FINAL DRAINAGE REPORT

SPACE VILLAGE FILING NO. 4

EL PASO COUNTY, COLORADO

PREPARED FOR:

COMMERCIAL BUILDING SERVICES
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PCD FILE NO. MS-22-007

JUNE 2023

STERLING
DESIGN ASSOCIATES
Civil Engineers | Landscape Architects

DESIGN 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 caused by any negligent acts, errors or omissions on my part in preparing this report.

Jay M. Newell, PE (CO #35219)
For and on behalf of Sterling Design Associates, llc

9 / 28 / 23

DEVELOPER'S STATEMENT

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

Hampton Yard 11, LLC
Business Name

By: _____

Title: Manager

Address: 3200 Arapahoe Creek S. Dr., Suite 630
Denver, CO 80209

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.

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

Date

Conditions:

STERLING
DESIGN ASSOCIATES
Civil Engineers | Landscape Architects

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1) GENERAL LOCATION AND DESCRIPTION

A) LOCATION

1. CITY AND COUNTY, AND LOCAL STREETS

The subject development is in unincorporated El Paso County. The Space Village Avenue right-of-way is immediate to the north property line. Intersection with Peterson Boulevard is one-quarter mile to the west while the Marksheffel Road intersection is a half mile to the east.

2. TOWNSHIP, RANGE, SECTION, 1/4 SECTION

Space Village Filing No. 4 is a parcel of land situated in the Northwest 1/4 of Section 17, Township 14 South, Range 65 West of the 6th Principal Meridian, in El Paso County, Colorado.

VICINITY MAP

3. MAJOR DRAINAGEWAYS AND EXISTING FACILITIES

No major drainageways nor existing facilities are described within the *Peterson Field Drainage Basin Master Plan Update* prepared by URS/NES and dated August 1984 (PETERSON FIELD DBPS) as being located either on or immediately adjacent to the site.

4. SURROUNDING DEVELOPMENTS

The property to the west is, except for a partial access road, an undeveloped portion of commercial Lot 1, Cowperwood SAIC. To the south is Peterson Air Force Base (PAFB). To the east is open space belonging to the City of Colorado Springs. Several commercial developments exist north of

the adjacent Space Village Avenue R.O.W. including Winwater's Colorado Springs wholesale yard and warehouse, Storage Sense's Colorado Springs/Peterson Air Force Base interior and exterior storage facilities, A Better R.V. Storage's exterior and covered storage facilities, and various other smaller retail, office, and related uses.

B) Description of Property

1. Area

The site is 22.8 acres.

2. Ground Cover

The east half of the site is covered with native grasses and a handful of widely spaced trees. The west half is largely denuded of significant vegetation.

3. General Topography

The terrain within the site generally falls north to south at 1.0 to 4.5 percent grades.

4. General Soil Conditions

The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey referenced for this site indicates Blakeland loamy sand, 1 to 9 percent slopes soil (8) with a Hydrologic Soil Group A rating. Where native grasslands remain, the soil is suspected to be in good condition and remain highly porous. In areas currently being used for storage there is evidenced loss of infiltration due to compaction by vehicle loading.

5. Major Drainageways

No major drainageways nor existing facilities are described within the PETERSON FIELD DBPS as being located either on or immediately adjacent to the site.

6. Irrigation Facilities

There are no irrigation facilities on or adjacent to the site that Sterling Design Associates, llc (SDA) is aware of.

7. Utilities and Other Encumbrances

A duel 30-inch CMP culvert under Space Village Avenue discharges onto the site approximately 260 feet from the east property line. It appears there is an offsite basin (Basin OS-E) of approximately 52 acres contributing to this facility. There is a shallow area onsite where, it is assumed, most runoff events have ponded and infiltrated as there is no evidence of a significant low flow channel or rill that would be caused by frequent subjection to flowing water further downstream.

There are three 30-foot utility easements on the property adjacent to Space Village Avenue, the alignments for two of which are identical. The north most is dedicated to the Cherokee Metropolitan District according to the *ALTA/NSPS Land Title Survey* prepared by Altura Land Consultants and dated April 28, 2022 (ALTA). The south most two are dedicated to Colorado Springs Utilities (CSU) and the Cherokee Metropolitan District according to the ALTA. As shown on the ALTA, maps provided by the CSU's online GIS Mapping Services, and information provided by

the Cherokee Metropolitan District, these easements contain an 8-inch PVC sanitary sewer main, a 12-inch steel waterline, and a 42-inch steel waterline. These utilities and their easements are not expected to be significantly disturbed or displaced by the proposed development, although an extension of conveyance facilities downstream of the dual 30-inch CMP is proposed across them as are two drive entrances off Space Village Avenue into the site.

The ALTA identifies two other easements along the site's southern property line. The north most is identified as a 30-foot temporary construction easement granted to the Cherokee Metropolitan District. The easement document, as linked to by the titlework provided by Land Title Guarantee Company dated November 24, 2021, states that…"The temporary construction easement described in Exhibit A shall expire and become void 60 days after acceptance of construction." The south most is identified as a 15-foot utility easement for the "…construction, reconstruction, maintenance and operation of a sanitary sewer force main…" which the ALTA does not include evidence of, but information provided by the Cherokee Metropolitan District does. Proposed drainage facilities described herein are intended to avoid significant disturbance or displacement of the south most easement and any utilities therein.

2) DRAINAGE BASINS AND SUB-BASINS

A) MAJOR BASIN DESCRIPTIONS

1. MAJOR DRAINAGEWAY PLANNING STUDIES

As shown within the PETERSON FIELD DBPS, the site is included in the far upper reaches of the Peterson Field Drainage Basin. The PETERSON FIELD DBPS states that…"Peterson Field Basin outfalls to Sand Creek which in turn outfalls to Fountain Creek." There are no existing deficiencies or proposed improvements within the site or immediate thereto identified in the PETERSON FIELD DBPS.

The site is identified as Zone X, "Areas determined to be outside the 0.2% annual chance floodplain," by the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) for El Paso County, Colorado and Incorporated Areas, Map Number 08041C0754G with an effective date of December 7, 2018.

2. MAJOR BASIN DRAINAGE CHARACTERISTICS

As described in the PETERSON FIELD DBPS, Peterson Field Drainage Basin encompasses approximately 8.6-square miles and is approximately 9-miles in overall length at elevations between 5750-feet and 5990-feet above sea level. In addition, the basin is predominantly comprised of Hydrologic Soil Group A rated soils with some Group B rated soils. Review of aerial imagery available online indicates the basin includes portions of PAFB, the Colorado Springs Airport, residential, commercial and light industrial land uses as well undeveloped land.

The site conveys surface runoff as sheet flow generally from north to south; however, likely due to the highly pervious soils there is no indication of continuous storm runoff flows either in low flow channels or rill on the site. Existing discharge of runoff from the site is similarly likely into the ground, as conveyance of flow onto PAFB to the south is not readily evident. It is intended that the 22.8 acre site be re-purposed as an outdoor storage yard.

3. IRRIGATION FACILITIES

As there are no irrigation facilities on or adjacent to the site that SDA is aware of; no irrigation facilities are expected to be impacted by runoff from the proposed development.

B) SUB-BASIN DESCRIPTION

1. HISTORIC DRAINAGE PATTERN

There are two low areas and a ridge that generally divide the site into an east (Basin H2; Q_{10} = 9.39 cfs, Q_{100} = 25.14 cfs) and west (Basin H1; Q_{10} = 11.39 cfs, Q_{100} = 29.79 cfs) basin for drainage consideration. Grades within both direct any excess rainfall runoff not infiltrated into the pervious native soil to the south toward, if not onto PAFB. Lack of evidence of past erosion or channel formation indicates this has been accomplished primarily as sheet flow up to now with limited runoff flowing through to PAFB as described in section 2.A.2 above.

2. OFFSITE DRAINAGE

The large shallow open space on the property to which the dual 30-inch CMP culverts under Space Village Avenue contribute, will become a part of the proposed storage yard. As such, it will become necessary to pass the associated offsite flow from Basin OS-E (Q_{10} = 89.48 cfs, Q_{100} = 146.46 cfs) around the yard. Basin OS-E is comprised of a variety of commercially developed properties including those described in section I.A.4 above which generally flow north to south across the basin. A perimeter channel can provide for conveyance of such flows. A second area, Basin OS-W (Q_{10} = 16.87 cfs, Q_{100} = 27.77 cfs) approximately 6.8 acres, north of Space Village Avenue and west of the larger basin (Basin OS-E) described above and comprised of similar commercially developed properties as described in section 1.A.4, could contribute discharge over the road and onto the western property boundary in very large rain events. There is no evidence this has occurred; however, there is no apparent means for water accumulating at that location to discharge other than into the ground or over the road and onto the site. A perimeter swale can provide for conveyance of such flows, in this eventuality.

3) DRAINAGE DESIGN CRITERIA

A) DEVELOPMENT CRITERIA REFERENCE

1. CRITERIA, MASTER PLANS, AND TECHNICAL INFORMATION

This report references Volumes 1 and 2 of the El Paso County *Drainage Criteria Manual*, as well as the Volume 1 Update (MANUAL); Volume 2 of the City of Colorado Springs *Drainage Criteria Manual* as adopted by El Paso County (DCMV2); Volumes 1, 2 and 3 of the Mile High Flood District (MHFD) Urban Storm Drainage Criteria Manual (USDCM); and the county *Engineering Criteria Manual* (ECM) where applicable for the needed technical information to make estimation of rate and volumetric stormwater considerations presented herein.

2. PRIOR STUDIES

As mentioned previously, the area of proposed development is a part of the upper reaches of the Peterson Field Drainage Basin presented in the PETERSON FIELD DBPS. The PETERSON FIELD

DBPS does not particularly address the area in question or describe any problems or drainage improvements that may be associated with it.

The site was, most recently, included in the *Preliminary Drainage Report for First Wing Development* prepared by JR Engineering and dated as revised July 2005 (FIRST WING PDR). In that report the subject site is referenced as Filing No. 2 of the First Wing Development. It is generally described as existing Basins EX-3 and EX-4, and as proposed Basin E; and is summarized as having an allowed, detained 100-year release onto PAFB of a total of 36 cfs. Two existing minor basins, OS-3 and OS-4, are shown to contribute to the site from areas of Space Village Avenue south of the road centerline. For the purposes of this report, these offsite basins (OS-3 and OS-4) are included in their respective downstream onsite basins (existing H1 and H2; and proposed A2, A4, B2 and B4). The inclusion of these offsite basins increases the FIRST WING PDR allowable 100-year release onto PAFB to a total of 54 cfs (i.e. 18 + 18 + 9 + 9 = 54 cfs). The FIRST WING PDR does not account for runoff from any other offsite basin(s).

B) Hydrologic Criteria

1. Design Rainfall

In accordance with the MANUAL Volume 1 Update, Chapter 6 – Hydrology, § 3.3 – Rainfall Intensity (I); design rainfall was determined using Figure 6-5. Times of concentration have been determined in accordance with the same criteria's § 3.2 – Time of Concentration; Equations 6.7, 6.8, and 6.9, and Table 6-7.

2. Runoff Calculation Method

Onsite and offsite basin runoff was determined through the use of the Rational Formula in accordance with the MANUAL Volume 1, Chapter 2 – Drainage Criteria, § 2.1 – Design Storm Water Runoff Determination; and the MANUAL Volume 1 Update, Chapter 6 – Hydrology, § 1.4 – Selecting Methods for Estimating Design Flows. In accordance with the MANUAL Volume 1 Update, Chapter 6 – Hydrology, § 3.1 – Rational Method Runoff Coefficient (C); Rational Formula coefficients were determined using Table 6-6.

3. Design Storm Recurrence Intervals

In accordance with the MANUAL Volume 1, Chapter 1 – Drainage Polciy, § 1.2.1 – Planning Process; § 1.2.3 – Drainage Systems; Chapter 2 – Drainage Criteria, § 2.1 – Design Storm Water Runoff Determination; and more specifically for detention storage in accordance with the same criteria's Chapter 2, § 2.5.3 – Volume and Release Requirements; and Chapter 6 – Design Criteria, § 6.6.4 – Non-Jurisdictional Dams; 10-year and 100-year storm recurrence intervals have been used as the minor and major events respectively.

4. Detention Discharge and Storage Calculation Method

The MANUAL Volume 1, Chapter 11 – Detention Storage, § 11.4 – Hydraulic Design Methods includes two detention pond sizing methods as suggestions; the Rational Stored Rate Method and the SCS Hydrograph Procedure. However, the MANUAL Volume 1 Update, Chapter 6 – Hydrology, § 13.0 – References, includes reference to MHFD's Full Spectrum design concept. In addition, the Volume 1 Update, § 2.3 – Hydrologic Basis of Design for Water Quality – Water Quality Capture Volume, states that "…the UDFCD…methods for the WQCV are acceptable for determining the WQCV…" Further, the DCMV2, Chapter 2 – Control Measure Selection, § 1.9 – Integration with Flood Control, recommends "…WQCV facilities be incorporated into flood control detention facilities…" and states, "Full spectrum detention shows more promise in controlling the peak flow rates in receiving waterways than…multi-stage designs…" Finally, the DCMV2 Chapter 3 –

Calculating the WQCV and Volume Reduction, § 2.4 – Excess Urban Runoff Volume (EURV) and Full Spectrum Detention, indicates that "Capture and treatment of the EURV is required as a part of…Full spectrum Detention…" and references its companion criteria's (the *Design Criteria Manual Volume 1*) Chapter 13 – Storage, as well as the MHFD USDCM Volume 3 for additional information including "…sizing and design criteria, and design procedures for…control measures…provided in the USDCM…Treatment BMP Fact Sheets."

Therefore, use of the design tool MHFD-Detetnion_v4.03.xlsm Excel worksheet (WORKSHEET) provided by the MHFD was relied upon to determine the various volumes incorporated into the drainage facility design for the site. In conjunction with the use of this design tool, and because the tool does not include point rainfall data for El Paso County required for use of the worksheet; 1-hour rainfall depths were excerpted from Table 6-2 of Volume 1 of the City of Colorado Springs *Drainage Criteria Manual* (2014) as adopted by El Paso County (DCMV1). In addition, the MANUAL, Volume 2, Chapter 4 – New development Stormwater Management, § 4.2 – New Development BMP Factsheets, stipulates that Sand Filter Extended Detention Basins (SFBs), which are the chosen control measure for the site development's stormwater quality management method in general, be sized based on a 40-hour drain time as opposed to the MHFD's 12-hour drain time for Sand Filters. Regardless, the county has directed use of a 12-hour drain time.

4) DRAINAGE FACILITY DESIGN

A) General Concept

1. Offsite Runoff Considerations

Offsite runoff coming into the site from the northeast via the dual 30-inch culverts will be intercepted in a grass lined channel which will route flows around the proposed detention and stormwater quality facility serving the eastern portion of the site. Potential offsite runoff coming into the site from the northwest over Space Village Road will be intercepted in a grass lined swale which will route flows around the proposed detention and stormwater quality facility serving the western portion of the site.

2. Anticipated and Proposed Drainage Patterns

Onsite drainage patterns are not anticipated to change with development as a storage yard. Runoff will be conveyed as surface flow to one of two proposed detention and stormwater quality facilities described in more detail in sections 4.B.2 and 4.B.4 below.

3. Tables, Charts, Figures, Etc.

All tables, charts, figures, etc. are sourced where they appear herein and are included in the appendices of this report for reference.

B) Specific Details

1. Existing and Proposed Hydrologic Conditions

Existing and proposed on and offsite basins are delineated on the included maps. Basin characteristics are noted on the same maps, described in sections 2.B.1 and 2.B.2 above, or described below. Additional information is included in the calculations within the appendices of this report.

The historic east basin (Basin H2) will be developed as gravel storage lot (Basin B1; Q_{10} = 21.49 cfs, Q_{100} = 35.93 cfs). Portions of the historic Basin H2 which exist as Space Village Avenue will generally

remain in their historic condition except for the inclusion of curb, gutter and attached walk required as a condition of development by the county (Basin B2; Q_{10} = 3.45 cfs, Q_{100} = 5.19 cfs and Basin B4; Q_{10} = 0.90 cfs, Q_{100} = 1.36 cfs). A final portion of Basin H2 which includes the proposed drainage channel conveying offsite runoff around the site, will also remain in its historic condition (native grass) (Basin B3; Q_{10} = 1.29 cfs, Q_{100} = 4.29 cfs).

The historic west basin (Basin H1) will also be developed as a gravel storage lot (Basin A1; Q_{10} = 23.22 cfs, Q_{100} = 38.30 cfs). Portions of the historic Basin H1 which exist as Space Village Avenue will generally remain in their historic condition except for the inclusion of curb, gutter and attached walk required as a condition of development by the county (Basin A2; Q_{10} = 4.74 cfs, Q_{100} = 7.14 cfs and Basin A4; Q_{10} = 0.84 cfs, Q_{100} = 1.26 cfs). A final portion of Basin H1 which includes the proposed drainage swale conveying offsite runoff around the site, will also return to its historic condition (native grass) (Basin A3; Q_{10} = 0.71 cfs, Q_{100} = 2.39 cfs).

The aforementioned proposed concrete curb and gutter changes the historic drainage pattern of Space Village Avenue from sheet flowing across the entire existing edge of pavement onto the site to that of being captured and conveyed by the proposed curb and gutter. This curb and gutter also impedes the potential upstream offsite runoff contribution from Basin OS-W described in section 2.B.2 above. In order to convey this runoff to and across the site to its historic discharge, and to avoid conflicts with existing underground utilities; curb openings with drainage chases have been designed and sized accordingly. These facilities capture runoff at low points in the curb and gutter and convey it via sidewalk chases either directly or indirectly to the downstream onsite drainage swale or channel described in sections 2.B.2 and 4.A.1 above. Riprap aprons have also been designed to protect the associated downstream slopes.

Table 1 below summarizes existing and proposed runoff at significant Design Points.

Table 1

Design Point	Q_{10} (cfs)		Q_{100} (cfs)	
	Existing	Proposed	Existing	Proposed
1	89.5	89.5	146.5	146.5
4	9.4	21.5	25.1	35.9
[1]5	75.9	76.2	127.9	128.0
6	16.9	16.9	27.8	27.8
9	11.4	23.2	29.8	38.3
[1]10	19.2	18.3	39.2	30.5

[1]Design Points 5 and 10 are the accumulated tributary flow including offsite basins (OS-E and OS-W). While the proposed curb and gutter along Space Village Avenue and the channelization of offsite flows through the site and around the ponds decreases the time of concentration subsequently increasing these basins' runoff contribution to PAFB; the infiltration ponds effectively eliminate the majority of onsite runoff contribution (Basins A1 and B1) and limit the discharge of runoff to PAFB to flows equivalent to the historic. This condition not only limits proposed developed runoff to historic rates, but maintains historic surface runoff contributions to downstream properties.
[2]The combined effect on total runoff of differing contributing basins and T_c (see footnote 1) with imprecision in interpolation of rainfall intensity from MANUAL Volume 1 Update, Figure 6-5 varies. Increases from historic to proposed total runoff at DP 5 are therefore negligible.
[3]Direct comparison of runoff to the FIRST WING PDR requires subtracting the contributions from Basins OS-E and OS-W at DP 5 and DP 10; resulting in Q_{100} = 7.7 cfs and 8.1 cfs respectively, or a total Q_{100} = 15.1 cfs < 54 cfs (Q_{100} = CIA from Basins B2, B3 and B4 at DP 5; and from Basins A2, A3, and A4 at DP 10 at 18 min. and 11 min. respectively. In addition to excluding runoff (and Tc contributions) from OS-E and OS-W, runoff (and Tc) from Basins B1 and A1 are fully infiltrated and therefore do not contribute to DP 5 and DP 10 in this comparison.)

2. APPROACH TO ACCOMMODATE DRAINAGE IMPACTS

Two detention and stormwater quality ponds are proposed to mitigate any increase in minor and major storm event runoff as a result of the increase in imperviousness due to development. These ponds are also intended to address the stormwater quality of any runoff conveyed downstream through provision of a Water Quality Capture Volume (WQCV), itself a part of the "Four Step Process" outlined within the MANUAL for addressing stormwater quality.

The four steps include: (1) Employ Runoff Reduction Practices, met for this site by employing Minimizing Directly Connected Impervious Areas (MDCIA) through the use of pavement materials (e.g. recycled concrete, gravel, or similar) that are more porous than typical asphalt or Portland cement concrete across the majority of the site.

(2) Stabilize Drainageways, met for this site by constructing a native grass lined channel and swale to convey offsite runoff across the site.

(3) Provide WQCV, met by this site by inclusion of the required volume within the proposed detention ponds.

(4) Consider Need for Industrial and Commercial BMPs, met for this site by recommending the Covering of Storage/Handling Areas which are anticipated as temporary, if at all. If such areas are incorporated, coverings may consist of tarpaulins, plastic sheeting, or other treatments that prevent rain and wind from spreading pollutants. In addition, although not anticipated, Spill Containment and Control is recommended at such times as contaminated material may be spilled onsite. Containment may be met by the installation of temporary berms that prevent spilled material from entering surface waters or downstream storm sewer systems. The proposed detention and stormwater quality ponds act similarly by collecting and containing site runoff prior to any potential discharge offsite.

3. PROPOSED FACILITIES

Proposed drainage facilities include the curb openings, chases, riprap aprons, channel, swale and associated level spreaders designed to convey potential upstream offsite runoff around the developed area of the site. Two detention and stormwater quality ponds along with their associated emergency spillways situated across the site's southern boundary will capture onsite runoff. The channel, swale, and detention and stormwater quality pond facilities are designed to be lined with native grasses.

4. SITE CONSTRAINTS

The site's most significant constraint is its lack of any downstream conveyance facility. This deficiency makes the discharge of runoff from any typical pond, channel, swale, or storm sewer difficult for several reasons. The first difficulty is designing proposed facilities to discharge to the existing surface elevation(s). Such a constraint requires any pond or conveyance facility to hold and/or include capacity for runoff above existing grades subsequently requiring any tributary area(s) normally located above such facilities to be located corresponding heights above existing grades (i.e. if the top of the pond must be located "x" feet above the existing grade(s), and the tributary site grades are "y" feet above the pond to allow gravity flow from the site "above" to the pond "below;" then the tributary site grades must be "x" plus "y" feet above the existing grades). The result, particularly on flat sites such as the subject site, is an undue increase in the amount of fill to "lift" the site above the depths necessary for required capacities and gravity flow. The second difficulty is designing proposed facilities, which typically concentrate flow, to discharge in a historic manner as sheet flow.

In addition, the site is constrained by its location adjacent to PAFB. PAFB staff have indicated their interest in mitigating the creation of habitat which might encourage the aggregating of birds adjacent to the base.

These constraints are addressed by the proposed detention and stormwater quality ponds' design to discharge all volumes by means of infiltration. This design allows lowering of the drainage facilities' discharge elevation below existing grades, minimizing necessary fill and minimizing excess overlot grading (a temporary erosion and sediment control strategy in itself). This design also eliminates concentrated discharge. The ponds are designed to provide one half the WQCV plus the 100-year volume in accordance with criteria. Discharge by infiltration effectively eliminates all discharge (and thus concentrated discharge) from onsite basins for these and lesser storm events. Correspondence with the Office of the State Engineer, Division of Water Resources personnel included in the appendices of this report indicates their agreement with this approach.

The *Geotechnical Engineering Report, Proposed Storage Yards, 0 Space Village Avenue, El Paso County, Colorado, CGG Project No. 22.22.155* prepared by Cole Gardner Geotechnical and dated August 16, 2022, (GEOTECHNICAL REPORT) includes field infiltration test results for various locations within the site. In correspondence from the geotechnical engineer, Glenn D. Ohlsen, PE of Cole Gardner Geotechnical, infiltration testing was described as…

"…modified double-ring infiltrometer testing at the site using cased bore holes. Solid PVC casing was pushed/seated into the bottom of the borehole at the approximate basin depth. Water was added to the pipe/holes and measurements were obtained at 15 minute intervals, based on the relatively fast infiltration rates associated with the silty sand soils present at the site. We pre-soaked test holes a day before testing. This method is commonly used in the region as an alternative to traditional double-ring testing. In order to perform traditional double-ring infiltrometer tests, the basin area must be excavated in order to perform the tests at the bottom of the basin. Alternatively, excavation of test pits can be provided to the approximate basin depth to run the test, however, this typically requires large benched excavations in order to safely perform tests, therefore…the cased borehole test is commonly performed."

The locations of infiltration test holes L1-IF2 and L1-IF3; and L2-IF2 and L2-IF3 are in close proximity to the proposed West and East Ponds respectively. Test results for these locations final infiltration rates (4.50 in/hr, 9.50 in/hr; avg. = 7.00 in/hr; 3.00 in/hr and 2.25 in/hr; avg. = 2.63 in/hr respectively) were averaged and used to model the proposed ponds' decayed infiltration rates. These rates are more than two times that required to drain the respective ponds' WQCVs in 12 hours (Table 2).

Table 2

	West Pond	East Pond
WQCV (cf)	8,464	7,547
[1]WQCV Depth (in.)	6.0	5.6
12 hr Infiltration Rate (in/hr)	0.50	0.47
2 x 12 hr Infiltration Rate (in/hr)	1.00	0.94
Design Infiltration Rate (in/hr)	7.00	2.63

[1]Refer to WSEL calculations in the appendices of this report

Calculations included in the appendices of this report also indicate compliance of the proposed ponds with Colorado Senate Bill 15-212, codified in the Colorado Revised Statutes (C.R.S.) Section 37-92-602(8). Modeling stage correlated discharge rates for this analysis was accomplished by converting the design infiltration rate of each pond from in/hr to hr/ft; applying this rate to the stage increments reported, resulting in a duration to drain the associated storage volume; and converting this to cfs.

Table 3 – West Pond

Elevation	Stage	Area	Volume	Time	Rate
(ft)	(ft)	(sf)	(cf)	(hr)	(cfs)
69.0	0.0	16,337	0		[2]2.63
70.0	1.0	19,880	18,108	1.71	2.93
71.0	2.0	23,503	39,800	3.43	3.22
72.0	3.0	27,208	65,155	5.14	3.52

[1]Design Rate = 7.00 in/hr; = 0.58 ft/hr; = 1.71 hr/ft
[2]Initial Rate = Subsequent Rate - $\Delta_{constant}$

Table 4 – East Pond

Elevation	Stage	Area	Volume	Time	Rate
(ft)	(ft)	(sf)	(cf)	(hr)	(cfs)
72.5	0.0	14,195	0		[2]0.86
73.0	0.5	15,994	7,547	2.29	0.92
74.0	1.5	19,611	25,350	6.86	1.03
75.0	2.5	23,340	46,825	11.43	1.14
75.5	3.0	25,238	58,970	13.71	1.19

[1]Design Rate = 2.63 in/hr; = 0.22 ft/hr; = 4.57 hr/ft
[2]Initial Rate = Subsequent Rate - $\Delta_{constant}$

The Stormwater Detention and Infiltration Design Data Sheets included in the appendices of this report indicate the West and East ponds will drain the majority of their respective volumes in approximately 6.7 hrs and 17.2 hours, minimizing habitat creation as well.

Emergency conditions for the ponds are addressed by the design of wide spillways which convey the 100-yr developed runoff downstream at non-erosive velocities to separate level spreader facilities described below.

Without existing downstream conveyance facilities, routing of the site's upstream offsite flows is also problematic. Therefore, the proposed channel and swale along the site's respective east and west boundaries are designed to flow into corresponding proposed level spreaders prior to discharging to downstream properties. Although all discharge from onsite basins (A1 and B1) is effectively eliminated as described above, runoff from the offsite and associated basins (A2 through A4, B2 through B4, OS-W, and OS-E) is allowed conveyance to the level spreaders located along the south edge of the site. As shown in Table 1 above, the combined effect of this approach, while limiting developed runoff, allows runoff equivalent to historic the opportunity to pass downstream.

The level spreader facilities incorporate wide and shallow spillways which discharge runoff (both solely from tributary basins, and from combined tributary basins and emergency pond overflow) at non-erosive velocities comparable to the historic condition.

The channel design includes centerline radii of curvature in excess of two times the top width of the channel in accordance with ECM Section 3.3.3.E. Channel freeboard is also provided in accordance with MANUAL Section 10.5.5 Equation 10-3 and Section 10.5.6 Equation 10-4. Calculations included within the appendices of this report indicate both the channel on the east and the swale on the west are designed to flow at non-erosive velocities (between 3.34 ft/s and 5.00 ft/s) for a variety of vegetative linings in accordance with MANUAL Table 10-4.

5. ENVIRONMENTAL FEATURES

   There are no specific environmental features or issues that SDA is aware of.

6. MAINTENANCE

   The proposed channel, swale, and ponds described in this report will be privately owned and maintained. County access to the facilities will be provided by the dedication of an easement(s) adjacent to and including the facilities. A *Standard Operation Procedures for Inspection and Maintenance* manual has been prepared under separate cover to guide the owner and operator of the facilities on how to maintain them which includes guidance on mosquito control responsibilities.

7. DOWNSTREAM DRAINAGE FACILITIES

   There are no proposed drainage facilities downstream of the detention and stormwater quality ponds described within this report. Existing downstream facilities include only the topography of PAFB which conveys runoff toward the PAFB Municipal Separate Storm Sewer System (MS4).

8. CONCLUSIONS

   The proposed drainage facilities including the detention and stormwater quality ponds are intended to eliminate runoff tributary to the PAFB drainage facilities or to convey runoff to the PAFB facilities in a manner which said facilities have experienced historically thereby not adversely affecting downstream or surrounding properties. Drainage fees (Drainage = $239,037; Bridge = $18,122) and an opinion of probable costs is included in the appendices of this report.

5) LIST OF REFERENCES

1. *Peterson Field Drainage Basin Master Plan Update*, URS / NES, August 1984.
2. *Soil Map – El Paso County Area, Colorado*, USDA NRCS Web Soil Survey, current online edition.
3. *ALTA/NSPS Land Title Survey*, Altura Land Consultants, April 28, 2022.
4. *Colorado Springs Utilities Public Map Viewer*, Colorado Springs Utilities, current online edition.
5. *Flood Insurance Rate Map, Map Number 08041C0754G*, FEMA, effective date December 7, 2018.
6. *Drainage Criteria Manual, Volumes 1 and 2, Volume 1 Update*, El Paso County, current online edition (October 31, 2018).
7. *Drainage Criteria Manual, Volume 2*, City of Colorado Springs, current online edition (revised December 2020).
8. *Urban Storm Drainage Criteria Manual, Volumes 1 through 3*, Mile High Flood District, current online edition.
9. *Preliminary Drainage Report for First Wing Development*, JR Engineering, Revised July 2005.
10. *NOAA Atlas 14, Volume 8, Version 2*, current online edition.
11. *Engineering Criteria Manual*, El Paso County, current online edition (October 14, 2020).

12. *Geotechnical Engineering Report, Proposed Storage Yards, 0 Space Village Avenue, El Paso County, Colorado, CGG Project No. 22.22.155*, Cole Gardner Geotechnical, August 16, 2022.

APPENDIX A

- Flood Insurance Rate Map
- NRCS Web Soil Survey Soil Maps

National Flood Hazard Layer FIRMette

FEMA

104°41'53"W 38°50'34"N

104°41'16"W 38°50'6"N

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

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

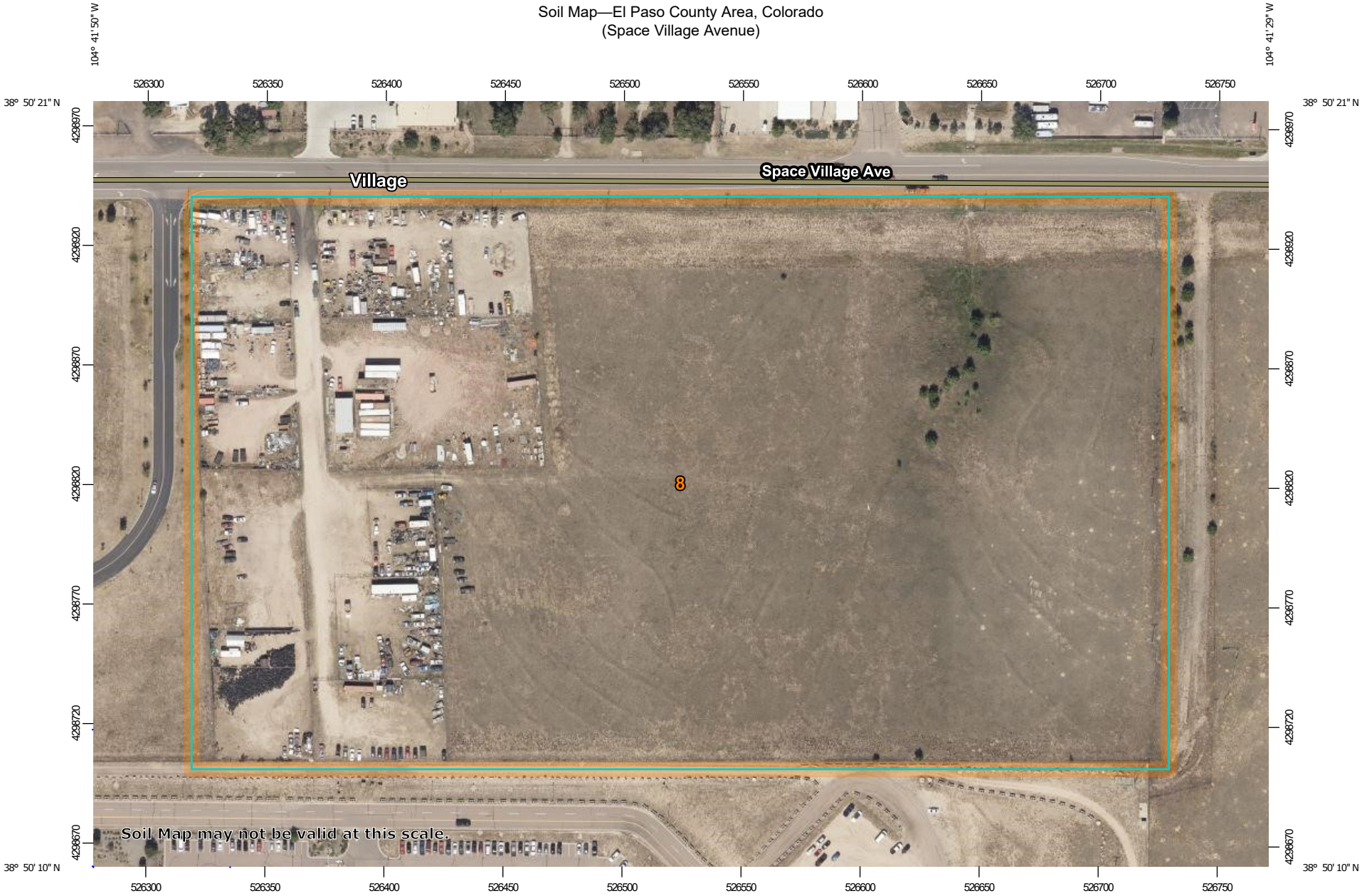
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/4/2022 at 6:52 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Soil Map—El Paso County Area, Colorado
(Space Village Avenue)



Map Scale: 1:2,260 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 30 60 120 180

Feet
0 100 200 400 600

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 19, Aug 31, 2021

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

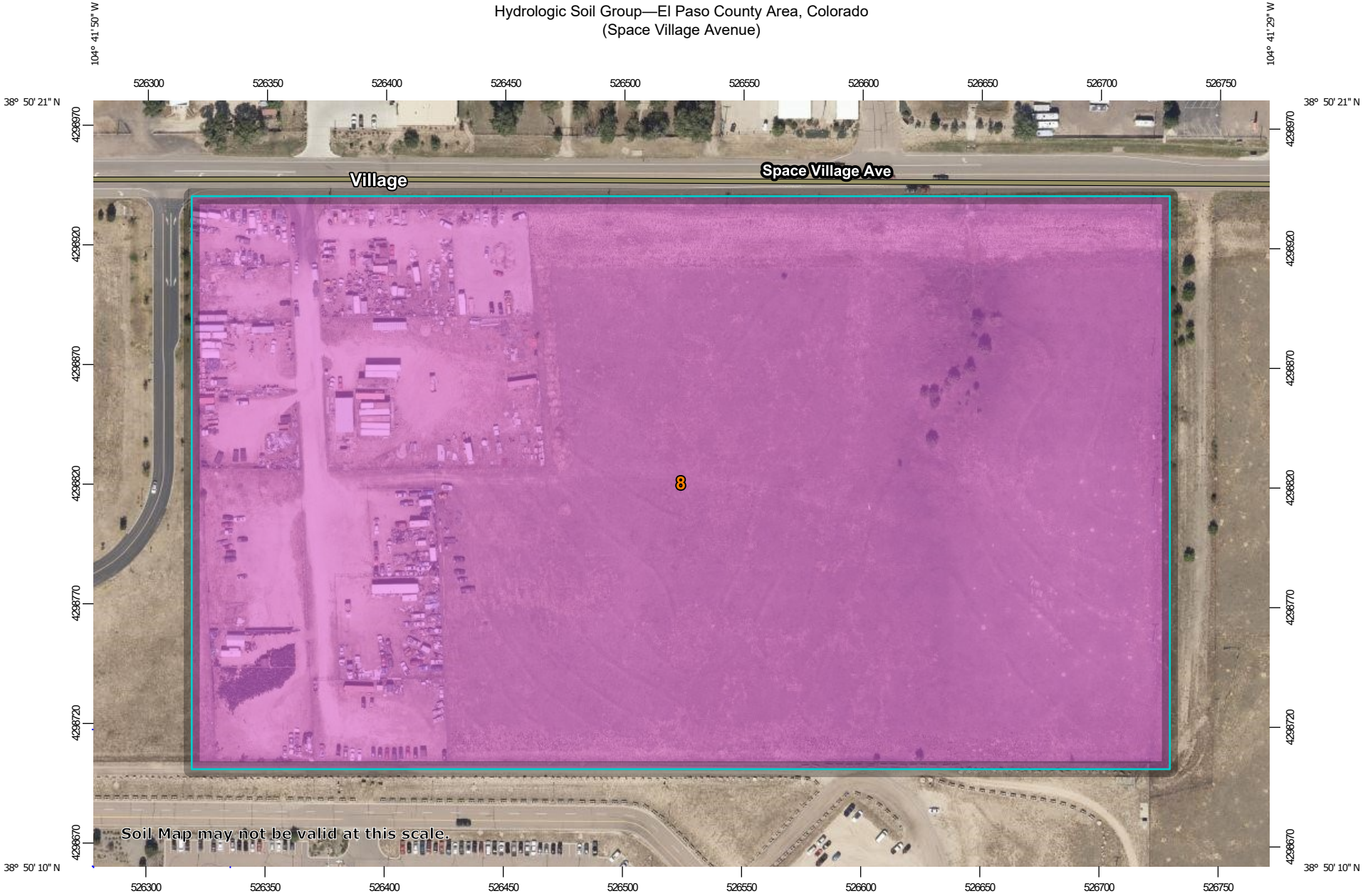
Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

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	24.4	100.0%
Totals for Area of Interest		**24.4**	**100.0%**

Hydrologic Soil Group—El Paso County Area, Colorado
(Space Village Avenue)



Map Scale: 1:2,260 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 30 60 120 180

Feet
0 100 200 400 600

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 Rating Polygons

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Lines

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Points

A
A/D
B
B/D
C
C/D
D
Not rated or not available

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.

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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)

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Survey Area Data: Version 19, Aug 31, 2021

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	24.4	100.0%
Totals for Area of Interest			**24.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Soil Map—El Paso County Area, Colorado
(SV - Off Site)

Map Scale: 1:4,320 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 200 400 800 1200

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 19, Aug 31, 2021

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

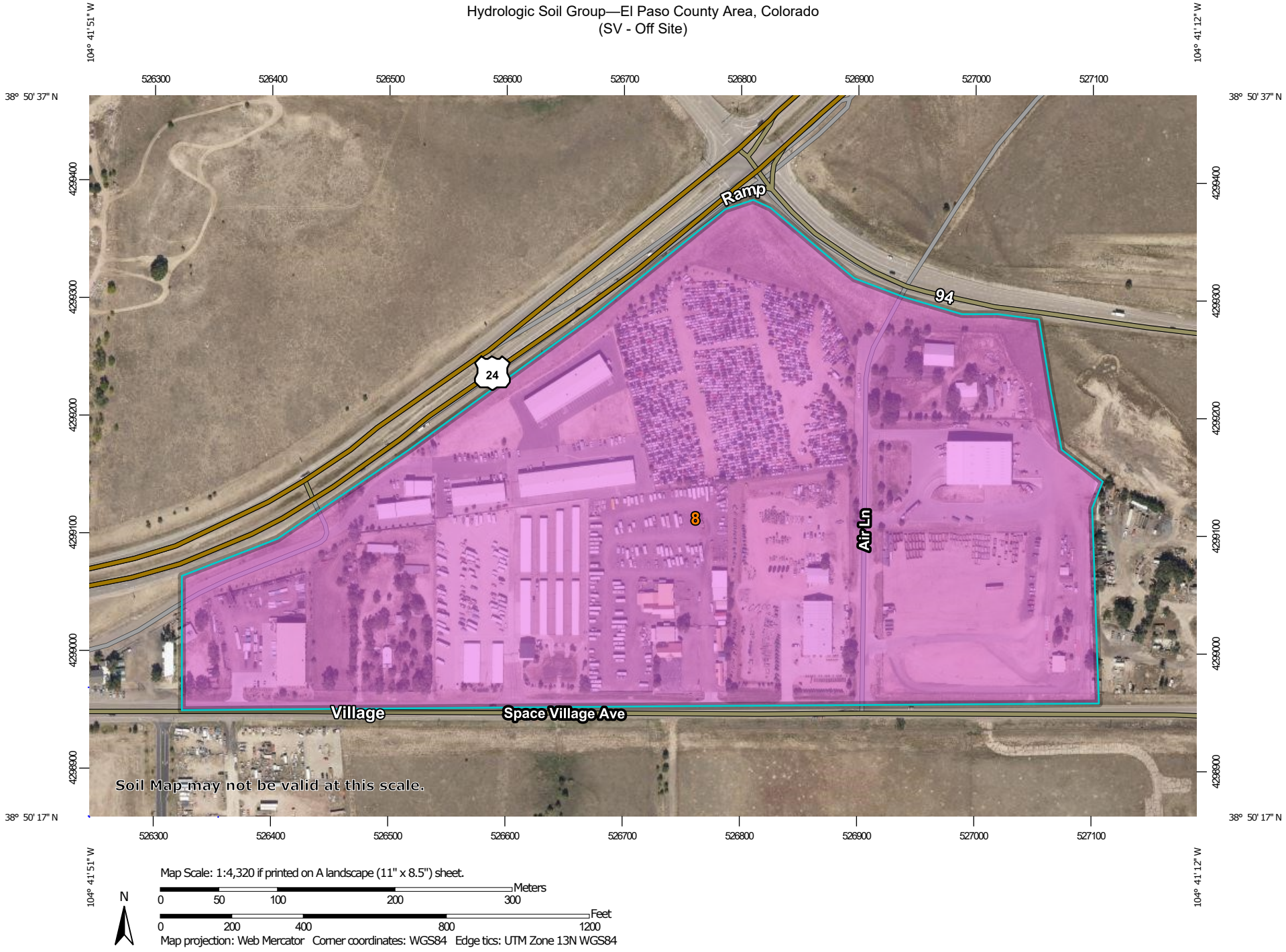
Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

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	56.1	100.0%
Totals for Area of Interest		**56.1**	**100.0%**

Hydrologic Soil Group—El Paso County Area, Colorado
(SV - Off Site)



Map Scale: 1:4,320 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 200 400 800 1200

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 Rating Polygons

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Lines

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Points

A
A/D
B
B/D
C
C/D
D
Not rated or not available

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 19, Aug 31, 2021

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	56.1	100.0%
Totals for Area of Interest			**56.1**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

APPENDIX B

- Hydrologic & Hydraulic Calculations and Analysis

STERLING
DESIGN ASSOCIATES
Civil Engineers | Landscape Architects

Weighted Imperviousness

Job Name: Space Village Filing No. 4

Date: 4/11/23

By: JMN

	[1]I	[1]C_5	[1]C_{10}	[1]C_{100}
Commercial Areas	95	0.81	0.83	0.88
Residential, 1 Acre	20	0.20	0.27	0.44
Industrial, Light	80	0.59	0.63	0.70
Industrial, Heavy	90	0.73	0.75	0.81
Historic Flow Analysis - Greenbelts, Agriculture	2	0.09	0.17	0.36
Pasture/Meadow	0	0.08	0.15	0.35
Offsite Flow (when landuse is undefined)	45	0.32	0.38	0.51
Streets, Paved	100	0.90	0.92	0.96
Streets, Gravel	80	0.59	0.63	0.70
Lawns	0	0.08	0.15	0.35
Drive and Walks	100	0.90	0.92	0.96
Roofs	90	0.73	0.75	0.81

[1]*Drainage Critieria Manual, Volume 1 Update* , EL Paso County, Table 6-6

OFFSITE

									Weighted Runoff Coeff		
Basin	Comm.	Residential	Ind. Light	Ind. Heavy	Paved	Historic	Total	I	C_5	C_{10}	C_{100}
[2] OS-E	13.09	0.59	12.60	14.10	3.85	7.85	52.08	76	0.63	0.66	0.74
[2] OS-W	4.06	2.76	0.00	0.00	0.00	0.00	6.82	65	0.56	0.60	0.70
Total	17.15	3.35	12.60	14.10	3.85	7.85	58.90	74	0.62	0.65	0.74

Hydrologic Soil Group = A (NRCS Web Soil Survey)

[2]*Zone Map 542,* El Paso County, Development Services Department

EXISTING ONSITE

									Weighted Runoff Coeff		
Basin	Comm.	Residential	Ind. Light	Ind. Heavy	Paved	Historic	Total	I	C_5	C_{10}	C_{100}
H2	0.00	0.00	0.00	0.00	0.70	11.57	12.27	8	0.14	0.21	0.39
H1	0.00	0.00	0.00	0.00	0.90	11.86	12.76	9	0.15	0.22	0.40
Total	0.00	0.00	0.00	0.00	1.60	23.43	25.03	8	0.14	0.22	0.40

Hydrologic Soil Group = A (NRCS Web Soil Survey)

PROPOSED ONSITE

									Weighted Runoff Coeff		
Basin	Comm.	Residential	Ind. Light	Gravel	Paved	Lawns	Total	I	C_5	C_{10}	C_{100}
B1	0.00	0.00	0.00	8.12	0.08	1.25	9.45	70	0.52	0.57	0.66
A1	0.00	0.00	0.00	9.19	0.08	1.68	10.95	68	0.51	0.56	0.65
B2	0.00	0.00	0.00	0.00	0.61	0.00	0.61	100	0.90	0.92	0.96
A2	0.00	0.00	0.00	0.00	0.85	0.00	0.85	100	0.90	0.92	0.96
B3	0.00	0.00	0.00	0.00	0.00	2.04	2.04	0	0.08	0.15	0.35
A3	0.00	0.00	0.00	0.00	0.00	0.82	0.82	0	0.08	0.15	0.35
B4	0.00	0.00	0.00	0.00	0.16	0.00	0.16	100	0.90	0.92	0.96
A4	0.00	0.00	0.00	0.00	0.15	0.00	0.15	100	0.90	0.92	0.96
Sub-Total B	0.00	0.00	0.00	8.12	0.85	3.30	12.27	60	0.47	0.52	0.62
Sub-Total A	0.00	0.00	0.00	9.19	1.07	2.50	12.76	66	0.52	0.56	0.65
Total	0.00	0.00	0.00	17.31	1.92	5.80	25.03	63	0.50	0.54	0.64

Hydrologic Soil Group = A (NRCS Web Soil Survey)

Table 6-6. Runoff Coefficients for Rational Method

(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients		
		5-year HSG A&B	10-year HSG A&B	100-year HSG A&B
Business				
Commercial Areas	95	0.81	0.83	0.88
Neighborhood Areas	70	0.49	0.53	0.62
Residential				
1/8 Acre or less	65	0.45	0.49	0.59
1/4 Acre	40	0.30	0.36	0.50
1/3 Acre	30	0.25	0.32	0.47
1/2 Acre	25	0.22	0.30	0.46
1 Acre	20	0.20	0.27	0.44
Industrial				
Light Areas	80	0.59	0.63	0.70
Heavy Areas	90	0.73	0.75	0.81
Parks and Cemeteries	7	0.12	0.20	0.39
Playgrounds	13	0.16	0.24	0.41
Railroad Yard Areas	40	0.30	0.36	0.50
Undeveloped Areas				
Historic Flow Analysis - Greenbelts, Agriculture	2	0.09	0.17	0.36
Pasture/Meadow	0	0.08	0.15	0.35
Forest	0	0.08	0.15	0.35
Esposed Rock	100	0.90	0.92	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.32	0.38	0.51
Streets				
Paved	100	0.90	0.92	0.96
Gravel	80	0.59	0.63	0.70
Drives and Walks	100	0.90	0.92	0.96
Roofs	90	0.73	0.75	0.81
Lawns	0	0.08	0.15	0.35

Zone Map 542

- El Paso County -
Development Services Department

Zoning Designations

- RS-20000: Residential Suburban (20,000 sq. ft.)
- RS-6000: Residential Suburban (6,000 sq. ft.)
- RS-5000: Residential Suburban (5,000 sq. ft.)
- RM-12: Residential Multi-Dwelling (12 DU/acre)
- RM-30: Residential Multi-Dwelling (30 DU/acre)
- RR-0.5: Residential Rural (0.5 acres)
- RR-2.5: Residential Rural (2.5 acres)
- RR-5: Residential Rural (5 acres)
- R-T: Residential - Topographic
- MHP: Mobile Home Park
- MHP-R: Mobile Home Park, Rural
- MHS: Mobile Home Subdivision
- RVP: Recreational Vehicle Park
- F-5: Forest & Recreation (5 acres)
- PUD: Planned Unit Development
- CC: Commercial Community
- CR: Commercial Regional
- CS: Commercial Service
- I-2: Limited Industrial
- I-3: Heavy Industrial
- A-5: Agricultural (5 acres)
- A-35: Agricultural (35 acres)
- C-1: ** Commercial
- C-2: ** Commercial
- M: ** Industrial
- R-4: ** Planned Development

** Indicates an obsolete designation

Supporting Data

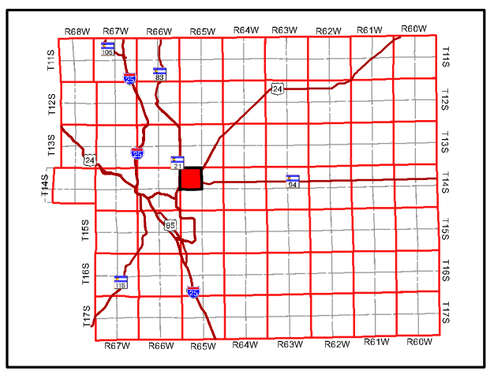
- Highways
- Major Roadways
- Creeks - Perennial
- Creeks - Intermittent
- Section Corner Nodes
- Sections
- Parcels
- Military
- Pike National Forest
- Incorporated Cities
- Zone Map Boundary
- Zoning Overlay
- Special Uses

1,600 800 0 1,600 Feet

1 inch = 1,600 feet

February 08, 2022

Vicinity Map



634 533 534 641 541 644 543 544

R65W T14S T15S

see map 542.04
see map 542.05
see map 542.06
see map 542.07
see map 542.08
see map 542.18

Commercial Airport Overlay

COLORADO SPRINGS
PETERSON AFB

Sand Creek
Jimmy Camp Creek
Fountain Creek

24 94

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Time of Concentration

Job Name: Space Village Filing No. 4

Date: 4/11/23

Calculated by: JMN

Sub-Basin Data			[1]Initial/Overland Time (Ti)			Travel Time Tt					***Tc Check Urbanized Basin		Final Tc	Remarks
Desig	C5	Area Ac	Length Ft	Slope Ft/Ft	Ti Min	Length Ft	Slope %	[3]Cv	[2]V Ft/s	Tt Min	Tot Len Ft	Tc Min	Min	
HISTORIC														
OS-E	0.63	52.08	100	0.020	6.8	130	0.330	7	4.0	0.5				
						100	0.020	20	2.8	0.6				
						900	0.014	10	1.2	12.7				
						900	0.014	10	1.2	12.7			33	
OS-W	0.56	6.82	100	0.020	7.7	80	0.020	20	2.8	0.5				
						465	0.017	10	1.3	5.9			14	
EXISTING														
H2	0.14	12.27	100	0.023	13.2	765	0.025	15	2.4	5.4			19	
H1	0.15	12.76	25	0.020	6.8	740	0.011	15	1.6	7.8			15	
PROPOSED														
B1	0.52	9.45	100	0.023	7.9	665	0.025	10	1.6	7.0			15	
A1	0.51	10.95	100	0.020	8.4	565	0.011	10	1.0	9.0			17	
Channel						650	0.005	15	1.1	10.2				
						315	0.016	15	1.9	2.8			13	
Swale						113	0.022	15	2.2	0.8				
						110	0.027	15	2.5	0.7				
						195	0.023	15	2.3	1.4				
						200	0.013	15	1.7	1.9				
						76	0.020	15	2.1	0.6			6	

[1]*Drainage Critieria Manual, Volume 1 Update* , EL Paso County, Equation 6-8

[2]*Drainage Critieria Manual, Volume 1 Update* , EL Paso County, Equation 6-9

[3]*Drainage Critieria Manual, Volume 1 Update* , EL Paso County, Table 6-7

Table 6-7. Conveyance Coefficient, Cv

Type of Land Surface	Cv
Heavy meadow	2.5
Tillage / field	5.0
Riprap (not buried) *	6.5
Short pasture and lawns	7.0
Nearly bare ground	10.0
Grassed waterway	15
Paved areas and shallow paved swales	20.0
*For buried riprap, select Cv value based on type of vegetative cover.	

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Existing Stormwater Runoff

Job Name: Space Village Filing No. 4

Date: 4/13/23
Calculated by: JMN
Design Storm: 5-yr

	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			
Design Point	Area Desig	Area (Ac)	Runoff Coeff	Tc (min)	CA	[1]I (in/hr)	Q (cfs)	Tc (min)	Total CA	[1]I (in/hr)	Q (cfs)	Slope %	Street Flow	Design Flow	Slope %	Pipe Size	Length (Ft)	Vel (fps)	Tt (min)	Remarks
1	OS-E	52.08	0.63	33	32.62	2.2	71.77													to H2
6	OS-W	6.82	0.56	14	3.84	3.5	13.44													to H1
4	H2	12.27	0.14	19	1.67	3.1	5.18													to DP 5
9	H1	12.76	0.15	15	1.88	3.4	6.40													to DP 10
5				52	34.29	1.8	60.01													to Offsite
10				29	5.72	2.4	14.01													to Offsite

[1]*Drainage Critieria Manual, Volume 1 Update* , EL Paso County, Figure 6-5

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Proposed Stormwater Runoff

Job Name: Space Village Filing No. 4

Date: 4/11/23
Calculated by: JMN
Design Storm: 5-yr

	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			
Design Point	Area Desig	Area (Ac)	Runoff Coeff	Tc (min)	CA	[1]I (in/hr)	Q (cfs)	Tc (min)	Total CA	[1]I (in/hr)	Q (cfs)	Slope %	Street Flow	Design Flow	Slope %	Pipe Size	Length (Ft)	Vel (fps)	Tt (min)	Remarks
1	OS-E	52.08	0.63	33	32.62	2.2	71.77													to DP 3
6	OS-W	6.82	0.56	14	3.84	3.5	13.44													to DP 8
	B4	0.16	0.90	5	0.14	5.2	0.75													to B2
	B2	0.61	0.90	5	0.55	5.2	2.88													to DP 2
2				5	0.70	5.2	3.63													to DP 3
3				33	33.32	2.2	73.30													to B3
	B3	2.04	0.08	13	0.16	3.6	0.59													to DP 5
4	B1	9.45	0.52	15	4.96	3.4	16.86													to Pond
5				46	33.48	1.8	60.27	[2]												to Offsite
	A4	0.15	0.90	5	0.13	5.2	0.70													to A2
	A2	0.85	0.90	5	0.76	5.2	3.96													to DP 7
7				5	0.90	5.2	4.66													to DP 8
8				14	4.74	3.5	16.58													to A3
	A3	0.82	0.08	6	0.07	5.0	0.33													to DP 10
9	A1	10.95	0.51	17	5.62	3.2	18.00													to Pond
10				20	4.80	3.0	14.41	[2]												to Offsite

[1] *Drainage Critieria Manual, Volume 1 Update* , EL Paso County, Figure 6-5

[2] At the Design Point, proposed Tc is faster than historic Tc anticipating an increase in runoff. However, there is a corresponding decrease in CA anticipating a decrease in runoff. Full infiltration pond design for onsite runoff limits proposed runoff downstream of pond to that from offsite basin(s) and offsite runoff conveyance basin(s)only, which bypass the pond(s). Coupled with imprecision in interpolation of rainfall intensity from *Drainage Critieria Manual, Volume 1 Update* , EL Paso County, Figure 6-5; the combined effect on total runoff varies. Increases from historic to proposed total runoff are negligible.

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Existing Stormwater Runoff

Job Name: Space Village Filing No. 4

Date: 4/13/23
Calculated by: JMN
Design Storm: 10-yr

	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			
Design Point	Area Desig	Area (Ac)	Runoff Coeff	Tc (min)	CA	[1]I (in/hr)	Q (cfs)	Tc (min)	Total CA	[1]I (in/hr)	Q (cfs)	Slope %	Street Flow	Design Flow	Slope %	Pipe Size	Length (Ft)	Vel (fps)	Tt (min)	Remarks
1	OS-E	52.08	0.66	33	34.42	2.6	89.48													to H2
6	OS-W	6.82	0.60	14	4.12	4.1	16.87													to H1
4	H2	12.27	0.21	19	2.61	3.6	9.39													to DP 5
9	H1	12.76	0.22	15	2.85	4.0	11.39													to DP 10
5				52	37.02	2.0	75.86													to Offsite
10				29	6.96	2.8	19.15													to Offsite

[1]*Drainage Critieria Manual, Volume 1 Update* , EL Paso County, Figure 6-5

STERLING
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Proposed Stormwater Runoff

Job Name: Space Village Filing No. 4

Date: 4/11/23
Calculated by: JMN
Design Storm: 10-yr

	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			
Design Point	Area Desig	Area (Ac)	Runoff Coeff	Tc (min)	CA	[1]I (in/hr)	Q (cfs)	Tc (min)	Total CA	[1]I (in/hr)	Q (cfs)	Slope %	Street Flow	Design Flow	Slope %	Pipe Size	Length (Ft)	Vel (fps)	Tt (min)	Remarks
1	OS-E	52.08	0.66	33	34.42	2.6	89.48													to DP 3
6	OS-W	6.82	0.60	14	4.12	4.1	16.87													to DP 8
	B4	0.16	0.92	5	0.15	6.1	0.90													to B2
	B2	0.61	0.92	5	0.57	6.1	3.45													to DP 2
2				5	0.71	6.1	4.35													to DP 3
3				33	35.13	2.6	91.33													to B3
	B3	2.04	0.15	13	0.31	4.2	1.29													to DP 5
4	B1	9.45	0.57	15	5.37	4.0	21.49													to Pond
5				46	35.43	2.2	76.18	[2]												to Offsite
	A4	0.15	0.92	5	0.14	6.1	0.84													to A2
	A2	0.85	0.92	5	0.78	6.1	4.74													to DP 7
7				5	0.92	6.1	5.58													to DP 8
8				14	5.03	4.1	20.63													to A3
	A3	0.82	0.15	6	0.12	5.8	0.71													to DP 10
9	A1	10.95	0.56	17	6.11	3.8	23.22													to Pond
10				20	5.15	3.5	18.29	[2]												to Offsite

[1] *Drainage Critieria Manual, Volume 1 Update* , EL Paso County, Figure 6-5

[2] At the Design Point, proposed Tc is faster than historic Tc anticipating an increase in runoff. However, there is a corresponding decrease in CA anticipating a decrease in runoff. Full infiltration pond design for onsite runoff limits proposed runoff downstream of pond to that from offsite basin(s) and offsite runoff conveyance basin(s)only, which bypass the pond(s). Coupled with imprecision in interpolation of rainfall intensity from *Drainage Critieria Manual, Volume 1 Update* , EL Paso County, Figure 6-5; the combined effect on total runoff varies. Increases from historic to prpoposed total runoff are negligible.

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Existing Stormwater Runoff

Job Name: Space Village Filing No. 4

Date: 4/13/23
Calculated by: JMN
Design Storm: 100-yr

	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			
Design Point	Area Desig	Area (Ac)	Runoff Coeff	Tc (min)	CA	[1]I (in/hr)	Q (cfs)	Tc (min)	Total CA	[1]I (in/hr)	Q (cfs)	Slope %	Street Flow	Design Flow	Slope %	Pipe Size	Length (Ft)	Vel (fps)	Tt (min)	Remarks
1	OS-E	52.08	0.74	33	38.54	3.8	146.46													to H2
6	OS-W	6.82	0.70	14	4.79	5.8	27.77													to H1
4	H2	12.27	0.39	19	4.84	5.2	25.14													to DP 5
9	H1	12.76	0.40	15	5.14	5.8	29.79													to DP 10
5				52	43.38	2.9	127.92													to Offsite
10				29	9.92	4.0	39.20													to Offsite

[1]*Drainage Critieria Manual, Volume 1 Update* , EL Paso County, Figure 6-5

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Proposed Stormwater Runoff

Job Name: Space Village Filing No. 4

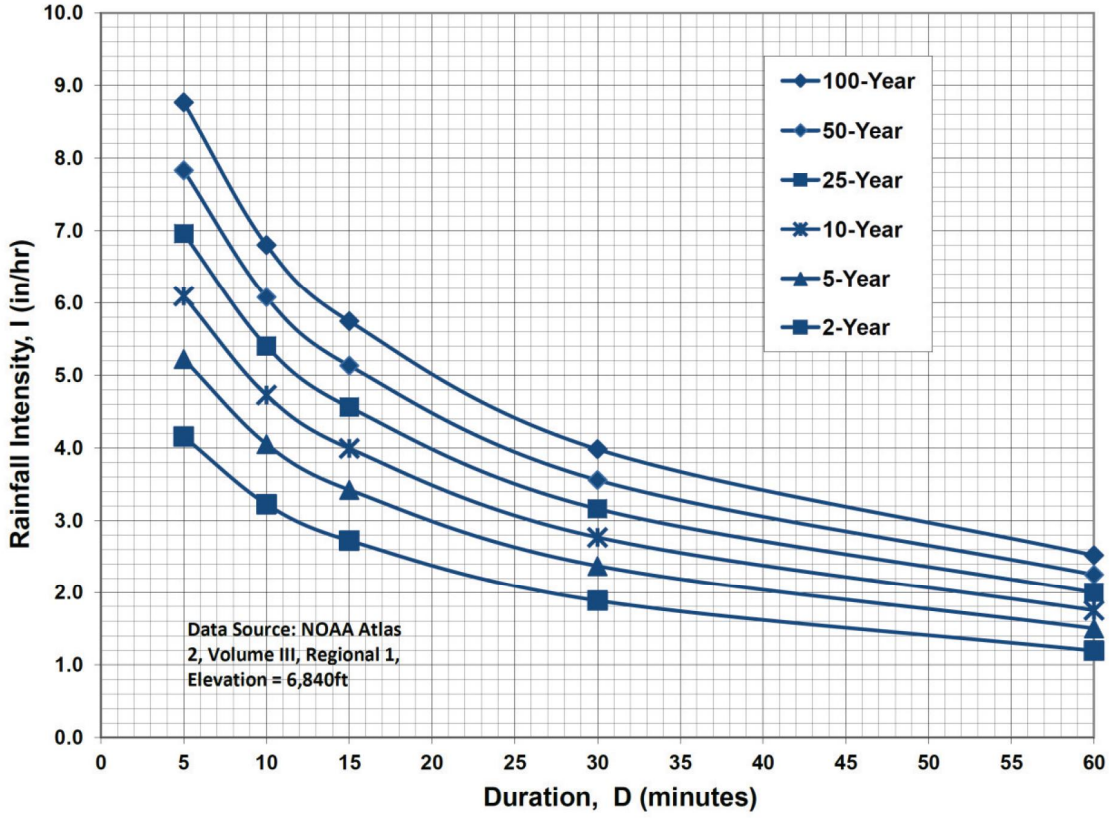
Date: 4/11/23
Calculated by: JMN
Design Storm: 100-yr

	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			
Design Point	Area Desig	Area (Ac)	Runoff Coeff	Tc (min)	CA	[1]I (in/hr)	Q (cfs)	Tc (min)	Total CA	[1]I (in/hr)	Q (cfs)	Slope %	Street Flow	Design Flow	Slope %	Pipe Size	Length (Ft)	Vel (fps)	Tt (min)	Remarks
1	OS-E	52.08	0.74	33	38.54	3.8	146.46													to DP 3
6	OS-W	6.82	0.70	14	4.79	5.8	27.77													to DP 8
	B4	0.16	0.96	5	0.15	8.8	1.36													to B2
	B2	0.61	0.96	5	0.59	8.8	5.19													to DP 2
2				5	0.74	8.8	6.55													to DP 3
3				33	39.29	3.8	149.29													to B3
	B3	2.04	0.35	13	0.71	6.0	4.29													to DP 5
4	B1	9.45	0.66	15	6.19	5.8	35.93													to Pond
5				46	40.00	3.2	128.01	[2]												to Offsite
	A4	0.15	0.96	5	0.14	8.8	1.26													to A2
	A2	0.85	0.96	5	0.81	8.8	7.14													to DP 7
7				5	0.96	8.8	8.41													to DP 8
8				14	5.74	5.8	33.31													to A3
	A3	0.82	0.35	6	0.29	8.3	2.39													to DP 10
9	A1	10.95	0.65	17	7.09	5.4	38.30													to Pond
10				20	6.03	5.0	30.45	[2]												to Offsite

[1] *Drainage Critieria Manual, Volume 1 Update* , EL Paso County, Figure 6-5

[2] At the Design Point, proposed Tc is faster than historic Tc anticipating an increase in runoff. However, there is a corresponding decrease in CA anticipating a decrease in runoff. Full infiltration pond design for onsite runoff limits proposed runoff downstream of pond to that from offsite basin(s) and offsite runoff conveyance basin(s)only, which bypass the pond(s). Coupled with imprecision in interpolation of rainfall intensity from *Drainage Critieria Manual, Volume 1 Update* , EL Paso County, Figure 6-5; the combined effect on total runoff varies. Increases from historic to prpoposed total runoff are negligible.

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

$I_{100} = -2.52 \ln(D) + 12.735$

$I_{50} = -2.25 \ln(D) + 11.375$

$I_{25} = -2.00 \ln(D) + 10.111$

$I_{10} = -1.75 \ln(D) + 8.847$

$I_{5} = -1.50 \ln(D) + 7.583$

$I_{2} = -1.19 \ln(D) + 6.035$

Note: Values calculated by equations may not precisely duplicate values read from figure.

STERLING DESIGN ASSOCIATES
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Curb Opening

Date: 6/14/23

Job Name: Space Village Filing No. 4

By: JMN

GENERAL

$Q = C_{BCW}LH^{1.5}$ (MHFD, USDCM Vol. 2, Eq. 12-8)

$C_{BCW} = 3.00$ (MHFD, USDCM Vol. 2, § 5.14.2)

$Q = (2/5)C_{BCW}ZH^{2.5}$ (MHFD, USDCM Vol. 2, Eq. 12-9)

$C_{BCW} = 3.00$ (MHFD, USDCM Vol. 2, § 5.14.2)

DP 2

$Q_{DESIGN} = 6.55$ cfs (Q_{100} at DP 2)

Elevation	H (ft)	L (ft)	Z	Q (cfs)
0.58	0.67	5.00		8.23
	0.67		0.00	0.00
	0.67		0.00	0.00
Total Capacity			=	8.23
w/ clogging			=	6.58 (MANUAL, Volume 1, Table 7-1)

DP 7

$Q_{DESIGN} = 8.41$ cfs (Q_{100} at DP 7)

$= 33.31$ cfs (Q_{100} at DP 7 w/ contribution from OS-W)

Elevation	H (ft)	L (ft)	Z	Q (cfs)
[1] 0.618	0.62	6.00		8.73
	0.62		0.00	0.00
	0.62		0.00	0.00
Total Capacity			=	8.73
w/ clogging			=	6.99 (MANUAL, Volume 1, Table 7-1)

Elevation	H (ft)	L (ft)	Z	Q (cfs)
[1] 0.653	0.65	6.00		9.49
	0.65		0.00	0.00
	0.65		0.00	0.00
Total Capacity			=	9.49
w/ clogging			=	7.59 (MANUAL, Volume 1, Table 7-1)

Elevation	H (ft)	L (ft)	Z	Q (cfs)
[1] 0.649	0.65	6.00		9.40
	0.65		0.00	0.00
	0.65		0.00	0.00
Total Capacity			=	9.40
w/ clogging			=	7.52 (MANUAL, Volume 1, Table 7-1)

Elevation	H (ft)	L (ft)	Z	Q (cfs)
[1] 0.606	0.61	6.00		8.49
	0.61		0.00	0.00
	0.61		0.00	0.00
Total Capacity			=	8.49
w/ clogging			=	6.79 (MANUAL, Volume 1, Table 7-1)

Quad Installation = 28.89 [2]

[1] Elevation (i.e. depth of curb opening) = average depth adjusted for no overtopping at curb low point

[2] Excess Q100 (±4.42 cfs) overtops curb at low point

5' Chase

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Normal Depth	0.58	ft
Bottom Width	5.00	ft

Results

Discharge	20.24	ft^3/s x 0.8 = 16.19 ft^3/s Capacity
Flow Area	2.92	ft^2
Wetted Perimeter	6.17	ft
Hydraulic Radius	0.47	ft
Top Width	5.00	ft
Critical Depth	0.80	ft
Critical Slope	0.00384	ft/ft
Velocity	6.94	ft/s
Velocity Head	0.75	ft
Specific Energy	1.33	ft
Froude Number	1.60	
Flow Type	Supercritical	

MANUAL Volume 1, Table 7-1 ... Sizing Adjustment for Clogging:

Curb Opening...Clogging (F) = 1.25

Therefore;
Design Capacity = Calculated Capacity x 0.8

DP 2 Q_{100} = 6.55 ft^3/s < 16.19 ft^3/s

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.58	ft
Critical Depth	0.80	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00384	ft/ft

6' Chase

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Normal Depth	0.58	ft
Bottom Width	6.00	ft

Results

Discharge	24.81	ft^3/s	x 0.8 = 19.85 ft^3/s Capacity x 4 = 79.40 ft^3/s
Flow Area	3.50	ft^2	
Wetted Perimeter	7.17	ft	
Hydraulic Radius	0.49	ft	
Top Width	6.00	ft	
Critical Depth	0.81	ft	
Critical Slope	0.00363	ft/ft	
Velocity	7.09	ft/s	
Velocity Head	0.78	ft	
Specific Energy	1.36	ft	
Froude Number	1.64		
Flow Type	Supercritical		

MANUAL Volume 1, Table 7-1 ... Sizing Adjustment for Clogging:

Curb Opening...Clogging (F) = 1.25

Therefore;
Design Capacity = Calculated Capacity x 0.8

DP 7 Q_{100} = 8.41 ft^3/s < 79.40 ft^3/s

Q_{100} = 33.31 ft^3/s < 79.40 ft^3/s
(Includes Basin OS-E contribution)

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.58	ft
Critical Depth	0.81	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00363	ft/ft

TABLE 7-1 INLET SIZING ADJUSTMENT FOR CLOGGING

	Adjustment Factor (F)
Curb Opening Inlet Length at Sump (Clogging)	1.25
Grate Inlet Area at Sump	2.0
Combination Inlets (Grate & Hood) at Sump	1.5
Grate Inlet Area for Continuous Grade	1.6

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Riprap Protection

Date: 4/11/23

Job Name: Space Village Filing No. 4

By: JMN

DESIGN POINT 2

Q_{100} = 6.55 cfs

Lp = (1/(2tanθ))*((At/Yt) - W) (MHFD, USDCM Vol. 2, Equation 9-11)

W = 5.00 ft

H = 0.58 ft

$Q/(WH^{1.5})$ = 2.94 < 8.0 (Froude Parameter)

Yt/H = 0.40 (MHFD, USDCM Vol. 2, § 3.2.3)

Yt = 0.23

1/(2tanθ) = 3.50 (MHFD, USDCM Vol. 2, Figure 9-36)

At = Q/V (MHFD, USDCM Vol. 2, Equation 9-12)

V = 5.00 ft/s

At = 1.31 sf

Lp = 2.14 ft

T = 2(Lptanθ) + W (MHFD, USDCM Vol. 2, Equation 9-14)

θ = $\tan^{-1}$(1/(2(Expansion Factor))) (MHFD, USDCM Vol. 2, Equation 9-13)

= 8.13 degrees

T = 5.61 ft

$Q/(WH^{0.5})$ = 1.71 (MHFD, USDCM Vol. 2, Figure 9-39)

Riprap = Type L (MHFD, USDCM Vol. 2, Figure 9-39)

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Riprap Protection

Date: 4/13/23

Job Name: Space Village Filing No. 4

By: JMN

DESIGN POINT 7

Q_{100} = 33.31 cfs

Lp = (1/(2tanθ))*((At/Yt) - W) (MHFD, USDCM Vol. 2, Equation 9-11)

W = 24.00 ft

H = 0.58 ft

$Q/(WH^{1.5})$ = 3.12 < 8.0 (Froude Parameter)

Yt/H = 0.40 (MHFD, USDCM Vol. 2, § 3.2.3)

Yt = 0.23

1/(2tanθ) = 3.75 (MHFD, USDCM Vol. 2, Figure 9-36)

At = Q/V (MHFD, USDCM Vol. 2, Equation 9-12)

V = 5.00 ft/s

At = 6.66 sf

Lp = 17.07 ft

T = 2(Lptanθ) + W (MHFD, USDCM Vol. 2, Equation 9-14)

$\theta = \tan^{-1}(1/(2(\text{Expansion Factor})))$ (MHFD, USDCM Vol. 2, Equation 9-13)

= 7.59 degrees

T = 28.55 ft

$Q/(WH^{0.5})$ = 1.82 (MHFD, USDCM Vol. 2, Figure 9-39)

Riprap = Type L (MHFD, USDCM Vol. 2, Figure 9-39)

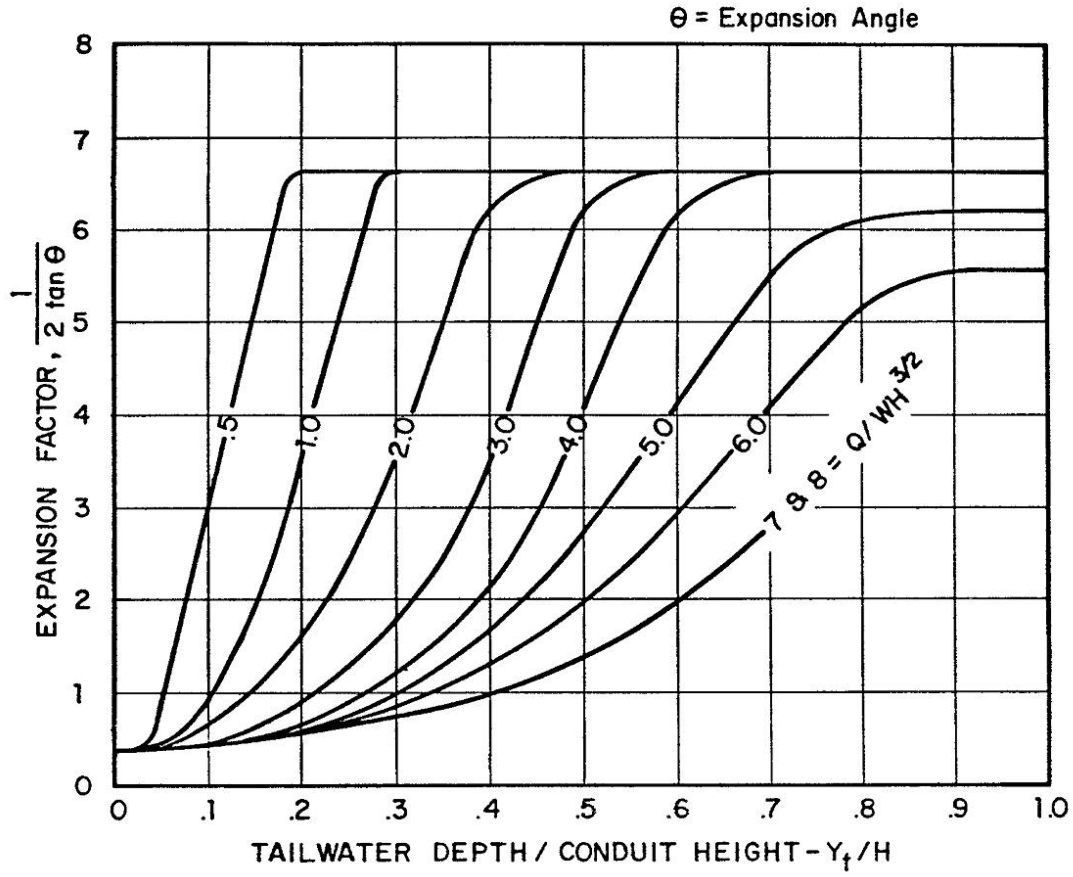
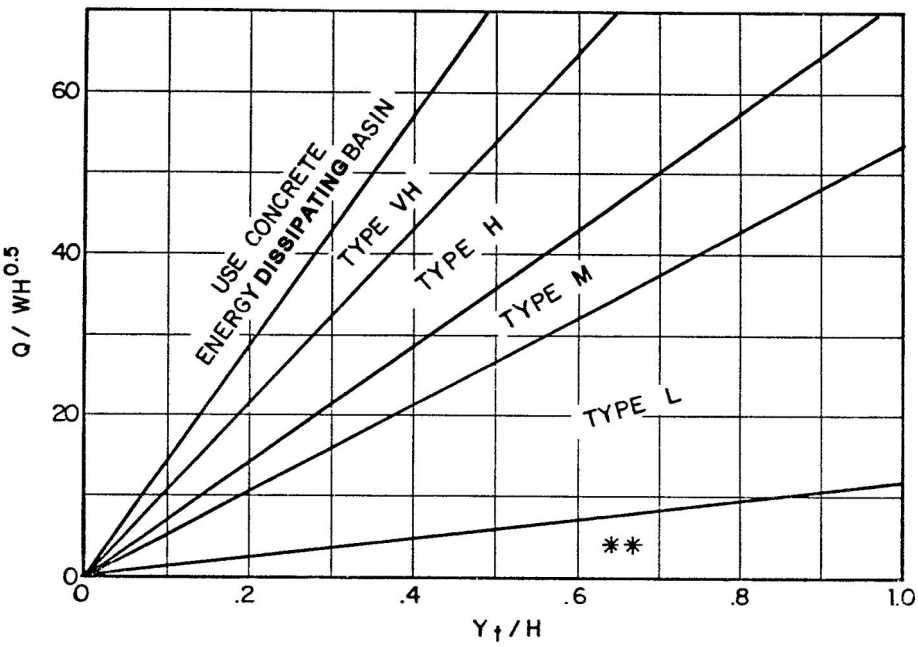


Figure 9-36. Expansion factor for rectangular conduits



Use H_a instead of H whenever culvert has supercritical flow in the barrel.
**Use Type L for a distance of 3H downstream.

Figure 9-39. Riprap erosion protection at rectangular conduit outlet (valid for Q/WH1.5 ≤ 8.0)

Channel @ 0.50% (5-yr)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.00500	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	15.00	ft
Discharge	73.30	ft^3/s

Results

Normal Depth	1.33	ft
Flow Area	27.13	ft^2
Wetted Perimeter	26.00	ft
Hydraulic Radius	1.04	ft
Top Width	25.67	ft
Critical Depth	0.84	ft
Critical Slope	0.02649	ft/ft
Velocity	2.70	ft/s
Velocity Head	0.11	ft
Specific Energy	1.45	ft
Froude Number	0.46	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.33	ft
Critical Depth	0.84	ft
Channel Slope	0.00500	ft/ft

Channel @ 1.60% (5-yr)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.01600	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	15.00	ft
Discharge	73.30	ft^3/s

Results

Normal Depth	0.97	ft
Flow Area	18.20	ft^2
Wetted Perimeter	22.96	ft
Hydraulic Radius	0.79	ft
Top Width	22.72	ft
Critical Depth	0.84	ft
Critical Slope	0.02649	ft/ft
Velocity	4.03	ft/s
Velocity Head	0.25	ft
Specific Energy	1.22	ft
Froude Number	0.79	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.97	ft
Critical Depth	0.84	ft
Channel Slope	0.01600	ft/ft

Channel @ 0.50% (100-yr)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.00500	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	15.00	ft
Discharge	149.29	ft^3/s

Results

Normal Depth	1.96	ft
Flow Area	44.68	ft^2
Wetted Perimeter	31.14	ft
Hydraulic Radius	1.43	ft
Top Width	30.66	ft
Critical Depth	1.29	ft
Critical Slope	0.02350	ft/ft
Velocity	3.34	ft/s
Velocity Head	0.17	ft
Specific Energy	2.13	ft
Froude Number	0.49	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.96	ft
Critical Depth	1.29	ft
Channel Slope	0.00500	ft/ft

Channel @ 1.60% (100-yr)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.01600	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	15.00	ft
Discharge	149.29	ft^3/s

Results

Normal Depth	1.43	ft
Flow Area	29.69	ft^2
Wetted Perimeter	26.81	ft
Hydraulic Radius	1.11	ft
Top Width	26.46	ft
Critical Depth	1.29	ft
Critical Slope	0.02350	ft/ft
Velocity	5.00	ft/s
Velocity Head	0.39	ft
Specific Energy	1.83	ft
Froude Number	0.84	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.43	ft
Critical Depth	1.29	ft
Channel Slope	0.01600	ft/ft

STERLING
DESIGN ASSOCIATES
Civil Engineers | Landscape Architects

Channel Calculations

Job Name: Space Village Filing No. 4

Date: 4/11/23

By: JMN

FREEBOARD

$H = 1.0 + 0.025vd^{0.33}$ (MANUAL; Equation 10-3)

v = 3.34 (ft/s)
d = 1.96 (ft)

H = 1.10 (ft)

SUPERELEVATION

$H = (Cv^2w) / (gR)$ (MANUAL; Equation 10-4)

C = 0.50 (MANUAL; Section 10.5.6)
v = 3.34 (ft/s)
w = 30.50 (ft)
g = 32.20 (ft/s^2)
R = 75.00 (ft) (R = 2w minimum; = 61 ft minimum) (ECM; Section 3.3.3)

H = 0.07 (ft)

TOTAL

H = 1.17 (ft)

FREEBOARD

$H = 1.0 + 0.025vd^{0.33}$ (MANUAL; Equation 10-3)

v = 5.00 (ft/s)
d = 1.43 (ft)

H = 1.14 (ft)

SUPERELEVATION

$H = (Cv^2w) / (gR)$ (MANUAL; Equation 10-4)

C = 0.50 (MANUAL; Section 10.5.6)
v = 5.00 (ft/s)
w = 30.50 (ft)
g = 32.20 (ft/s^2)
R = 75.00 (ft) (R = 2w minimum; = 61 ft minimum) (ECM; Section 3.3.3)

H = 0.16 (ft)

TOTAL

H = 1.30 (ft)

Swale @ 1.30% (100-yr)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.01300	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Discharge	33.31	ft^3/s

Results

Normal Depth	1.54	ft
Flow Area	9.54	ft^2
Wetted Perimeter	12.73	ft
Hydraulic Radius	0.75	ft
Top Width	12.35	ft
Critical Depth	1.34	ft
Critical Slope	0.02775	ft/ft
Velocity	3.49	ft/s
Velocity Head	0.19	ft
Specific Energy	1.73	ft
Froude Number	0.70	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.54	ft
Critical Depth	1.34	ft
Channel Slope	0.01300	ft/ft
Critical Slope	0.02775	ft/ft

Swale @ 3.30%(100-yr)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.03300	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Discharge	33.31	ft^3/s

Results

Normal Depth	1.30	ft
Flow Area	6.72	ft^2
Wetted Perimeter	10.69	ft
Hydraulic Radius	0.63	ft
Top Width	10.37	ft
Critical Depth	1.34	ft
Critical Slope	0.02775	ft/ft
Velocity	4.95	ft/s
Velocity Head	0.38	ft
Specific Energy	1.68	ft
Froude Number	1.08	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.30	ft
Critical Depth	1.34	ft
Channel Slope	0.03300	ft/ft
Critical Slope	0.02775	ft/ft

TABLE 10-2

TYPICAL ROUGHNESS COEFFICIENTS FOR OPEN CHANNELS

Type of Channel and Description	Minimum	Normal	Maximum
8. Very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush	0.075	0.100	0.150
LINED OR BUILT-UP CHANNELS			
a. Corrugated Metal	0.021	0.025	0.030
b. Concrete			
1. Trowel finish	0.011	0.013	0.015
2. Float finish	0.013	0.015	0.016
3. Finished, with gravel on bottom	0.015	0.017	0.020
4. Unfinished	0.014	0.017	0.020
5. Gunite, good section	0.016	0.019	0.023
6. Gunite, wavy section	0.018	0.022	0.025
7. On good excavated rock	0.017	0.020	

Type of Channel and Description	Minimum	Normal	Maximum
8. On irregular excavated rock	0.022	0.027	
c. Concrete bottom float finished with sides of			
1. Dressed stone in mortar	0.015	0.017	0.020
2. Random stone in mortar	0.017	0.020	0.024
3. Cement rubble masonry, plastered	0.016	0.020	0.024
4. Cement rubble masonry	0.020	0.025	0.030
5. Dry rubble or riprap	0.020	0.030	0.035
d. Gravel bottom with sides of			
1. Formed concrete	0.017	0.020	0.025
2. Random stone in mortar	0.020	0.023	0.026
3. Dry rubble or riprap	0.023	0.033	0.036
e. Asphalt			

Type of Channel and Description	Minimum	Normal	Maximum
1. Smooth		0.013	
2. Rough		0.016	
f. Grassed	0.030	0.040	0.050

[1]EL PASO COUNTY DRAINAGE CRITERIA MANUAL , VOLUME 1, CHAPTER 10, SECTION 10.5 CHANNEL CROSS SECTIONS

[2](REFERENCE: CHOW, VEN TE, 1959; OPEN-CHANNEL HYDRAULICS)

TABLE 10-4

MAXIMUM PERMISSIBLE VELOCITIES FOR EARTH CHANNELS WITH GRASS LININGS AND SLOPES

Channel Slope	**Lining**	**Permissible Mean Channel Velocity* (ft/sec)**
0 - 5%	Sodded grass	7
	Bermudagrass	6
	Reed canarygrass	5
	Tall fescue	5
	Kentucky bluegrass	5
	Grass-legume mixture	4
	Red fescue	2.5
	Redtop	2.5
	Sericea lespedeza	2.5
	Annual lespedeza	2.5
	Small grains (temporary)	2.5
5 - 10%	Sodded grass	6
	Bermudagrass	5
	Reed canarygrass	4
	Tall fescue	4
	Kentucky bluegrass	4

Channel Slope	Lining	Permissible Mean Channel Velocity* (ft/sec)
	Grass-legume mixture	3
Greater than 10%	Sodded grass	5
	Bermudagrass	4
	Reed canarygrass	3
	Tall fescue	3
	Kentucky bluegrass	3
*For highly erodible soils, decrease permissible velocities by 25%.		
*Grass lined channels are dependent upon assurances of continuous growth and maintenance of grass.		

[1]EL PASO COUNTY DRAINAGE CRITERIA MANUAL , VOLUME 1, CHAPTER 10, SECTION 10.5 CHANNEL CROSS SECTIONS

STERLING DESIGN ASSOCIATES
Civil Engineers | Landscape Architects

Spillway

Date: 6/14/23

Job Name: Space Village Filing No. 4

By: JMN

GENERAL

$Q = C_{BCW}LH^{1.5}$ (MHFD, USDCM Vol. 2, Eq. 12-8)

$C_{BCW} = 3.00$ (MHFD, USDCM Vol. 2, § 5.14.2)

$Q = (2/5)C_{BCW}ZH^{2.5}$ (MHFD, USDCM Vol. 2, Eq. 12-9)

$C_{BCW} = 3.00$ (MHFD, USDCM Vol. 2, § 5.14.2)

SECTION B-B

$Q_{DESIGN} = 128.01$ cfs (Q_{100} at DP 5 w/o Basin BI)

$= 147.83$ cfs (Q_{100} at DP 5 w Basin BI / Emergency Spill)

Elevation	H (ft)	L (ft)	Z	Q (cfs)
74.45	0.45	140.49		127.23
	0.45		67.50	11.00
	0.45		75.00	12.23
Total				150.46

SECTION D-D

$Q_{DESIGN} = 30.45$ cfs (Q_{100} at DP 10 w/o Basin AI)

$= 66.26$ cfs (Q_{100} at DP 10 w Basin AI / Emergency Spill)

Elevation	H (ft)	L (ft)	Z	Q (cfs)
70.75	0.25	211.24		79.22
	0.25		13.30	0.50
	0.25		78.00	2.93
Total				82.64

SECTION E-E

$Q_{DESIGN} = 38.30$ cfs (Q_{100} at DP 9)

Elevation	H (ft)	L (ft)	Z	Q (cfs)
72.10	0.10	477.89		45.34
	0.10		4.00	0.02
	0.10		35.80	0.14
Total				45.49

SECTION F-F

$Q_{DESIGN} = 35.93$ cfs (Q_{100} at DP 4)

Elevation	H (ft)	L (ft)	Z	Q (cfs)
75.65	0.15	349.02		60.83
	0.15		2.00	0.02
	0.15		1.50	0.02
Total				60.87

East Level Spreader Spillway

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02800	ft/ft	
Discharge	147.83	ft^3/s	(DP 5 Q_{100} = 128.01 ft^3/s < 147.83 ft^3/s) (147.83 ft^3/s incl. Basin B1 contribution)

Section Definitions

Station (ft)	Elevation (ft)
1+00	75.00
1+68	74.00
3+08	74.00
3+83	75.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(1+00, 75.00)	(1+68, 74.00)	0.040
(1+68, 74.00)	(3+08, 74.00)	0.040
(3+08, 74.00)	(3+83, 75.00)	0.040

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth		0.33	ft
Elevation Range	74.00 to 75.00 ft		
Flow Area		54.34	ft^2
Wetted Perimeter		187.69	ft
Hydraulic Radius		0.29	ft
Top Width		187.69	ft
Normal Depth		0.33	ft

East Level Spreader Spillway

Results

Critical Depth		0.31	ft
Critical Slope		0.03602	ft/ft
Velocity		2.72	ft/s (non-erosive)
Velocity Head		0.12	ft
Specific Energy		0.45	ft
Froude Number		0.89	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.33	ft
Critical Depth	0.31	ft
Channel Slope	0.02800	ft/ft
Critical Slope	0.03602	ft/ft

West Level Spreader Spillway

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04000	ft/ft	
Discharge	66.26	ft^3/s	(DP 10 Q_{100} = 30.45 ft^3/s < 66.26 ft^3/s) (66.26 ft^3/s incl. Basin A1 contribution)

Section Definitions

Station (ft)	Elevation (ft)
1+00	71.80
1+17	70.50
3+29	70.50
3+74	71.00
3+84	71.80

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(1+00, 71.80)	(3+29, 70.50)	0.040
(3+29, 70.50)	(3+74, 71.00)	0.040
(3+74, 71.00)	(3+84, 71.80)	0.040

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth		0.15	ft
Elevation Range	70.50 to 71.80 ft		
Flow Area		32.49	ft^2
Wetted Perimeter		226.58	ft
Hydraulic Radius		0.14	ft
Top Width		226.57	ft

West Level Spreader Spillway

Results

Normal Depth		0.15	ft
Critical Depth		0.14	ft
Critical Slope		0.04506	ft/ft
Velocity		2.04	ft/s (non-erosive)
Velocity Head		0.06	ft
Specific Energy		0.21	ft
Froude Number		0.95	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.15	ft
Critical Depth	0.14	ft
Channel Slope	0.04000	ft/ft
Critical Slope	0.04506	ft/ft

Design Procedure Form: Sand Filter (SF)

UD-BMP (Version 3.07, March 2018) **Sheet 1 of 2**

Designer:	**Jay M. Newell, PE**
Company:	**Sterling Design Associates, llc**
Date:	**April 11, 2023**
Project:	**Space Village Fil. No. 4 - East Pond**
Location:	**El Paso County, CO**

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a (100% if all paved and roofed areas upstream of sand filter): I_a = 70.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a/100$): i = 0.700

C) Water Quality Capture Volume (WQCV) Based on 12-hour Drain Time
$WQCV = 0.8 * (0.91* i^3 - 1.19 * i^2 + 0.78 * i)$: WQCV = 0.22 watershed inches

D) Contributing Watershed Area (including sand filter area): Area = 411,592 sq ft

E) Water Quality Capture Volume (WQCV) Design Volume
$V_{WQCV} = WQCV / 12 * Area$: V_{WQCV} = 7,547 cu ft

F) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm: d_6 = in

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume: $V_{WQCV\ OTHER}$ = cu ft

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

2. Basin Geometry

A) WQCV Depth: D_{WQCV} = 0.5 ft

B) Sand Filter Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred). Use "0" if sand filter has vertical walls.: Z = 3.00 ft / ft

C) Minimum Filter Area (Flat Surface Area): A_{Min} = 3601 sq ft

D) Actual Filter Area: A_{Actual} = 15994 sq ft

E) Volume Provided: V_T = 7547 cu ft

3. Filter Material

Choose One
- ○ 18" CDOT Class B or C Filter Material
- ◉ Other (Explain):

Native Soil - Blakeland loamy sand, 1 to 9 percent slopes (8)
Hydrologic Soil Group Rating A

4. Underdrain System

A) Are underdrains provided?

Choose One
- ○ YES
- ◉ NO

B) Underdrain system orifice diameter for 12 hour drain time

i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice: y = N/A ft

ii) Volume to Drain in 12 Hours: Vol_{12} = N/A cu ft

iii) Orifice Diameter, 3/8" Minimum: D_O = N/A in

Design Procedure Form: Sand Filter (SF)

Designer: Jay M. Newell, PE
Company: Sterling Design Associates, llc
Date: April 11, 2023
Project: Space Village Fil. No. 4 - East Pond
Location: El Paso County, CO

5. Impermeable Geomembrane Liner and Geotextile Separator Fabric A) Is an impermeable liner provided due to proximity of structures or groundwater contamination?	Choose One: ○ YES ◉ NO
6. Inlet / Outlet Works A) Describe the type of energy dissipation at inlet points and means of conveying flows in excess of the WQCV through the outlet	n/a

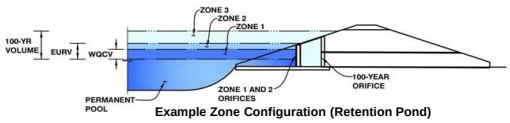
Notes: Sheet flow discharge into facility therefore no energy dissipation required. Full Infiltration of detained volumes therefore no conveyance of flows in excess of the WQCV through an outlet.

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: Space Village Fil. No. 4 - East Pond

Basin ID:



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	SF	
Watershed Area =	9.45	acres
Watershed Length =	750	ft
Watershed Length to Centroid =	375	ft
Watershed Slope =	0.025	ft/ft
Watershed Imperviousness =	70.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	12.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

		Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.173	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	0.838	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.585	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.764	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.907	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	1.087	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.263	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.474	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.14 in.) =	1.937	acre-feet	inches
Approximate 2-yr Detention Volume =	0.547	acre-feet	
Approximate 5-yr Detention Volume =	0.714	acre-feet	
Approximate 10-yr Detention Volume =	0.857	acre-feet	
Approximate 25-yr Detention Volume =	1.027	acre-feet	
Approximate 50-yr Detention Volume =	1.128	acre-feet	
Approximate 100-yr Detention Volume =	1.229	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.173	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.665	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	0.477	acre-feet
Total Detention Basin Volume =	1.315	acre-feet
Initial Surcharge Volume (ISV) =	N/A	ft^3
Initial Surcharge Depth (ISD) =	N/A	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	N/A	ft
Slope of Trickle Channel (S_{TC}) =	N/A	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Media Surface	--	0.00	--	--	--	14,195	0.326		
	--	0.50	--	--	--	15,994	0.367	7,547	0.173
	--	1.50	--	--	--	19,611	0.450	25,350	0.582
	--	2.50	--	--	--	23,340	0.536	46,825	1.075
	--	3.00	--	--	--	25,238	0.579	58,970	1.354

Stormwater Detention and Infiltration Design Data Sheet

SDI-Design Data v2.00, Released January 2020

Stormwater Facility Name: East Pond

Facility Location & Jurisdiction: Lot 2, Block 1, Space Village Filing No. 4., El Paso County, CO

User Input: Watershed Characteristics

Sand Filter (SF)	SF	
Watershed Area =	9.45	acres
Watershed Length =	750	ft
Watershed Length to Centroid =	375	ft
Watershed Slope =	0.025	ft/ft
Watershed Imperviousness =	70.0%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	12.0	hours

Location for 1-hr Rainfall Depths (use dropdown):

User Input

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Once CUHP has been run and the Stage-Area-Discharge information has been provided, click 'Process Data' to interpolate the Stage-Area-Volume-Discharge data and generate summary results in the table below. Once this is complete, click 'Print to PDF'.

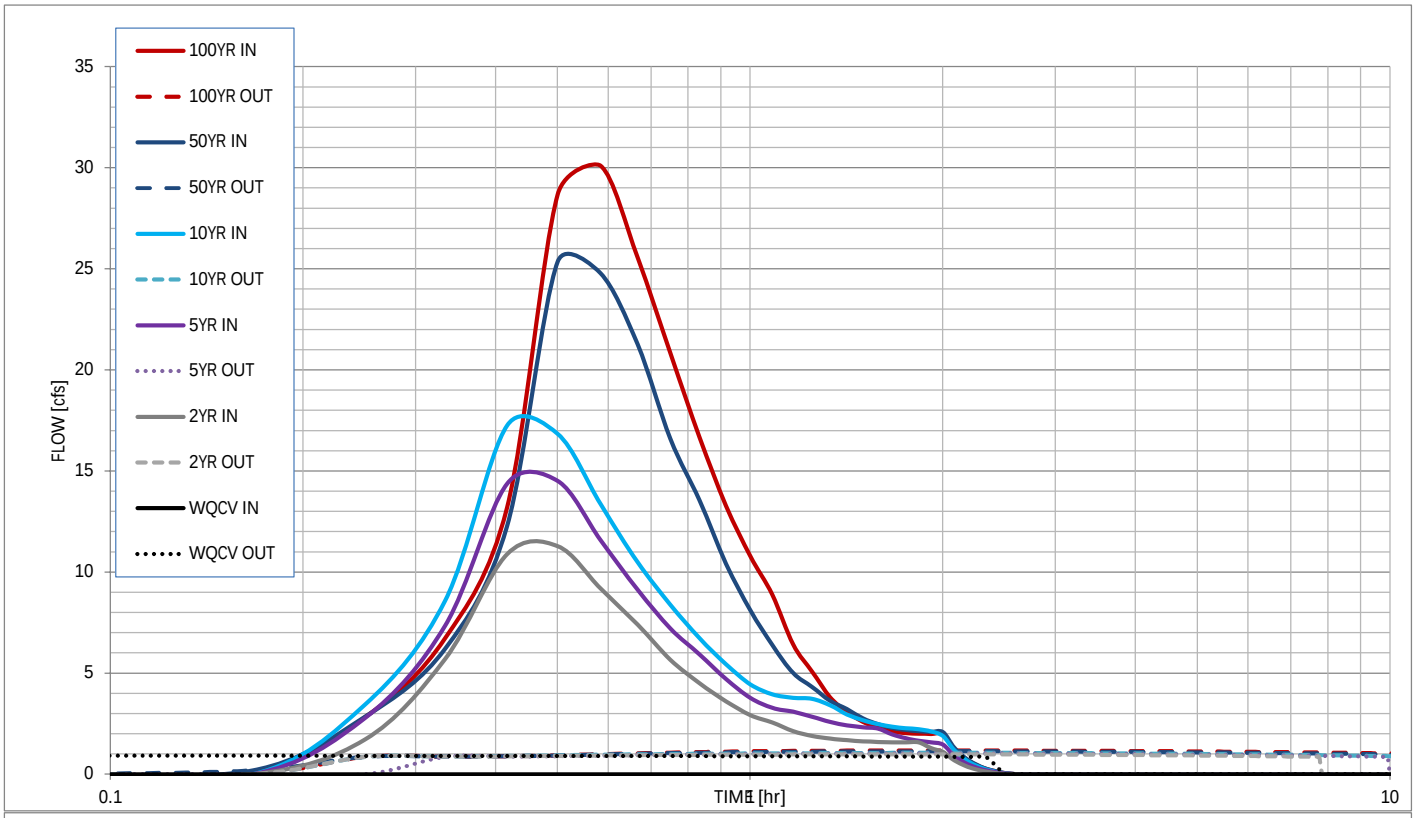
After completing and printing this worksheet to a pdf, go to:
https://maperture.digitaldataservices.com/gvh/?viewer=cswdif
Create a new stormwater facility, and attach the PDF of this worksheet to that record.

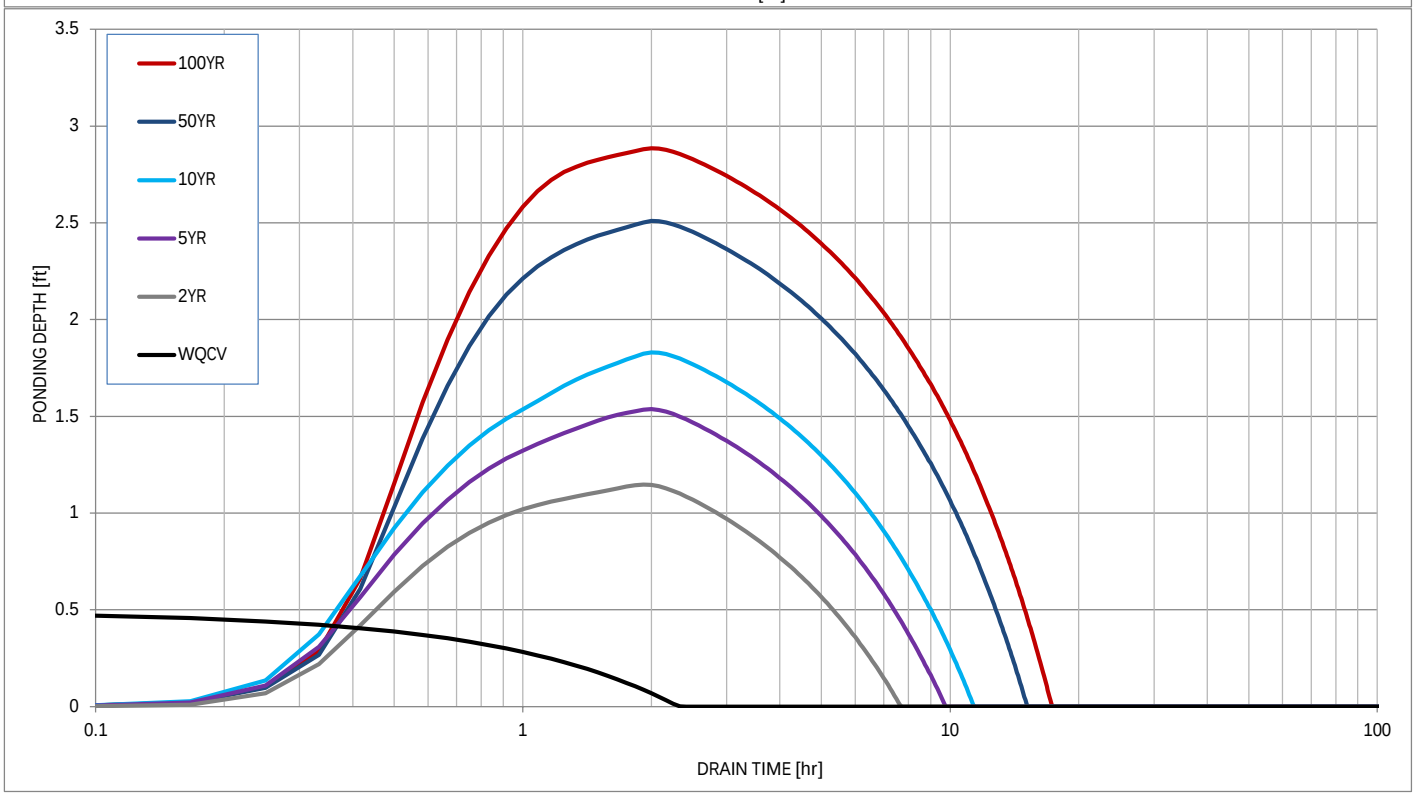
User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	14,195	0.00	0.86
0.50	15,994	0.50	0.92
1.50	19,611	1.50	1.03
2.50	23,340	2.50	1.14
3.00	25,238	3.00	1.19

Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	N/A	1.19	1.50	1.75	2.25	2.52	in
CUHP Runoff Volume =	0.173	0.585	0.764	0.907	1.263	1.474	acre-ft
Inflow Hydrograph Volume =	N/A	0.585	0.764	0.907	1.263	1.474	acre-ft
Time to Drain 97% of Inflow Volume =	2.3	7.5	9.5	11.0	14.7	16.8	hours
Time to Drain 99% of Inflow Volume =	2.3	7.7	9.7	11.3	15.0	17.2	hours
Maximum Ponding Depth =	0.50	1.15	1.54	1.83	2.51	2.89	ft
Maximum Ponded Area =	0.37	0.42	0.45	0.48	0.54	0.57	acres
Maximum Volume Stored =	0.174	0.428	0.598	0.734	1.079	1.288	acre-ft

Stormwater Detention and Infiltration Design Data Sheet





East Pond Spillway

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.33300	ft/ft	
Discharge	35.93	ft³/s	(DP 4 Q_{100})

Section Definitions

Station (ft)	Elevation (ft)
1+00	76.65
1+10	75.50
4+59	75.50
4+64	76.65

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(1+00, 76.65)	(4+59, 75.50)	0.040
(4+59, 75.50)	(4+64, 76.65)	0.040

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth		0.04	ft
Elevation Range	75.50 to 76.65 ft		
Flow Area		14.21	ft²
Wetted Perimeter		349.57	ft
Hydraulic Radius		0.04	ft
Top Width		349.57	ft
Normal Depth		0.04	ft
Critical Depth		0.07	ft

East Pond Spillway

Results

Critical Slope		0.05685	ft/ft
Velocity		2.53	ft/s (non-erosive)
Velocity Head		0.10	ft
Specific Energy		0.14	ft
Froude Number		2.21	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.04	ft
Critical Depth	0.07	ft
Channel Slope	0.33300	ft/ft
Critical Slope	0.05685	ft/ft

Design Procedure Form: Sand Filter (SF)

UD-BMP (Version 3.07, March 2018) **Sheet 1 of 2**

Designer: Jay M. Newell, PE
Company: Sterling Design Associates, llc
Date: April 11, 2023
Project: Space Village Fil No. 4 - West Pond
Location: El Paso County, CO

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a (100% if all paved and roofed areas upstream of sand filter): I_a = 68.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a/100$): i = 0.680

C) Water Quality Capture Volume (WQCV) Based on 12-hour Drain Time
$WQCV = 0.8 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i)$: WQCV = 0.21 watershed inches

D) Contributing Watershed Area (including sand filter area): Area = 476,810 sq ft

E) Water Quality Capture Volume (WQCV) Design Volume
$V_{WQCV} = WQCV / 12 * Area$: V_{WQCV} = 8,464 cu ft

F) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm: d_6 = in

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume: $V_{WQCV\ OTHER}$ = cu ft

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

2. Basin Geometry

A) WQCV Depth: D_{WQCV} = 0.47 ft

B) Sand Filter Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred). Use "0" if sand filter has vertical walls.: Z = 3.00 ft / ft

C) Minimum Filter Area (Flat Surface Area): A_{Min} = 4053 sq ft

D) Actual Filter Area: A_{Actual} = 17952 sq ft

E) Volume Provided: V_T = 8464 cu ft

3. Filter Material

Choose One
- ○ 18" CDOT Class B or C Filter Material
- ◉ Other (Explain):

Native Soil - Blakeland loamy sand, 1 to 9 percent slopes (8)
Hydrologic Soil Group Rating A

4. Underdrain System

A) Are underdrains provided?

Choose One
- ○ YES
- ◉ NO

B) Underdrain system orifice diameter for 12 hour drain time

i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice: y = N/A ft

ii) Volume to Drain in 12 Hours: Vol_{12} = N/A cu ft

iii) Orifice Diameter, 3/8" Minimum: D_O = N/A in

Design Procedure Form: Sand Filter (SF)

Designer: Jay M. Newell, PE
Company: Sterling Design Associates, llc
Date: April 11, 2023
Project: Space Village Fil No. 4 - West Pond
Location: El Paso County, CO

5. Impermeable Geomembrane Liner and Geotextile Separator Fabric A) Is an impermeable liner provided due to proximity of structures or groundwater contamination?	Choose One: ○ YES ◉ NO
6. Inlet / Outlet Works A) Describe the type of energy dissipation at inlet points and means of conveying flows in excess of the WQCV through the outlet	n/a

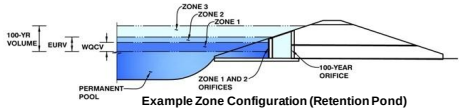
Notes: Sheet flow discharge into facility therefore no energy dissipation required. Full infiltration of detained volumes therefore no conveyance of flows in excess of the WQCV through an outlet.

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: Space Village Fil. 4 - West Pond

Basin ID:



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	SF	
Watershed Area =	10.95	acres
Watershed Length =	750	ft
Watershed Length to Centroid =	375	ft
Watershed Slope =	0.026	ft/ft
Watershed Imperviousness =	68.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	12.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.194	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	0.936	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.652	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.853	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.014	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	1.219	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.420	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.663	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.14 in.) =	2.194	acre-feet	inches
Approximate 2-yr Detention Volume =	0.610	acre-feet	
Approximate 5-yr Detention Volume =	0.797	acre-feet	
Approximate 10-yr Detention Volume =	0.958	acre-feet	
Approximate 25-yr Detention Volume =	1.150	acre-feet	
Approximate 50-yr Detention Volume =	1.264	acre-feet	
Approximate 100-yr Detention Volume =	1.380	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.194	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.741	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	0.542	acre-feet
Total Detention Basin Volume =	1.478	acre-feet
Initial Surcharge Volume (ISV) =	N/A	ft^3
Initial Surcharge Depth (ISD) =	N/A	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	N/A	ft
Slope of Trickle Channel (S_{TC}) =	N/A	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio (R_{LW}) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Media Surface	--	0.00	--	--	--	16,337	0.375		
	--	1.00	--	--	--	19,880	0.456	18,108	0.416
	--	2.00	--	--	--	23,503	0.540	39,800	0.914
	--	3.00	--	--	--	27,208	0.625	65,155	1.496

Stormwater Detention and Infiltration Design Data Sheet

SDI-Design Data v2.00, Released January 2020

Stormwater Facility Name: West Pond

Facility Location & Jurisdiction: Lot1, Block 1, Space Village Filing No. 4, El Paso County, CO

User Input: Watershed Characteristics

Sand Filter (SF)	SF	
Watershed Area =	10.95	acres
Watershed Length =	750	ft
Watershed Length to Centroid =	375	ft
Watershed Slope =	0.026	ft/ft
Watershed Imperviousness =	68.0%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	12.0	hours

Location for 1-hr Rainfall Depths (use dropdown):

User Input

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Once CUHP has been run and the Stage-Area-Discharge information has been provided, click 'Process Data' to interpolate the Stage-Area-Volume-Discharge data and generate summary results in the table below. Once this is complete, click 'Print to PDF'.

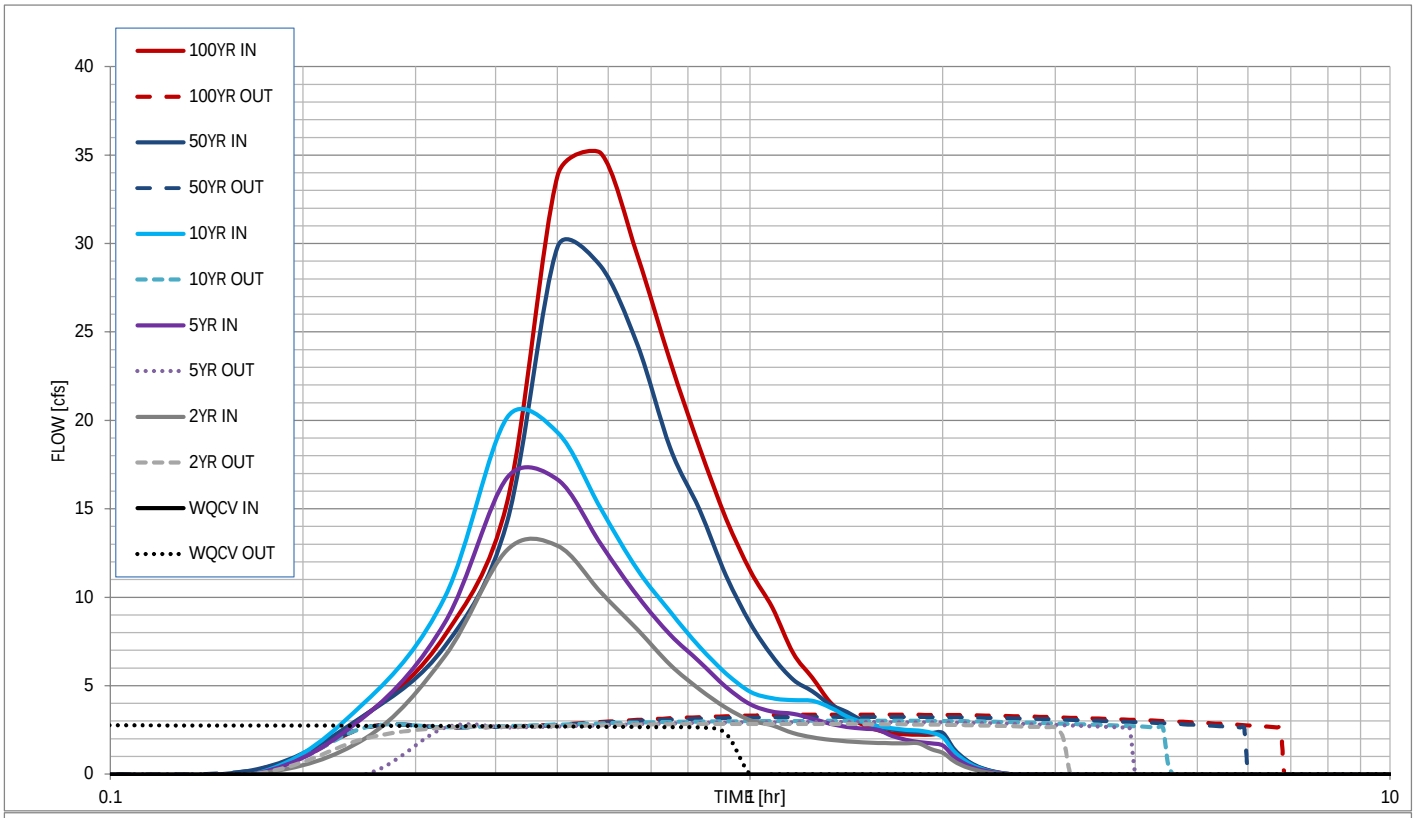
After completing and printing this worksheet to a pdf, go to:
https://maperture.digitaldataservices.com/gvh/?viewer=cswdif
Create a new stormwater facility, and attach the PDF of this worksheet to that record.

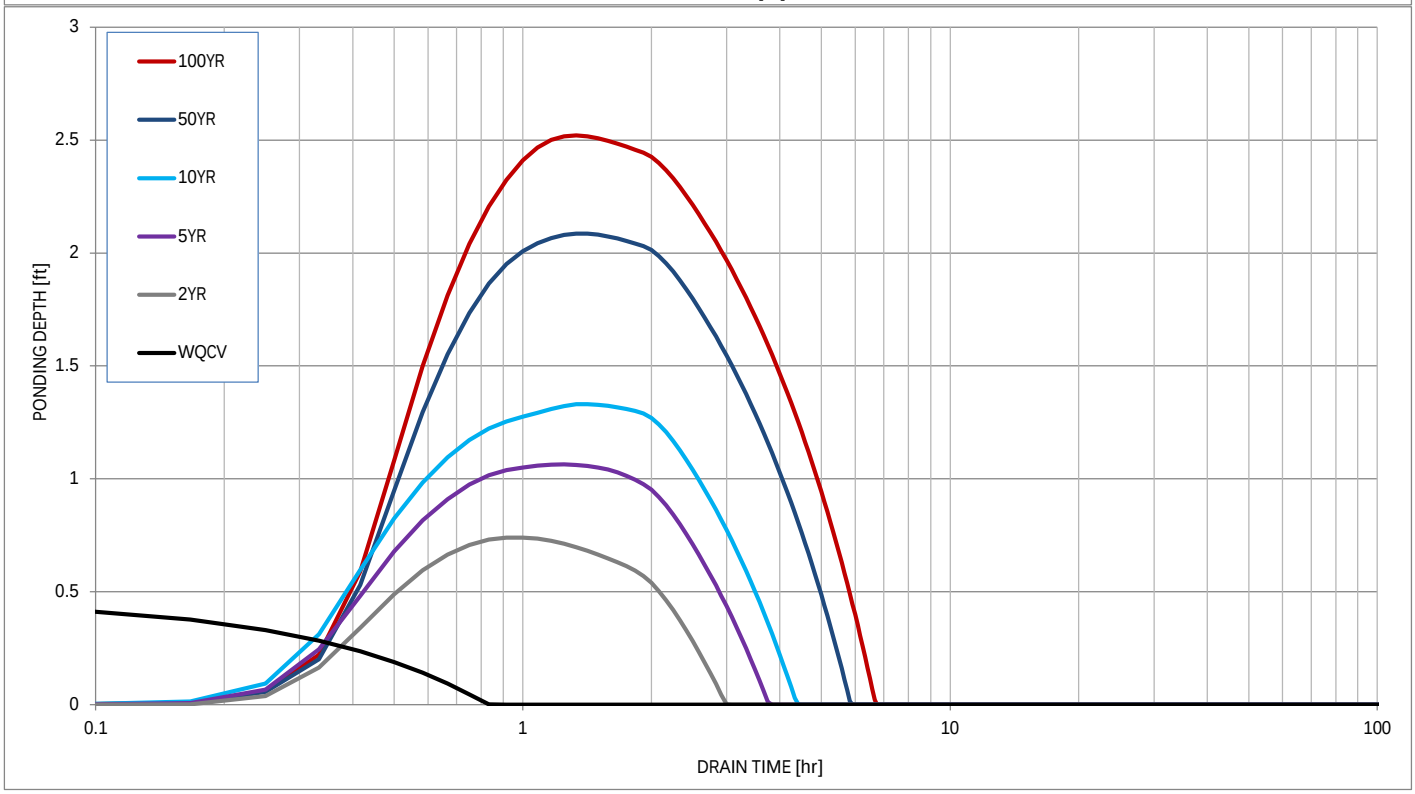
User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	16,337	0.00	2.63
1.00	19,880	1.00	2.93
2.00	23,503	2.00	3.22
3.00	27,208	3.00	3.52

Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	N/A	1.19	1.50	1.75	2.25	2.52	in
CUHP Runoff Volume =	0.194	0.652	0.853	1.014	1.420	1.663	acre-ft
Inflow Hydrograph Volume =	N/A	0.652	0.853	1.014	1.420	1.663	acre-ft
Time to Drain 97% of Inflow Volume =	0.8	2.9	3.7	4.3	5.7	6.5	hours
Time to Drain 99% of Inflow Volume =	0.8	3.0	3.8	4.4	5.8	6.7	hours
Maximum Ponding Depth =	0.49	0.74	1.06	1.33	2.09	2.52	ft
Maximum Ponded Area =	0.42	0.44	0.46	0.48	0.55	0.58	acres
Maximum Volume Stored =	0.195	0.299	0.444	0.570	0.960	1.205	acre-ft

Stormwater Detention and Infiltration Design Data Sheet





West Pond Spillway

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.25000	ft/ft	
Discharge	38.30	ft³/s	(DP 9 Q_{100})

Section Definitions

Station (ft)	Elevation (ft)
1+00	73.10
1+12	72.00
5+90	72.00
6+32	73.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(1+00, 73.10)	(5+90, 72.00)	0.040
(5+90, 72.00)	(6+32, 73.10)	0.040

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth		0.04	ft
Elevation Range	72.00 to 73.10 ft		
Flow Area		18.13	ft²
Wetted Perimeter		479.77	ft
Hydraulic Radius		0.04	ft
Top Width		479.77	ft
Normal Depth		0.04	ft
Critical Depth		0.06	ft

West Pond Spillway

Results

Critical Slope		0.06015	ft/ft
Velocity		2.11	ft/s (non-erosive)
Velocity Head		0.07	ft
Specific Energy		0.11	ft
Froude Number		1.92	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.04	ft
Critical Depth	0.06	ft
Channel Slope	0.25000	ft/ft
Critical Slope	0.06015	ft/ft

STERLING
DESIGN ASSOCIATES
Civil Engineers | Landscape Architects

Detention Pond Calculations

Job Name: Space Village Filing No. 4

Date: 4/13/23

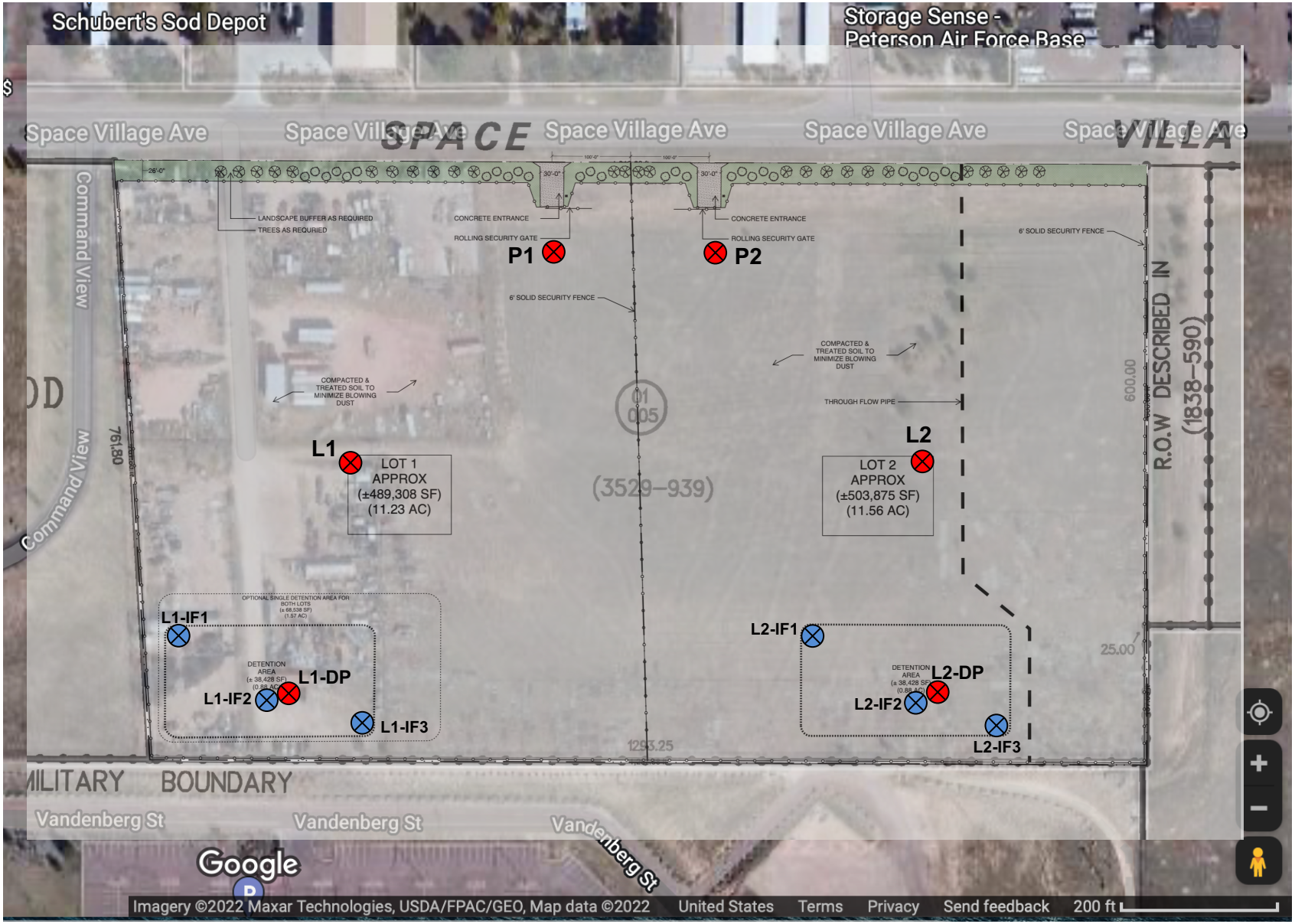
By: JMN

WATER SURFACE ELEVATIONS (EAST POND)

Event	Req'd Volume (cf)	(acft)	Water Surface Elevation
WQCV	7,547	0.173	73.00
EURV	36,503	0.838	
100-year	53,535	1.229	75.28
Total Req'd	57,281	1.315	75.43
Total Prov.	58,970	1.354	75.50
Excess	1,689	0.039	75.50

WATER SURFACE ELEVATIONS (WEST POND)

Event	Req'd Volume (cf)	(acft)	Water Surface Elevation
WQCV	8,464	0.194	69.47
EURV	40,772	0.936	
100-year	60,113	1.380	71.80
Total Req'd	64,382	1.478	71.97
Total Prov.	65,155	1.496	72.00
Excess	773	0.018	72.00



APPROXIMATE BORING LOCATIONS

APPROXIMATE INFILTRATION TEST HOLE LOCATIONS

FIGURE 1 - BORING LOCATION DIAGRAM
PROPOSED STORAGE YARDS
0 SPACE VILLAGE AVENUE
EL PASO COUNTY, COLORADO
CGG PROJECT NO. 22.22.155

Cole Garner Geotechnical
1070 W. 124th Ave., Suite 300
Westminster, CO 80234
(303) 996-2999

Cole Garner Geotechnical
1070 West 124th Avenue, Ste. 300
Westminster, CO 80234
(303) 996-2999

Field Infiltration Rate Test No. L1-IF1

Project Name:	0 Space Village Ave	Date:	8/8/2022
Cole Garner Project No.:	22.22.155	Hole diameter (in):	6
Eng./Tech.:	T.M.C.	Approx. Test Depth (in):	60

Interval Start Time (hh:mm)	Interval End Time (hh:mm)	Length of Interval (min)	Water Level Drop (in)	Infiltration Rate During Interval (min/in)	Infiltration Rate During Interval (in/hr)
16:50	17:05	15	2 13/16	5.33	11.25
17:05	17:20	15	2 1/4	6.67	9.00
17:20	17:35	15	2	7.50	8.00
17:35	17:50	15	1 3/8	10.91	5.50
17:50	18:05	15	7/8	17.14	3.50
18:05	18:20	15	5/8	24.00	2.50
18:20	18:35	15	11/16	21.82	2.75
18:35	18:50	15	5/8	24.00	2.50

REMARKS: Modified infiltrometer test (cased borehole; 4-inch solid pipe) performed in the silty sand soils at a depth of about 5 feet below existing site grade.

Final Infiltration Rate:	**2.50**
Average Infiltration Rate:	**7.45**

Cole Garner Geotechnical
1070 West 124th Avenue, Ste. 300
Westminster, CO 80234
(303) 996-2999

Field Infiltration Rate Test No. L1-IF2

Project Name:	0 Space Village Ave	Date:	8/8/2022
Cole Garner Project No.:	22.22.155	Hole diameter (in):	6
Eng./Tech.:	T.M.C.	Approx. Test Depth (in):	60

Interval Start Time (hh:mm)	Interval End Time (hh:mm)	Length of Interval (min)	Water Level Drop (in)	Infiltration Rate During Interval (min/in)	Infiltration Rate During Interval (in/hr)
16:50	17:05	15	2 1/8	7.06	8.50
17:05	17:20	15	2	7.50	8.00
17:20	17:35	15	2 5/16	6.49	9.25
17:35	17:50	15	1 3/4	8.57	7.00
17:50	18:05	15	1 1/2	10.00	6.00
18:05	18:20	15	1 1/4	12.00	5.00
18:20	18:35	15	1 3/8	10.91	5.50
18:35	18:50	15	1 1/8	13.33	4.50

REMARKS: Modified infiltrometer test (cased borehole; 4-inch solid pipe) performed in the silty sand soils at a depth of about 5 feet below existing site grade.

Final Infiltration Rate:	**4.50**
Average Infiltration Rate:	**7.75**

Cole Garner Geotechnical
1070 West 124th Avenue, Ste. 300
Westminster, CO 80234
(303) 996-2999

Field Infiltration Rate Test No. L1-IF3

Project Name:	0 Space Village Ave	Date:	8/8/2022
Cole Garner Project No.:	22.22.155	Hole diameter (in):	6
Eng./Tech.:	T.M.C.	Approx. Test Depth (in):	60

Interval Start Time (hh:mm)	Interval End Time (hh:mm)	Length of Interval (min)	Water Level Drop (in)	Infiltration Rate During Interval (min/in)	Infiltration Rate During Interval (in/hr)
16:50	17:05	15	6 11/16	2.24	26.75
17:05	17:20	15	5 11/16	2.64	22.75
17:20	17:35	15	5 5/16	2.82	21.25
17:35	17:50	15	4 3/16	3.58	16.75
17:50	18:05	15	3	5.00	12.00
18:05	18:20	15	3 11/16	4.07	14.75
18:20	18:35	15	1 3/8	10.91	5.50
18:35	18:50	15	2 3/8	6.32	9.50

REMARKS: Modified infiltrometer test (cased borehole; 4-inch solid pipe) performed in the silty sand soils at a depth of about 5 feet below existing site grade.

Final Infiltration Rate:	**9.50**
Average Infiltration Rate:	**19.90**

Cole Garner Geotechnical
1070 West 124th Avenue, Ste. 300
Westminster, CO 80234
(303) 996-2999

Field Infiltration Rate Test No. L2-IF1

Project Name:	0 Space Village Ave	Date:	8/8/2022
Cole Garner Project No.:	22.22.155	Hole diameter (in):	6
Eng./Tech.:	T.M.C.	Approx. Test Depth (in):	60

Interval Start Time (hh:mm)	Interval End Time (hh:mm)	Length of Interval (min)	Water Level Drop (in)	Infiltration Rate During Interval (min/in)	Infiltration Rate During Interval (in/hr)
16:50	17:05	15	2 3/8	6.32	9.50
17:05	17:20	15	1 15/16	7.74	7.75
17:20	17:35	15	2	7.50	8.00
17:35	17:50	15	1 15/16	7.74	7.75
17:50	18:05	15	1 13/16	8.28	7.25
18:05	18:20	15	1 3/8	10.91	5.50
18:20	18:35	15	1 7/16	10.43	5.75
18:35	18:50	15	1 1/2	10.00	6.00

REMARKS: Modified infiltrometer test (cased borehole; 4-inch solid pipe) performed in the silty sand soils at a depth of about 5 feet below existing site grade.

Final Infiltration Rate:	**6.00**
Average Infiltration Rate:	**8.05**

Cole Garner Geotechnical
1070 West 124th Avenue, Ste. 300
Westminster, CO 80234
(303) 996-2999

Field Infiltration Rate Test No. L2-IF2

Project Name:	0 Space Village Ave	Date:	8/8/2022
Cole Garner Project No.:	22.22.155	Hole diameter (in):	6
Eng./Tech.:	T.M.C.	Approx. Test Depth (in):	60

Interval Start Time (hh:mm)	Interval End Time (hh:mm)	Length of Interval (min)	Water Level Drop (in)	Infiltration Rate During Interval (min/in)	Infiltration Rate During Interval (in/hr)
16:50	17:05	15	1 1/4	12.00	5.00
17:05	17:20	15	7/8	17.14	3.50
17:20	17:35	15	1	15.00	4.00
17:35	17:50	15	1	15.00	4.00
17:50	18:05	15	7/8	17.14	3.50
18:05	18:20	15	3/4	20.00	3.00
18:20	18:35	15	3/4	20.00	3.00
18:35	18:50	15	3/4	20.00	3.00

REMARKS: Modified infiltrometer test (cased borehole; 4-inch solid pipe) performed in the silty sand soils at a depth of about 5 feet below existing site grade.

Final Infiltration Rate:	**3.00**
Average Infiltration Rate:	**4.00**

Cole Garner Geotechnical
1070 West 124th Avenue, Ste. 300
Westminster, CO 80234
(303) 996-2999

Field Infiltration Rate Test No. L2-IF3

Project Name:	0 Space Village Ave	Date:	8/8/2022
Cole Garner Project No.:	22.22.155	Hole diameter (in):	6
Eng./Tech.:	T.M.C.	Approx. Test Depth (in):	60

Interval Start Time (hh:mm)	Interval End Time (hh:mm)	Length of Interval (min)	Water Level Drop (in)	Infiltration Rate During Interval (min/in)	Infiltration Rate During Interval (in/hr)
16:50	17:05	15	2 5/8	5.71	10.50
17:05	17:20	15	1 5/8	9.23	6.50
17:20	17:35	15	1 3/4	8.57	7.00
17:35	17:50	15	15/16	16.00	3.75
17:50	18:05	15	15/16	16.00	3.75
18:05	18:20	15	9/16	26.67	2.25
18:20	18:35	15	13/16	18.46	3.25
18:35	18:50	15	9/16	26.67	2.25

REMARKS: Modified infiltrometer test (cased borehole; 4-inch solid pipe) performed in the silty sand soils at a depth of about 5 feet below existing site grade.

Final Infiltration Rate:	**2.25**
Average Infiltration Rate:	**6.30**

APPENDIX C

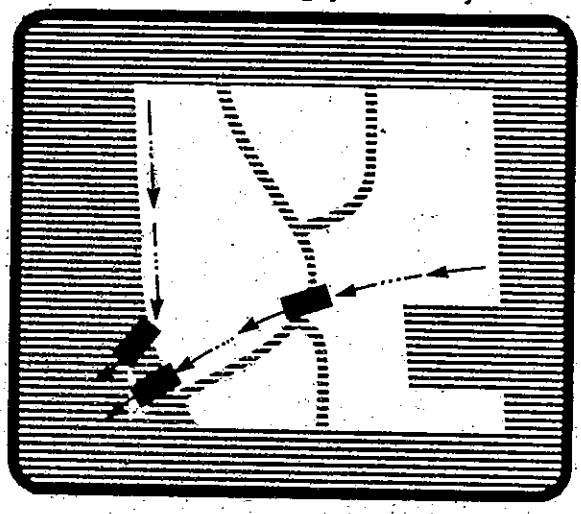
- Excerpts of Existing Reports and Documents
  - Peterson Field Drainage Basin Master Plan Update
  - Preliminary Drainage Report for First Wing Development
  - ALTA/NSPS Land Title Survey
  - Colorado Springs Utilities Public Utility Map
  - Cherokee Metropolitan District Map

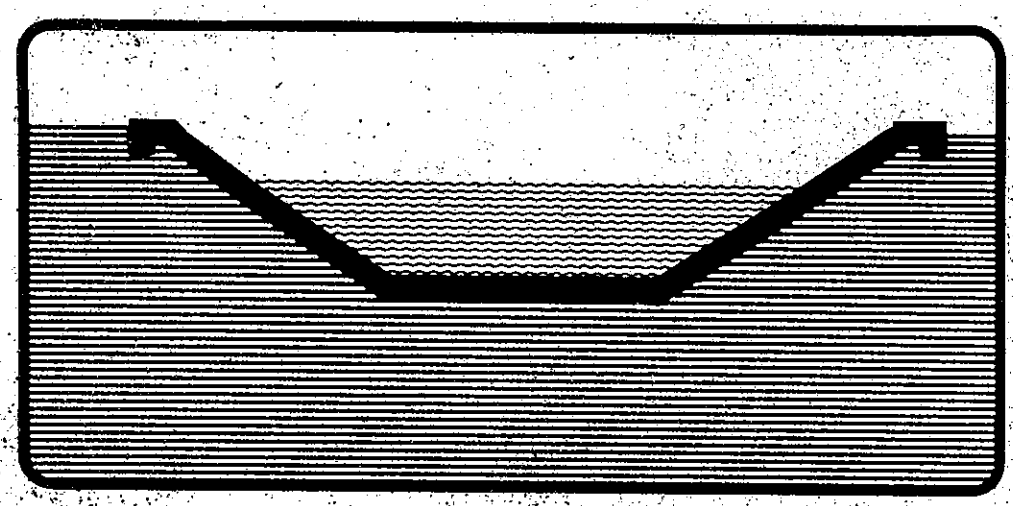
Return to
Ford Dev.
105. W Costilla
C.S. Colorado
578-6564

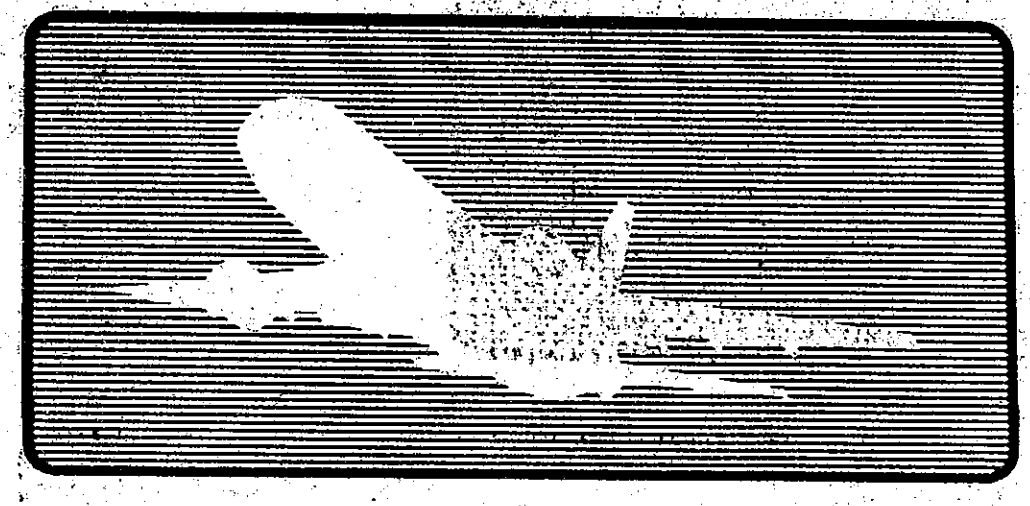
Peterson Field Drainage Basin Master Plan Update

City of Colorado Springs, Co.

August 1984







URS

Approved by City Council
December 11, 1984

PETERSON FIELD DRAINAGE MASTER PLAN
COLORADO SPRINGS, COLORADO
SEPTEMBER 28, 1984

PREPARED BY:

URS/NES 911 South 8th Street
Colorado Springs, Colorado 80906
(303) 471-0073

C E R T I F I C A T I O N

I, Stephen C. Behrens, a Registered Engineer in the State of Colorado, hereby certify that the attached Drainage Study for the Peterson Field Drainage Basin was prepared under my direction and supervision and is correct to the best of my knowledge and belief. I further certify that said Drainage Study is in accordance with all City of Colorado Springs Ordinances, Specifications, and Criteria.

Stephen C. Behrens

Stephen C. Behrens, P.E.

A P P R O V A L

The City of Colorado Springs City Council and Department of Public Works do hereby approve the contents of the attached Peterson Field Drainage Study. The Study shall be used as a guide for development of all drainage facilities within the study area.

Department of Public Works
(SEE ALSO ATTACHED MINUTES
OF THE CITY OF COLORADO
SPRINGS DRAINAGE BOARD)

(SEE ATTACHED RESOLUTION)
City Council

Haynes
Raider
Hauck

CITY OF COLORADO SPRINGS

December 13, 1984

TO: Bob Gordon
DeWitt Miller
Jim Phillips
Jim Ringe
Larry Schenk
Chief Smith
Chief Stratton
Jim Wilson
Jim Colvin
Bob Parker
Johnnie Rogers
Larry Allison
Sterling Campbell
Ann Altier
Pauline Knopp
Bud Owsley
Dick Zickefoose
Bob Wilder
Jim Alice Scott
Rolf Philipsen
Dave Nickerson

FROM: City Manager

SUBJECT: Council Actions of December 11, 1984

At its regular meeting of December 11, 1984, City Council took the following actions with regard to contracts, agreements, ordinances and other fiscal matters.

PARK AND RECREATION

1) Approved a resolution accepting gifts to the Park and Recreation Department and expressing gratitude to the donors for their generous gifts.

2) Approved 1985 Budgeted and approved annual Contracts for the Park and Recreation Department sundry services.

UTILITIES (Cont'd.)

10) Tabled until the first meeting in January a request for water and wastewater service to Lots 1 - 6, Block 2 and Lot 23, Park Vista Addition by John R. Manus on behalf of Jon R. Staples.

PUBLIC WORKS

1) Tabled approval of Dry Creek Drainage Basin Master Study and establishment of a new drainage fee for the Dry Creek Drainage Basin equal to $6,364.00 per acre.

2) Approved Peterson Field Drainage Basin Master Plan Update and establishment of a new drainage fee in the amount of $3,612.00 per acre for a new bridge fee in the amount of $209.00 per acre.

3) See Park and Recreation No. 4.

4) Approved award of contract in the amount of $2,353,974.00 to Schmidt-Tiago Construction Company for 1985 asphaltic materials, with permission to extend the contract amount to the budgeted amount of $2,505,000.00.

5) See Utilities No. 10.

6) Authorized the proper City officials to enter into contracts with MRC and the Health Association of the Pikes Peak Region for transportation of the handicapped for 1985.

7) See Attorney No. 1 and 2.

8) Approved expenditure of $90,000.00 from Projects to be Determined Fund for engineering services for Centennial Boulevard - Fillmore to Fontanero.

POLICE

1) Approved Ordinance No. 84-310 on second reading amending the Code of the City of Colorado Springs 1980, as amended, relating to contributions to the Police and Fire Pension Funds.

2) Approved request by Silver Key Senior Services of donating the van frequently used by Silver Key as an extension of its contract for services.

CITY OF COLORADO SPRINGS
The "America the Beautiful" City
DEPARTMENT OF PUBLIC WORKS CITY ENGINEERING DIVISION (303) 578-6606
30 S. NEVADA SUITE 403 P.O. BOX 1575
COLORADO SPRINGS, COLORADO 80901

M I N U T E S

COLORADO SPRINGS/EL PASO COUNTY DRAINAGE BOARD

of November 15, 1984

The Colorado Springs/El Paso County Drainage Board met at 2:00 P.M. on Thursday, November 15, 1984 in the City Council Chambers, City Administration Building, 30 S. Nevada Avenue.

Members Present	Members Absent	Others Present
William Weber, Chairman	Rick Brown	DeWitt Miller, Dir Public Works
Leigh Whitehead	Fred Gibson	Gary Haynes, City Engineer
Richard Dailey		Jack Smith, Asst City Attorney
George Jury		Chris Smith, Subdivision Admin
Mike Mallon		Ken Jorgensen
		Roger Sams
		Laurence Schenk
		Others

The meeting was called to order at 2:00 P.M.

Item 1

Approval of the minutes of the October 18, 1984 Board Meeting. (The minutes were previously mailed.) The motion to accept the minutes was made by Mr. Jury. Mr. Whitehead seconded the motion and the motion was passed with a unanimous vote.

Items 2, 3 and 4

Items 2, 3 and 4 were acted upon by the Board with one motion. The items were treated as Consent Items.

A motion was made by Mr. Jury to accept the City Engineer's recommendations on Items 2, 3 and 4 (see Drainage Board Agenda, November 15th). The motion was seconded by Mr. Dailey. The motion passed with a unanimous vote.

Item 5

Request for credits for construction of drainage facilities within the Spring Creek Drainage Basin, Greystone Subdivision, Fountain and Academy Associates, Developer.

After review of the item by the City Engineer, the Board heard a motion by Mr. Whitehead to approve the staff's recommendation (see Drainage Board Agenda, November 15th). Mr. Mallon seconded the motion. The vote was unanimous in favor of the motion.

Item 6

Request for cash reimbursement for construction of drainage facilities within the Cottonwood Creek Drainage Basin, Dublin Business Park Subdivision Filing No. 1, Gibralter Development Corporation, Developer.

The item was reviewed by the City Engineer. The Board heard a motion by Mr. Dailey to accept the staff's recommendation (see Drainage Board Agenda, November 15th). The motion received a second by Mr. Whitehead. The motion passed with a unanimous vote.

Item 7

Establishment of drainage and bridge fees for the Peterson Field Drainage Basin.

The City Engineer presented the Board with the revised proposed basin fees. The proposed fee included the Basin Fund Balance as of September 1984, as well as the basin deficit per the Board's motion of October 18, 1984 (see Drainage Board Agenda, November 15th).

Mr. Miller stated that it was his opinion that the Board should rescind their previous action of the October 18, 1984 meeting. The Board was in agreement and heard a motion by Mr. Whitehead to rescind the Board action of October 18, 1984. The motion was seconded by Mr. Dailey. The vote was unanimous in favor of the motion.

During discussion of this item, Mr. Jury stated that he was in opposition to the new fee. Mr. Jury expressed concern that the new fee would have a negative impact on the potential for development of the unplatted acreage in the basin.

Mr. Whitehead also expressed Mr. Jury's concern but felt that the new fees established in conjunction with a basin restudy must address fund deficits to make the basin fund balance out at build out.

The Board heard a motion by Mr. Whitehead to approve the staff's recommendation that a drainage fee of $3,612.00 per acre and a bridge fee of $209.00 per acre be established for the Peterson Field Basin. The motion was seconded by Mr. Dailey. The vote was 4 - 1 in favor of the motion with Mr. Jury voting in opposition to the motion.

Item 8

Request by City Engineer to revise the cash reimbursement for construction of drainage facilities for Columbine Indust-Rail Center, Miscellaneous Drainage Basin, Columbine Industrail Development, Mr. Kenneth B. Jorgensen, Developer.

Mr. Whitehead excused himself for this item.

URS
AN INTERNATIONAL PROFESSIONAL SERVICES ORGANIZATIC

URS COMPANY
3955 EAST EXPOSITION AVENUE
DENVER, COLORADO 80209
TEL: (303) 744-1861

ANCHORAGE
ARLINGTON
ATLANTA
BUFFALO
CLEVELAND
COLOMBIA
COLORADO SPRINGS
DALLAS
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LAS VEGAS
MONTVALE
NEW ORLEANS
NEW YORK
PARIS
SALT LAKE CITY
SAN BERNARDINO
SAN FRANCISCO
SAN MATEO
SANTA BARBARA
SANTA FE
SEATTLE
TAMPA
WASHINGTON, D.C.

October 10, 1984

Mr. Gary Haynes, City Engineer
City of Colorado Springs, Colorado
30 South Nevada, Suite 402
P.O. Box 1575
Colorado Springs, Colorado 80901

Re: Peterson Field Drainage Basin
Master Plan Update

Dear Mr. Haynes:

As you are aware, URS has been retained by the Crestone Development Corporation of Colorado Springs to prepare update recommendations to the 1976 Peterson Field Drainage Masterplan to reflect existing and planned changes which have developed over the last several years.

On August 23, 1984 URS met with the Airport Advisory Commission and received the Commission's approval to abandon the 1976 masterplanned storm water detention area proposed immediately east of planned Powers Boulevard. The Commission's approval was granted based on the following information:

a) The existing two large storm water detention ponds within Peterson Field reduce the future fully developed peak 100-year storm runoff west of Powers Boulevard to a level below that proposed in the 1976 Masterplan.

b) The masterplanned storm drainage facilities identified in the 1984 update are adequate to convey future fully developed 100-year peak flood flows without having to provide additional storm water detention within Peterson Field proper.

c) Airport operators are solely responsible for the construction of any and all drainage storm drainage improvements required within Peterson Field proper.

The report includes a basin description, hydrology, hydraulics, design criteria, and a cost estimate for the remaining improvements for the basin. The report utilizes information obtained from previous studies for the Peterson Field drainage basin. A map has been prepared as a Master Drainage Plan showing existing and proposed improvements for the basin.

The study has been prepared as a Master Plan guide for coordinated drainage facility construction as development occurs in the study area. The recommended improvements are often general in nature as to size and location. The intent of the preliminary facility design has been to include enough construction costs in the basin fee to insure a fund for reimbursement that will theoretically "zero out" after all facilities are in place. The recommendations included herein should therefore be used as a guide in planning future development in Peterson Field Drainage Basin.

Very truly yours,

URS COMPANY

Stephen C. Behrens

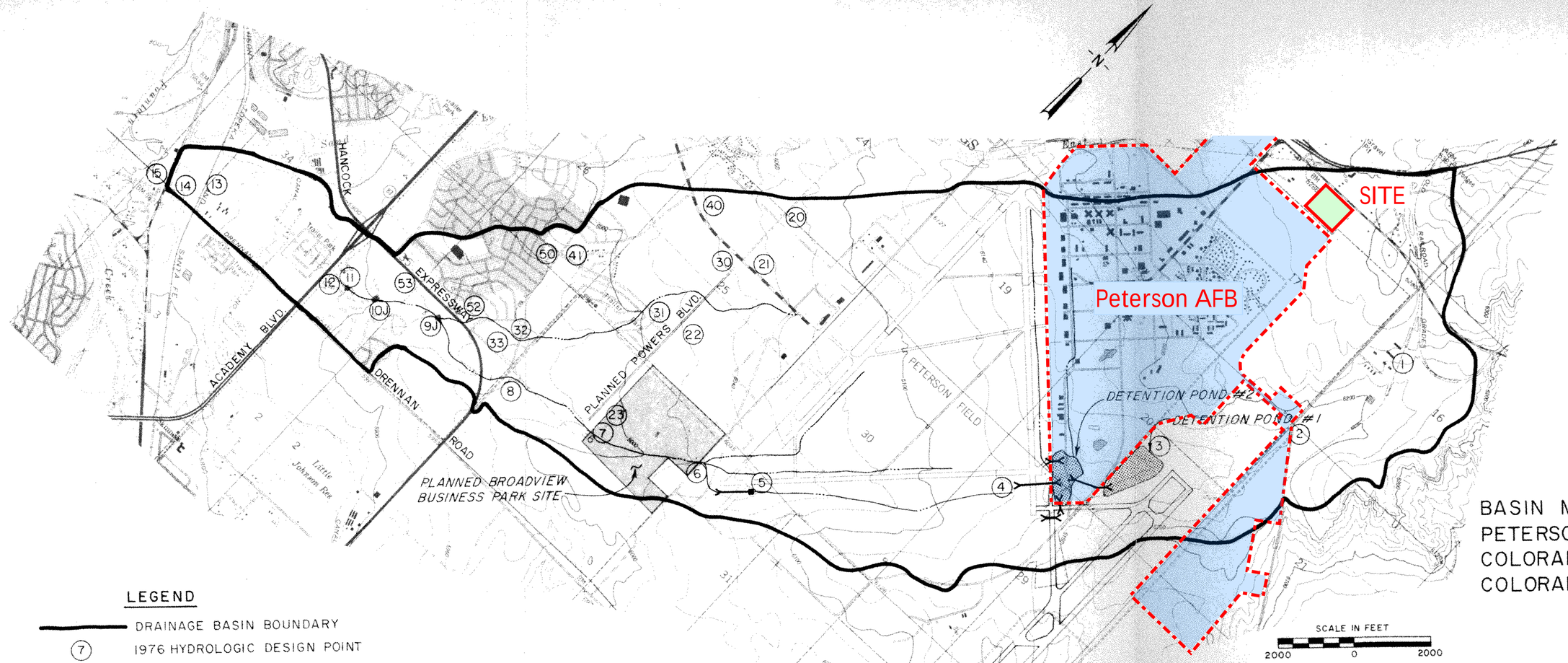
Stephen C. Behrens, P.E.
Vice President

SCB/pk

2. BASIN DESCRIPTION

The Project Study Area encompasses that portion of Peterson Field Drainage Basin located east of planned Powers Boulevard as shown on Figure 1. Features of interest within the Study Area include planned Powers Boulevard, planned Hancock Expressway, Fountain Boulevard, Peterson Field, Colorado Highway 94, and U.S. Highway 24. The central portion of the Study Area is within the City of Colorado Springs, Colorado. The eastern and western portions of the Study Area are within unincorporated El Paso County.

Peterson Field Basin outfalls to Sand Creek which in turn outfalls to Fountain Creek. Sand Creek Basin is a major drainage planning basin located north of the Peterson Field Basin. Chandelle and Windmill Gulch basins are major drainageway planning basins located south of the Peterson Field Basin. Peterson Field Basin encompasses a total of approximately 8.6 square miles above Fountain Creek of which the Project Study Area encompasses a total of approximately 7.2 square miles. Peterson Field proper occupies approximately 3.9 square miles of the Project Study Area. Peterson Field Basin has a total length of approximately nine miles of which approximately six miles are within the Project Study Area. Elevations within



BASIN MAP
PETERSON FIELD BASIN
COLORADO SPRINGS,
COLORADO

BROADVIEW BUSINESS PARK FILING NO. 1

FIGURE 1

Peterson Field Basin are approximately 5750 at Fountain Creek, 5990 at planned Powers Boulevard, and 6440 at the upper end of the Basin.

Basin soil and land use characteristics directly affect the relationship between rainfall and runoff within a basin. The U.S. Soil Conservation Service classifies soils into four hydrologic groups (A, B, C and D) according to a soil's runoff potential. Group A soils exhibit high infiltration rates when thoroughly wetted and are considered to have low runoff potential. Group B soils exhibit moderate infiltration rates when thoroughly wetted. Group C soils exhibit slow infiltration rates when throughly wetted. Group D soils exhibit very slow infiltration rates when throughly wetted and are considered to have high runoff potential.

Soil types within the Peterson Field Basin are listed in Table 1 and delineated in Figure 2. The Peterson Field Basin encompasses approximately 2.5 square miles of group 'B' hydrologic soils and the remainder are group 'A' soils. Most of the soils in the Peterson Field Basin have a high infiltration rate, are excessively drained, and are easily erodible. Reservoir embankments, dikes and levees constructed of Peterson Field Basin soils may be subject to piping and seepage. Water storage reservoirs constructed in Peterson Field Basin soils may experience

excessive seepage. Group 'A' hydrologic soils in the Peterson Field Basin are expected to have relatively low potential for frost action. Group 'B' hydrologic soils in the Peterson Field Basin are expected to have moderate potential for frost action.

7. MASTER PLAN RECOMMENDATIONS

Elements of the recommended drainage Master Plan are shown on the attached drawing and are listed in Table 4.

Peterson Field storm water detention ponds #1 and #2 have approximately twice the storage capacity of the detention ponds recommended in the 1976 Master Drainage Report. These existing detention ponds result in future fully developed peak flood flow less than or equal to the peak flood flows estimated in the 1976 Basin Master Drainage Report. The existing major drainageway improvements between the basin outfall and the west side of Hancock Expressway are adequate to convey presently anticipated future fully developed design flood flows.

Concrete channels are recommended to provide durable improvements which minimize the area within the basin committed to drainage improvements. These channels were sized based on a maximum allowable average flow velocity of twenty feet per second with freeboard of at least 25 percent of design depth of flow. Drop structures will probably be required in most master planned channels to limit average flow velocities to twenty feet per second. The location and height of these drop structures are to be determined during final design.

Required secondary drainage improvements within Peterson Field proper are presented in the 1973 Peterson Field Drainage Report prepared by R. Keith Hook and Associates. Construction of drainage facilities within Peterson Field proper is the sole responsibility of the Airport.

Drainage facilities should be provided along the west side of Peterson Field to intercept and convey storm runoff to the main stem. These drainage improvements are the sole responsibility of the Airport.

The proposed secondary channel along the east side of planned Powers Boulevard is to be constructed within the 210 foot wide roadway right-of-way.

Storm runoff intercepted by the proposed channel along the east side of planned Powers Boulevard should join the main stem west of planned Powers Boulevard; that is separate crossing should be provided under planned Powers Boulevard for storm runoff intercepted along the east side of Powers Boulevard due to the uncertainties and possible adverse effects of combining high velocity flows of the same order of magnitude of near right angles.

Guardrail is recommended along planned Powers Boulevard and Hancock Expressway in conjunction with the planned major and secondary channels along these roadways.

Maintenance access to all drainage facilities is required. A 12 foot wide maintenance access road is required along all channels unless located adjacent to and parallel to roadways. Planned channels along Hancock Expressway (extended) and planned Powers Boulevard do not require a 12 foot maintenance access road as they can be accessed from the adjacent roadways.

Because all of the concrete lined channels proposed herein are supercritical, planned roadway crossing should be carefully designed to assure that backwater associated with such a constriction does not result in upstream flow depths greater than critical depth which would result in a hydraulic jump.

A storm water detention facility is <u>not required within the planned Broadview Business Park Site</u> because the existing Peterson Field storm water detention ponds #1 and #2 have twice the storage capacity of the master planned storm water detention ponds recommended in the 1976 report. Our analysis indicates that the 100-year future fully developed peak flood flow on the east side of Powers Boulevard (given the existing Peterson Field storm water detention ponds #1 and #2) (2615 cfs) is less than the 1976 master planned 100-year peak flow rate (3590 cfs).

Additional major detention facilities within Peterson Field to reduce the cost of required drainage improvements west of Peterson Field are economically unwarranted (Appendix B for information).

On August 23, 1984, URS met with the Airport Advisory Commission and received the Commission's approval to abandon the 1976 master planned storm water detention area proposed immediately east of planned Powers Boulevard. The Commission's approval was granted based on the following information:

(a) Existing Peterson Field Detention Ponds #1 and #2 reduce the future fully developed peak 100-year storm runoff west of Powers Boulevard to a level below that proposed in the 1976 Report.

(b) The storm drainage facilities identified in the drainage Master Plan are adequate to convey future fully developed 100-year peak flood flows without having to provide additional storm water detention within Peterson Field proper.

(c) Airport operators are solely responsible for the construction of any and all drainage storm drainage improvements required within Peterson Field proper.

No additional major storm water detention facilities are required or recommended within Peterson Field Basin as part of this Basin Master Plan Report.

Presently anticipated reimbursable storm drainage improvements within the planned Broadview Business Park site are shown in Figure 4. Drainage facilities in addition to those specifically identified in this Drainage Master Plan will be required in conjunction with future development of the basin. These additional non-specified drainage facilities will consist of minor drainage facilities such as inlets, manholes, storm sewer conduits and small open channels. Actual costs for these additional drainage facilities cannot be estimated without detailed site specific development plans. A line item cost allowance was however included in the Drainage Master Plan cost estimate for these additional non-specified drainage facilities. The magnitude of this line item cost allowance was estimated based on consideration of projected land use, topography and associated design storm runoff.

BIBLIOGRAPHY

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Grading and Drainage Project
October 1982
HNTB

Colorado Springs Municipal Airport
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F.A.A. Project No. 3-08-0010-01
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HNTB 5/18/83

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NES
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R. Keith Hook and Associates and
William Weber and Associates

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U.S. Department of Agriculture
Soil Conservation Service
In Cooperation with Colorado Agricultural
Experiment Station
June 1981

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Determination of Storm Runoff Criteria
March 1977
Including supplements and revisions

As-Constructed Drawings
Colony Hills/Peterson Field
Drainage Improvements
Sheets 1-37 of 37
Gilbert, Meyer and Sams
August 15, 1983

NEW DOC

J·R ENGINEERING
A Westrian Company

PRELIMINARY DRAINAGE REPORT
FOR
FIRST WING DEVELOPMENT

May 2005
Revised July 2005

Prepared For:

COWPERWOOD COMPANY
6102 Broadway, Suite B-2
San Antonio, TX 78209
(210) 930-5192

Prepared By:

JR ENGINEERING
4310 ArrowsWest Drive
Colorado Springs, CO 80907
(719) 593-2593

Job No. 9965.10

PRELIMINARY DRAINAGE REPORT
FOR
FIRST WING DEVELOPMENT

DRAINAGE REPORT STATEMENT

J·R ENGINEERING
A Westrian Company

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 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.

COLORADO REGISTERED TROY D. KENT 35996 PROFESSIONAL ENGINEER

Troy D. Kent, Colorado P.E.#35996
For and On Behalf of JR Engineering

7-29-05
Date

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

Business Name: Cowperwood Company

By: K. WADE GIDDENS

By: VICE PRESIDENT

Address: 6102 Broadway, Suite B-2

San Antonio, TX 78209

EL PASO COUNTY ONLY:
Filed in accordance with Section 51.1 of the El Paso Land Development Code, as amended.

John A. McCarty
John McCarty
County Engineer

8-11-05
Date

Conditions:

4310 ArrowsWest Drive, Colorado Springs, CO 80907
719-593-2593 • Fax: 719-528-6613 • www.jrengineering.com

PRELIMINARY DRAINAGE REPORT FOR FIRST WING DEVELOPMENT

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EROSION AND SEDIMENT CONTROL 8

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PROPOSED BASIN PARAMETERS

EXISTING HYDROLOGIC CALCULATIONS

PROPOSED HYDROLOGIC CALCULATIONS

PROPOSED DETENTION POND CALCULATIONS

EXISTING DESIGN POINTS

PROPOSED DESIGN POINTS

EXISTING AND PROPOSED ON-SITE DRAINAGE MAPS

PRELIMINARY DRAINAGE REPORT
FOR FIRST WING DEVELOPMENT

PURPOSE

The purpose of this preliminary drainage report is to identify and estimate existing and proposed drainage patterns, determine storm water runoff quantities resulting from First Wing Development Filings No. 1 and 2, and to recommend proposed drainage facilities within the development. Additionally, this report will show that there will be no impacts from this development downstream.

GENERAL DESCRIPTION

The proposed First Wing Development occupies a 37.0-acre site in El Paso County in the north half of the northwest quarter of Section 17, Township 14 South, Range 65 West of the Sixth Principal Meridian in the County of El Paso. The site is bounded on the northwest by an existing retail development, on the north by Space Village Road, on the west by Peterson Road, and on the east by undeveloped land owned by the city of Colorado Springs. Peterson Air Force Base borders the south side of this site. First Wing Development has been planned in two filings; Filing No. 1 occupies the western-most 14 acres of the site and will be developed in two phases. The first phase will be the 6.9-acre Cowperwood SAIC site that will be developed immediately; the remaining second phase will be developed at some indefinite point in the future. Filing No. 2 occupies the eastern-most 23 acres and will be developed at some indefinite point in the future. (See VICINITY MAP in the Appendix).

EXISTING DRAINAGE CONDITIONS

The First Wing Development site drains into two basins. The western-most 10 acres currently drain towards Sand Creek Basin while the remaining 27 acres drain to Peterson Air Field Basin. Existing drainage flows overland to the southern boundary of the site and onto Peterson Air Force Base. There are no existing drainage facilities on-site. (See EXISTING DRAINAGE MAP in the Appendix).

The portions of this site that drain to Sand Creek Basin were included in the Sand Creek Drainage Basin Planning Study prepared by Kiowa Engineering in 1993 and revised as recently as March 1996. For planning purposes, it was assumed that this area would be developed as industrial property. According to the impervious values used in that model, office uses are less impervious, therefore slightly reducing developed flows from this area that might impact the Sand Creek Basin.

Existing vegetation on the proposed site consists primarily of native grasses. The terrain is sloped generally from north to south and ranges at 2%. Overland flow currently drains to the southern boundary of the site and onto Peterson Air Force Base. The soil types on-site are Blakeland Loamy Sand, with a small amount of Truckton Sandy Loam along the western edge of Filing No. 1, of the S.C.S. Hydrologic Soils Group Classification. Blakeland Loamy Sand is an AASHTO type A-2 soil, as is Truckton Sandy Loam. These soil types indicate a well draining soil with moderate erosion potential. (See the USGS MAP in the Appendix).

Basin OS-1 encompasses the 0.6 acres along the east and south boundaries of hotel site north of Filing No. 1 that drain into our site. Drainage from this area flows overland onto Filing No. 1. Historic flows from this off-site basin are 3 cfs in the 5-year storm and 6 cfs in the 100-year storm. (See the EXISTING BASIN PARAMETERS and EXISTING HYDROLOGIC CALCULATIONS in the Appendix).

Basin OS-2 consists of the 9.8 acres of developments to the north of Filing No. 1 that contribute flows to the Peterson Road right-of-way. Areas which contribute to this include the Space Village mall on the southeast corner of Space Village and Peterson, Value Inn Motel east of Peterson along Space Village the single-family residence just north of the Filing No. 1 entrance from Space Village, and the southern side of Space Village from its high point and south along Peterson Road in front of the Space Village mall. Flows in this basin are carried in the street section west along Space Village and then south along Peterson Road onto Peterson Air Force Base. Existing flows from this off-site basin are 31 cfs in the 5-year storm and 61 cfs in the 100-year storm. These flows will not change with the road realignment. Design of the road improvements in this area will include capacity to carry this existing flow. (See the EXISTING BASIN PARAMETERS and EXISTING HYDROLOGIC CALCULATIONS in the Appendix).

Basin OS-3 encompasses the 0.7 acres of Space Village from the high point north of Filing No. 1 to the ridgeline that divides Filing No. 2. Drainage from this area flows south across the street section onto Filing No. 2. Properties north of Space Village drain to the north side of the road where they are conveyed in roadside ditches away from our site. Historic flows from this off-site basin are 5 cfs in the 5-year storm and 9 cfs in the 100-year storm. (See the EXISTING BASIN PARAMETERS and EXISTING HYDROLOGIC CALCULATIONS in the Appendix).

The 0.8 acres of Space Village from the ridgeline that divides Filing No. 2 to its eastern boundary comprise Basin OS-4. Drainage from this area flows south across the street section onto Filing No. 2. Properties north of Space Village drain to the north side of the road where they are conveyed in roadside ditches away from our site. Historic flows from this off-site basin are 5 cfs in the 5-year storm and 9 cfs in the 100-year storm. (See the EXISTING BASIN PARAMETERS and EXISTING HYDROLOGIC CALCULATIONS in the Appendix).

Basin EX-1 is comprised of the western 10.3 acres of Filing No. 1 and drains to the Sand Creek Drainage Basin. The land in this basin is currently undeveloped. All storm runoff flows overland to the southern boundary of the site and onto Peterson Air Force Base. (See the EXISTING BASIN PARAMETERS and EXISTING HYDROLOGIC CALCULATIONS in the Appendix).

Along the boundary of Filing No. 1, 4.4 acres make up Basin EX-2. This basin drains to the Peterson Drainage Basin, specifically to the low point in the southwest corner of Filing No. 1. The land in this basin is currently undeveloped. All storm runoff flows overland to the low point and onto Peterson Air Force Base. (See the EXISTING BASIN PARAMETERS and EXISTING HYDROLOGIC CALCULATIONS in the Appendix).

Basin EX-3 includes 11.4 acres along the boundary between the filings and the western half of Filing No. 2. This basin drains to the Peterson Drainage Basin. The land in this basin is currently undeveloped. All storm runoff flows overland to southwest corner of Filing No. 2 and onto Peterson Air Force Base. (See the EXISTING BASIN PARAMETERS and EXISTING HYDROLOGIC CALCULATIONS in the Appendix).

The eastern half of Filing No. 2 comprises Basin EX-4 (11.0 acres). This basin drains to the Peterson Drainage Basin. The land in this basin is currently undeveloped. All storm runoff flows overland to the lowpoint along the southern boundary of the site in the middle of the basin and onto Peterson Air Force Base. (See the EXISTING BASIN PARAMETERS and EXISTING HYDROLOGIC CALCULATIONS in the Appendix).

The hydrologic calculations shown in the Appendix for the existing conditions calculate the historic drainage rates of the existing drainage basins. These rates are 6 cfs for the 5-year storm and 16 cfs for the 100-year storm for basin EX-1; basin EX-2 runoff is Q_5 =3 cfs and Q_{100} = 7 cfs; historic rates for basin EX-3 are 7 cfs and 18 cfs for the 5 and 100-year storms respectively; and basin EX-4 runoff is Q_5 =7 cfs and Q_{100} = 18 cfs.

PROPOSED DRAINAGE CONDITIONS

First Wing Development Filing No. 1 is a 14-acre proposed business development. The 6.9-acre Cowperwood SAIC site will be developed immediately including one 85,000 square foot office building and the road through phase two which provides access to Space Village Drive. Development of phase two will include one 120,000 square foot office building and required parking. There are currently no plans to develop this portion of the site.

Runoff from 3.6-acre Basin A will be directed to the west pond as surface runoff and through gutter pans. These flows will enter the west pond through a curb chase located along the eastern boundary of the pond at Design Point 1 (Q_5 = 14cfs, Q_{100} = 27 cfs). Drainage from the pond will flow offsite into the Sand Creek Basin. (See PROPOSED DRAINAGE MAP and PROPOSED HYDROLOGIC CALCULATIONS in Appendix.)

Draining flows from proposed Basin B will collect in an inlet directly south of the phase 1 building (at design point 2) and will flow overland into Pond 1 along the western boundary of the site (Q_5 = 10cfs, Q_{100} = 19 cfs). (See PROPOSED DRAINAGE MAP and HYDROLOGIC CALCULATIONS in Appendix.)

Flows from Basin C (Q_5 = 4cfs, Q_{100} = 8 cfs) will flow via curb and gutter to the west onto Peterson Road at DP 4.

Basin D is comprised of 6.7 acres along the eastern boundary of the site and will have developed flows of Q_5 = 27 cfs, Q_{100} = 51 cfs. This area will be developed in the second phase of development. Developed storm runoff will drain via surface flow to pond 2, the pond in the southeast corner of Filing No. 1.

Two detention ponds will be built in Filing No. 1. Pond 1 will be built in conjunction with Phase 1; Pond 2 will be built with Phase 2. Runoff will be conveyed to the detention ponds via overland flow, channelized flows in gutter pans and swales. (See PROPOSED DRAINAGE MAP in the Appendix.) The detention ponds will restrict flows to historic rates and were sized using Haestad Methods Pond Pack software. (See Detention Pond Design below.)

The remaining 23 acres, which form Filing No. 2, will remain zoned for a heavy industrial district (PHID) including a maximum of 400,000 square feet of industrial space. There are currently no plans to plans to develop this portion of the site. Storm runoff from Filing No. 2 (Basin E) will continue to flow into Peterson Drainage Basin. A detention pond will be built in the southeast corner of the site. Runoff (Q_5 = 95 cfs, Q_{100} = 178 cfs) will be conveyed to the detention pond (Design Point 8) via overland flows and channelized flows in gutter pans. (See PROPOSED DRAINAGE MAP and HYDROLOGIC CALCULATIONS in Appendix.) This detention pond will restrict flows to historic rates (Design Point 9) and was sized using Haestad Methods Pond Pack software. (See Detention Pond Design below.)

DRAINAGE BASIN TRANSFERS

Existing on-site basins EX-2, EX-3 and EX-4 flow to Peterson Drainage Basin for a total area of 26.8 acres. Only basin EX-1, area of 10.3 acres, currently flows to Sand Creek Drainage Basin. Once development of Filing No. 1 occurs, proposed basins D and E will flow to Peterson Drainage Basin. This will be a total area of 29.5 acres, for an increase of 2.7 acres from the existing tributary area. This 2.7-acre increase in tributary area will not affect the basin downstream because the detention ponds being proposed for basins D and E will restrict flows to

historic rates, regardless of the increase in area. (See PROPOSED and EXISTING DRAINAGE MAPS in the Appendix.)

DETENTION POND DESIGN

The southwest detention pond will receive flows from the proposed Basin A and B. The flows resulting from development on this basin are Q_5 = 24 cfs and Q_{100} = 46 cfs. The pond was sized using the Haestad Methods Pond Pack software and requires 0.8 acre-ft storage to restrict flows offsite to the historic levels of Q_5 = 8 cfs and Q_{100} = 18 cfs (DP 5). The actual size of this detention basin is 1.46 acre-ft and the 100-year water surface elevation is 6194.3'. The pond bottom elevation is 6192.0' and the top of the berm is 6195.6'. Water will flow to this detention pond via overland flows. (See PROPOSED DRAINAGE MAP in the Appendix.) The flows from design points 3 and 4 will exit the site at design point 5, combining with flows along the east side of Peterson Road.

In order to keep the developed flows exiting the site at design point 5 at historic rates, without restricting the flows from design point 4, flows exiting the pond at the outlet structure will be restricted to Q_5 = 2 cfs and Q_{100} = 8 cfs. The outlet structure consists of two parts. The first part is an 18" RCP culvert that conveys low flows (including the 5-year) through the pond wall to an 18" RCP flared end section (FES) to release the water at historic rates to Peterson Road. There is also a concrete standpipe, to be detailed in the construction drawings, which conveys additional flows from larger storms (including the 100-year) into the 18" RCP culvert for outlet through the FES. An emergency spillway is located on the south side of the pond.

The southeast detention pond will collect drainage from proposed Basin D to be developed as part of the second phase. (See the PROPOSED DRAINAGE MAP in the Appendix.) This pond was sized using Haestad Methods Pond Pack software. The necessary capacity is 1.0 acre-ft to store the developed flows of Q_5 = 27 cfs and Q_{100} = 51 cfs (DP 6). The bottom elevation of the pond will be 6197.00 and the top of berm elevation is 6200.00. The 100-year water surface elevation is 6198.3'. Flows from the pond will outfall through a triangular weir on the south side of the pond. The flow through this weir will be restricted to the historic flows of Q_5 = 3 cfs and Q_{100} = 7 cfs (DP 7).

The detention pond in Filing No. 2 will collect drainage from proposed Basin E to be developed as part of Filing No. 2. (See the PROPOSED DRAINAGE MAP in the Appendix.) This pond was sized using Haestad Methods Pond Pack software. The necessary capacity is 3.4 acre-ft to store the developed flows of Q_5 = 95 cfs and Q_{100} = 178 cfs (DP 8). The bottom elevation of the pond will be 6100.00 and the top of berm elevation is 6106.00. The 100-year water surface elevation is 6105.2'. Flows from the pond will outfall through an outfall structure on the south side of the pond. The flow through this structure will be restricted to the historic flows of Q_5 = 14 cfs and Q_{100} = 36 cfs (DP 10). These flow rates represent a combination of the historic flows at design points 9 and 10. Since there will be no water exiting Filing No. 2 at design point 9, flows equal to the historic flows from Filing No. 2 onto Peterson Air Force Base will be released at design point 10.

Erosion control for flows exiting the First Wing Development and flowing onto Peterson Air Force Base will be addressed in the Final Drainage Report.

DRAINAGE DESIGN CRITERIA

This report has been prepared in accordance with the 1991 County Drainage Criteria Manual, revised October 1994. All proposed and existing basin flows were determined using the Rational Method. (See PROPOSED HYDROLOGIC CALCULATIONS and EXISTING HYDROLOGIC CALCULATIONS in the Appendix). All proposed drainage systems were designed to handle runoff from both the initial design storm (5 year event) and the major design storm (100 year event). All proposed culverts are 18" or greater in diameter, per El Paso County standards. Preliminary detention ponds were sized using Haestead Methods Pond Pack software.

FLOODPLAIN STATEMENT

The First Wing Development site is not within a designated F.E.M.A. Floodplain as determined by the Flood Insurance Rate Map, Community Panel Number 02041 CO754 F, effective date March 17, 1997. (See FLOOD INSURANCE RATE MAP OF EL PASO COUNTY in the Appendix).

EROSION AND SEDIMENT CONTROL

Proposed erosion control measures will be shown on the grading plan for this site to be submitted and approved and with the construction documents for each filing of this development.

MAINTENANCE OF PRELIMINARY DESIGN

All of the proposed on-site storm sewer system is private and will be maintained by the parcel owners. Easements through this area will be written to include use for drainage system and maintenance.

SUMMARY

Drainage runoff will be conveyed through this site by means of overland flow, proposed storm sewers and swales as discussed in this report. Development of the site will increase flows. To accommodate for increased development flows, three private detention ponds will detain developed discharges to below historic levels for the required design storms.

PREPARED BY:

JR Engineering

Angela Howard, E.I.
Project Engineer

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REFERENCES

1. City of Colorado Springs/County of El Paso Drainage Criteria Manual, dated November 1991.

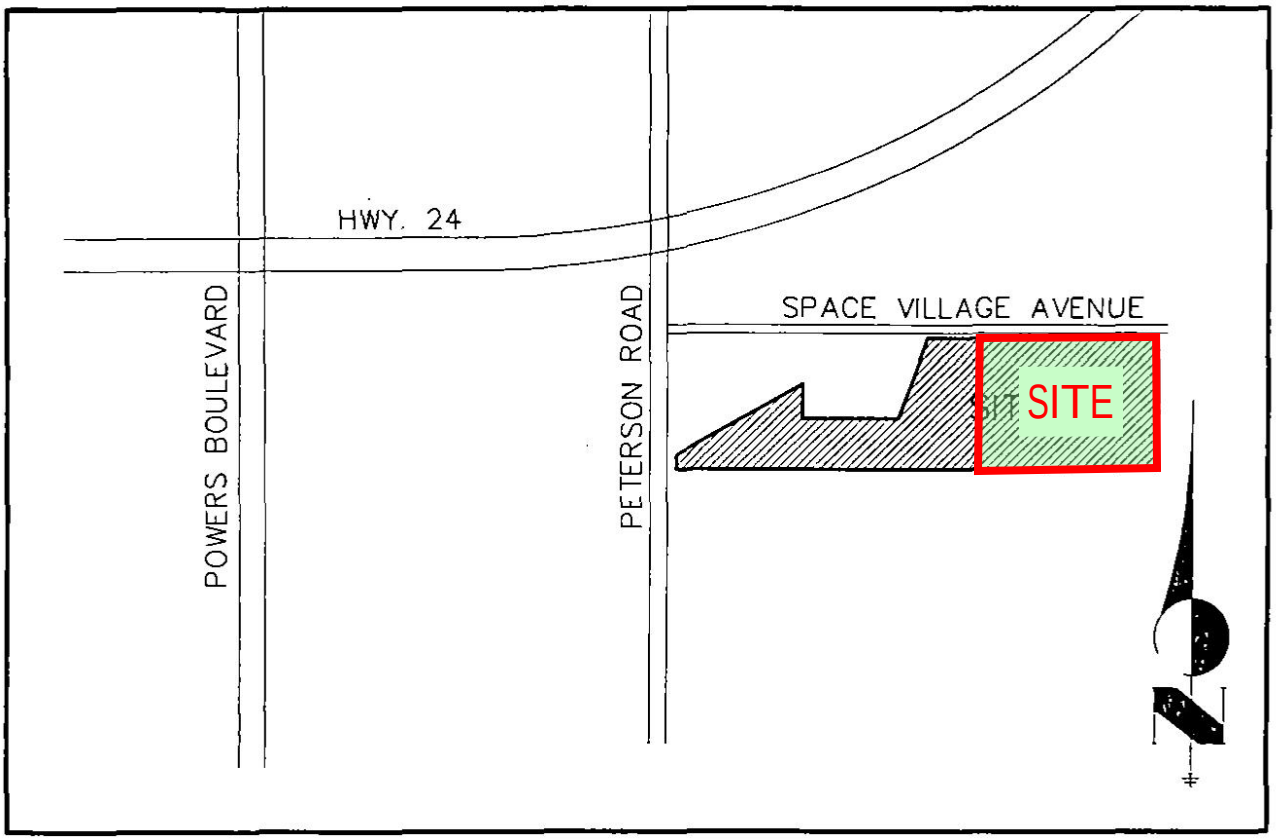
2. FIRM Flood Insurance Rate Map, El Paso County Colorado and Incorporated Areas, Map No. 08041C0754 F, dated March 17, 1997.

3. Sand Creek Drainage Basin Planning Study, Kiowa Engineering, revised March 1996.

4. Peterson Drainage Basin Planning Study.

APPENDIX

VICINITY MAP



VICINITY MAP
N.T.S.

EXISTING BASIN PARAMETERS

FIRST WING
PRELIMINARY DRAINAGE REPORT
(Area Runoff Summary)

		Historic Weighted		Historic Weighted	
BASIN	TOTAL AREA (Acres)	C(5)	C(100)	CA(5)	CA(100)
EX-1	10.3	0.25	0.35	2.57	3.60
EX-2	4.4	0.25	0.35	1.11	1.55
EX-3	11.4	0.25	0.35	2.86	4.00
EX-4	11.0	0.25	0.35	2.76	3.86
OS-1	0.6	0.90	0.95	0.53	0.56
OS-2	9.8	0.71	0.78	7.01	7.64
OS-3	0.7	0.90	0.95	0.67	0.71
OS-4	0.8	0.90	0.95	0.71	0.75

PROPOSED BASIN PARAMETERS

FIRST WING PRELIMINARY DRAINAGE REPORT
(Proposed Area Runoff Summary)

		WEIGHTED		*WEIGHTED*		*Historic Weighted*		*Historic Weighted*	
BASIN	TOTAL AREA *(Acres)*	C(5)	C(100)	CA(5)	CA(100)	C(5)	C(100)	CA(5)	CA(100)
A	3.6	**0.77**	**0.83**	**2.79**	**3.00**	**0.25**	**0.35**	**0.90**	**1.26**
B	2.6	**0.74**	**0.80**	**1.921**	**2.08**	**0.25**	**0.35**	**0.65**	**0.91**
C	1.4	**0.76**	**0.82**	**1.064**	**1.15**	**0.25**	**0.35**	**0.35**	**0.49**
D	6.7	**0.78**	**0.84**	**5.25**	**5.65**	**0.25**	**0.35**	**1.68**	**2.35**
E	22.8	**0.90**	**0.95**	**20.54**	**21.68**	**0.25**	**0.35**	**5.71**	**7.99**

EXISTING HYDROLOGIC CALCULATIONS

FIRST WING
PRELIMINARY DRAINAGE REPORT
(Area Drainage Summary)

		WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				Tc	INTENSITY		TOTAL FLOWS	
BASIN	AREA TOTAL	C(5)	C(100)	C(5)	Length	Height	Tc	Length	Slope	Velocity	Tc	TOTAL	I(5)	I(100)	Q(5)	Q(100)
	(Acres)				(ft)	(ft)	(min)	(ft)	(%)	(fps)	(min)	(min)	(in/hr)	(in/hr)	(c.f.s.)	(c.f.s.)
EX-1	10.3	0.25	0.35	0.25	825	32	29.2	0 0	10.0% 4.0%	11.1 7.0	0.0 0.0	29.2	2.5	4.4	6	16
EX-2	4.4	0.25	0.35	0.25	765	32	27.4	0	12.0%	12.1	0.0	27.4	2.5	4.5	3	7
EX-3	11.4	0.25	0.35	0.25	765	32	27.4					27.4	2.5	4.5	7	18
EX-4	11.0	0.25	0.35	0.25	765	32	27.4					27.4	2.5	4.5	7	18
OS-1	0.6	0.90	0.95					450	3.1%	6.2	1.2	1.2	6.4	11.3	3	6
OS-2	9.8	0.71	0.78					1750	1.1%	3.7	7.9	7.9	4.5	7.9	31	61
OS-3	0.7	0.90	0.95					50	2.0%	4.9	0.2	0.2	6.9	12.2	5	9
OS-4	0.8	0.90	0.95					50	2.0%	4.9	0.2	0.2	6.9	12.2	5	9

PROPOSED HYDROLOGIC CALCULATIONS

FIRST WING
PRELIMINARY DRAINAGE REPORT
(Area Drainage Summary)

		WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				Tc	INTENSITY		TOTAL FLOWS	
BASIN	AREA TOTAL	C(5)	C(100)	C(5)	Length	Height	Tc	Length	Slope	Velocity	Tc	TOTAL	I(5)	I(100)	Q(5)	Q(100)
	(Acres)				(ft)	(ft)	(min)	(ft)	(%)	(fps)	(mins)	(min)	(in/hr)	(in/hr)	(c.f.s.)	(c.f.s.)
A NW	3.6	0.77	0.83	0.77				575	1.6%	4.4	2.2	5.0	5.1	9.1	14	27
B SE	2.6	0.74	0.80	0.74				460	1.5%	4.3	1.8	5.0	5.1	9.1	10	19
C SOUTH	1.4	0.76	0.82	0.76				300	1.0%	3.5	1.4	5.0	5.1	9.1	5	10
D PHASE 2	6.7	0.78	0.84	0.78				300	1.0%	3.5	1.4	5.0	5.1	9.1	27	51
E FILING 2	22.8	0.90	0.95	0.90				1500	1.0%	3.5	7.1	7.1	4.6	8.2	95	178

EXISTING DESIGN POINTS

FIRST WING PRELIMINARY DRAINAGE REPORT
(Existing Flows at Design Points)

Historic Flows					*Intensity*		*Flow*	
Design Point(s)	*Contributing Basins*	*Equivalent CA(5)*	*Equivalent CA(100)*	*Maximum Tc*	*I(5)*	*I(100)*	*Q(5)*	*Q(100)*
5	OS-1, EX-1	3.10	4.15	29.19	2.5	4.4	*8*	*18*
7	EX-2	1.11	1.55	27.4	2.5	4.5	*3*	*7*
9	EX-3	2.86	4.00	27.4	2.5	4.5	*7*	*18*
10	EX-4	2.76	3.86	27.4	2.5	4.5	*7*	*18*
11	OS-2	7.01	7.64	7.9	4.5	7.9	*31*	*61*

PROPOSED DESIGN POINTS

FIRST WING PRELIMINARY DRAINAGE REPORT
(Developed Flows at Design Points)

Developed Flows					*Intensity*		*Flow*	
Design Point(s)	*Contributing Basins*	*Equivalent CA(5)*	*Equivalent CA(100)*	*Maximum Tc*	*I(5)*	*I(100)*	*Q(5)*	*Q(100)*
1	A	2.79	3.00	5.00	5.1	9.1	*14*	*27*
2	B	1.92	2.08	5.00	5.1	9.1	*10*	*19*
3	Phase 1 Detention Pond						*2*	*8*
4	C	1.06	1.15	5.00	5.1	9.1	*5*	*10*
5	Design points 3 & 4						*8*	*18*
6	D	5.25	5.65	5.00	5.1	9.1	*27*	*51*
7	Phase 2 Detention Pond						*3*	*7*
8	E	20.54	21.68	7.14	4.6	8.2	*95*	*178*
10	Filing No. 2 Detention Pond						*14*	*36*
11	OS-2: Flows along Peterson Road	7.01	7.64	7.95	4.5	7.9	*31*	*61*

EXISTING AND PROPOSED
ON-SITE DRAINAGE MAPS

COWPERWOOD SAIC

COUNTY OF EL PASO, STATE OF COLORADO

PROPOSED DRAINAGE MAP

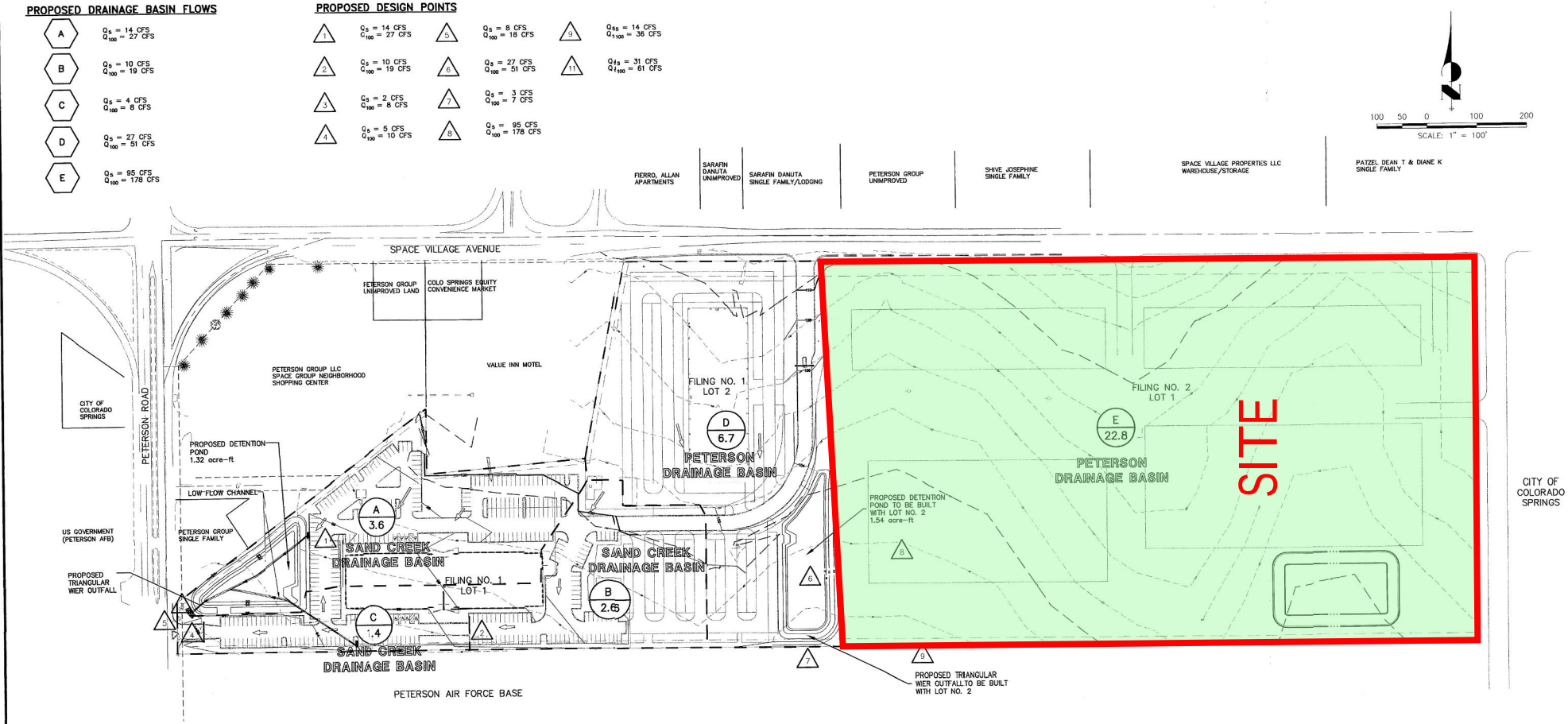
JULY 2005

PROPOSED DRAINAGE BASIN FLOWS

A	Q_5 = 14 CFS, Q_{100} = 27 CFS
B	Q_5 = 10 CFS, Q_{100} = 19 CFS
C	Q_5 = 4 CFS, Q_{100} = 8 CFS
D	Q_5 = 27 CFS, Q_{100} = 51 CFS
E	Q_5 = 95 CFS, Q_{100} = 178 CFS

PROPOSED DESIGN POINTS

1	Q_5 = 14 CFS, Q_{100} = 27 CFS	5	Q_5 = 8 CFS, Q_{100} = 18 CFS	9	Q_{55} = 14 CFS, Q_{T100} = 36 CFS
2	Q_5 = 10 CFS, Q_{100} = 19 CFS	6	Q_5 = 27 CFS, Q_{100} = 51 CFS	11	Q_{55} = 31 CFS, Q_{T100} = 61 CFS
3	Q_5 = 2 CFS, Q_{100} = 8 CFS	7	Q_5 = 3 CFS, Q_{100} = 7 CFS		
4	Q_5 = 5 CFS, Q_{100} = 10 CFS	8	Q_5 = 95 CFS, Q_{100} = 178 CFS		



PREPARED FOR
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719-593-2593 • Fax 719-593-2636

NO.	REVISION	BY	DATE

H-SCALE 1"=100'
V-SCALE N/A
DATE 3/11/05
DESIGNED BY AMH
DRAWN BY AMH

COWPERWOOD SAIC

PRELIMINARY DRAINAGE REPORT

PROPOSED DRAINAGE MAP

SHEET 1 OF 2

JOB NO. 29965.20

COWPERWOOD SAIC

COUNTY OF EL PASO, STATE OF COLORADO

EXISTING DRAINAGE MAP

JULY 2005

EXISTING DRAINAGE BASIN FLOWS

EX-1	Q_5 = 6 CFS, Q_{100} = 16 CFS
EX-2	Q_5 = 3 CFS, Q_{100} = 7 CFS
EX-3	Q_5 = 7 CFS, Q_{100} = 18 CFS
EX-4	Q_5 = 7 CFS, Q_{100} = 18 CFS

DESIGN POINT SUMMARY

5	Q_5 = 8 CFS, Q_{100} = 18 CFS
7	Q_5 = 3 CFS, Q_{100} = 7 CFS
9	Q_5 = 7 CFS, Q_{100} = 18 CFS
10	Q_5 = 7 CFS, Q_{100} = 18 CFS
11	Q_5 = 31 CFS, Q_{100} = 61 CFS

LEGEND

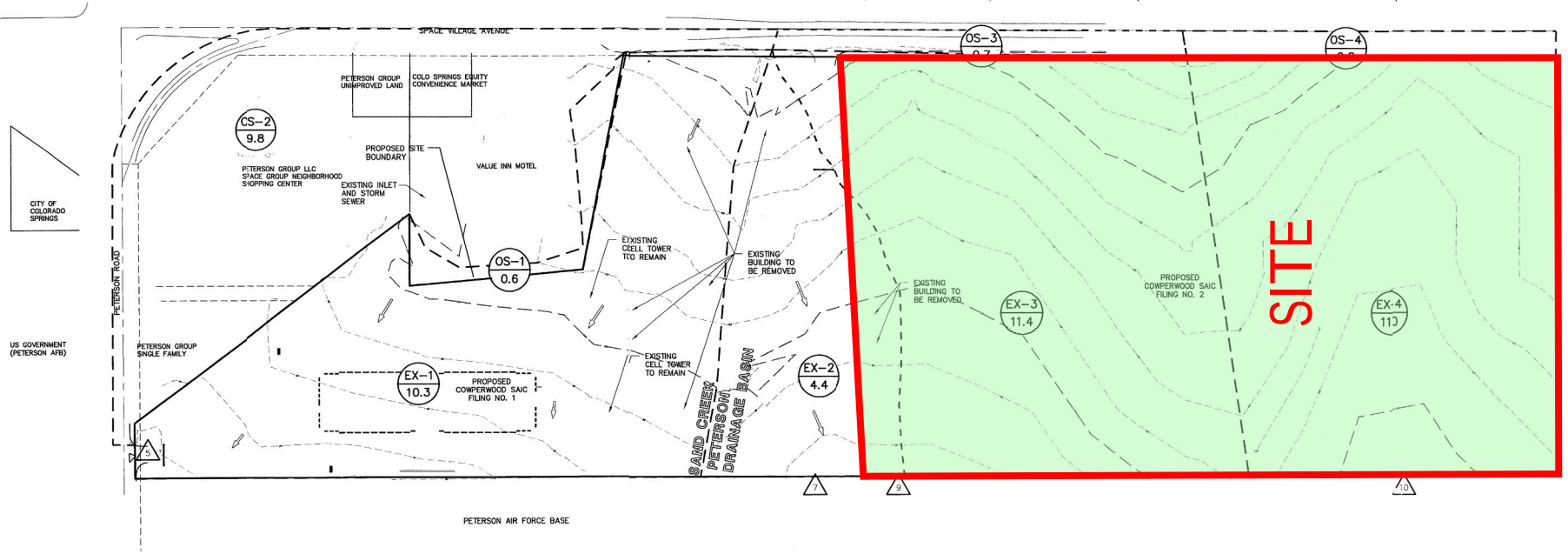
DESCRIPTION	SYMBOL
BASIN IDENTIFIER / AREA IN ACRES	EX-1 / 6.7
DESIGN POINT	7
EXISTING DRAINAGE ARROW	
EXISTING GROUND CONTOUR	
EXISTING DRAINAGE BOUNDARY	

N

100 50 0 100 200

SCALE: 1" = 100'

FIERRO, ALLAN APARTMENTS | SARAFIN DANUTA UNIMPROVED | SARAFIN DANUTA SINGLE FAMILY/LODGING | PETERSON GROUP UNIMPROVED | SHIVE JOSEPHINE SINGLE FAMILY | SPACE VILLAGE PROPERTIES LLC WAREHOUSE/STORAGE | PATZEL DEAN T & DIANE K SINGLE FAMILY



UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE ENGINEERING AGENCIES, J.R. ENGINEERING APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

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No.	REVISION	BY	DATE

H-SCALE 1"=100' | V-SCALE N/A | DATE 3/11/05 | DESIGNED BY AMH | DRAWN BY AMH | CHECKED BY

COWPERWOOD SAIC

PRELIMINARY DRAINAGE REPORT

EXISTING DRAINAGE MAP

SHEET 2 OF 2

JOB NO. 29965.20

LEGAL DESCRIPTION

A TRACT OF LAND BEING A PORTION OF THE NORTHWEST QUARTER OF SECTION 17, TOWNSHIP 14 SOUTH, RANGE 65 WEST OF THE SIXTH PRINCIPAL MERIDIAN, COUNTY OF EL PASO, STATE OF COLORADO, BEING DESCRIBED AS FOLLOWS:

BASIS OF BEARINGS: THE EASTERLY BOUNDARY LINE OF LOT 1, AS PLATTED IN COWPERWOOD SAIC, AS RECORDED UNDER RECEPTION NO. 205122346, RECORDS OF EL PASO COUNTY, COLORADO, BEING MONUMENTED AT THE SOUTHERLY END BY A NO. 5 REBAR WITH A 2-1/2" ALUMINUM SURVEYOR'S CAP STAMPED "JR ENG PLS 31161" AND BEING MONUMENTED AT THE NORTHERLY END BY A NO. 5 REBAR WITH A 2-1/2" ALUMINUM SURVEYOR'S CAP STAMPED "JR ENG PLS 31161", BEING ASSUMED TO BEAR N03°02'00"W, A DISTANCE OF 761.80 FEET.

COMMENCING AT THE NORTHEASTERLY CORNER OF LOT 1 AS PLATTED IN COWPERWOOD SAIC, AS RECORDED UNDER RECEPTION NO. 205122346, RECORDS OF EL PASO COUNTY, COLORADO, SAID POINT BEING ON THE SOUTHERLY RIGHT-OF-WAY LINE OF SPACE VILLAGE AVENUE, SAID POINT ALSO BEING THE POINT OF BEGINNING;
THENCE S89°53'54"E ON SAID SOUTHERLY RIGHT-OF-WAY LINE, A DISTANCE OF 1327.50 FEET TO A POINT ON THE EAST LINE OF THE NORTHWEST QUARTER OF SECTION 17, TOWNSHIP 14 SOUTH, RANGE 65 WEST OF THE SIXTH PRINCIPAL MERIDIAN, EL PASO COUNTY, COLORADO;
THENCE S00°12'31"E ON SAID EAST LINE, A DISTANCE OF 757.08 FEET;
THENCE S89°56'31"W, A DISTANCE OF 1289.94 FEET TO THE SOUTHEASTERLY CORNER OF SAID LOT 1;
THENCE N03°02'00"W ON THE EASTERLY BOUNDARY LINE OF SAID LOT 1, A DISTANCE OF 761.80 FEET TO THE POINT OF BEGINNING.

NOTES CORRESPONDING TO SCHEDULE B-2 ITEMS

9. ANY TAX, LIEN, FEE, OR ASSESSMENT BY REASON OF INCLUSION OF SUBJECT PROPERTY IN THE CIMARRON HILLS FIRE PROTECTION DISTRICT, AS EVIDENCED BY INSTRUMENT RECORDED DECEMBER 13, 1972, UNDER RECEPTION NO. 941974. **(BLANKET IN NATURE).**

10. TERMS, CONDITIONS, PROVISIONS, BURDENS AND OBLIGATIONS AS SET FORTH IN RESOLUTION NO. 79-39, LAND USE-19 REGARDING EXTRACTION OF COMMERCIAL MINERAL DEPOSITS, RECORDED OCTOBER 19, 1979 IN BOOK 3242 AT PAGE 141. **(BLANKET IN NATURE).**

11. TERMS, CONDITIONS, PROVISIONS, BURDENS, OBLIGATIONS AND EASEMENTS AS SET FORTH AND GRANTED IN AGREEMENT AND EASEMENT "AS BUILT" RECORDED NOVEMBER 22, 1994 IN BOOK 6566 AT PAGE 682. **(DOES NOT AFFECT SUBJECT PROPERTY).**

12. RIGHT OF WAY EASEMENT AS GRANTED TO THE UNITED STATES OF AMERICA IN INSTRUMENT RECORDED FEBRUARY 27, 1995, IN BOOK 6609 AT PAGE 61. **(DOES NOT AFFECT SUBJECT PROPERTY).**

(13) RIGHT OF WAY EASEMENT AS GRANTED TO THE CHEROKEE METROPOLITAN DISTRICT IN INSTRUMENT RECORDED DECEMBER 07, 1995, IN BOOK 6779 AT PAGE 2. **(PLOTTED HEREON).**

14. TERMS, CONDITIONS, PROVISIONS, BURDENS AND OBLIGATIONS AS SET FORTH IN LEASE DATED OCTOBER 14, 1996 BY AND BETWEEN DONALD KVOLS AND EILEEN KVOLS, AS LANDLORD, AND WESTERN PCS III LICENSE CORPORATION, AS TENANT, AS MEMORIALIZED BY MEMORANDUM OF LEASE RECORDED JANUARY 13, 1997 UNDER RECEPTION NO. 97004020.

A LEASE AND MANAGEMENT AGREEMENT DATED AUGUST 29, 2013 BY AND BETWEEN T-MOBILE WEST TOWER LLC, A DELAWARE LIMITED LIABILITY COMPANY, LESSOR, AND CCTMO LLC, A DELAWARE LIMITED LIABILITY COMPANY, LESSEE, AS MEMORIALIZED BY MEMORANDUM OF MASTER PREPAID LEASE AND MANAGEMENT AGREEMENT RECORDED SEPTEMBER 19, 2013 UNDER RECEPTION NO. 213119122. **(BLANKET IN NATURE).**

NOTE: THE PRESENT OWNERSHIP OF THE LEASEHOLD CREATED BY SAID LEASE AND OTHER MATTERS AFFECTING THE INTEREST OF THE LESSEE ARE NOT SHOWN HEREIN.

15. TERMS, CONDITIONS, PROVISIONS, BURDENS AND OBLIGATIONS AS SET FORTH IN COVENANT AND AGREEMENT RECORDED FEBRUARY 26, 1997 UNDER RECEPTION NO. 97021340. **(BLANKET IN NATURE).**

16. TERMS, CONDITIONS, PROVISIONS, BURDENS AND OBLIGATIONS AS AS SET FORTH IN RESOLUTION NO. 97-78, LAND USE-30 REGARDING USE SUBJECT TO SPECIAL REVIEW, RECORDED APRIL 04, 1997, UNDER RECEPTION NO. 97038656. **(DOES NOT AFFECT SUBJECT PROPERTY).**

17. TERMS, CONDITIONS, PROVISIONS, BURDENS AND OBLIGATIONS AS SET FORTH IN NOTICE OF CHEROKEE METROPOLITAN DISTRICT WATER DISTRIBUTION SYSTEM AND SEWAGE COLLECTION SYSTEM RECOVERY AGREEMENT RECORDED JUNE 19, 2001 UNDER RECEPTION NO. 201084507. **(BLANKET IN NATURE).**

(18) RIGHT OF WAY EASEMENT AS GRANTED TO THE CHEROKEE METROPOLITAN DISTRICT IN INSTRUMENT RECORDED JULY 06, 2001, UNDER RECEPTION NO. 201095053. **(PLOTTED HEREON).**

19. TERMS, CONDITIONS, PROVISIONS, BURDENS AND OBLIGATIONS AS SET FORTH IN COMMUNICATIONS SITE LEASE AGREEMENT AS DATED MAY 8, 2003 BY AND BETWEEN K VENTURES, LLLP, A COLORADO LIMITED LIABILITY LIMITED PARTNERSHIP, LANDLORD, AND NEXTEL WEST CORP., A DELAWARE CORPORATION, D/B/A NEXTEL COMMUNICATIONS, TENANT, AS MEMORIALIZED BY MEMORANDUM OF AGREEMENT RECORDED JUNE 09, 2003 AT RECEPTION NO. 203126317. ASSIGNMENT AND ASSUMPTION OF GROUND LEASE RECORDED OCTOBER 6, 2008 UNDER RECEPTION NO. 208109347. **(DOES NOT AFFECT SUBJECT PROPERTY).**

NOTE: THE PRESENT OWNERSHIP OF THE LEASEHOLD CREATED BY SAID LEASE AND OTHER MATTERS AFFECTING THE INTEREST OF THE LESSEE ARE NOT SHOWN HEREIN.

20. TERMS, CONDITIONS, PROVISIONS, BURDENS AND OBLIGATIONS AS SET FORTH IN RESOLUTION NO. 03-391 REGARDING USE SUBJECT TO SPECIAL REVIEW, RECORDED MARCH 08, 2004, UNDER RECEPTION NO. 204038525. **(BLANKET IN NATURE).**

21. TERMS, CONDITIONS, PROVISIONS, BURDENS AND OBLIGATIONS AS SET FORTH IN LEASE BETWEEN K VENTURES LLLP, A COLORADO LIMITED LIABILITY LIMITED PARTNERSHIP, LESSOR, AND AT&T WIRELESS PCS, LLC, A DELAWARE LIMITED LIABILITY COMPANY, D/B/A AT&T WIRELESS, LESSEE, AS MEMORIALIZED BY MEMORANDUM OF LEASE RECORDED JUNE 30, 2004, UNDER RECEPTION NO. 204108944. **(DOES NOT AFFECT SUBJECT PROPERTY).**

NOTE: THE PRESENT OWNERSHIP OF THE LEASEHOLD CREATED BY SAID LEASE AND OTHER MATTERS AFFECTING THE INTEREST OF THE LESSEE ARE NOT SHOWN HEREIN.

22. TERMS, CONDITIONS, PROVISIONS, BURDENS AND OBLIGATIONS AS SET FORTH IN AND IMPOSED BY ZONING RESOLUTION NO. 05-207 RECORDED JUNE 23, 2005, UNDER RECEPTION NO. 205093750. **(BLANKET IN NATURE).**

23. TERMS, CONDITIONS, PROVISIONS, BURDENS AND OBLIGATIONS AS SET FORTH IN RESOLUTION NO. 05-208 APPROVING PRELIMINARY PLAN FOR FIRST WING DEVELOPMENT, RECORDED JUNE 23, 2005, UNDER RECEPTION NO. 205093751. **(BLANKET IN NATURE).**

(24) EASEMENT GRANTED TO THE CITY OF COLORADO SPRINGS ON BEHALF OF ITS ENTERPRISE, COLORADO SPRINGS UTILITIES, FOR UTILITY LINES, APPURTENANCES, AND INCIDENTAL PURPOSES, BY INSTRUMENT RECORDED JANUARY 07, 2013, UNDER RECEPTION NO. 213002461. **(PLOTTED HEREON).**

25. TERMS, CONDITIONS, PROVISIONS, BURDENS AND OBLIGATIONS AS SET FORTH IN ADMINISTRATIVELY APPROVED PERMIT ISSUED TO CONDUCT A DESIGNATED ACTIVITY OF STATE INTEREST OR TO ENGAGE IN DEVELOPMENT IN A DESIGNATED AREA OF STATE INTEREST RECORDED FEBRUARY 19, 2014 UNDER RECEPTION NO. 214013392. **(NOT A PLOTTABLE ITEM).**

VICINITY MAP

GENERAL NOTES

1) THIS SURVEY DOES NOT CONSTITUTE A TITLE SEARCH BY ALTURA LAND CONSULTANTS, LLC. TO DETERMINE RECORD TITLE, EASEMENTS OR RIGHTS-OF WAY. TITLE COMMITMENT NO. SC55101684, WITH AN EFFECTIVE DATE OF NOVEMBER 16, 2021, PREPARED BY LAND TITLE GUARANTEE COMPANY WAS RELIED UPON FOR ALL INFORMATION REGARDING TITLE OF RECORD, EASEMENTS OF RECORD AND RIGHTS-OF-WAY.

2) THE WORD "CERTIFY" AS SHOWN AND USED HEREON MEANS AN EXPRESSION OF PROFESSIONAL OPINION REGARDING THE FACTS OF THIS SURVEY AND DOES NOT CONSTITUTE A GUARANTEE OR WARRANTY, EITHER EXPRESSED OR IMPLIED.

3) THIS SURVEY WAS PREPARED FOR THE EXCLUSIVE USE OF THE ENTITIES NAMED IN THE SURVEYOR'S CERTIFICATE HEREON. SAID CERTIFICATE DOES NOT EXTEND TO ANY UNNAMED PERSON OR ENTITY WITHOUT AN EXPRESS WRITTEN RECERTIFICATE BY THE SURVEYOR OF RECORD NAMING SAID PERSON OR ENTITY.

4) THIS SURVEY DOES NOT SHOW THE LOCATION OF, OR ENCROACHMENTS BY, SUBSURFACE FOOTINGS AND/OR FOUNDATIONS OF ANY BUILDINGS SHOWN HEREON. IF FLOOD ZONE DATA, ZONING AND SETBACK DATA, OR BUILDING RESTRICTION LINES ARE SHOWN HEREON, IT IS FOR INFORMATIONAL PURPOSES ONLY, HAVING BEEN OBTAINED FROM RELIABLE AND RESPONSIBLE SOURCES NOT CONNECTED WITH ALTURA LAND CONSULTANTS, LLC. NO GUARANTEE OR WARRANTY, EITHER EXPRESSED OR IMPLIED, IS MADE AS TO THE ACCURACY OR THOROUGHNESS OF SUCH INFORMATION.

5) BURIED UTILITIES AND/OR PIPELINES SHOWN HEREON ARE PER VISIBLE AND APPARENT SURFACE EVIDENCE, RECORD DRAWINGS OF THE CONSTRUCTED UTILITY LINES OBTAINED FROM RELIABLE AND RESPONSIBLE SOURCES NOT CONNECTED WITH ALTURA LAND CONSULTANTS, LLC. OR MARKINGS PROVIDED BY AN INDEPENDENT LOCATING CONTRACTOR. NO GUARANTEE OR WARRANTY, EITHER EXPRESSED OR IMPLIED, IS MADE AS TO THE ACCURACY OR THOROUGHNESS OF SUCH INFORMATION. IF MORE ACCURATE LOCATIONS OF UNDERGROUND UTILITIES OR PIPE LINES ARE REQUIRED, THE UTILITY OR PIPELINE WILL HAVE TO BE VERIFIED BY FIELD POTHOLING. ALTURA LAND CONSULTANTS, LLC. AND THE SURVEYOR OF RECORD SHALL NOT BE HELD LIABLE FOR THE LOCATION OF OR THE FAILURE TO NOTE THE LOCATION OF NON-VISIBLE UTILITIES OR PIPELINES.

6) FIELD WORK FOR THIS SURVEY WAS PERFORMED ON APRIL 22, 2022.

7) THE LINEAL UNITS OF MEASURE SHOWN ON THIS SURVEY ARE BASED UPON THE U.S. SURVEY FOOT.

8) ALL STREETS AND/OR ALLEYS SHOWN HEREON ARE DULY DEDICATED AND MAINTAINED PUBLIC ROADWAYS.

9) THERE IS NO OBSERVABLE EVIDENCE OF EARTH MOVING WORK, BUILDING CONSTRUCTION OR BUILDING ADDITIONS WITHIN THE RECENT MONTHS.

10) THERE ARE NO CHANGES IN STREET RIGHT OF WAY LINES EITHER COMPLETED OR PROPOSED, AND AVAILABLE FROM THE CONTROLLING JURISDICTION. THERE IS NO OBSERVATION EVIDENCE OF RECENT STREET OR SIDEWALK CONSTRUCTION OR REPAIRS.

BENCH MARK

NGS BENCH MARK "R 76"

LOCATED 0.2 MILE EAST ALONG HIGHWAY 94 FROM PETERSON ROAD, 22 FEET SOUTH-SOUTHEAST OF THE SOUTHEAST CORNER OF AN ADDITION TO THE BUILDING (SANDY'S RESTAURANT), 48 FEET NORTH OF THE CENTERLINE OF THE HIGHWAY, 3.5 FEET SOUTH OF A POWER POLE AND 3 FEET SOUTH OF A FIBERGLASS WITNESS POST.

ELEVATION = 6289.86 FEET (NAVD 1988)

LAND AREA

SUBJECT PROPERTY CONTAINS: 994,018 SQUARE FEET OR 22.820 ACRES, MORE OR LESS.

ZONING INFORMATION

NO ZONING REPORT OR ZONING LETTER HAS BEEN RECEIVED BY ALTURA LAND CONSULTANTS, LLC AT THE TIME OF SURVEY.

ZONING ORDINANCES IN EFFECT AS OF THE DATE OF THIS SURVEY. ZONING REPORT NOT PROVIDED

SETBACKS:
FRONT:
BACK:
SIDE:

ZONING:

BASIS OF BEARINGS

BEARINGS SHOWN HEREON ARE BASED UPON THE EAST LINE OF LOT 1, COWPERWOOD SAIC, WHICH BEARS N03°02'00"W BETWEEN THE MONUMENTS SHOWN HEREON, PER COWPERWOOD SAIC RECORDED AS RECEPTION NO. 205122346 IN THE RECORDS OF THE EL PASO COUNTY CLERK AND RECORDER'S OFFICE.

SURVEYOR'S STATEMENT

TO: HAMPTON YARDS, LLC, A COLORADO LIMITED LIABILITY COMPANY
FIRST WING DEVELOPMENT, LLP, A COLORADO LIMITED LIABILITY LIMITED PARTNERSHIP
LAND TITLE GUARANTEE COMPANY.

THIS IS TO CERTIFY THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2021 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/NSPS LAND TITLE SURVEYS, JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND NSPS, AND INCLUDES ITEMS 1, 2, 3, 4, 5, 6(b), 7(a), 8, 9, 11, 13, 14, 16, 17, 18 AND 19 OF TABLE A THEREOF. THE FIELD WORK WAS COMPLETED ON APRIL 22, 2022.

PRELIMINARY

JESUS A. LUGO, PLS 38081
COLORADO LICENSED PROFESSIONAL LAND SURVEYOR
FOR AND ON THE BEHALF OF ALTURA LAND CONSULTANTS, LLC.

NOTICE:

ACCORDING TO COLORADO LAW YOU MUST COMMENCE ANY LEGAL ACTION BASED UPON ANY DEFECT IN THIS SURVEY WITHIN THREE YEARS AFTER YOU FIRST DISCOVER SUCH DEFECT. IN NO EVENT, MAY ANY ACTION BASED UPON ANY DEFECT IN THIS SURVEY BE COMMENCED MORE THAN TEN YEARS FROM THE DATE OF CERTIFICATION SHOWN HEREON.

DEPOSITING CERTIFICATE

DEPOSITED THIS _____ DAY OF _____, 20___, IN BOOK _____, PAGE _____ OF THE COUNTY SURVEYOR'S LAND SURVEY PLATS/RIGHT-OF-WAY SURVEYS, RECEPTION NO. _____.

PREPARED FOR:

PREPARED BY:

ALTURA LAND CONSULTANTS
6950 S. Tucson Way, Unit C
Centennial, CO 80112
Phone: (720) 488-1303

NO.	DATE:	REVISION DESCRIPTION:	BY:
1	05/31/22	BOUNDARY ADJUSTMENT	KJS

PROJECT INFORMATION:

ALTA/NSPS LAND TITLE SURVEY

SPACE VILLAGE AVE.
A PORTION OF THE NW 1/4 OF SEC. 17
T14S, R65W, OF THE 6TH P.M.
CITY OF COLORADO SPRINGS, COUNTY OF EL PASO

SCALE:	
DATE:	APRIL 28, 2022
BY:	JT
JOB NO.	22032

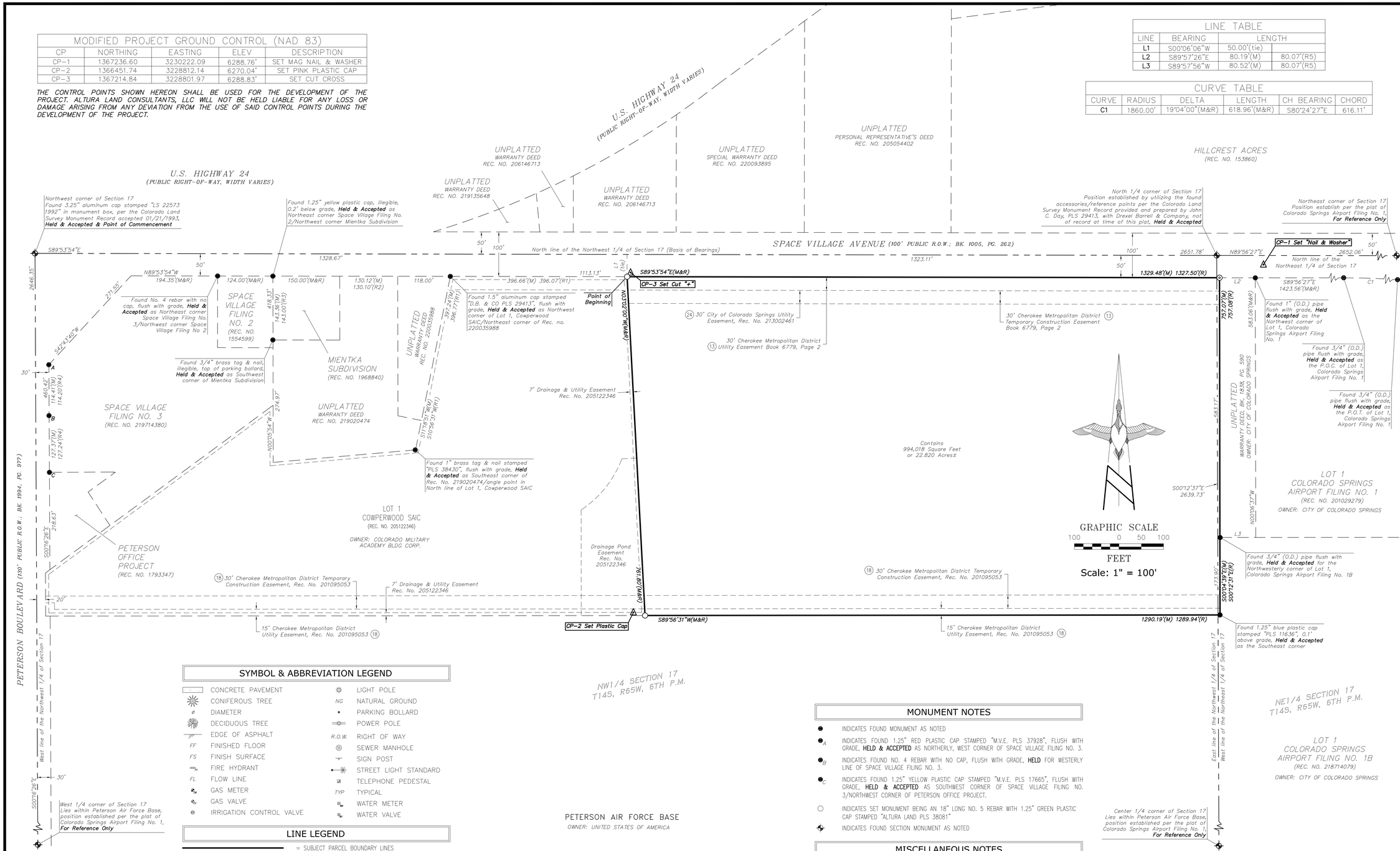
SHEET 1 OF 6

MODIFIED PROJECT GROUND CONTROL (NAD 83)				
CP	NORTHING	EASTING	ELEV	DESCRIPTION
CP-1	1367236.60	3230222.09	6288.76'	SET MAG NAIL & WASHER
CP-2	1366451.74	3228812.14	6270.04'	SET PINK PLASTIC CAP
CP-3	1367214.84	3228801.97	6288.83'	SET CUT CROSS

THE CONTROL POINTS SHOWN HEREON SHALL BE USED FOR THE DEVELOPMENT OF THE PROJECT. ALTURA LAND CONSULTANTS, LLC WILL NOT BE HELD LIABLE FOR ANY LOSS OR DAMAGE ARISING FROM ANY DEVIATION FROM THE USE OF SAID CONTROL POINTS DURING THE DEVELOPMENT OF THE PROJECT.

LINE TABLE			
LINE	BEARING	LENGTH	
L1	S00°06'06"W	50.00'(tie)	
L2	S89°57'26"E	80.19'(M)	80.07'(R5)
L3	S89°57'56"W	80.52'(M)	80.07'(R5)

CURVE TABLE					
CURVE	RADIUS	DELTA	LENGTH	CH BEARING	CHORD
C1	1860.00'	19°04'00"(M&R)	618.96'(M&R)	S80°24'27"E	616.11'



SYMBOL & ABBREVIATION LEGEND

	CONCRETE PAVEMENT		LIGHT POLE
	CONIFEROUS TREE	NG	NATURAL GROUND
ø	DIAMETER		PARKING BOLLARD
	DECIDUOUS TREE		POWER POLE
	EDGE OF ASPHALT	R.O.W.	RIGHT OF WAY
FF	FINISHED FLOOR		SEWER MANHOLE
FS	FINISH SURFACE		SIGN POST
	FIRE HYDRANT		STREET LIGHT STANDARD
FL	FLOW LINE		TELEPHONE PEDESTAL
	GAS METER	TYP	TYPICAL
	GAS VALVE		WATER METER
	IRRIGATION CONTROL VALVE		WATER VALVE

LINE LEGEND

- = SUBJECT PARCEL BOUNDARY LINES
- = SECTION LINES
- = ADJOINING PARCEL BOUNDARY LINES
- = EASEMENT LINES
- = RIGHT OF WAY LINES
- = FLOOD PLANE LINES
- = BARBED WIRE FENCE
- = CHAINLINK FENCE
- E = UNDERGROUND ELECTRIC LINES
- G = UNDERGROUND GAS LINES
- OHE = OVERHEAD ELECTRIC LINES
- SS = UNDERGROUND SANITARY SEWER LINES
- T = UNDERGROUND TELEPHONE LINES
- W = UNDERGROUND WATER LINES

UNDERGROUND UTILITY NOTE

BURIED UTILITIES AND/OR PIPELINES SHOWN HEREON ARE PER VISIBLE AND APPARENT SURFACE EVIDENCE, RECORD DRAWINGS OF THE CONSTRUCTED UTILITY LINES OBTAINED FROM RELIABLE AND RESPONSIBLE SOURCES NOT CONNECTED WITH ALTURA LAND CONSULTANTS, LLC. OR MARKINGS PROVIDED BY AN INDEPENDENT LOCATING CONTRACTOR. NO GUARANTEE OR WARRANTY, EITHER EXPRESSED OR IMPLIED, IS MADE AS TO THE ACCURACY OR THOROUGHNESS OF SUCH INFORMATION. IF MORE ACCURATE LOCATIONS OF UNDERGROUND UTILITIES OR PIPE LINES ARE REQUIRED, THE UTILITY OR PIPELINE WILL HAVE TO BE VERIFIED BY FIELD POTHOLING. ALTURA LAND CONSULTANTS, LLC AND THE SURVEYOR OF RECORD SHALL NOT BE HELD LIABLE FOR THE LOCATION OF OR THE FAILURE TO NOTE THE LOCATION OF NON-VISIBLE UTILITIES OR PIPELINES.

MONUMENT NOTES

- ● INDICATES FOUND MONUMENT AS NOTED
- $●_A$ INDICATES FOUND 1.25" RED PLASTIC CAP STAMPED "M.V.E. PLS 37928", FLUSH WITH GRADE, **HELD & ACCEPTED** AS NORTHERLY, WEST CORNER OF SPACE VILLAGE FILING NO. 3.
- $●_B$ INDICATES FOUND NO. 4 REBAR WITH NO CAP, FLUSH WITH GRADE, **HELD** FOR WESTERLY LINE OF SPACE VILLAGE FILING NO. 3.
- $●_C$ INDICATES FOUND 1.25" YELLOW PLASTIC CAP STAMPED "M.V.E. PLS 17665", FLUSH WITH GRADE, **HELD & ACCEPTED** AS SOUTHWEST CORNER OF SPACE VILLAGE FILING NO. 3/NORTHWEST CORNER OF PETERSON OFFICE PROJECT.
- ○ INDICATES SET MONUMENT BEING AN 18" LONG NO. 5 REBAR WITH 1.25" GREEN PLASTIC CAP STAMPED "ALTURA LAND PLS 38081"
- INDICATES FOUND SECTION MONUMENT AS NOTED

MISCELLANEOUS NOTES

- (R) INDICATES RECORD INFORMATION PER THE SPECIAL WARRANTY DEED RECORDED MARCH 27, 2008 AT RECEPTION NO. 208034949.
- (R1) INDICATES RECORD INFORMATION PER THE PLAT OF COWPERWOOD SAIC RECORDED AUGUST 9, 2005 AT RECEPTION NO. 205122346.
- (R2) INDICATES RECORD INFORMATION PER THE SPECIAL WARRANTY DEED RECORDED FEBRUARY 27, 2019 AT RECEPTION NO. 219020474.
- (R3) INDICATES RECORD INFORMATION PER THE PLAT OF MIENTKA SUBDIVISION RECORDED OCTOBER 4, 1990 AT RECEPTION NO. 1968840.
- (R4) INDICATES RECORD INFORMATION PER THE PLAT OF SPACE VILLAGE FILING NO. 3 RECORDED AUGUST 8, 2019 AT RECEPTION NO. 219714380.
- (R5) INDICATES RECORD INFORMATION PER THE PLAT OF COLORADO SPRINGS AIRPORT FILING NO. 1 RECORDED MARCH 9, 2001 AT RECEPTION NO. 201029279.
- (M) INDICATES MEASURED BEARINGS AND DISTANCES
- (M&R) INDICATES MEASURED AND RECORD BEARINGS AND DISTANCES

BOUNDARY DETAIL

PREPARED FOR:

PREPARED BY:

ALTURA LAND CONSULTANTS
6950 S. Tucson Way, Unit C
Centennial, CO 80112
Phone: (720) 488-1303

REVISION DESCRIPTION:	NO.	DATE:	BY:
BOUNDARY ADJUSTMENT	1	05/31/22	KJS

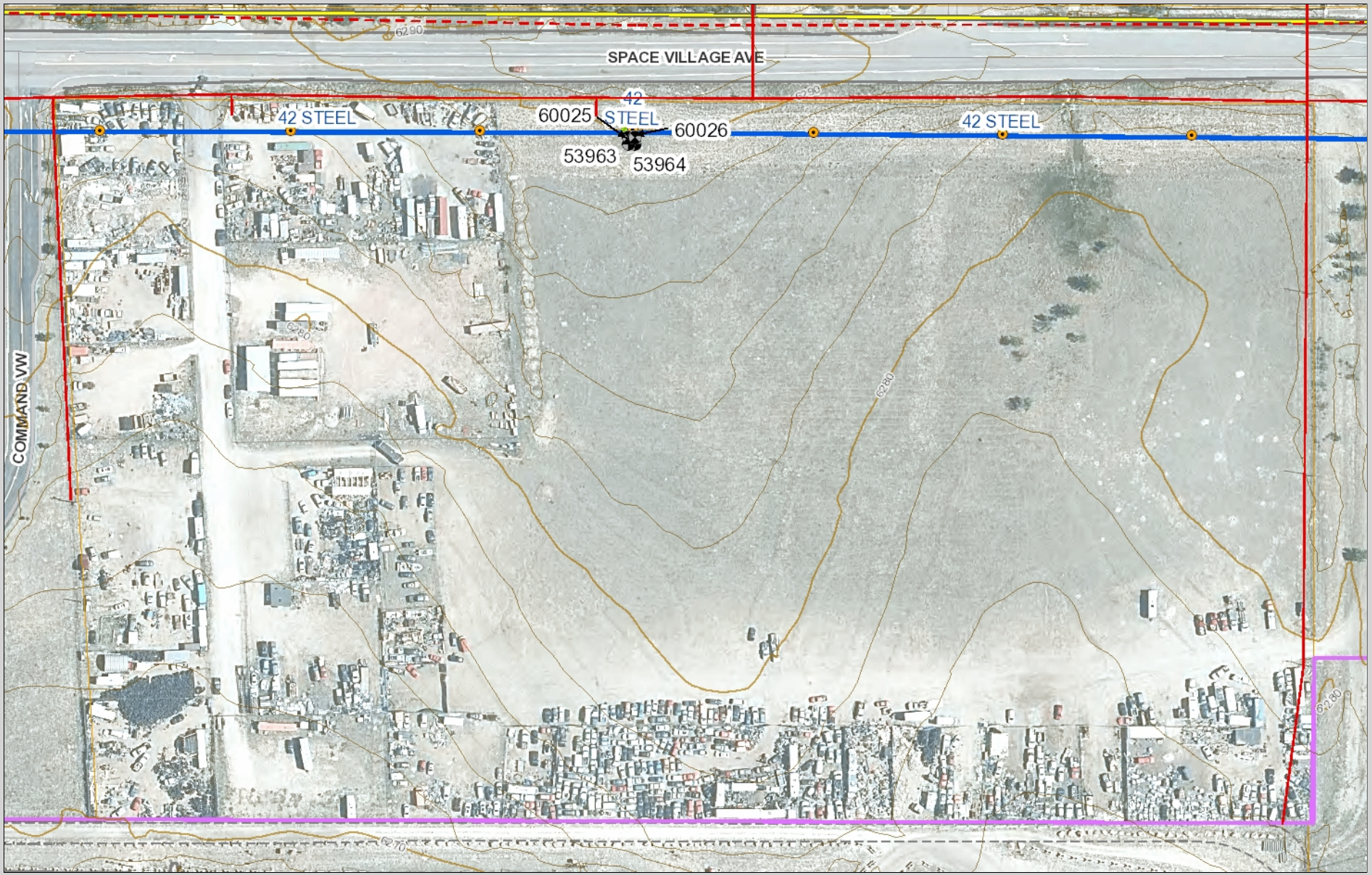
PROJECT INFORMATION:

ALTA/NSPS LAND TITLE SURVEY

SPACE VILLAGE AVE.
A PORTION OF THE NW 1/4 OF SEC. 17
T14S, R65W, OF THE 6TH P.M.
CITY OF COLORADO SPRINGS, COUNTY OF EL PASO

SCALE:	1" = 100'
DATE:	APRIL 28, 2022
BY:	JT
JOB NO.	22032

SHEET 2 OF 6



Colorado Springs Utilities
It's how we're all connected

N

Colorado Springs Utilities Public Map Viewer

1:2,257

188 0 94 188
Feet

Map Created: 12/26/2021

811 Know what's **below.** **Call** before you dig.

Cherokee Metropolitan District Map

APPENDIX D

- Fees & Cost(s)

Engineer's Opinion of Probable Costs
Space Village Filing No. 4

Item #	Description	Quantity	Unit	Unit Cost	Total Cost
	Drainage Fees				
	Drainage (63% impervious x 22.8 ac)	14.36	ac	16,646.00	$239,036.56
	Bridge (63% impervious x 22.8 ac)	14.36	ac	1,262.00	$18,122.32
	Total Drainage Fees				$257,158.88
	Detention & Stormwater Quality Facilities				
	Earthwork (East & West Pond(s))	7157	cy	5.00	$35,785.00
	Total				$35,785.00

[1]Refer to Weighted Imperviouness calculations for site imperviouness = 63%

[2]Lot 1 and Lot 2, Block 1, Space Village Filing No. 4 = 22.8 acres

[3]2023 Drainage and Bridge Fee(s) from El Paso County webiste; El Paso County Drainage Basin Fees (Resolution No. 22-442 and 23-35)

El Paso County Drainage Basin Fees

Resolution No. 22-442 and 23-35

Basin Number	Receiving Waters	Year Studied	Drainage Basin Name	2023 Drainage Fee (per Impervious Acre)	2023 Bridge Fee (per Impervious Acre)
Drainage Basins with DBPS's:					
CHMS0200	Chico Creek	2013	Haegler Ranch	$12,985	$1,916
CHWS1200	Chico Creek	2001	Bennett Ranch	$14,536	$5,576
CHWS1400	Chico Creek	2013	Falcon	$37,256	$5,118
FOFO2000	Fountain Creek	2001	West Fork Jimmy Camp Creek	$15,802	$4,675
FOFO2600	Fountain Creek	1991*	Big Johnson / Crews Gulch	$23,078	$2,980
FOFO2800	Fountain Creek	1988*	Widefield	$23,078	$0
FOFO2900	Fountain Creek	1988*	Security	$23,078	$0
FOFO3000	Fountain Creek	1991*	Windmill Gulch	$23,078	$346
FOFO3100 / FOFO3200	Fountain Creek	1988*	Carson Street / Little Johnson	$14,077	$0
FOFO3400	Fountain Creek	1984*	Peterson Field	$16,646	$1,262
FOFO3600	Fountain Creek	1991*	Fisher's Canyon	$23,078	$0
FOFO4000	Fountain Creek	1996	Sand Creek	$23,821	$9,743
FOFO4200	Fountain Creek	1977	Spring Creek	$11,969	$0
FOFO4600	Fountain Creek	1984*	Southwest Area	$23,078	$0
FOFO4800	Fountain Creek	1991	Bear Creek	$23,078	$1,262
FOFO5800	Fountain Creek	1964	Camp Creek	$2,557	$0
FOMO1000	Monument Creek	1981	Douglas Creek	$14,514	$321
FOMO1200	Monument Creek	1977	Templeton Gap	$14,900	$346
FOMO2000	Monument Creek	1971	Pulpit Rock	$7,653	$0
FOMO2200	Monument Creek	1994	Cottonwood Creek / S. Pine	$23,078	$1,262
FOMO2400	Monument Creek	1966	Dry Creek	$18,219	$660
FOMO3600	Monument Creek	1989*	Black Squirrel Creek	$10,478	$660
FOMO3700	Monument Creek	1987*	Middle Tributary	$19,259	$0
FOMO3800	Monument Creek	1987*	Monument Branch	$23,078	$0
FOMO4000	Monument Creek	1996	Smith Creek	$9,409	$1,262
FOMO4200	Monument Creek	1989*	Black Forest	$23,078	$628
FOMO5200	Monument Creek	1993*	Dirty Woman Creek	$23,078	$1,262
FOMO5300	Fountain Creek	1993*	Crystal Creek	$23,078	$1,262
Miscellaneous Drainage Basins: [1]					
CHBS0800	Chico Creek		Book Ranch	$21,654	$3,135
CHEC0400	Chico Creek		Upper East Chico	$11,797	$342
CHWS0200	Chico Creek		Telephone Exchange	$12,962	$304
CHWS0400	Chico Creek		Livestock Company	$21,351	$254
CHWS0600	Chico Creek		West Squirrel	$11,129	$4,619
CHWS0800	Chico Creek		Solberg Ranch	$23,078	$0
FOFO1200	Fountain Creek		Crooked Canyon	$6,968	$0
FOFO1400	Fountain Creek		Calhan Reservoir	$5,817	$339
FOFO1600	Fountain Creek		Sand Canyon	$4,203	$0
FOFO2000	Fountain Creek		Jimmy Camp Creek	$23,078	$1,079
FOFO2200	Fountain Creek		Fort Carson	$18,219	$660
FOFO2700	Fountain Creek		West Little Johnson	$1,521	$0
FOFO3800	Fountain Creek		Stratton	$11,070	$495
FOFO5000	Fountain Creek		Midland	$18,219	$660
FOFO6000	Fountain Creek		Palmer Trail	$18,219	$660
FOFO6800	Fountain Creek		Black Canyon	$18,219	$660
FOMO4600	Monument Creek		Beaver Creek	$13,797	$0
FOMO3000	Monument Creek		Kettle Creek	$12,463	$0
FOMO3400	Monument Creek		Elkhorn	$2,094	$0
FOMO5000	Monument Creek		Monument Rock	$10,003	$0
FOMO5400	Monument Creek		Palmer Lake	$15,995	$0
FOMO5600	Monument Creek		Raspberry Mountain	$5,380	$0
PLPL0200	Monument Creek		Bald Mountain	$11,465	$0
Interim Drainage Basins: [2]					
FOFO1800	Fountain Creek		Little Fountain Creek	$2,950	$0
FOMO4400	Monument Creek		Jackson Creek	$9,135	$0
FOMO4800	Monument Creek		Teachout Creek	$6,343	$953

1. The miscellaneous drainage fee previous to September 1999 resolution was the average of all drainage fees for basins with Basin Planning Studies performed within the last 14 years.

2. Interim Drainage Fees are based upon draft Drainage Basin Planning Studies or the Drainage Basin Identification and Fee Estimation Report. (Best available information suitable for setting a fee.)

APPENDIX E

- State Engineer, Division of Water Resources Correspondence

Jay Newell

From: Van Der Poel - DNR, Melissa <melissa.vanderpoel@state.co.us>
Sent: Thursday, April 6, 2023 6:05 PM
To: Jay Newell
Subject: Stormwater infiltration facility

Dear Mr. Newell,

In response to your email, I understand that you are designing onsite detention and stormwater quality pond(s) for a development in El Paso County, and that the detention pond(s) are proposed to be designed as a full infiltration facility for storms at or below the 100-year event. Flows resulting from larger storms would be designed to bypass the pond(s) by means of an emergency overflow. You have indicated that El Paso County is concerned that a full infiltration facility which is designed to release all detained volumes (those up to and including that from a 100-year event) by infiltration to the underlying soil, in lieu of release as surface flow, may injure downstream rights. It is this concern that the county would like the Office of the State Engineer (DWR) to comment on.

DWR is responsible for administration of water rights within Colorado's water right priority system. DWR administers stormwater detention facilities in accordance with Section 37-92-602(8), C.R.S. This statute directs that stormwater detention facilities shall be exempt from administration if they comply with the specific criteria described in Section 37-92-602(8). **Note that DWR has not been given the statutory responsibility to review construction plans, or approve or deny stormwater detention facilities.**

However, as a courtesy, DWR may provide informal comments on such facilities in the course of DWR's normal water administration duties. Based on the information provided in your previous email regarding the subject development site and the soils at this site *("Site soils are Hydrologic Soil Group Rating A (Blakeland loamy sand, 1 to 9 percent slopes [8])and an associated site specific geotechnical report indicates existing onsite infiltration rates of 2.25 in/hr to 9.50 in/hr. My research and site walk with PAFB personnel along the south property line did not turn up any specific outfall (storm sewer, channel, swale, etc.) from the site to downstream properties or conveyances. These factors lead me to consider that existing runoff may currently infiltrate onsite."),* your proposal to create a full infiltration facility for storms at or below the 100-year event, appears reasonable.

If you or the county have further questions, let me know.

Sincerely,

Melissa A. van der Poel, P.E.
Team Leader, Team 237
Division of Water Resources

COLORADO
Division of Water Resources
Department of Natural Resources

Phone 303-866-3581 ext 8208
1313 Sherman St., Room 818, Denver, CO 80203
melissa.vanderpoel@state.co.us | www.colorado.gov/water

APPENDIX F

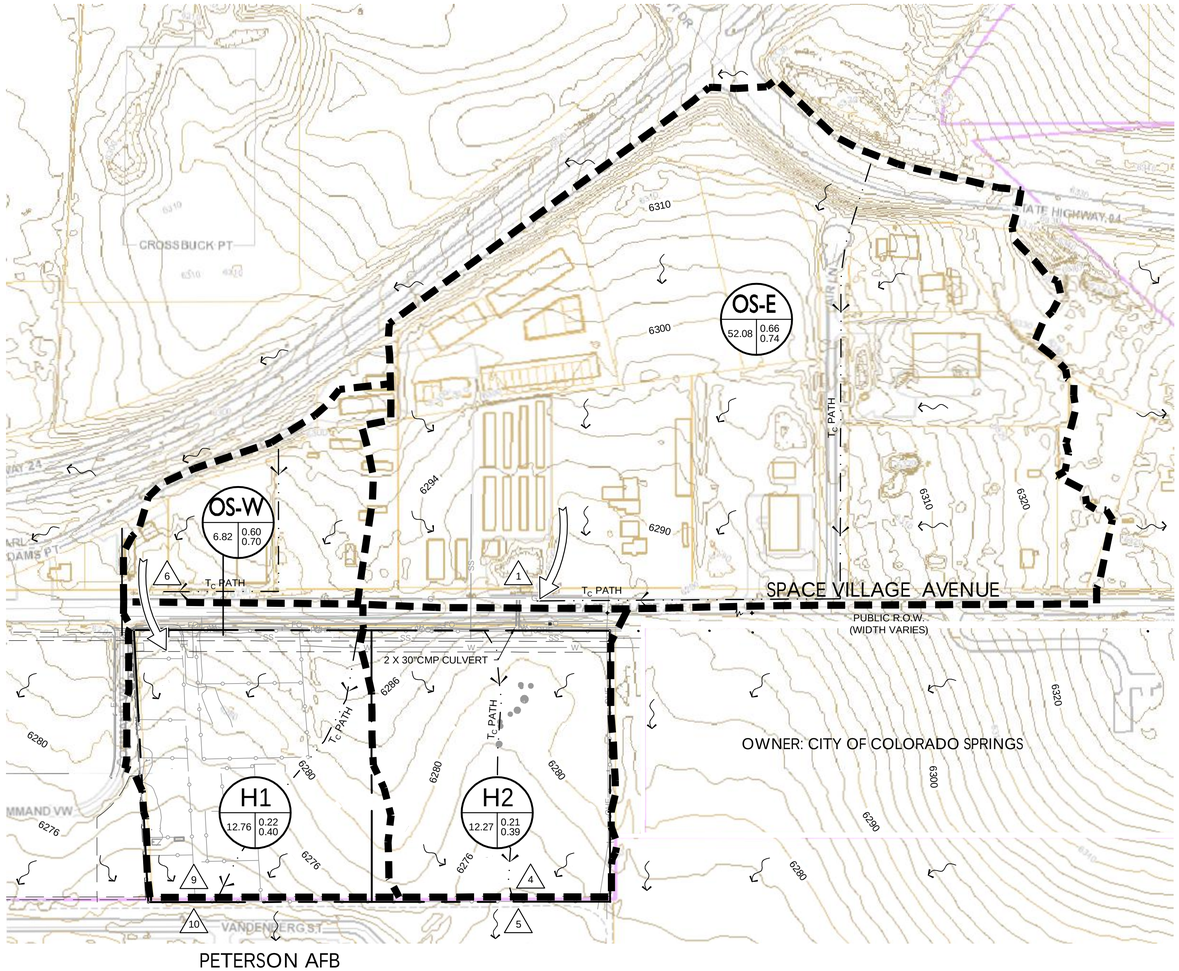
- Drainage Plans

NOTE

COUNTY PLAN REVIEW IS PROVIDED ONLY FOR GENERAL CONFORMANCE WITH COUNTY DESIGN CRITERIA. THE COUNTY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE COUNTY, THROUGH THE APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.

SPACE VILLAGE FILING NO. 4

A PORTION OF THE NW 1/4 OF SEC. 17, T14S,
R65W, OF THE 6th P.M., EL PASO COUNTY, COLORADO
FINAL DRAINAGE PLAN



LOT 1, COWPERWOOD SAIC
EL PASO COUNTY
OWNER: COLORADO MILITARY
ACADEMY BUILDING CORPORATION

PETERSON AFB
OWNER: UNITED STATES OF AMERICA

SUMMARY RUNOFF TABLE

DESIGN POINT	BASIN	AREA (AC.)	IMP. (%)	C_{10}	C_{100}	Q_{10} (CFS)	Q_{100} (CFS)	REMARKS
1	OS-E	52.08	76	0.66	0.74	89.48	146.46	TO H2
6	OS-W	6.82	65	0.60	0.70	16.87	27.77	TO H1
4	H2	12.27	8	0.21	0.39	9.39	25.14	TO DP 5
9	H1	12.76	9	0.22	0.40	11.39	29.79	TO DP 10
5						75.86	127.92	TO OFFSITE
10						19.15	39.20	TO OFFSITE

LEGEND

- PROPERTY LINE
- ADJACENT PROPERTY LINE
- EASEMENT LINE
- 6275 — EXIST. MAJOR CONTOUR
- EXIST. MINOR CONTOUR
- EXIST. FENCE
- EXIST. EDGE OF ASPHALT
- EXIST. CURB AND GUTTER
- OHE — EXIST. OVERHEAD ELECTRIC
- SS — EXIST. SANITARY SEWER
- W — EXIST. WATERLINE
- G — EXIST. GAS LINE
- E — EXIST. ELECTRIC
- T — EXIST. TELEPHONE
- FO — EXIST. FIBER OPTIC
- RN / 0.80 / 0.21 / 0.37 — BASIN ID, C_{10}, C_{100}
- AREA (AC.)
- 6 — DESIGN POINT
- FLOW DIRECTION
- BASIN LIMIT
- OFF-SITE BASIN CONTRIBUTION
- T_C PATH

FLOODPLAIN

ZONE X, "AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN." AS SHOWN ON FEMA FIRM MAP NO. 08041C0754G, EFFECTIVE DATE, DECEMBER 7, 2018.

NORTH

0 100 200 400
SCALE: 1"= 200'

STERLING DESIGN ASSOCIATES
Civil Engineers | Landscape Architects
2009 W. Littleton Blvd. #300 Littleton, CO 80120
303.794.4727 | www.SterlingDesignAssociates.com

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ISSUES & REVISIONS
NO.: 1 DATE: BY:
DESCRIPTION:
NO.: 2 DATE: - BY: -
DESCRIPTION: -
NO.: 3 DATE: - BY: -
DESCRIPTION: -
NO.: 4 DATE: - BY: -
DESCRIPTION: -
NO.: 5 DATE: - BY: -
DESCRIPTION: -
NO.: 6 DATE: - BY: -
DESCRIPTION: -

DATE: **4/2023**
SCALE: **1" = 200'-0"**
PROJECT MANAGER: **JS**
PROJECT NO.:
DRAWN BY: **JN**
DRAWING FILE:

PROJECT:

SPACE VILLAGE FILING NO. 4
EL PASO COUNTY, CO

CLIENT:

COMMERCIAL BUILDING SERVICES
7561 S. GRANT STR., SUITE A-4
LITTLETON, COLORADO 80122

TEL: (303) 730-3001

SHEET TITLE:

FINAL DRAINAGE PLAN (EXISTING)

SHEET NUMBER:

1 OF 2

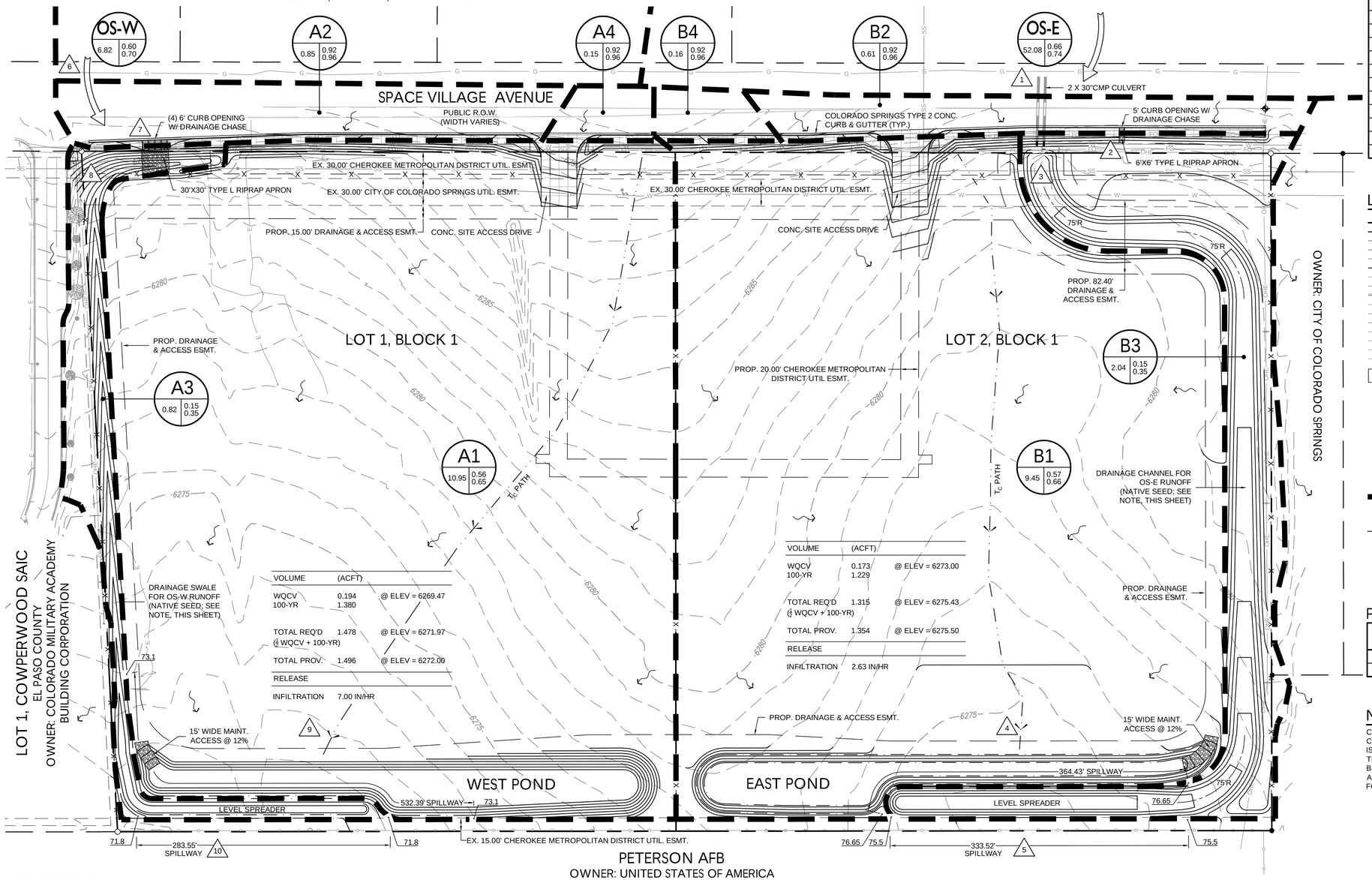
SPACE VILLAGE FILING NO. 4

A PORTION OF THE NW 1/4 OF SEC. 17, T14S,
R65W, OF THE 6th P.M., EL PASO COUNTY, COLORADO
FINAL DRAINAGE PLAN

NATIVE SEED

USDA NATURAL RESOURCES CONSERVATION SERVICE (NRCS) NATIVE SEED MIX

COMMON NAME	SCIENTIFIC NAME	GROWTH SEASON / FORM	% OF MIX	POUNDS PLS
BLUESTEM, BIG	ANDROPOGON GERARDII 'KAW'	WARM, BUNCH	20	2.18
BLUESTEM, LITTLE	SCHIZACHYRIUM SCOPARIUM 'PASTURA'	WARM, BUNCH	10	0.67
GRAMA, BLUE	BOUTELOUA GRACILIS 'HACHITA'	WARM, SOD	20	0.25
GRAMA, SIDEOATS	BOUTELOUA CURTIPENDULA 'VAUGHN'	WARM, SOD	10	0.91
INDIAN GRASS, YELLOW	SORGHASTRUM NUTANS 'CHEYENNE'	WARM, BUNCH/SOD	10	1.02
WHEATGRASS, WESTERN	PASCOPYRUM SMITHII 'ARRIBA'	COOL, SOD	20	3.20
SWITCHGRASS	PANICUM VIRGATUM 'BLACKWELL'	WARM, SOD	10	0.40
SANDSEED, PRAIRIE	CALIMOVILFA LONGIFOLIA 'GOSHEN'	WARM, SOD	10	0.64
		SEED RATE (LBS PLS / ACRE)		9.26



SUMMARY RUNOFF TABLE

DESIGN POINT	BASIN	AREA (AC)	IMP. (%)	C_{10}	C_{100}	Q_{10} (CFS)	Q_{100} (CFS)	REMARKS
1	OS-E	52.08	76	0.66	0.74	89.48	146.46	TO DP 3
6	OS-W	6.82	65	0.60	0.70	16.87	27.77	TO DP 8
	B4	0.16	100	0.92	0.96	0.90	1.36	TO B2
	B2	0.61	100	0.92	0.96	3.45	5.19	TO DP 2
2						4.35	6.55	TO DP 3
3						91.33	149.29	TO B3
	B3	2.04	0	0.15	0.35	1.29	4.29	TO DP 5
4	B1	9.45	70	0.57	0.66	21.49	35.93	TO POND
5						76.18	128.01	TO OFFSITE
	A4	0.15	100	0.92	0.96	0.84	1.26	TO A2
	A2	0.85	100	0.92	0.96	4.74	7.14	TO DP 7
7						5.58	8.41	TO DP 8
8						20.63	33.31	TO A3
	A3	0.82	0	0.15	0.35	0.71	2.39	TO DP 10
9	A1	10.95	68	0.56	0.65	23.22	38.30	TO POND
10						18.29	30.45	TO OFFSITE

LEGEND

- PROPERTY LINE
- ADJACENT PROP. LINE
- EASEMENT LINE
- EXIST. MAJOR CONTOUR (6275)
- EXIST. MINOR CONTOUR
- PROP. CONTOUR (75)
- EXIST. FENCE
- EXIST. EDGE OF ASPHALT
- EXIST. CURB & GUTTER
- EXIST. OVERHEAD ELEC. (OHE)
- EXIST. SAN. SEWER (SS)
- EXIST. WATERLINE (W)
- EXIST. GAS LINE (G)
- EXIST. ELECTRIC (E)
- EXIST. TELEPHONE (T)
- EXIST. FIBER OPTIC (FO)
- PROP. CONCRETE
- BASIN ID (RN)
- C_{10} / C_{100} (0.80 / 0.21 / 0.37)
- AREA (AC.)
- DESIGN POINT (6)
- FLOW DIRECTION
- BASIN LIMIT
- OFF-SITE BASIN CONTRIBUTION
- T_C PATH

PBMP SUMMARY TABLE

BASIN	PBMP TRIBUTARY AREA (AC)	PBMP
B1	9.45	EAST POND
A1	10.95	WEST POND

NOTE

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NORTH

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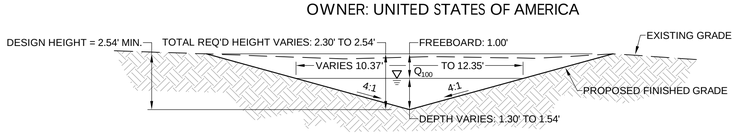
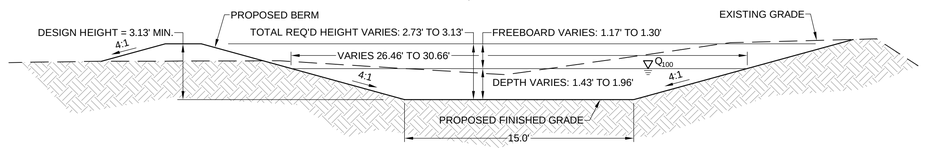
SCALE: 1"= 60'



DRAINAGE SWALE
NOT TO SCALE
A



DRAINAGE CHANNEL
NOT TO SCALE
B

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