly. Unresolved. Check all the other inlets.
Provide greater detail. Unclear how offsite flows on main street (Commercial) does not continue into the residential based on the proposed contours and inlet locations shown.
Install a crosspan.
Provide the riprap sizing calculation.
If this is the edge of the perennial baseflow then extend the hydraulic analysis of the outflow discharge to this location for the minor flow. Additional improvements may be needed.
Indicate the emergency overflow path for the Commercial sub-basin and update to discuss in the narrative.
Unresolved. Update the subbasin narrative. Based on the flowpath shown what is the impact on Southmoor Drive?
MAPPED 100-YR FLOODPLAIN
END (P) GRASS SWALE DIVERSION INTO FOUNTAIN CREEK BEGIN 100-YR SLOPE ARMORING
HISTORIC BASIN 75 Q5=20.28/Q100=45.99 DIVERTED IN (P) SWALE
(P) GRASS SWALE 10' BOTTOM WIDTH 2' DEPTH, 3:1 SIDESLOPES 0.5% SLOPE
(P) EMERGENCY OVERFLOW PATH
EXISTING PRIVATE DETENTION POND
RIVERBEND SUBDIVISION FILING NO 2
RIVERBEND SUBDIVISION FILING NO 1
LOT 1 DOMINICS CATHOLIC CHURCH
UNPLATTED
FOUNTAIN CREEK
MAPPED FLOODWAY
MAPPED BASE FLOOD ELEVATION (TYP)
(P) FULL SPECTRUM EXTENDED DETENTION BASIN
END (P) 100-YR SLOPE ARMORING
INFLOW FROM COMMERCIAL DEVELOPMENT/ BASIN C
(P) RIVERBEND CROSSING COMMONS
US HWY 85 - 87 (275' ROW)
SOUTHMOOR DRIVE 60' ROW
LOT 1 FOUNTAIN VALLEY SENIOR CENTER FILING NO. 2
LOT 2 FOUNTAIN VALLEY SENIOR CENTER FILING NO. 2
MAIN STREET
5700
5697
5694
5691
5688
5708
A1 1.30
B1 1.70
B2 1.33
B3 2.29
B4 1.26
B5 3.57
B6 1.67
B7 3.79
B8 0.33
B9 3.19
B10 2.15
B11 4.41
B12 3.74
B13 1.96
B14 1.35
B15 1.15
B16 2.19
B17 0.87
B18 4.86
C 11.25



VICINITY MAP
SCALE: N.T.S.

PROPOSED DRAINAGE BASINS							
BASIN	AREA (ACRES)	Q2 (CFS)	Q5 (CFS)	Q10 (CFS)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)
A1	1.30	0.2	0.6	1.1	1.8	2.3	2.9
B1	1.70	2.1	2.9	3.8	4.9	5.8	6.9
B2	1.33	2.0	2.7	3.4	4.3	5.1	6.0
B3	2.29	2.9	4.0	5.2	6.6	7.9	9.3
B4	1.26	1.8	2.5	3.2	4.0	4.8	5.6
B5	3.57	4.8	6.6	8.4	10.5	12.5	14.6
B6	1.67	2.1	2.9	3.7	4.6	5.5	6.4
B7	3.79	4.0	5.7	7.7	9.9	11.9	14.2
B8	0.33	0.5	0.7	0.9	1.1	1.3	1.6
B9	3.19	4.3	5.9	7.6	9.5	11.3	13.2
B10	2.15	3.0	4.0	5.2	6.5	7.6	9.0
B11	4.41	6.0	8.2	10.6	13.2	15.7	18.4
B12	3.74	5.1	7.0	9.0	11.3	13.3	15.6
B13	1.96	2.6	3.5	4.6	5.7	6.7	7.9
B14	1.35	1.8	2.5	3.2	4.0	4.7	5.5
B15	1.15	1.2	1.6	2.1	2.6	3.1	3.7
B16	2.19	2.4	3.3	4.2	5.3	6.3	7.4
B17	0.87	1.2	1.7	2.2	2.7	3.2	3.7
B18	4.86	1.9	3.6	5.8	8.5	10.7	13.3
C	11.25	20.6	26.3	31.5	37.3	42.4	48.0

PROPOSED DESIGN POINTS						
DESIGN POINT	Q2 (CFS)	Q5 (CFS)	Q10 (CFS)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)
1	3.9	5.4	7.0	8.9	10.5	12.4
2	4.6	6.4	8.3	10.4	12.4	14.6
3	10.9	14.9	19.2	24.1	28.6	33.6
4	38.7	53.0	68.6	86.1	102.0	119.9
5	4.4	6.3	8.4	10.9	13.0	15.5
6	11.3	15.8	20.6	26.0	31.0	36.5
7	26.7	36.5	47.2	59.3	70.2	82.5
8	11.2	15.2	19.6	24.5	28.9	33.9
9	15.5	21.1	27.1	33.8	40.0	46.9
10	17.2	23.4	30.1	37.5	44.4	52.1
11	17.5	23.8	30.6	38.2	45.2	53.0
12	39.6	54.3	70.2	88.1	104.3	122.6
A1	4.6	6.3	8.1	10.1	11.9	13.9
P-IN	61.2	83.0	105.7	131.6	154.8	180.8
P-OUT	1.0	2.6	7.8	18.2	27.2	36.4

LEGEND

EXISTING	(E)
FUTURE	(F)
PROPOSED	(P)
CURB AND GUTTER	C&G
EASEMENT	ESMT
BOUNDARY	
RIGHT-OF-WAY	
LOT LINE	
EASEMENT	
SETBACK	
(E) CONTOUR, INDEX	5970
(E) CONTOUR	
(E) STORM SEWER, INLET, MH	
(P) CONTOUR, INDEX	5970
(P) CONTOUR	
(P) FENCE	
(P) STORM SEWER, INLET, MH	
BASIN BOUNDARY	

POND SUMMARY
TRIBUTARY AREA = 54.90 ACRES (65.40% IMPERVIOUS)
WQCV/ELEVATION =1.170 A-FT/5685.95
100-YR VOL/ELEVATION = 6.117 A-FT/5689.98
OUTLET WIER ELEVATION = 5690.00
EMERGENCY SPILLWAY WIDTH/EL = 60'/5691.00
SPILLWAY FLOW DEPTH = 0.98'
FOREBAY REQUIRED = 0.035 A-FT
FOREBAY DEPTH/AREA = 2.5'/610 SF MIN

REV.	DESCRIPTION	DATE

PREPARED FOR:
AVATAR EQUITIES
6800 JERICHO TURNPIKE
SUITE 120W, #204
SYOSSET, NY 11791

CATAMOUNT ENGINEERING
321 W. HENRIETTA AVE, PO BOX 221, WOODLAND PARK, CO 80866, (719)426-2124

RIVERBEND CROSSING
PROPOSED DRAINAGE PLAN

DESIGNED BY:	DLM	DRAWN BY:	DBM
SCALE:	1" = 60'	DATE:	09/12/19
JOB NUMBER	17-115	SHEET	1 OF X