DRAINAGE MEMO

Rename to Preliminary/Final Drainage Report

LOT 1, SPACE VILLAGE FILING NO. 3
6809 SPACE VILLAGE AVENUE
EL PASO COUNTY, COLORADO

PREPARED FOR:

Kum & Go, L.C.
6400 Westown Parkway
West Des Moines, IA 50266
(515) 457-6232
Contact: Ryan Halder

PREPARED BY:

Olsson Associates
1880 Fall River Drive, Suite 200
Loveland, CO 80538
(970) 461-7733
Contact: Josh Erramouspe

Add SF-18-016

May 17, 2018

PCD Project No. SP-17-009

Olsson Project No. 017-1754

OLSSON ASSOCIATES

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

_____
Josh Erramouspe
Colorado Licensed Professional Engineer No. 42141

DEVELOPER'S STATEMENT
I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Kum & Go, L.C. hereby certifies that the drainage facilities for 6809 Space Village Avenue (Kum & Go #692) 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 EL Paso County reviews drainage plans pursuant to Colorado Revised Statutes, Title 30, Article 28; but cannot, on behalf of 6809 Space Village Avenue (Kum & Go #692), guarantee that final drainage design review will absolve Kum & Go, L.C. 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.

_____
Kum & Go, L.C.

By: _____

Title: _____

Address: _____

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

_____ _____
Jenifer Irvine, PE Date
Count Engineer/ECM Administrator

Table of Contents

1.0 GENERAL PROPERTY DESCRIPTION

The SITE is a 4.132-acre parcel situated in the northwest quarter of Section 17, Township 14 South, Range 65 West of the Sixth Principal Meridian, County of El Paso, State of Colorado. The SITE is bounded to the north by Space Village Avenue, to the east by Lot 1, Space Village Filing No. 2 and 6685 Space Village Avenue, to the west by Peterson Road, and to the south by Lot 1, Cowperwood SAIC and Lot 1, Peterson Office Project. 1.77 acres of the site will consist of future commercial development. The remaining 2.36 acres has already been developed with retail uses and their associated drive aisles and parking lots.

Add a flood plain statement

2.0 GENERAL EXISTING DRAINAGE CHARACTERISTICS

2.1 Soils Condition

Existing soils within the SITE consist entirely of Truckton sandy loam. The NRCS hydrologic soil classification assigned to this type of soil is Type A. Refer to Appendix A for NRCS web soil survey mapping.

2.2 Existing Site Conditions

The SITE, which lies within the Sand
parking lot for the surrounding develc
50% of the SITE. The remaining area

Change convenience store to Lot 1 or future commercial development. Since a specific site plan application has not been submitted, this report needs to analyze based on a more general commercial development and not a specific use.

2.3 Existing Drainage Conditions

The existing drainage on the site generally flows from northeast to southwest with slopes ranging from 1%-10%. Refer to the Existing Drainage Basin Map in Appendix C.

Basin EX-1 encompasses approximately 1.77 acres. The basin is comprised of approximately 50% grassy landscape and 50% asphalt pavement. Runoff (Q_5=2.64 cfs, Q_{100}=7.18 cfs) flows into the existing 24" RCP culvert located on the west side of the SITE. The runoff is discharged from the culvert to the west side of Peterson Road.

Basin EX-2 encompasses approximately 0.93 acres south of the proposed convenience store lot. The basin is comprised of mostly asphalt pavement, with small portions of roof & landscape. Runoff (Q_5=3.52 cfs, Q_{100}=7.82 cfs) flows into the existing 24" RCP culvert located on the west side of the SITE. The runoff is discharged from the culvert on the west side of Peterson Road. The drainage patterns within the basin will not be altered after the convenience store lot is developed, however the basin has been analyzed here since the runoff from this basin will be routed through the convenience store's proposed detention basin.

Basin EX-3 encompasses an additional 1.50 acres of land to the north & west of the SITE currently discharges stormwater surface runoff (Q_5=3.14 cfs, Q_{100}=7.67 cfs) to the existing 24" RCP culvert located on the west side of the SITE. Again, since the drainage patterns associated with this additional 1.50 acres will not be altered after the convenience store lot is developed, we have not performed any additional analysis for this acreage. We have, however, included the runoff
sizing calculations for the proposed grated inlet that will replace the exi
section located on the west side of the SITE.

Provide a summary of Design Point 4. What is the peak combined flow going into the existing 24" RCP culvert.

3.0 PROPOSED D

3.1 Proposed Basin Description

Upon future development of the site, developed runoff should drain through a private storm sewer system to a private on-site detention facility and will ultimately enter the El Paso County

Lot 1

Revise. County GIS does not indicate that Peterson Blvd or the inlet and culvert are County owned or maintained. Double check with the City or AFB and update the narrative accordingly.

If the off-site flow is routed through the detention facility then the OS-1 area and imperviousness must be included in the detention pond sizing calculation or else the drainage conveyance design must by-pass the detention facility. Update the UD-Detention calculation and/or narrative accordingly.

storm sewer system. The detention facility should discharge to the existing 24" RCP pipe at the west side of the SITE. Refer to the Proposed Drainage Basin Map for more detail on basin delineation. A more detailed breakdown of the runoff generated on-site is described as follows:

- Basin B-1 is the on-site portion of flow that should be routed to a detention facility. This basin encompasses approximately 1.77 acres and is assumed to be commercial development. It has been assumed that development of the SITE will result in an 80% imperviousness ratio. Runoff generated on the SITE (Q_5=5.63 cfs, Q_{100}=12.37 cfs) was calculated using the rational method and should be routed to a detention facility via overland flow, curb and gutter, and private storm sewer if necessary.
- Basin OS-1 is the off-site portion of flow that should be routed to a detention facility. This basin encompasses approximately 0.93 acres and is comprised of asphaltic concrete pavement and existing rooftop. Runoff generated within this basin (Q_5=3.63 cfs, Q_{100}=7.99 cfs) should flow through a detention facility and should not be detained as it is not being detained in the existing condition.

Update. The majority of OS-1 is on-site of the subdivision plat.

3.2 Allowable Release Rate

The future detention facility's allowable unit release rate was determined using UD-Detention Version 3.07. The allowable release rate was determined to be 1.06 cfs given the following parameters:

Include the UD-Detention in the report.

- NRCS Soil Type A
- Watershed Slope = 0.018 ft/ft
- Watershed Length = 450 ft
- Watershed Area = 1.77 acres (77,077 ft^2)

It is anticipated that there will be a small portion of the site's runoff that is not able to be routed to a detention facility. The release rate for the detention facility should be reduced by the amount of undetained flow.

Revise to note pond design for Full-Spectrum Detention

3.3 Detention Facility

A privately owned & maintained detention facility should be utilized to provide water quality on-site. The water quality capture volume (WQCV) and detention pond should be sized using UD-Detention_v3.07 and the composite site imperviousness should be determined at the time of development. Runoff generated on-site should be detained in the future detention facility, and a three-stage outlet system should be designed and constructed. Emergency overflow routing should be provided within the future detention facility by means of bypassing the detention to flow into Peterson Boulevard.

Revise the last sentence. I'm not sure what you are trying to say regarding the emergency overflow routing.

4.0 DRAINAGE FEES

This project is located in the Sand Creek Drainage Basin. The development's drainage/bridge fees are as follows and will be paid at the time of platting:

Drainage Fee: $17,197 per impervious acre x (0.80 x 1.77ac) = $24,350.95

Bridge Fee: $5,210 per impervious acre x (0.80 x 1.77ac) = $7,377.36

Total Fees: $22,407 per impervious acre x (0.80 x 1.77ac) = $31,728.31

* These fees are based on the 2018 fee schedule and are due prior to recordation of the plat.

Revise the area to 4.13 acres and update the imperviousness based on the the entire subdivision not just Lot 1 since this is unplatted and drainage/bridge fees have never been paid.

5.0 SUMMARY

In summary, assuming the SITE (6809 Space Village Avenue) will be commercial development, the drainage pattern of the SITE will be minimally altered when compared to existing drainage patterns. The ultimate discharge point will remain the same for this site (the 24" RCP culvert crossing Peterson Boulevard). Runoff generated on-site should be detained in a detention facility and released at a controlled rate to the afore mentioned existing 24" RCP culvert. The detention facility should be designed using the full spectrum detention method, and as such, should have three different release rates (WQCV, EURV, and the 100YR event). A full, site-specific drainage report will need to be submitted to El Paso County for review and approval in conjunction with a Site Development Plan for the lot.

6.0 REFERENCES

"Drainage Criteria Manual Volume 1." Colorado Springs, CO (1994)

"Urban Storm Drainage." Criteria Manual Volume 1 (2017)

"Urban Storm Drainage." Criteria Manual Volume 2 (2017)

"Urban Storm Drainage." Criteria Manual Volume 3 (2010)

Provide the capacity calculation of the 24 RCP. Update the narrative to discuss the findings. Is the existing culvert hydraulically adequate?

Include the Sand Creek DBPS in the reference. Add a section regarding Major Basin Description and provide a narrative regarding how the subdivision adheres to the DBPS and whether or not the DBPS identifies any public improvements within or adjacent to the development.

Add a section regarding the 4-step process (see ECM Appendix I section I.7.2). List each step and below each step describe how the particular process is implement or considered with regards to the drainage plan.

Move the existing and proposed drainage map to be at the end of the report

EX-3
1.50 | 0.64 / 0.77

WITHIN CDOT R.O.W.

EX-1
1.77 | 0.50 / 0.66

EX-2
0.93 | 0.84 / 0.91

EXISTING 24" RCP CULVERT
W INV. OUT=6263.60' @ 1.00%

EXISTING 24" RCP FES

3.14
7.67
A

MATCHLINE

SEE DETAIL THIS SHEET

SPACE VILLAGE FILING NO. 2
LOT 1
PETERSON GROUP LLC
PARCEL# 5417001001
PLAT BOOK: B4 PAGE: 177
19,992 SQUARE FEET OR 0.458 ACRES

COWPERWOOD SAIC
THOMAS PROFESSIONAL & REG GRP
PARCEL# 5417001004
REC.# 205122346

N
W E
S
0' 10' 20' 40'
SCALE IN FEET

NOTE:
ALL PROPOSED STORM PIPE SHALL BE PRIVATELY OWNED AND MAINTAINED, AND SHALL BE HDPE UNLESS OTHERWISE NOTED.

BASIN OS-1 DETAIL

LEGEND

EXISTING PROPERTY LINE	
PROPOSED PROPERTY LINE	
PROPOSED MAJOR CONTOUR	5280
PROPOSED MINOR CONTOUR	5279
EXISTING MAJOR CONTOUR	5280
EXISTING MINOR CONTOUR	5279
PROPOSED STORM SEWER	12"SD
BASIN DELINEATION	
TIME OF CONCENTRATION FLOWPATH	
DRAINAGE ARROW	

A = BASIN DESCRIPTION
B = BASIN AREA
C = MINOR EVENT COMPOSITE C-VALUE
D = MAJOR EVENT COMPOSITE C-VALUE
E = DESIGN POINT
F = MINOR EVENT PEAK RUNOFF (CFS)
G = MAJOR EVENT PEAK RUNOFF (CFS)

Expand the analysis to include the southern part of the subdivision. Analysis must be for the entire space village Filing 3 property.

Revise DP-4. Contributing Basins at DP 4 is EX-1, EX-2, EX-3

SUMMARY RUNOFF TABLE

BASIN NAME	AREA (ACRES)	C5	C100	Q5 (CFS)	Q100 (CFS)
EX-1	1.77	0.50	0.66	2.64	7.18
EX-2	0.93	0.84	0.91	3.52	7.82
EX-3	1.50	0.64	0.77	3.14	7.67

DESIGN POINT SUMMARY

DESIGN POINT	CONTRIBUTING BASINS	Q5 (CFS)	Q100 (CFS)
4	EX-3	3.14	7.67

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www.olssonassociates.com

SPACE VILLAGE FILING NO. 3
SPACE VILLAGE AVENUE AND PETERSON BOULEVARD

EXISTING DRAINAGE BASIN MAP

REVISIONS
DATE
REVISION DESCRIPTION

DATE: 09-08-2017

SHEET NUMBER: 1 OF 1

DWG: F:\2017\1501-2000\017-1754\40-Design\Reports\GNCV\Drainage Memo\AutoCAD\C_XBSN_71754.dwg USER: emorton
DATE: May 17, 2018 5:39pm XREFS: C_XBASE_71754 C_PCONT_71754

WITHIN CDOT R.O.W.

Add a developed condition DP-4 in the summary table. Contributing Basins at DP 4 is EX-3, B-1, OS-1.

The flow going into the existing 24" RCP culvert must be equal to or less than the existing condtion.

EXISTING 24" RCP CULVERT W INV. OUT=6263.60' @ 1.00%

Remove the word "underground"

UNDERGROUND DETENTION AREA

B-1
1.77 | 0.74 | 0.80

OS-1
0.93 | 0.86 | 0.93

SPACE VILLAGE FILING NO. 2
LOT 1
PETERSON GROUP LLC
PARCEL# 5417001001
PLAT BOOK: B4 PAGE: 177
19,992 SQUARE FEET OR 0.458 ACRES

COWPERWOOD SAIC
THOMAS PROFESSIONAL & REG GRP
PARCEL# 5417001004
REC.# 205122346

NOTE:
ALL PROPOSED STORM PIPE SHALL BE PRIVATELY OWNED AND MAINTAINED, AND SHALL BE HDPE UNLESS OTHERWISE NOTED.

N
W E
S
0' 10' 20' 40'
SCALE IN FEET

LEGEND

EXISTING PROPERTY LINE	
PROPOSED PROPERTY LINE	
PROPOSED MAJOR CONTOUR	5280
PROPOSED MINOR CONTOUR	5279
EXISTING MAJOR CONTOUR	5280
EXISTING MINOR CONTOUR	5279
PROPOSED STORM SEWER	12"SD
BASIN DELINEATION	
TIME OF CONCENTRATION FLOWPATH	
DRAINAGE ARROW	

A = BASIN DESCRIPTION
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D = MAJOR EVENT COMPOSITE C-VALUE
E = DESIGN POINT
F = MINOR EVENT PEAK RUNOFF (CFS)
G = MAJOR EVENT PEAK RUNOFF (CFS)

SUMMARY RUNOFF TABLE

BASIN NAME	AREA (ACRES)	C5	C100	Q5 (CFS)	Q100 (CFS)
B-1	1.77	0.74	0.80	5.63	12.37
OS-1	0.93	0.86	0.93	3.63	7.99

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SPACE VILLAGE FILING NO. 3

SPACE VILLAGE AVENUE AND PETERSON BOULEVARD

PROPOSED DRAINAGE BASIN MAP

REVISIONS

△	DATE	REVISION DESCRIPTION

DATE: 11-07-2017

SHEET NUMBER: 1 OF 1

DWG: F:\2017\1501-2000\017-1754\40-Design\Reports\GNCV\Drainage Memo\AutoCAD\C_PBSN_71754.dwg USER: emorton
DATE: May 17, 2018 5:34pm XREFS: C_PBASE_71754 C_XBASE_71754

Basin Name	Basin Description	Paved 100% (acres)	Building 90% (acres)	Gravel 40% (acres)	Landscape 2% (acres)	Total Area (ac)	C5	C100	Percent Imperviousness
EX-1	On-Site	0.90	-	-	0.87	1.77	0.50	0.66	51.6%
EX-2	Off-Site	0.73	0.16	-	0.04	0.93	0.84	0.91	94.2%
EX-3	Off-Site	1.03	-	-	0.47	1.50	0.64	0.77	69.2%
					TOTAL	2.70	0.61	0.75	66%

Update Basin Description. The majority of EX-2 is On-site

BASIN	OVERLAND FLOW				GUTTER FLOW 1			GUTTER FLOW 2			Total T_c (min)	Check T_c Eq 6-5	Final T_c (min)
	L1 (ft)	S1 (%)	C5	Ti (min)	L2 (ft)	V (ft/s)	T2 (min)	L3 (ft)	V (ft/s)	T3 (min)			
EX-1	130.0	0.46%	0.50	16.33	300.0	2.9	1.7				18.06	12.36	12.36
EX-2	100.0	1.54%	0.84	4.76	90.0	2.8	0.5				5.29	4.76	5.00
EX-3	100.0	2.50%	0.64	6.17	666.0	2.6	4.3				10.47	10.96	10.47

100' max for urban land uses.

Basin Characteristics						Intensities		Sub-basin	
BASIN NAME	Description	AREA (acres)	C5	C100	Tc* (min)	I5 (in/hr)	I 100 (in/hr)	Q 5-yr (cfs)	Q 100-yr (cfs)
EX-1	On-Site	1.77	0.50	0.66	12.4	3.01	6.16	2.64	7.18
EX-2	Off-Site	0.93	0.84	0.91	5.0	4.52	9.24	3.52	7.82
EX-3	Off-Site	1.50	0.64	0.77	10.5	3.25	6.63	3.14	7.67
* If time of concentration was less than 5 minutes, 5 minutes was used.									

I5 values are low. See Chapter 6 Figure 6-6 of the City DCM. Also double check the I100 values.

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Update the basin descriptions for OS-1 and B-1. Majority of OS-1 is within the subdivision. B-1 consist mainly of Lot 1, but not the entire site.

COMPOSITE PERCENT IMPERVIOUSNESS

Basin Name	Basin Description	Paved 100% (acres)	Building 90% (acres)	Gravel 40% (acres)	Landscape 2% (acres)	Total Area (ac)	C5	C100	Percent Imperviousness
OS-1	Off-Site Improvements	0.76	0.16	-	0.01	0.93	0.86	0.93	97.4%
B-1	Entire Site	-	-	-	-	1.77	0.74	0.80	80.0%

Update. Without a specific site plan the default is to use the value in Table 6-6 for Commercial Areas which is 95% imperviousness.

TIME OF CONCENTRATION CALCULATIONS

BASIN	OVERLAND FLOW				GUTTER FLOW 1			GUTTER FLOW 2			Total T_c (min)	Check T_c Eq 6-5	Final T_c (min)
	L1 (ft)	S1 (%)	C5	Ti (min)	L2 (ft)	V (ft/s)	T2 (min)	L3 (ft)	V (ft/s)	T3 (min)			
OS-1	130.0	1.54%	0.86	4.27	90.0	2.9	0.5				4.79	4.26	5.00
B-1	50.0	2.00%	0.74	3.70	250.0	2.0	2.1				5.78	7.48	5.78

100' max for urban land uses.

STORM DRAINAGE CALCULATION

Storm Duration 60 minutes

Basin Characteristics						Intensities		Sub-basin	
Basin Name	Description	Area (acres)	C5	C100	Tc* (min)	I5 (in/hr)	I 100 (in/hr)	Q 5-yr (cfs)	Q 100-yr (cfs)
OS-1	Off-Site Improvements	0.93	0.86	0.93	5.00	4.52	9.24	3.63	7.99
B-1	Entire Site	1.77	0.74	0.80	5.78	4.30	8.74	5.63	12.37
* If time of concentration was less than 5 minutes, 5 minutes was used.									

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Custom Soil Resource Report
Soil Map

Map Scale: 1:800 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 10 20 40 60

Feet: 0 35 70 140 210

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 14, Sep 23, 2016

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

Date(s) aerial images were photographed: Jun 3, 2014—Jun 17, 2014

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

El Paso County Area, Colorado (CO625)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
96	Truckton sandy loam, 0 to 3 percent slopes	2.2	100.0%
Totals for Area of Interest		**2.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

El Paso County Area, Colorado

96—Truckton sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 36bf
Elevation: 6,000 to 7,000 feet
Mean annual precipitation: 14 to 15 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60

Map Unit Composition

Truckton and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Truckton

Setting

Landform: Flats
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

Typical profile

A - 0 to 8 inches: sandy loam
Bt - 8 to 24 inches: sandy loam
C - 24 to 60 inches: coarse sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Ecological site: Sandy Foothill (R049BY210CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

NOAA Atlas 14, Volume 8, Version 2 COLORADO
SPGS MUNI AP
Station ID: 05-1778
Location name: Colorado Springs, Colorado, USA*
Latitude: 38.81°, Longitude: -104.6883°
Elevation:
Elevation (station metadata): 6181 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	2.87 (2.42-3.43)	3.47 (2.93-4.15)	4.52 (3.80-5.44)	5.47 (4.56-6.59)	6.86 (5.54-8.68)	8.02 (6.30-10.2)	9.24 (6.97-12.1)	10.5 (7.60-14.2)	12.4 (8.53-17.2)	13.9 (9.24-19.4)
10-min	2.10 (1.77-2.51)	2.54 (2.14-3.04)	3.31 (2.78-3.98)	4.00 (3.34-4.82)	5.02 (4.06-6.35)	5.87 (4.61-7.51)	6.76 (5.11-8.87)	7.72 (5.56-10.4)	9.07 (6.25-12.6)	10.1 (6.77-14.2)
15-min	1.71 (1.44-2.04)	2.06 (1.74-2.47)	2.69 (2.26-3.23)	3.26 (2.72-3.92)	4.08 (3.30-5.16)	4.77 (3.75-6.10)	5.50 (4.15-7.21)	6.28 (4.52-8.47)	7.37 (5.08-10.2)	8.25 (5.50-11.6)
30-min	1.31 (1.11-1.57)	1.58 (1.33-1.89)	2.06 (1.73-2.47)	2.48 (2.07-2.99)	3.11 (2.52-3.94)	3.63 (2.86-4.65)	4.19 (3.16-5.49)	4.78 (3.44-6.45)	5.62 (3.87-7.79)	6.29 (4.19-8.80)
60-min	0.878 (0.741-1.05)	1.03 (0.870-1.24)	1.32 (1.11-1.58)	1.59 (1.33-1.92)	2.01 (1.64-2.57)	2.38 (1.87-3.06)	2.77 (2.10-3.66)	3.21 (2.32-4.36)	3.85 (2.66-5.36)	4.37 (2.91-6.11)
2-hr	0.550 (0.468-0.654)	0.636 (0.540-0.756)	0.804 (0.680-0.958)	0.968 (0.814-1.16)	1.23 (1.02-1.57)	1.47 (1.17-1.88)	1.73 (1.32-2.27)	2.02 (1.47-2.73)	2.44 (1.70-3.39)	2.79 (1.88-3.89)
3-hr	0.405 (0.346-0.479)	0.460 (0.393-0.545)	0.574 (0.489-0.682)	0.691 (0.584-0.825)	0.887 (0.739-1.14)	1.06 (0.855-1.37)	1.26 (0.975-1.67)	1.49 (1.10-2.02)	1.83 (1.28-2.53)	2.11 (1.42-2.93)
6-hr	0.231 (0.199-0.272)	0.260 (0.224-0.306)	0.323 (0.277-0.381)	0.389 (0.332-0.462)	0.502 (0.423-0.641)	0.606 (0.491-0.777)	0.724 (0.563-0.950)	0.859 (0.636-1.16)	1.06 (0.750-1.46)	1.23 (0.836-1.70)
12-hr	0.126 (0.109-0.147)	0.144 (0.125-0.169)	0.182 (0.157-0.213)	0.220 (0.189-0.259)	0.281 (0.238-0.355)	0.337 (0.275-0.427)	0.399 (0.312-0.518)	0.469 (0.350-0.625)	0.573 (0.408-0.783)	0.659 (0.451-0.902)
24-hr	0.070 (0.061-0.081)	0.082 (0.071-0.095)	0.103 (0.090-0.120)	0.125 (0.108-0.146)	0.158 (0.134-0.196)	0.187 (0.153-0.234)	0.219 (0.172-0.281)	0.254 (0.190-0.335)	0.306 (0.219-0.414)	0.348 (0.240-0.474)
2-day	0.040 (0.035-0.046)	0.046 (0.041-0.054)	0.059 (0.052-0.068)	0.070 (0.061-0.081)	0.087 (0.074-0.107)	0.102 (0.084-0.127)	0.119 (0.094-0.151)	0.137 (0.103-0.178)	0.162 (0.117-0.218)	0.183 (0.127-0.247)
3-day	0.029 (0.026-0.033)	0.034 (0.030-0.039)	0.042 (0.037-0.049)	0.050 (0.044-0.058)	0.062 (0.053-0.076)	0.072 (0.060-0.089)	0.083 (0.066-0.105)	0.095 (0.072-0.124)	0.112 (0.081-0.150)	0.126 (0.088-0.170)
4-day	0.023 (0.021-0.027)	0.027 (0.024-0.031)	0.034 (0.030-0.039)	0.040 (0.035-0.046)	0.049 (0.042-0.059)	0.057 (0.047-0.070)	0.065 (0.052-0.082)	0.074 (0.056-0.096)	0.087 (0.063-0.115)	0.097 (0.068-0.130)
7-day	0.015 (0.014-0.017)	0.018 (0.016-0.020)	0.022 (0.020-0.025)	0.026 (0.023-0.030)	0.031 (0.027-0.038)	0.036 (0.030-0.044)	0.041 (0.033-0.051)	0.046 (0.035-0.059)	0.054 (0.039-0.071)	0.059 (0.042-0.079)
10-day	0.012 (0.011-0.014)	0.014 (0.013-0.016)	0.017 (0.015-0.020)	0.020 (0.018-0.023)	0.024 (0.021-0.029)	0.028 (0.023-0.033)	0.031 (0.025-0.039)	0.035 (0.027-0.044)	0.040 (0.029-0.053)	0.044 (0.031-0.059)
20-day	0.008 (0.007-0.009)	0.009 (0.008-0.010)	0.011 (0.010-0.013)	0.013 (0.011-0.015)	0.015 (0.013-0.018)	0.017 (0.014-0.020)	0.019 (0.015-0.023)	0.021 (0.016-0.027)	0.024 (0.017-0.031)	0.026 (0.018-0.034)
30-day	0.006 (0.006-0.007)	0.007 (0.007-0.008)	0.009 (0.008-0.010)	0.010 (0.009-0.011)	0.012 (0.010-0.014)	0.013 (0.011-0.016)	0.015 (0.012-0.018)	0.016 (0.012-0.020)	0.018 (0.013-0.023)	0.019 (0.014-0.025)
45-day	0.005 (0.005-0.006)	0.006 (0.005-0.007)	0.007 (0.007-0.008)	0.008 (0.007-0.009)	0.009 (0.008-0.011)	0.011 (0.009-0.012)	0.012 (0.009-0.014)	0.013 (0.010-0.016)	0.014 (0.010-0.018)	0.015 (0.011-0.019)
60-day	0.004 (0.004-0.005)	0.005 (0.005-0.006)	0.006 (0.006-0.007)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.009 (0.008-0.011)	0.010 (0.008-0.012)	0.011 (0.008-0.013)	0.012 (0.009-0.015)	0.012 (0.009-0.016)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical

4.1.2 100-year Release Rates

The maximum allowable 100-year release rate for a full spectrum detention facility is equal to 90 percent of the predevelopment discharge for the upstream watershed. This release rate for full spectrum detention basins has been shown to be effective in controlling future development peak discharges in a watershed to levels below predevelopment conditions in the 2-, 5-, 10-, 25-, 50-, and 100-year events downstream of multiple detention basins.

The predevelopment 100-year unit discharge for specific soil types per acre of tributary catchment varies based on the ratio of the flow length squared to the watershed area as well as the watershed slope and is provided in Tables 12-6, 12-7, and 12-8. The values in these tables must be multiplied by 0.9 to determine the allowable 100-year release from a watershed.

Development of these tables is documented in a Technical Memorandum entitled *UDFCD Predeveloped Peak Unit Flowrates*, dated December 21, 2016. This is available at www.udfcd.org.

Table 12-6. Predevelopment peak unit discharge for NRCS hydrologic soil group A

Unit Discharge (cfs/acre): NRCS Hydrologic Soil Group A

Watershed Slope ≤ 0.01 ft/ft

(L = total flow length)	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
L^2/Area: ≤2:1	0.0009	0.009	0.016	0.18	0.38	0.62	1.14
L^2/Area: 3:1	0.0008	0.008	0.013	0.15	0.32	0.53	0.97
L^2/Area: ≥4:1	0.0007	0.007	0.011	0.14	0.28	0.47	0.87

Watershed Slope = 0.02 ft/ft

	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
L^2/Area: ≤2:1	0.0011	0.011	0.018	0.21	0.44	0.72	1.30
L^2/Area: 3:1	0.0009	0.009	0.015	0.18	0.37	0.60	1.11
L^2/Area: ≥4:1	0.0008	0.008	0.013	0.16	0.33	0.54	0.99

Watershed Slope = 0.03 ft/ft

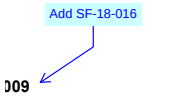
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
L^2/Area: ≤2:1	0.0011	0.012	0.020	0.23	0.48	0.78	1.41
L^2/Area: 3:1	0.0010	0.010	0.016	0.19	0.40	0.66	1.20
L^2/Area: ≥4:1	0.0009	0.009	0.014	0.17	0.35	0.58	1.07

Watershed Slope ≥ 0.04 ft/ft

	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
L^2/Area: ≤2:1	0.0012	0.013	0.021	0.25	0.51	0.82	1.48
L^2/Area: 3:1	0.0010	0.011	0.017	0.21	0.43	0.69	1.26
L^2/Area: ≥4:1	0.0009	0.009	0.015	0.18	0.38	0.62	1.13

Markup Summary

dsdlaforce (28)



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Date: 6/15/2018 8:23:19 AM
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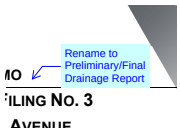
Add SF-18-016



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Author: dsdlaforce
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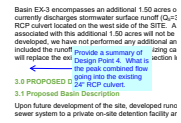
Rename to Preliminary/Final Drainage Report

Subject: Callout
Page Label: 4
Lock: Locked
Author: dsdlaforce
Date: 6/15/2018 8:23:23 AM
Color:

Change convenience store to Lot 1 or future commercial development. Since a specific site plan application has not been submitted, this report needs to analyze based on a more general commercial development and not a specific use.



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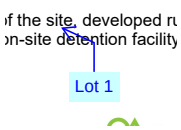
Provide a summary of Design Point 4. What is the peak combined flow going into the existing 24" RCP culvert.



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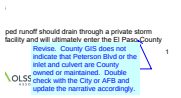
Color:

Lot 1



Subject: Callout
Page Label: 4
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Author: dsdlaforce
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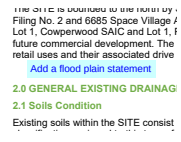
Color:

Revise. County GIS does not indicate that Peterson Blvd or the inlet and culvert are County owned or maintained. Double check with the City or AFB and update the narrative accordingly.



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Author: dsdlaforce
Date: 6/15/2018 8:23:38 AM
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Add a flood plain statement

Subject: Callout
Page Label: 5
Lock: Locked
Author: dsdlaforce
Date: 6/15/2018 8:23:41 AM
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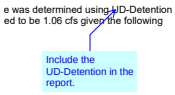
If the off-site flow is routed through the detention facility then the OS-1 area and imperviousness must be included in the detention pond sizing calculation or else the drainage conveyance design must by-pass the detention facility. Update the UD-Detention calculation and/or narrative accordingly.



Subject: Callout
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Lock: Locked
Author: dsdlaforce
Date: 6/15/2018 8:23:46 AM
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Include the UD-Detention in the report.

Subject: Callout
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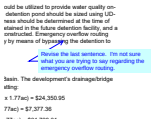
Lock: Locked
Author: dsdlaforce
Date: 6/15/2018 8:23:47 AM
Color:

Revise to note pond design for Full-Spectrum Detention



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Revise the last sentence. I'm not sure what you are trying to say regarding the emergency overflow routing.

Subject: Callout
Page Label: 5
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Author: dsdlaforce
Date: 6/15/2018 8:23:53 AM
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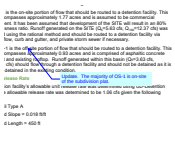
Revise the area to 4.13 acres and update the imperviousness based on the the entire subdivision not just Lot 1 since this is unplatted and drainage/bridge fees have never been paid.



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Update. The majority of OS-1 is on-site of the subdivision plat.

Subject: Callout
Page Label: 6
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Author: dsdlaforce
Date: 6/15/2018 8:24:00 AM
Color:

Provide the capacity calculation of the 24 RCP. Update the narrative to discuss the findings. Is the existing culvert hydraulically adequate?

Subject: Callout
Page Label: 6
Lock: Locked
Author: dsdlaforce
Date: 6/15/2018 8:24:01 AM
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Include the Sand Creek DBPS in the reference. Add a section regarding Major Basin Description and provide a narrative regarding how the subdivision adheres to the DBPS and whether or not the DBPS identifies any public improvements within or adjacent to the development.

Subject: Text Box
Page Label: 6
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Author: dsdlaforce
Date: 6/15/2018 8:24:08 AM
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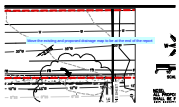
Add a section regarding the 4-step process (see ECM Appendix I section I.7.2). List each step and below each step describe how the particular process is implement or considered with regards to the drainage plan.



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Date: 6/15/2018 8:24:10 AM
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Move the existing and proposed drainage map to be at the end of the report

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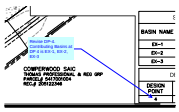

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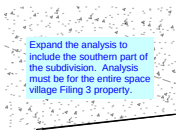
Revise DP-4. Contributing Basins at DP 4 is EX-1, EX-2, EX-3



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Date: 6/15/2018 8:24:16 AM
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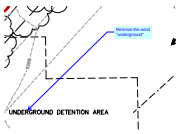
Expand the analysis to include the southern part of the subdivision. Analysis must be for the entire space village Filing 3 property.



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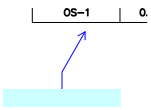
Remove the word "underground"



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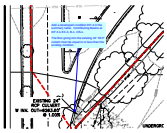

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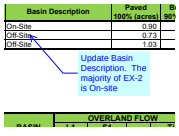
Add a developed condition DP-4 in the summary table. Contributing Basins at DP 4 is EX-3, B-1, OS-1.

The flow going into the existing 24" RCP culvert must be equal to or less than the existing condtion.



Subject: Callout
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Author: dsdlaforce
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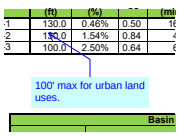
Update Basin Description. The majority of EX-2 is On-site



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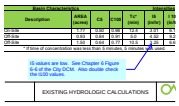
100' max for urban land uses.



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Author: dsdlaforce
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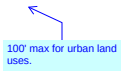
I5 values are low. See Chapter 6 Figure 6-6 of the City DCM. Also double check the I100 values.



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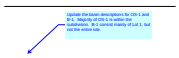
100' max for urban land uses.



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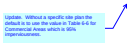
Update the basin descriptions for OS-1 and B-1. Majority of OS-1 is within the subdivision. B-1 consist mainly of Lot 1, but not the entire site.



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Update. Without a specific site plan the default is to use the value in Table 6-6 for Commercial Areas which is 95% imperviousness.