Final Drainage Report
For
Wildcat Residences
1807 Wildcat Avenue
Fruita, Colorado

Prepared For:

Wildcat Acquisitions LLC
312D Aspen Airport Business Center
Aspen, Co 81611

Prepared By:
Austin Civil Group, Inc.
123 North 7th Street, Ste 300
Grand Junction, Colorado 81501
(970) 242-7540

ACG JOB#: 1456.0003

Date: September 21, 2023

I hereby certify this Final Drainage Report (plan) for the Wildcat Residences project located at 1807 Wildcat Avenue in Fruita, Colorado was prepared by me (or under my direct supervision) in accordance with the provisions of the Stormwater Management Manual for the owners thereof, I understand the City of Fruita does not and will not assume liability for drainage facilities designed by others.

Mark Austin
Registered Professional Engineer
State of Colorado No. 29778

Wildcat Acquisitions LLC hereby certify the drainage facilities for the Wildcat Residences project shall be constructed according to the design presented in this report. I understand that the City of Fruita does not and will not assume liability for the drainage facilities designed and/or certified by my engineer. I understand the City of Fruita reviews drainage plans but cannot on behalf of Wildcat Acquisitions LLC guarantee that final drainage design will absolve Wildcat Acquisitions LLC and/or their successor and/or assigns of the future liability for improper design. I understand that approval of the Plan does not imply approval of my engineer's drainage design.

I further understand that as the owner of the property, I am responsible for the maintenance of the stormwater drainage pipes, inlets, detention and water quality facilities. These facilities will require routine maintenance in order to minimize damage that may result from flooding or ponding water.

_____
Wildcat Acquisitions LLC

Table of Contents

Appendices

I. INTRODUCTION

A. Background

..... 1. Identify report preparer and purpose.

This report is prepared by Austin Civil Group, Inc. and the purpose of the report is for the construction of 2 ea 20 unit apartment buildings and 7ea 5 unit row home buildings located at 1807 Wildcat Avenue in Fruita, Colorado.

..... 2. Identify date of letter with previous City/County comments.

This is a final drainage report and no prior comments have been received from the City of Fruita.

B. Project Location

..... 1. Identify Township, Range, and Section.

SW1/4, SW1/4, Section 16, Township 1 N, Range 2 West, Ute Meridian.

..... 2. Identify adjacent street.

The subject property is located at the northeast corner of Wildcat Avenue and South Pine Street.

..... 3. Reference to General Location Map.

A general location map is provided in **Appendix A** and is depicted in the photo below:

Project Location Map

C. Property Description

..... 1. Identify area in acres of entire contiguous ownership.

The project site, approximately 3.66-acres in size, is located at the southern end of Legacy PUD Subdivision, which is a planned development approved by the City of Fruita in 2007.

..... 2. Describe existing ground cover, vegetation, soils, topography and slopes.

The existing project site is covered with noxious weeds and sparse vegetation. An existing detention pond facility for The Legacy PUD Subdivision is located at the northern portion of site.

The topography on the site is extremely flat and has an existing ground elevation of approximately 4516 across the entire property. Listed below is a 2-ft contour map depicting the project and surrounding areas:

Current Project Site Conditions and 2-ft Topography

The site historically drains appears to have historically drained to adjacent street right of way areas in Wildcat Avenue at the south and South Pine Street at the west.

Soils on the property have been classified by the US Department of Agriculture Soil Conservation Service and primarily consist of Fruitland sandy clay loam. These soils have slow infiltration rates and are classified as hydrologic soil type 'B' soil. **Appendix B** of this report provides more information from the NRCS report.

..... 3. Describe existing drainage facilities, such as channels, detention areas, or structures.

The site does not have any drainage facilities on the 3.66-acre site. However, there are two existing detention facilities for the Legacy PUD Subdivision located at the north side of the site. See the air photo below:

Existing Drainage Facilities

..... 4. Describe existing irrigation facilities, such as ditches, head-gates, or diversions.

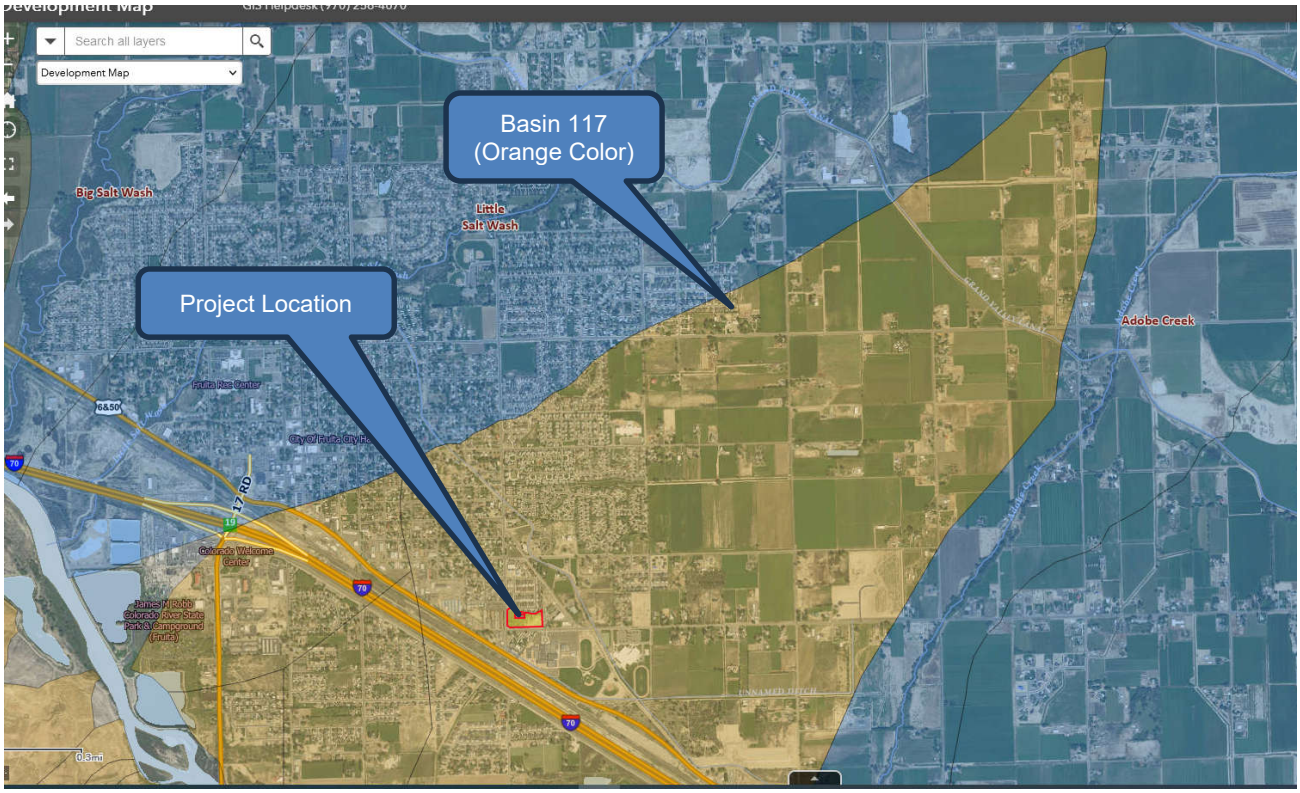
There are no public irrigation facilities on the site. A private irrigation line for the Legacy PUD Subdivision runs along the west, south and east property lines as well as the north property line which helps provide irrigation water to the detention facilities. Listed below is the City of Fruita GIS layer information for irrigation:

City of Fruita GIS Irrigation Facilities

D. Previous Investigations

..... 1. Identify drainage master plans that include the project area, including floodplain studies.

According to the Mesa County / City of Grand Junction GIS database for Drainage Basins, the project is located at the bottom portion of drainage basin 117, which starts near the intersection of 20 Road and L Road in Mesa County. A map depicting the project location within this basin is depicted below:



Major Drainage Basin 117 Map

The project is not located within any FEMA designed special flood hazard areas. An except map from FEMA is depicted below:

FEMA National Flood Hazard FIRM Map

2. Identify drainage reports for adjacent development.

This 3.66-acre site is part of the Legacy PUD Subdivision project (18.47-acres) which was approved by the City of Fruita in 2007. Vortex Engineer completed a drainage report for this development which was dated February 23, 2006. Excerpts of this report are included in Appendix D of this report.

II. DRAINAGE SYSTEM DESCRIPTION

A. Existing Drainage Conditions

..... 1. Describe existing topography and provide map with contours extending a minimum of 100 feet beyond property limits.

The existing project site is covered with noxious weeds and sparse vegetation. An existing detention pond facility for The Legacy PUD Subdivision is located at the northern portion of site.

The topography on the site is extremely flat and has an existing ground elevation of approximately 4516 across the entire property. Listed below is a 2-ft contour map depicting the project and surrounding areas:

Current Project Site Conditions and 2-ft Topography

The site historically drains appears to have historically drained to adjacent street right of way areas in Wildcat Avenue at the south and South Pine Street at the west.

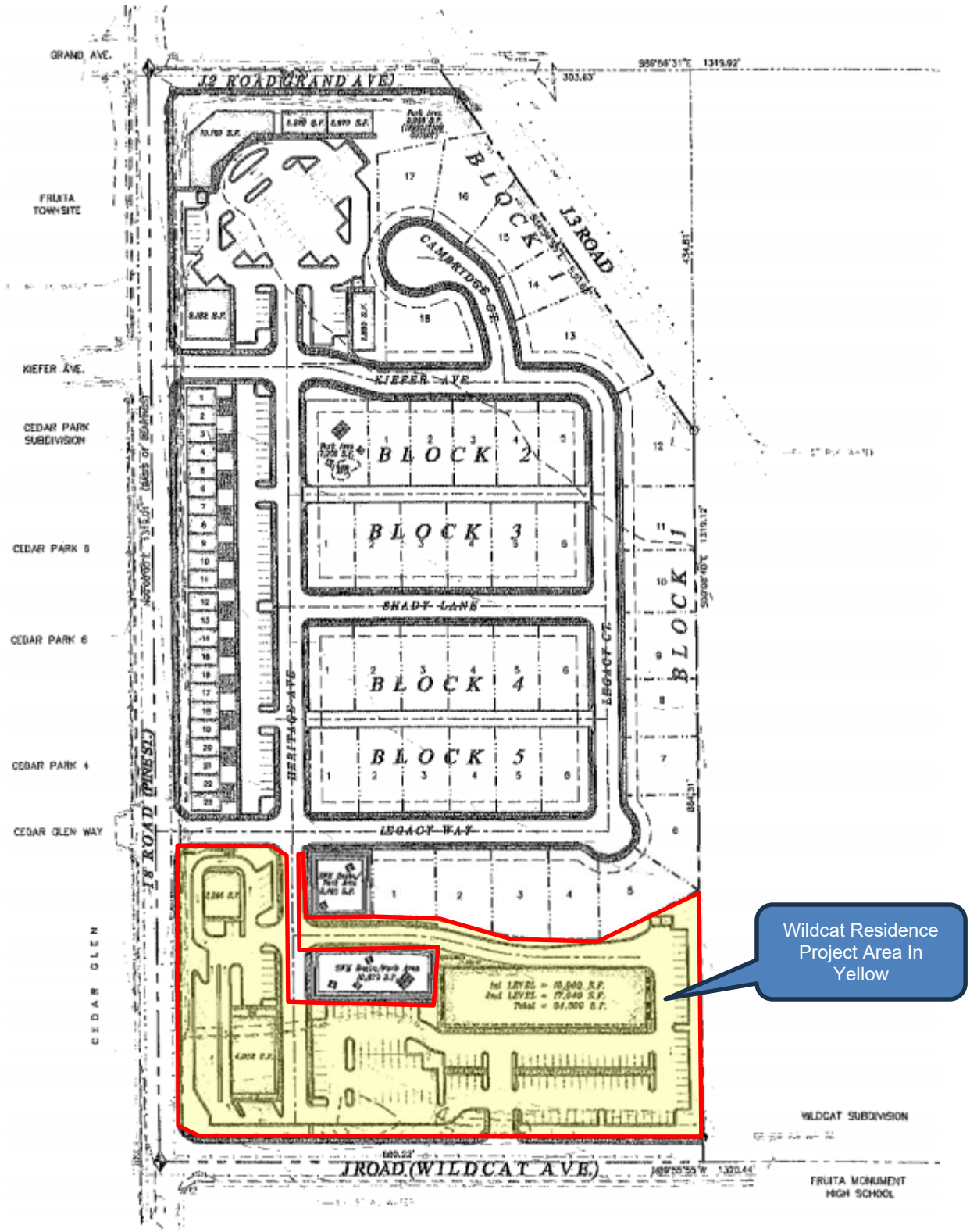
..... 2. Identify major drainage way or outfall drainage way and describe map showing location of proposed development within the drainage ways.

As previously stated, the 3.66-acre property is adjacent to the two existing detention facilities constructed for the Legacy PUD Subdivision. These detention facilities are located along the northern boundary of the 3.66-acre site. A photo of this condition is depicted below:

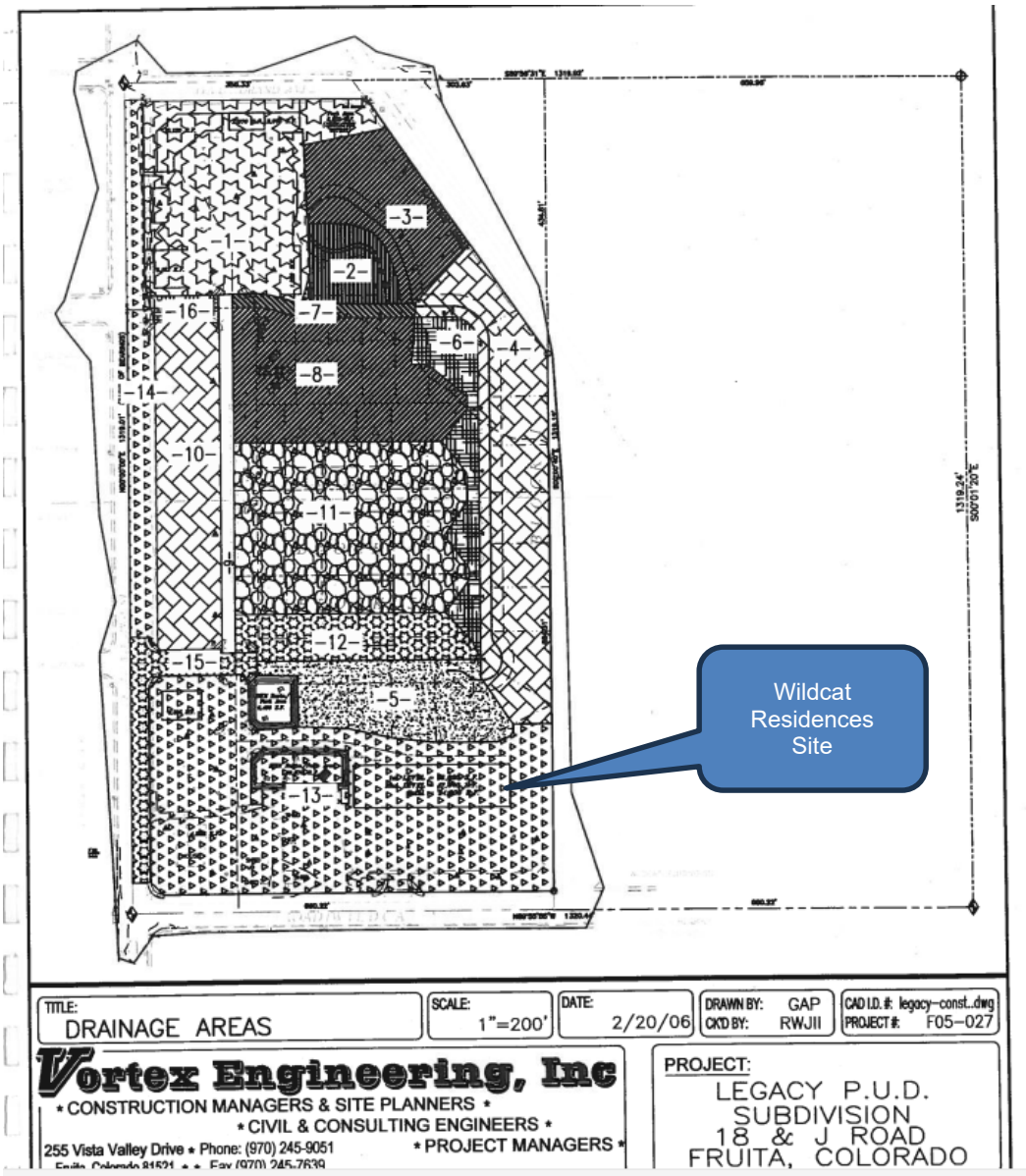
Existing Drainage Facilities

3. Identify pre-developed drainage patterns and describe map showing pre-developed sub-basins and concentrated discharge locations. Provide calculations of pre-developed peak flows entering and leaving the site.

The 3.66-acre project site is part of the 18.47-acre Legacy PUD Subdivision. Vortex Engineering prepared a drainage report which addressed this site which was identified as drainage basin area 13, as depicted below:



Legacy PUD Subdivision Plan from Vortex Engineering



2006 Vortex Engineering Drainage Report Map For Legacy PUD

Vortex Engineering utilized Win TR-55 and TF-20 to model stormwater on the 18.47-acre project site for the 2-yr and 100-yr storm events. The project included two detention basins provide approximately 48,000 cubic fee of storage. The existing outlet control structure, which is located on the southern most detention pond, has an outlet control structure with a 6-inch diameter opening at the bottom of the structure which was designed to release 1.82-cfs for the 100-yr storm event at a water surface elevation of

4515.84, which is approximately 52% of the historic rate. Excerpts from the Vortex Engineering report are included in Appendix D of this report.

B. Master Drainage Plan

..... 1. Describe location of the project relative to a previously prepared master drainage plan, including drainage plans prepared for adjacent development.

The project is not located in any previous drainage master plans.
.

C. Offsite Tributary Area

..... 1. Identify all offsite drainage basins that are tributary to the project.

The project does not have any offsite drainage flow to this portion of the project area. However, the project is part of the Legacy PUD Subdivision and the subdivisions detention facilities are located along the northern boundary of the site.

..... 2. Identify assumptions regarding existing and future land use and effects of offsite detention on peak flows.

The project does not have offsite flows and all upgradient areas are fully developed and will not impact any peak flows.

D. Proposed Drainage System Description

..... 1. Identify how offsite stormwater is collected and conveyed through the site and ultimately to the receiving water(s).

The Legacy PUD Subdivision has existing stormwater infrastructure and detention facilities at the north end of the Wildcat Residence project site. Drainage from these detention facilities discharges through an outlet control structure on the southern most pond, which discharges to an underground storm sewer system in Pine Street which is part of the City of Fruita storm drainage system, which discharges to the Colorado River approximately one mile south of the project location.

2. Identify sub-basins and describe, in general terms, how onsite stormwater is collected and conveyed through the site for each location where stormwater is discharged from the site.

The Wildcat Residence project will have two developed drainage basin areas.

Developed drainage basin D-1, approximately 2.81-acres in size, consist of the majority of the developed project area, with the exception of the street frontage areas along Wildcat

Avenue and Pine Street. Drainage from this basin area sheet flows into new site stormwater infrastructure which discharges into the existing south detention pond, or sheet flows directly to the south detention pond.

Developed drainage basin areas D-2, approximately 0.85-acres ins size, consists of the street frontage area along Wildcat Avenue and South Pine Street. Drainage from these basin areas sheet flows across the street frontage landscape area and discharges into street curb and gutter system.

Development Major Basins Runoff Calculations

Basin	Size (ac)	Storm Event	"C" Value	Runoff (cfs)
D-1	2.81	10-Yr	0.62	3
		100-Yr	0.71	7
D-2	0.85	10-Yr	0.46	1
		100-Yr	0.60	2

Developed Basin Area D-1 was further delineated into three sub-basin areas to size stormwater infrastructure.

Developed sub-basin area D-1.1, approximately 0.88-acres in size, consists of the north-eastern portion of the project site and includes one -half of the roof area from Building 1 and 2. Drainage from this basin area sheet flows west and discharges into the existing south detention pond.

Developed sub-basin area D-1.2, approximately 1.72-acres in size, consists of the middle portion of the project site and includes one -half of the roof area from Buildings 1, 2, 3, 4, and 5 and one half of the roof area from the two storage unit buildings. Drainage from this basin area sheet flows to new site storm sewer infrastructure which discharges to the existing south detention pond.

Developed sub-basin area D-1.3, approximately 0.52-acres in size, consists of the western portion of the project site and includes one-half of the roof area from Buildings 5 and 6, and one half of the roof area from the two storage unit buildings. Drainage from this basin area sheet flows to new site storm sewer infrastructure which discharges to the existing south detention pond.

Development Sub- Basin Runoff Calculations

Basin	Size (ac)	Storm Event	"C" Value	Runoff (cfs)
D-1.1	3.58	10-Yr	0.36	1
		100-Yr	0.56	2
D-1.2	0.13	10-Yr	0.73	2
		100-Yr	0.79	5
D-1.3	0.11	10-Yr	0.77	1
		100-Yr	0.83	2

A map identifying the developed drainage basins, sub-basin areas and site conditions for the project site is provided in **Appendix E** of this report. Post-developed runoff calculations using the Rational Method are summarized below and detail calculation information is provided in **Appendix F** of this report:

..... * 3. Describe detention volumes, release rates and pool elevations.

As stated previously, the Wildcat Residence project is part of a larger master planned developed called Legacy PUD Subdivision. The Legacy PUD Sudivision has already installed detention facilities for the overall development, which includes the Wildcat Residence project.

Therefore, no changes or modification are proposed from the Legacy PUD Sudivision drainage report prepared by Vortex Engineer.

..... * 4. Identify the difference in elevation between pond invert and the groundwater table.

This project is not making any change to the existing detention facilities on the project.

The existing detention facilities are dry and show no signs of influence from high ground water table elevations.

..... 5. Describe how stormwater is discharged from the site, including both concentrated and dispersed discharges.

The project is not changing any stormwater discharge controls for the existing detention facilities.

The Wildcat Residence project will collect onsite stormwater runoff and discharge it to the existing detention facilities at the north side of the project.

However, street frontage areas along Wildcat Avenue and Pine Street will sheet flow the street curb and gutter system.

..... 6. Describe stormwater quality facilities.

The existing stormwater detention facilities for Legacy PUD Subdivision were constructed prior to 2007 when the newer stormwater water quality requirements were triggered. Therefore, the Wildcat Residence project will install additional outlet control measures in the existing outlet control structure to provide water quality treatment of the Wildcat Residence project's water quality treatment requirements.

The water quality treatment will utilize the Extended Basin Design standards for water quality treatment of stormwater as defined in the 2007 version of the SWMM manual.

Details for this calculation are included in **APPENDIX G** and summarized in the table below:

Water Quality Storage Requirements

WATER QUALITY CAPTURE VOLUME (WQCV)						
LOCATION	K(1)	a(2)	I(3)	WQCV(4)	A(5)	Design Volume(6)
			decimal	inches	acres	cubic feet
D-1	0.65	1.00	0.70	0.18	3.66	2,855

(1) Adjustment to equation for Mesa County area = $d_6/0.43$; where d_6 =0.28, therefore K = 0.65 --- per SWMM 1604.2

(2) Adjustment for BMPs drain time --- per SWMM 1604.2

(3) Watershed impervious as a decimal

(4) Water Quality Capture Volume is in watershed inches = $K(a((0.91*I^3) - (1.19*I^2) + (0.78*I)))$ ---- per SWMM 1604.2

(5) Tributary watershed area in acres

(6) Design Volume is 120% of the WQCV = WQCV * A * 1.2 * (1/12) * 43,560

The Vortex Engineering drainage report includes a stage vs storage table for the south pond. The invert elevation at the outlet control structure and bottom elevation of the south pond is at an elevation of 4512.50. Using this table, the water quality capture volume requirement of 2,855 cubic feet occurs at a water surface elevation of 4513.20, which is approximately 0.7-ft (8-1/2-inches) deep. The table from the Vortex Report is depicted below:

Vortex Engineering Stage Vs Storage Table for South Pond

South Basin

Elevation [ft.]	Length	Width	Area [ft²]	Area [acre]	Change in Elevation [ft]	Average Area [acre]	Incremental Volume [acre-ft]	Volume [ft³]	Cumulative Volume ft^3	Cumulative Volume acre-ft
4517.00	150.00	65.00	9623.0	0.2209	1.0	0.2049	0.2049	8,927	30,388	0.6976
4516.00	144.00	59.00	8231.0	0.1890	1.0	0.1745	0.1745	7,602	21,461	0.4927
4515.00	138.00	53.00	6972.0	0.1601	1.0	0.1467	0.1467	6,392	13,860	0.3182
4514.00	132.00	47.00	5811.0	0.1334	1.0	0.1206	0.1206	5,256	7,468	0.1714
4513.00	126.00	41.00	4700.0	0.1079	0.5	0.1016	0.0508	2,213	2,213	0.0508
4512.50	123.00	38.00	4150.0	0.0953	0.0	0.0476	0.0000	0	0	0.0000

4513.2 — 2,855 CF

Using the Urban Drainage and Flood Control District drain time formula for a 40-hour drain time with holes spaced at 4-inches on center, the hole size for the water quality control plate will need to be 9/16” diameter with holes spaces at 4-inches on center.

* 7. Describe maintenance access aspects of design.

Stormwater management practices will be required for all onsite disturbed areas to minimize sediment migration into the detention / water quality pond facility.

Routine maintenance of the pond's outlet structure and trash screens will be required. The screens should be checked after significant storm events or when it appears stagnate water is in the bottom of the pond.

Area inlets should be checked after major storm events or if water is observed ponding above the inlets. In most cases, the grates will need to be cleaned to remove leaves and debris.

..... * 8. Describe easements and tracts for drainage purposes, including limitation on use.

The project will not have any drainage easements or tracts for the underground system. The property will be professionally maintained and managed by a property management system.

Mesa County Stormwater O&M Agreements will be provided which will require yearly maintenance and inspections for the facility.

E. Drainage Facility Maintenance

..... * 1. Identify responsible parties for maintenance of each drainage and water quality facility.

The property owner's association will be responsible for maintenance of drainage facilities on the property. The existing site detention facilities are maintained by the existing Legacy PUD Subdivision Homeowners Association.

..... * 2. Identify general maintenance activities and schedules.

The detention pond and its outlet structure will operate and be maintained in good working order as reasonably determined by the Mesa County Stormwater District, the Qualified Erosion Control Specialist (QES), and this report.

The detention pond and its outlet structure should be inspected quarterly and after any significant rainfall during the 1st year of operation by the QES. At any time during the inspections the QES finds a significant collection of sediment and/or debris that inhibits the facility from functioning properly, appropriate means shall be selected by the QES to clean and maintain the facility to its original working order.

After the first year of operation, the QES has the option to reduce the interval of inspections based on the previous year(s) reports but should be inspected a minimum of 1 time per year. The Post-Construction Stormwater Control Operations and Maintenance Agreement entered into by the Landowner and the Mesa County Stormwater District shall constitute a covenant running with the Property and shall be equitable servitude binding on present and subsequent owners of the Property in whole or in part, and their administrators, executors, assigns, heirs and successors in interest.

III. DRAINAGE ANALYSIS AND DESIGN CRITERIA

A. Regulations

..... 1. Identify that analysis and design was prepared in accordance with the provisions of the Manual.

The existing site detention facilities were designed by Vortex Engineering and constructed in 2006 as part of the Legacy PUD Subdivision. The design for these facilities was completed in accordance with 1996 Mesa County Stormwater Manual requirements.

The Wildcat Residence project is responsible to provide stormwater “quality” treatment because the site disturbs more than one-acre of land. The stormwater quality facilities will be added to the existing detention pond outlet structure. All water quality analysis and design was prepared in accordance with the 2007 Mesa County/City of Grand Junction Stormwater Management Manual.

2. Identify other regulations or criteria which have been used to prepare analysis and design.

None.

B. Development Criteria

..... 1. Identify drainage constraints placed on the project, such as by a major drainage study, floodplain study or other drainage reports relevant to the project.

There are no drainage constraints for this project.

..... 2. Identify drainage constraints placed on the project, such as from major street alignments, utilities, existing structures, and other developments.

There are no design constrains on this project.

C. Hydrologic Criteria (If Manual was followed without deviation, then a statement to that effect is all that is required. Otherwise provide the following information where the criteria used deviates from the Manual.)

This project will provide water quality treatment only and follows the requirements of the 2007 Mesa County/City of Grand Junction Stormwater Management Manual.

..... 1. Identify how storm runoff peak flows and volumes were determined, including rainfall intensity or design storm.

Peak runoff for improvements constructed by the Wildcat Residence project was determined in accordance with the 2007 SWMM using the rational method for the 10-yr and 100-yr storm events.

..... 2. Identify which storm events were used for minor and major flood analysis and design.

The Manual was followed which calls for analysis for the 10-yr and 100-yr storm events.

..... 3. Identify how and why any other deviations from the Manual occurred.

There are no deviations to the manual.

D. Hydraulic Criteria (If Manual was followed without deviation, then a statement to that effect is all that is required. Otherwise provide the following information where the criteria used deviates from the Manual.)

Hydraulic analysis and design was prepared in accordance with the Stormwater Management Manual.

..... * 1. Identify type(s) of streets within and adjacent to development and source for allowable street capacity.

There are no streets modified or added by this project.

..... * 2. Identify which type(s) of storm inlets were analyzed or designed and source for allowable capacity.

The project is not proposing to install any public storm sewer inlets.

A new storm sewer inlets and infrastructure will be constructed with this project to address the runoff from the private improvements. The private storm sewer system was

modeled using StormCAD and allowable capacities were followed using the 2007 SWMM using the rational method for the 10-yr and 100-yr storm events.

..... * 3. Identify which type of storm sewers which were analyzed or designed and Manning's n-values used.

The storm sewer system provided for this project are all private.

Capacity analysis for main storm sewer systems within the project assume a concrete pipe with a mannings N value of 0.13, and used StormCAD version 1.0 analysis software. The analysis shows the system is capable of conveying the 100-yr flow. The results of the analysis are provided in **Appendix H** of this report.

..... * 4. Identify which method was used to determine detention volume requirements and how allowable release rates were determined.

The site's detention facilities were designed as part of the original subdivision project and this project is not changing any detention requirements.

..... * 5. Identify how the capacity of open channels and culverts were determined.

There are no new open channels or culverts installed with this project.

..... * 6. Identify any special analysis or design requirements not contained with the Manual.

None

..... 7. Identify how and why any other deviations from the Manual occurred.

There are no deviations from the manual

E. Variance from Criteria

..... 1. Identify any provisions of the Manual for which a variance is requested.

There are no variances from the manual

..... 2. Identify pre-existing conditions which cause the variance request.

None.

*IV. POST CONSTRUCTION STORMWATER MANAGEMENT.

See Manual Section 1600 for requirements. The Final Drainage Plan and the Construction SWMP (see SWMM Section 1500) meets the requirements of the MS4s Permit. In general, this section identifies permanent BMP practices to control the discharge of pollutants after construction is complete.

*A. Stormwater Quality Control Measures

.....* 1. Describe the post-construction BMPs to control discharge of pollutants from the project site.

The site improvements and landscape plan will provide final site stabilization to minimize pollutants from the site.

A water quality control plate has been provided to slowly release the water quality capture volume over a 40 hour period, using the extended basin design procedures.

.....* 2. If compensating detention is provided, discuss practices to address water quality from area not tributary to detention area.

The project is not modifying any detention facilities.

.....* 3. If underground detention is proposed, discuss how water quality facilities will be provided on the surface.

There are no underground detention facilities.

.....4. If proprietary BMPs are proposed, provide the justification and sizing requirements (see SWMM Section 1603.3).

N/A

*B. Calculations

.....1. Provide methods and calculations for WQCV, sediment storage, and water quality outlet structure.

The detailed analysis for the water quality capture volume (WQCV) using the SWMM criteria in Section 1600 is depicted in **Appendix G** of this report and is summarized in the table below:

WATER QUALITY CAPTURE VOLUME (WQCV)						
LOCATION	K[1]	a[2]	I[3]	WQCV[4]	A[5]	Design Volume[6]
			decimal	inches	acres	cubic feet
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(2) Adjustment for BMPs drain time --- per SWMM 1604.2

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(4) Water Quality Capture Volume is in watershed inches = $K(a((0.91*I^3) - (1.19*I^2) + (0.78*I)))$ ---- per SWMM 1604.2

(5) Tributary watershed area in acres

(6) Design Volume is 120% of the WQCV = WQCV * A * 1.2 * (1/12) * 43,560

The Vortex Engineering drainage report includes a stage vs storage table for the south pond. The invert elevation at the outlet control structure and bottom elevation of the south pond is at an elevation of 4512.50. Using this table, the water quality capture volume requirement of 2,855 cubic feet occurs at a water surface elevation of 4513.20, which is approximately 0.7-ft (8-1/2-inches) deep. The table from the Vortex Report is depicted below:

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4513.00	126.00	41.00	4700.0	0.1079	0.5	0.1016	0.0508	2,213	2,213	0.0508
4512.50	123.00	38.00	4150.0	0.0953	0.0	0.0476	0.0000	0	0	0.0000

4513.2 — 2,855 CF

Using the Urban Drainage and Flood Control District drain time formula for a 40-hour drain time with holes spaced at 4-inches on center, the hole size for the water quality control plate will need to be 9/16" diameter with holes spaces at 4-inches on center. This water quality control plate will be constructed in front of the existing orifice controls in the outlet structure which control the 2-yr and 100-yr discharge rates.

The detailed calculations for this water quality discharge plate are presented in **Appendix G** of this report.

V. CONCLUSIONS

A. Compliance with Manual
..... Compliance with Manual and other approved documents, such as drainage plans and floodplain studies.

This report has been prepared in accordance with the Manual.

B. Design Effectiveness
..... Effectiveness of drainage design to control impacts of storm runoff.

The water quality facilities have been designed to comply with SWMM requirements for mitigation of stormwater quality impacts.

C. Areas in Flood Hazard Zone

..... Meet requirements of Floodplain Regulations: Mesa County Land Development Code, Section 7.13; City of Grand Junction Zoning and Development Code, Section 7.1.

The project site is not located within any special flood hazard areas.

D. Variances from Manual
..... Applicant shall identify any requested variances and provide basis for approving variance. If no variances are requested, applicant shall state that none are requested.

None

VI. REFERENCES

..... Provide a reference list of all criteria, master plans, drainage reports, and technical information used.

1. Stormwater Management Manual, (SWMM), Mesa County and the City of Grand Junction, December 31, 2007.

2. Flood Map Service Center, FEMA Floodplain Mapping Information at http.msc.fema.gov/portal

3. United States Department of Agriculture – Natural Resources Conservation Service, http://websoilsurvey.nrcs.usda.gov/app/.

4. Urban Drainage and Flood Control Technical Memorandum on Water Quality Orifice Sizing Equation for EURV and QQCV Detention Basins, dated July 13, 2010, by Ken MacKenzie

5. Flowmaster Software analysis version v5.13, as manufactured by Haestad Methods, Inc

APPENDIX A

Location Map

APPENDIX B

NRCS Soil Information

Hydrologic Soil Group—Mesa County Area, Colorado
(NRCS Soils Data)

Map Scale: 1:1,050 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N 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: Mesa County Area, Colorado
Survey Area Data: Version 13, Sep 6, 2022

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

Date(s) aerial images were photographed: Jun 24, 2020—Jul 8, 2020

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
Rc	Fruitland sandy clay loam, 0 to 2 percent slopes	B	3.7	98.7%
Tr	Turley clay loam, 0 to 2 percent slopes	C	0.0	1.3%
Totals for Area of Interest			**3.7**	**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

Tie-break Rule: Higher

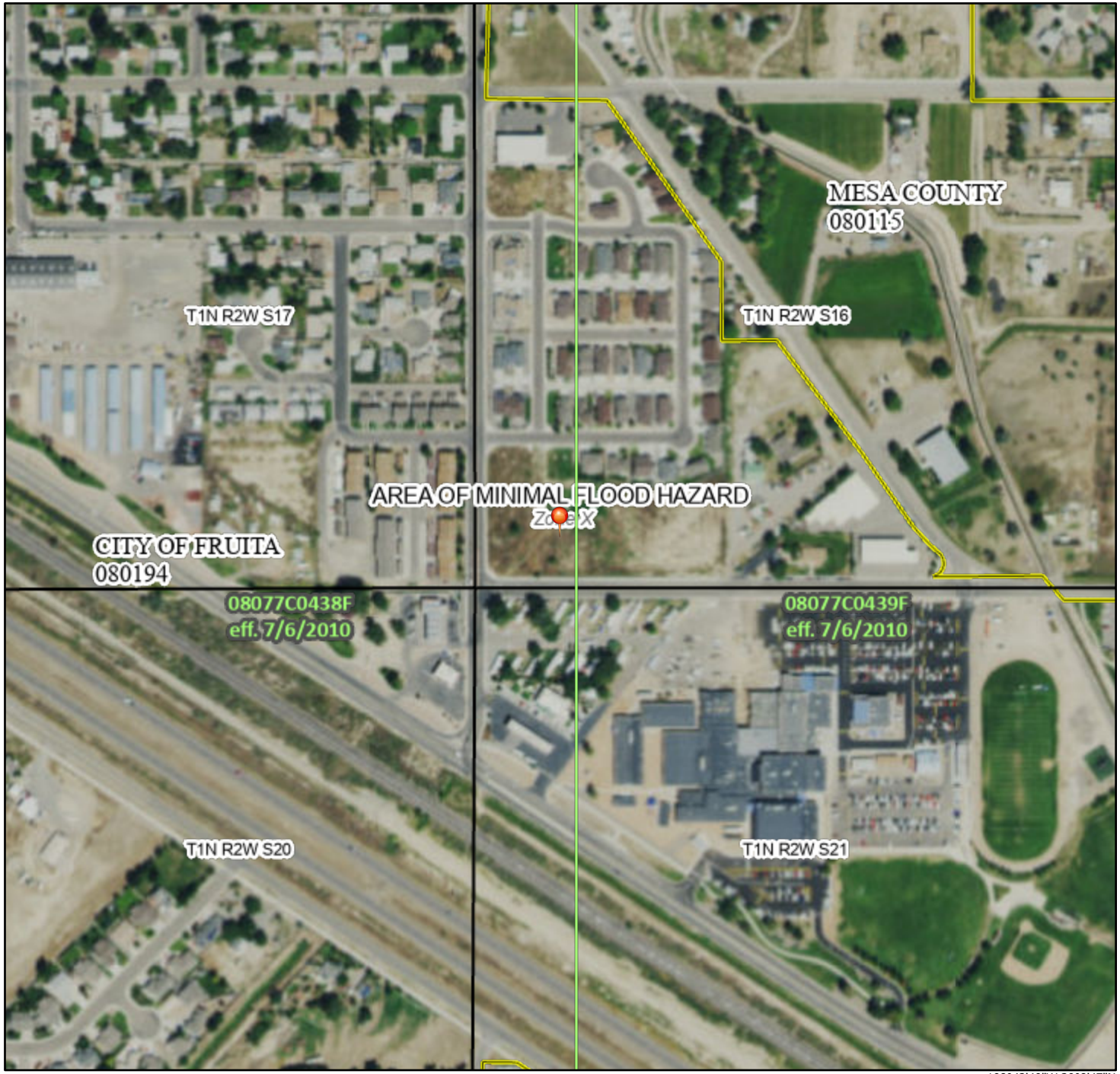
APPENDIX C

FEMA Flood Map

National Flood Hazard Layer FIRMette

FEMA

108°43'27"W 39°9'15"N



108°42'49"W 39°8'47"N

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

1:6,000

Basemap Imagery Source: USGS National Map 2023

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
- 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 9/22/2023 at 3:21 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.

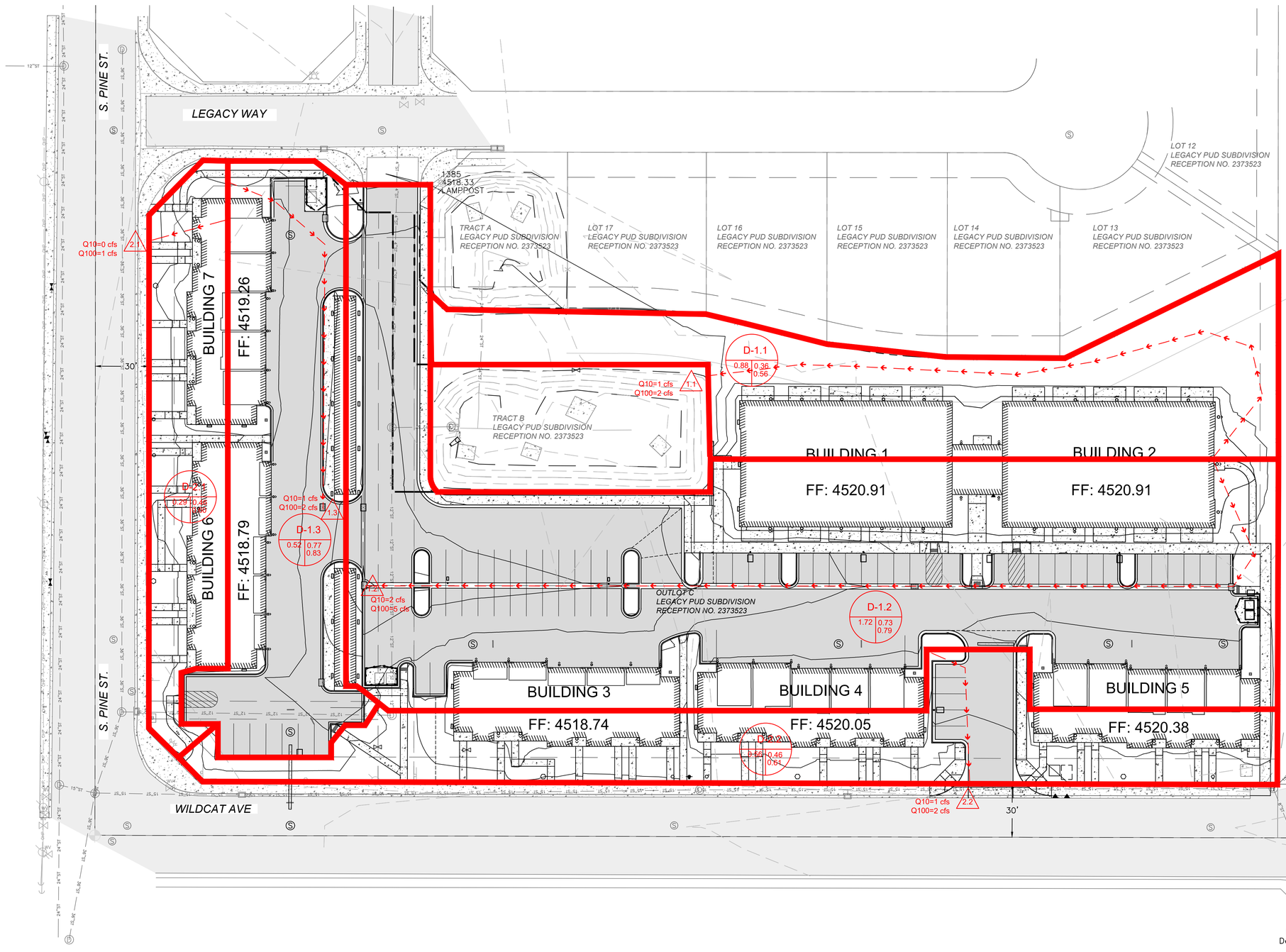
This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory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

APPENDIX D

Vortex Engineering Drainage Report
For
Legacy PUD Subdivision

APPENDIX E

Post-Developed Drainage Map



GENERAL NOTES:

1. No building, structure, or fill will be placed in the detention areas and no change or alterations affecting the hydraulic characteristics of the detention area will be made without the approval of the City.

2. Maintenance and operation of the detention and water quality areas is the responsibility of the property owner. If the owner fails in this responsibility, the City has the right to enter the property, maintain the detention areas, and be reimbursed for the costs incurred.

3. Detention pond volumes, all drainage appurtenances, and basin boundaries shall be verified. As-built drawing shall be prepared by a registered professional engineer prior to the issuance of a certificate of occupancy for any structure within the development.

4. Permission to reproduce these plans is hereby given to City / County for purposes associated with plan review, approval, permitting, inspection and construction of the work.

Basin ID
H-2
2.01 | 0.26 | 0.51
Basin Area in Acres
Rational Method C Value for 10-yr & 100-yr
Basin Area Design Point
1
Q10=2.82 cfs
Q100=6.86 cfs
10-yr & 100-yr Flow in cfs

= Drainage Basin Flow Direction
= Drainage Basin Boundary
= Drainage Basin Flow Path

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NO	DESCRIPTION	DATE	BY
	REVISIONS		

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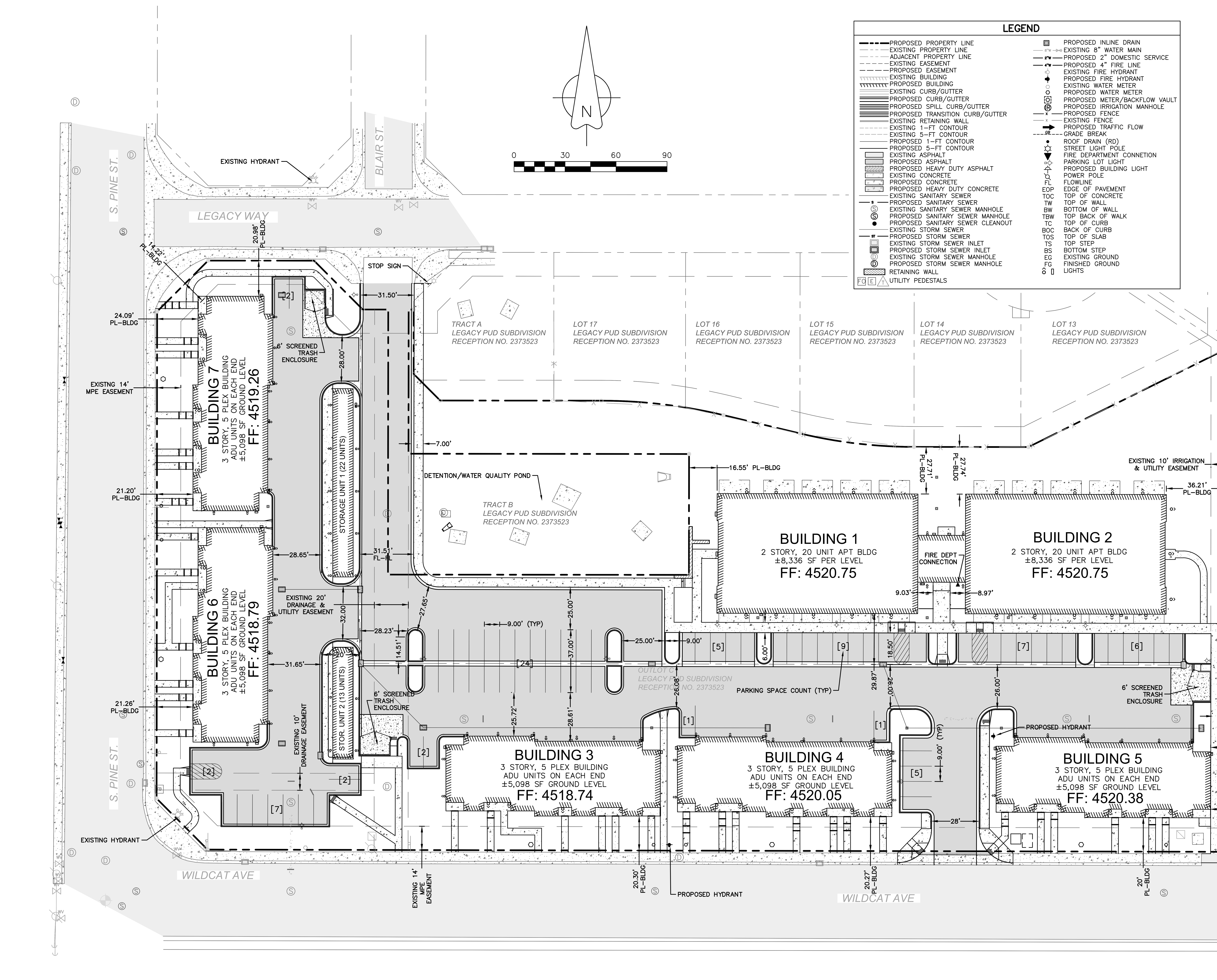
AUSTIN CIVIL GROUP, INC.
Land Planning ▪ Civil Engineering ▪ Development Services
123 North 7th Street, Suite 300 ▪ Grand Junction, Colorado 81501
(970) 242-7540

LEGACY PUD FILING 3
description
##########
WILDCAT AVE
prepared for
Wildcat Aquisition LLC

DRAWN BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:
JWC	JWC	MRA	MRA

JOB NUMBER: 1456.0003
DATE: 9-21-2023
SCALE: 1"=30'
SHEET NO: ###



GENERAL NOTES:

1. ALL PARKING SPACES ARE 9–FT WIDE X 18.5–FT LONG UNLESS OTHERWISE NOTED.
2. ALL ADA PARKING SPACES SHALL BE SIGNED AND STRIPED PER CITY OF FRUITA STANDARDS.
3. THE CONTRACTOR SHALL CONDUCT A PRE–CONSTRUCTION MEETING WITH THE CITY OF FRUITA PRIOR TO ANY WORK ON THE SITE & TO ALSO MAKE SURE AND OBTAIN ALL CONSTRUCTION STORMWATER PERMITS & BMPS.

BUILDING UNIT SUMMARY

UNIT	LEVELS	GROUND LEVEL SF	TOTAL SF	4 BED	1 BED/ STUDIO	2 BED	ADU
BUILDING 1	2	8,336	16,672	--	18	2	--
BUILDING 2	2	8,336	16,672	--	18	2	--
BUILDING 3	3	5,089	12,996	5	--	--	2
BUILDING 4	3	5,089	12,996	5	--	--	2
BUILDING 5	3	5,089	12,996	5	--	--	2
BUILDING 6	3	5,089	12,996	5	--	--	2
BUILDING 7	3	5,089	12,996	5	--	--	2
TOTALS				25	36	4	10

LAND USE SUMMARY

USE	ACRES	PERCENT
BUILDINGS	0.99	27%
LANDSCAPE	1.03	28%
ASPHALT/PKG/CONC	1.64	45%
ROW DEDICATION	0	0%
TOTAL	3.66	100%

PARKING SUMMARY

REQUIRED PARKING: 113 SPACES
2 ea 20 PLEX BUILDING REQUIREMENTS = 42
36 1 Bed/Studios @ 1 Space Ea = 36
4 2 Bed/Studios @ 1.5 Space Ea = 6
5 ea ROW APARTMENT BUILDING REQUIREMENTS = 60
5ea 4 Bed/Apts @ 2 Space Ea = 50 Spaces
2ea ADUs @ 1 Space Ea = 10 Spaces
Additional: 1 sp/ 6 DU = 65 units / 6 = 11

PARKING PROVIDED: 143 SPACES
73 SURFACE PARKING SPACES
50 INTERIOR GARAGE SPACES (10 spaces per Bldg)
20 EXTERIOR GARAGE SPACES (Bldg 4 & 5)

UTILITIES AND AGENCIES

CITY OF FRUITA SANITARY SEWER	SAM ATKINS	858–8377
UTE WATER	JIM DAUGHERTY	242–7491
CITY OF FRUITA IRRIGATION	SAM ATKINS	858–8377
CITY OF FRUITA STORM SEWER	SAM ATKINS	858–8377
XCEL ENERGY – GAS & ELECTRIC	MIKE CASTRO	260–6804
CENTURY LINK	CHRIS JOHNSON	244–4333
CHARTER	JOHN VALDEZ	245–8750
MESA COUNTY STORMWATER	JOSH MARTINEZ	683–4206

ACCEPTANCE BLOCK

THE CITY OF FRUITA REVIEW CONSTITUTES GENERAL COMPLIANCE WITH THE CITY'S DEVELOPMENT STANDARDS, SUBJECT TO THESE PLANS BEING SEALED, SIGNED, AND DATED BY THE PROFESSIONAL OF RECORD. REVIEW BY THE CITY DOES NOT CONSTITUTE APPROVAL OF THE PLAN DESIGN. THE CITY NEITHER ACCEPTS NOR ASSUMES ANY LIABILITY FOR ERRORS OR OMISSIONS. ERRORS IN THE DESIGN OR CALCULATIONS REMAIN THE RESPONSIBILITY OF THE PROFESSIONAL OF RECORD.

CONSTRUCTION MUST COMMENCE WITHIN ONE YEAR FROM THE DATE OF PLAN SIGNATURE.

CITY DEVELOPMENT ENGINEER DATE

CITY PLANNER DATE

Issued for Review

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A · C · G
AUSTIN CIVIL GROUP, INC.
Land Planning • Civil Engineering • Development Services
123 North 7th Street, Suite 300 • Grand Junction, Colorado 81501
(970) 242-7540

WILDCAT RESIDENCES
description
SITE PLAN
WILDCAT AVE
prepared for
Wildcat Aquisition LLC

DRAWN BY: JWC
DESIGNED BY: JWC
CHECKED BY: MRA
APPROVED BY: MRA

JOB NUMBER: 1456.0003
DATE: 10-3-2023
SCALE: 1"=30'
SHEET NO: C-4

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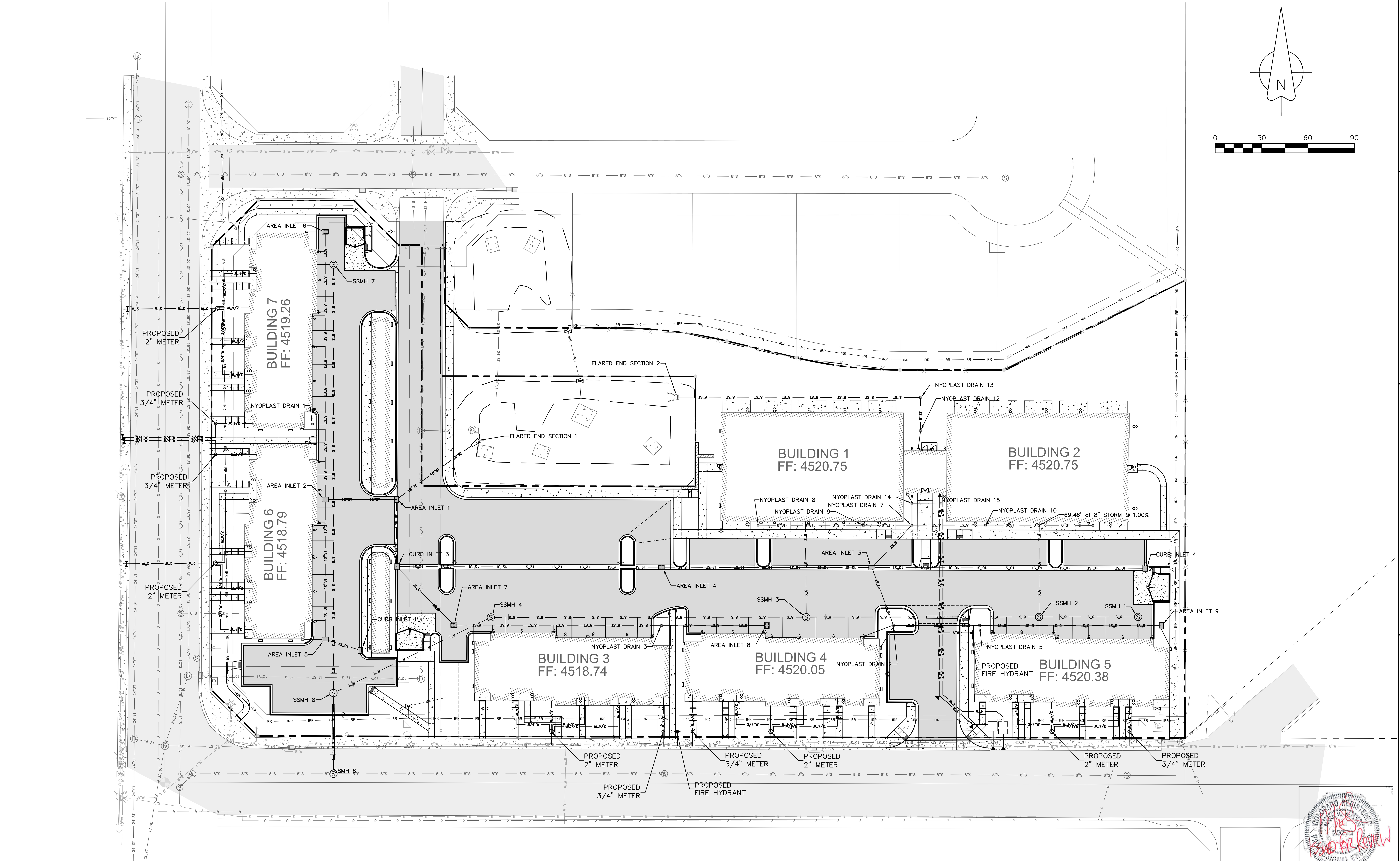

ACCEPTANCE BLOCK

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CITY DEVELOPMENT ENGINEER DATE

CITY PLANNER DATE

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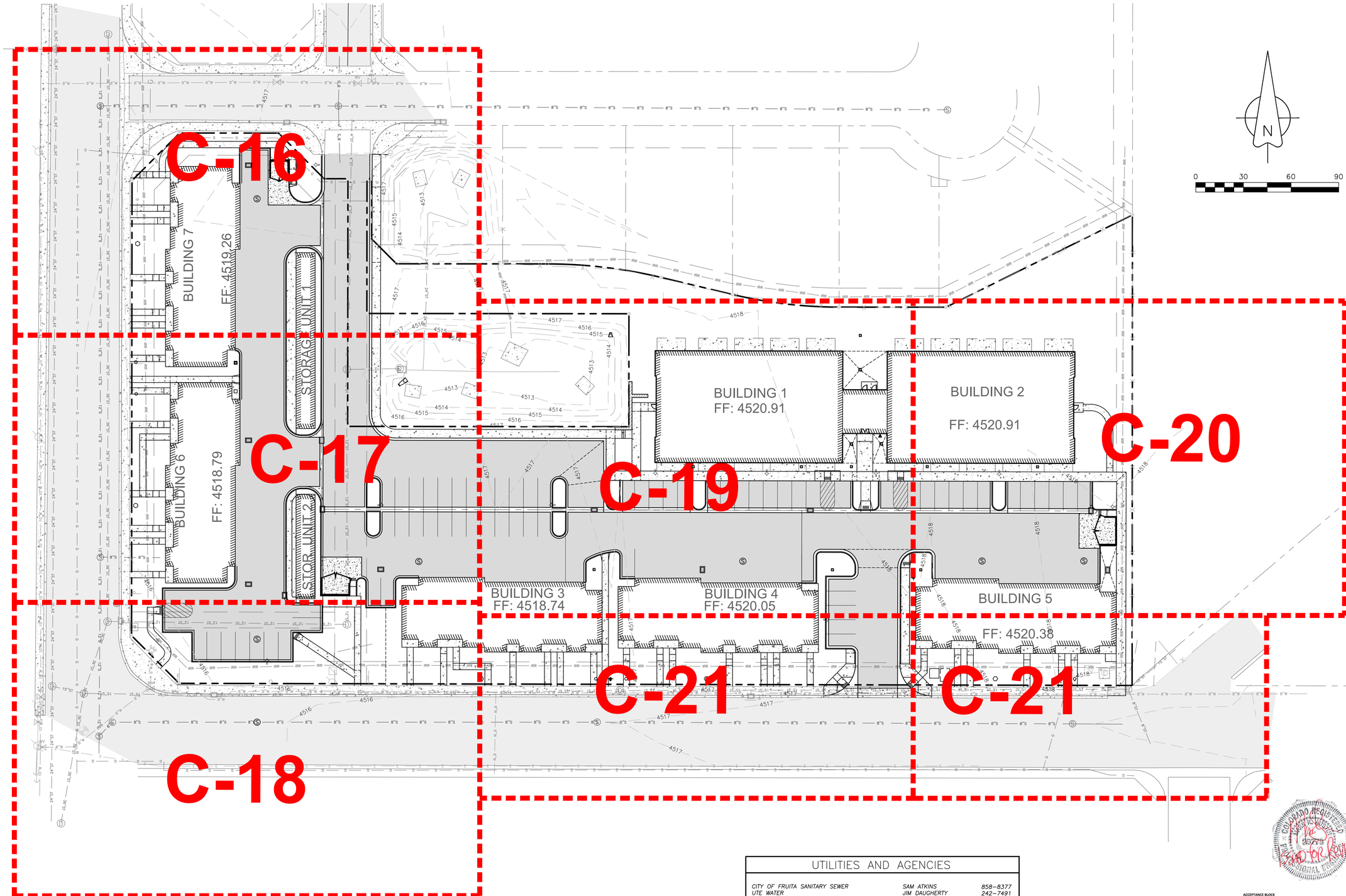
Land Planning ▪ Civil Engineering ▪ Development Services
123 North 7th Street, Suite 300 ▪ Grand Junction, Colorado 81501
(970) 242-7540

WILDCAT RESIDENCES

description
UTILITY COMPOSITE SHEET – OVERALL
WILDCAT AVE
prepared for
Wildcat Aquisition LLC

DRAWN BY: JWC
DESIGNED BY: JWC
CHECKED BY: MRA
APPROVED BY: MRA
JOB NUMBER: 1456.0003
DATE: 10–3–2023
SCALE: 1"=30'
SHEET NO: C-6



UTILITIES AND AGENCIES

CITY OF FRUITA SANITARY SEWER	SAM ATKINS	858-8377
UTE WATER	JIM DAUGHERTY	242-7491
CITY OF FRUITA IRRIGATION	SAM ATKINS	858-8377
CITY OF FRUITA STORM SEWER	SAM ATKINS	858-8377
XCEL ENERGY - GAS & ELECTRIC	MIKE CASTRO	260-6804
CENTURY LINK	CHRIS JOHNSON	244-4333
CHARTER	JOHN VALDEZ	245-8750
MESA COUNTY STORMWATER	JOSH MARTINEZ	683-4206

ACCEPTANCE BLOCK

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CONSTRUCTION MUST COMMENCE WITHIN ONE YEAR FROM THE DATE OF PLAN SIGNATURE.

CITY DEVELOPMENT ENGINEER DATE

CITY PLANNER DATE

COLORADO REGISTERED PROFESSIONAL ENGINEER 30773 — NOT FOR REVIEW

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(970) 242-7540

WILDCAT RESIDENCES
description
GRADING INDEX SHEET
WILDCAT AVE
prepared for
Wildcat Aquisition LLC

DRAWN BY:	DESIGNED BY:	CHECKED BY:	APPROVED BY:
JWC	JWC	MRA	MRA

JOB NUMBER: 1456.0003
DATE: 10-3-2023
SCALE: 1"=30'
SHEET NO: C-15

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APPENDIX F

Rational Method Flow Analysis

WILDCAT RESIDENCE PROJECT
RATIONAL METHOD FLOW ANALYSIS

AREA + RUNOFF CURVE NUMBER CALCULATIONS																			TIME OF CONCENTRATION & RATE OF RUNOFF											
BASIN	STORM EVENT	SOIL	Total Basin Area [1]	Land Use and Areas												Composite i[3]	Composite C[4]	Composite CN[5]	K[6]	Initial Flow			Travel Time-Surface					Totals			
				Landscape		Roof		Gravel		Impervious		Undeveloped		Multi Fam						Length	Slope	t_i[7]	Length	S_w	Cv[8]	Vel[9]	t_t[10]	Average Slope[11]	T_c[12]	Intensity, I[13]	Runoff, Q[14]
				i[2]	A[1]	i[2]	A[1]	i[2]	A[1]	i[2]	A[1]	i[2]	A[1]	i[2]	A[1]					feet	%	min.	feet	ft/ft		ft/sec	min.		min.	in./hr.	cfs
OVERALL DEVELOPED DEVELOPED DRAINAGE BASIN																														
D-1	10-YEAR	C	2.81	0.02	0.60	0.9	0.78	0.40		1.00	1.43	0.02				0.76	0.62	92	0.58	75	2	6.39	488	0.005	20	1.4	5.75	0.70	12.14	1.60	2.8
	100-YEAR	C	2.81	0.02	0.60	0.9	0.78	0.40		1.00	1.43	0.02				0.76	0.71	92	0.58	75	2	6.39	488	0.005	20	1.4	5.75	0.70	12.14	3.39	6.8
D-2	10-YEAR	C	0.85	0.02	0.40	0.9	0.32	0.40		1.00	0.13	0.02				0.50	0.46	86	0.40	20	1	5.65	65	0.015	20	2.4	0.44	1.38	6.10	2.05	0.8
	100-YEAR	C	0.85	0.02	0.40	0.9	0.32	0.40		1.00	0.13	0.02				0.50	0.60	86	0.40	20	1	5.65	65	0.015	20	2.4	0.44	1.38	6.10	4.36	2.2
DEVELOPED SUB-BASIN DRAINAGE BASINS																														
D-1.1	10-YEAR	C	0.88	0.02	0.67	0.9	0.19	0.40		1.00	0.02	0.02				0.23	0.36	80	0.27	300	0.5	11.67	79	0.005	7	0.5	2.66	0.50	14.33	1.48	0.5
	100-YEAR	C	0.88	0.02	0.67	0.9	0.19	0.40		1.00	0.02	0.02				0.23	0.56	80	0.27	300	0.5	11.67	79	0.005	7	0.5	2.66	0.50	14.33	3.15	1.5
D-1.2	10-YEAR	C	1.72	0.02	0.20	0.9	0.44	0.40		1.00	1.08	0.02				0.86	0.73	95	0.69	75	2	5.03	488	0.005	20	1.4	5.75	0.70	10.79	1.68	2.1
	100-YEAR	C	1.72	0.02	0.20	0.9	0.44	0.40		1.00	1.08	0.02				0.86	0.79	95	0.69	75	2	5.03	488	0.005	20	1.4	5.75	0.70	10.79	3.57	4.9
D-1.3	10-YEAR	C	0.52	0.02	0.04	0.9	0.15	0.40		1.00	0.33	0.02				0.90	0.77	96	0.75	20	1.5	5.00	176	0.015	20	2.4	1.20	1.50	6.20	2.04	0.8
	100-YEAR	C	0.52	0.02	0.04	0.9	0.15	0.40		1.00	0.33	0.02				0.90	0.83	96	0.75	20	1.5	5.00	176	0.015	20	2.4	1.20	1.50	6.20	4.34	1.9
D-2.1	10-YEAR	C	0.29	0.02	0.14	0.9	0.13	0.40		1.00	0.03	0.02				0.50	0.46	86	0.40	43	2	6.59						2.00	6.59	2.00	0.3
	100-YEAR	C	0.29	0.02	0.14	0.9	0.13	0.40		1.00	0.03	0.02				0.50	0.60	86	0.40	43	2	6.59						2.00	6.59	4.26	0.7
D-2.2	10-YEAR	C	0.56	0.02	0.26	0.9	0.19	0.40		1.00	0.11	0.02				0.51	0.46	86	0.40	20	1	5.61	65	0.015	20	2.4	0.44	1.38	6.05	2.05	0.5
	100-YEAR	C	0.56	0.02	0.26	0.9	0.19	0.40		1.00	0.11	0.02				0.51	0.61	86	0.40	20	1	5.61	65	0.015	20	2.4	0.44	1.38	6.05	4.37	1.5
OVERALL DEVELOPED DEVELOPED DRAINAGE BASIN																														
D-1	10-YEAR	C	3.66	0.02	1.00	0.9	1.10	1.20		1.00	1.56	0.02				0.70	0.57	91	0.53												
	100-YEAR	C	3.66	0.02	1.00	0.9	1.10	1.20		1.00	1.56	0.02				0.70	0.68	91	0.53												

(1) Area in acres
(2) Imperviousness Value from Table 701 of SWMM as a decimal
(3) Composite Impervious Value as a decimal - ((i1*A1)+(i2*A2)+(i3*A3)+(i4*A4)+(i5*A5)+(i6*A6))/(A1+A2+A3+A4+A5+A6)
(4) Runoff Coefficient from Table 702 in SWMM
(5) SCS Curve Number (CN) - SWMM Equation 708
(6) Flow Resistance Coefficients = Table 702 of SWMM with $C_{5\text{-}yr}$ Value Based on Soil Type and Imperviousness Value in (4)
(7) Initial or Overland Flow Time (minutes): $t_i = (1.8 * (1.1\text{-}K) * L_o^{1/2}) / S^{1/3}$ - Limited to 300-ft max = Per SWMM, Equation 702; t_{imin} = 5 minutes; t_{imax} = (L/180) + 10 (urbanized watersheds) Equation 704
(8) Travel Time Conveyance Coefficient per Table 703 of SWMM
(9) $V = C_v * S_w^{1/2}$ -- per SWMM Equation 703
(10) Travel Time in Concentrated Flow: $t_t = L/(V*60)$
(11) Average Slope as a Percentage
(12) Total $T_c = t_i + t_t$
(13) Average Intensity (in./hr.); $I_{10yr} = (28.9 * 0.63)/(10 + T_c)^{0.786}$; $I_{100yr} = (28.9 * 1.34)/(10 + T_c)^{0.786}$ -- per SWMM 604
(14) Storm Runoff: $Q_{cfs} = C * I_{(in/hr)} * A_{(acres)}$ -- per SWMM Equation 710

Manually Input Columns
Calculated Columns

Prepared By: Austin Civil Group, Inc.

9/28/2023

RECOMMENDED IMPERVIOUSNESS VALUES

Land Use or Surface Characteristic	Percentage Imperviousness
Business	
Commercial Areas	85
Neighborhood Areas	70
Residential	
Single Family	(see figures)
Multi-unit (detached)	60
Multi-unit (attached)	75
Half-acre lot or larger	(see figures)
Apartments	80
Industrial	
Light industrial	80
Heavy industrial	90
Parks, cemeteries	5
Playgrounds	10
Schools	50
Railroad yards	15
Undeveloped Areas	
Historic flow analysis	2
Greenbelts, agriculture	2
Off-site flow analysis (when land use not defined)	45
Streets	
Paved (concrete/asphalt)	100
Gravel	40
Drives and walks	90
Roofs	90
Lawns (all soils)	0

NOTES:

1. The imperviousness values are representative of land uses shown and are for future development projections only. Impervious values for existing land uses may vary.
2. For areas that will not be developed, 2% imperviousness is an appropriate assumption where soil and vegetative cover are present. Areas with geological features, including significant rock outcroppings, need to be accounted for. See Section 702.2.

Revision	Date
ORIGINAL ISSUE	3/27/06
CHANGED BUS. VALUES	12/6
ADDED NOTE 2	1/2[illegible]

RATIONAL FORMULA RUNOFF COEFFICIENTS

Equation:

$$C_{CD} = K_{CD} + (0.858i^3 - 0.786i^2 + 0.774i + 0.04$$
$$C_A = K_A + (1.31i^3 - 1.44i^2 + 1.135i - 0.12)$$
$$C_B = (C_A + C_{CD})/2$$

KCD VALUES						
NRCS Soil	2-year	5-year	10-year	25-year	50-year	100-year
C and D	0	-0.10i+0.11	-0.18i+0.21	-0.28i+0.33	-0.33i+0.40	-0.39i+0.46
A	0	-0.08i+0.09	-0.14i+0.17	-0.19i+0.24	-0.22i+0.28	-0.25i+0.32

Impervious Decimal	Type A					
	2-year	5-year	10-year	25-year	50-year	100-year
0.0	0.00	0.00	0.08	0.14	0.18	0.23
0.1	0.00	0.06	0.14	0.20	0.24	0.28
0.2	0.06	0.13	0.20	0.26	0.30	0.33
0.3	0.13	0.19	0.25	0.31	0.34	0.37
0.4	0.19	0.25	0.30	0.35	0.38	0.41
0.5	0.25	0.30	0.35	0.40	0.42	0.45
0.6	0.33	0.37	0.41	0.45	0.47	0.50
0.7	0.42	0.45	0.49	0.53	0.54	0.56
0.8	0.54	0.56	0.60	0.63	0.64	0.66
0.9	0.69	0.71	0.73	0.76	0.77	0.79
1.0	0.89	0.90	0.92	0.94	0.95	0.96

Impervious Decimal	Type B					
	2-year	5-year	10-year	25-year	50-year	100-year
0.0	0.00	0.08	0.17	0.27	0.32	0.36
0.1	0.06	0.14	0.22	0.31	0.36	0.40
0.2	0.12	0.20	0.27	0.35	0.40	0.44
0.3	0.18	0.25	0.32	0.39	0.43	0.47
0.4	0.23	0.30	0.36	0.42	0.46	0.50
0.5	0.29	0.35	0.40	0.46	0.50	0.52
0.6	0.37	0.41	0.46	0.51	0.54	0.56
0.7	0.45	0.49	0.53	0.58	0.60	0.63
0.8	0.57	0.59	0.63	0.66	0.69	0.70
0.9	0.71	0.73	0.75	0.78	0.80	0.81
1.0	0.89	0.90	0.92	0.94	0.95	0.96

Impervious Decimal	Type C and D Soil					
	2-year	5-year	10-year	25-year	50-year	100-year
0.0	0.05	0.16	0.26	0.38	0.46	0.51
0.1	0.11	0.21	0.30	0.41	0.48	0.53
0.2	0.17	0.26	0.34	0.44	0.50	0.55
0.3	0.22	0.30	0.38	0.47	0.53	0.57
0.4	0.28	0.35	0.42	0.50	0.55	0.58
0.5	0.34	0.40	0.46	0.53	0.57	0.60
0.6	0.41	0.46	0.51	0.57	0.61	0.63
0.7	0.49	0.53	0.57	0.62	0.66	0.68
0.8	0.60	0.63	0.66	0.70	0.73	0.74
0.9	0.73	0.75	0.77	0.80	0.83	0.83
1.0	0.89	0.90	0.92	0.94	0.96	0.96

Revision	Date
ORIGINAL ISSUE	3/27/06
ADDED 0% IMPERVIOUS	12/6/07
CORRECTED FORMULA	1/25/08

WRC ENGINEERING, INC.

REFERENCE:
UDFCD 2001. Urban Storm Drainage Criteria Manual, Volume 1 (revised)

TABLE 702

APPENDIX G

Water Quality Capture Volume And Outlet Control Structure

WILDCAT RESIDENCE
WATER QUALITY CAPTURE VOLUME REQUIREMENTS

WATER QUALITY CAPTURE VOLUME (WQCV)						
LOCATION	K[1]	a[2]	I[3]	WQCV[4]	A[5]	Design Volume[6]
			decimal	inches	acres	cubic feet
D-1	0.65	1.00	0.70	0.18	3.66	2,855

(1) Adjustment to equation for Mesa County area = $d_6/0.43$; where d_6 =0.28, therefore K = 0.65 --- per SWMM 1604.2

(2) Adjustment for BMPs drain time --- per SWMM 1604.2

(3) Watershed impervious as a decimal

(4) Water Quality Capture Volume is in watershed inches = $K(a((0.91*I^3) - (1.19*I^2) + (0.78*I)))$ ---- per SWMM 1604.2

(5) Tributary watershed area in acres

(6) Design Volume is 120% of the WQCV = WQCV * A * 1.2 * (1/12) * 43,560

Prepared By: Austin Civil Group, Inc.

Wildcat Residence
WATER QUALITY CONTROL PLATE DESIGN
Job #: 1456.0003
9/22/2023 mra

Given: = Values to be entered

WQCV =	2,855	cubic feet
Box Invert Elevation=	4512.50	ft
WQCV elevation =	4513.20	ft

Urban Drainage & Flood Control District Equation EDB-3 for 40-hr Drain Time, 4" Hole Spacing

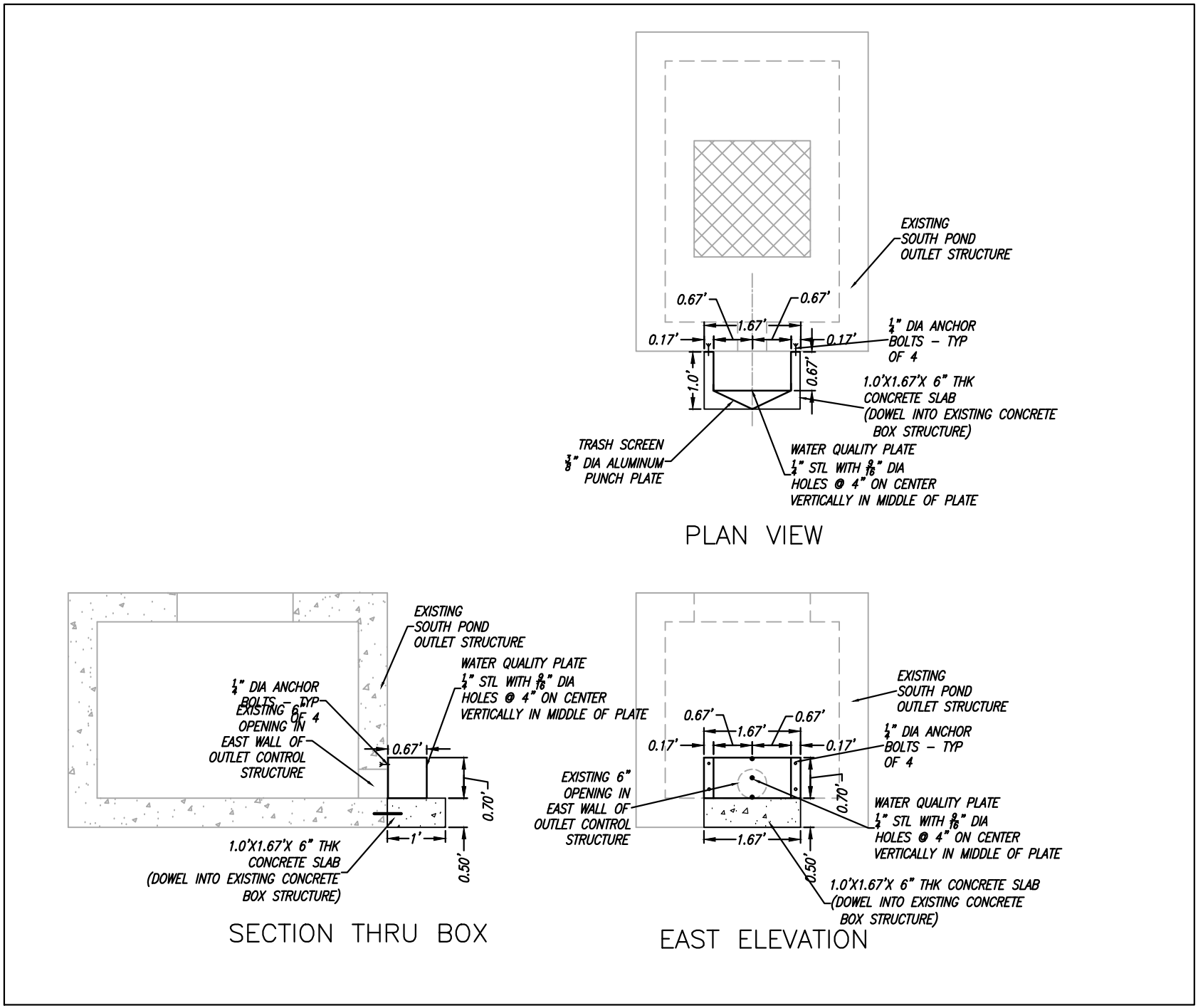
A = (88*(WQCV^(0.95/H^0.085)))/(Td*S^0.09*H^(2.6*S^0.3))

A =	Hole Area in Square Inches for holes at 4" On Center
WQCV =	Water Quality Capture Volume in Acre-Feet
H =	Depth of Volume in feet (WQCV - Box Invert Elevation)
Td =	Time to Drain the WQCV Volume in hours
S =	Slope in feet vertical / feet horiziontal

Solving for A:

WQCV =	0.07	Acre-Ft
H =	0.70	ft
Td =	40	hours
S =	0.001	ft/ft
A =	0.244	Area of Hole In Square inches

Hole Diameter In Inches = 0.557248838 = Approx. 9/16"



URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

Paul A. Hindman, Executive Director
2480 W. 26th Avenue, Suite 156B
Denver, CO 80211-5304

Telephone 303-455-6277
Fax 303-455-7880
www.udfcd.org

TECHNICAL MEMORANDUM

FROM: Ken MacKenzie

SUBJECT: Water quality orifice sizing equation for EURV and WQCV detention basins

DATE: July 13, 2010

The purpose of this memorandum is to document the derivation of the orifice sizing equation developed to drain the urban excess runoff volume (EURV) from full spectrum detention basins and to drain the water quality capture volume (WQCV) from extended detention basins, constructed wetland basins, and water quality retention ponds. It is important to drain these facilities over the proper length of time in order to assure the optimum level of sediment and pollutant removal. This equation is applicable when the individual orifices are spaced four inches on center vertically (for example, a two foot storage depth would have orifices at of 0, 4, 8, 12, 16, and 20 inches from the bottom of the storage volume). To develop this equation, storage volumes were modeled using the USEPA Storm Water Management Model (SWMM) Version 5.0.018. One hundred forty storage volume cases were modeled as 2:1 rectangular basins at five different trickle channel slopes and seven different depths. Side slopes of 4:1 were assumed for the storage above the sloped floor of the basin. The result of the modeling was the development of an equation to size each orifice in the orifice plate column such that the runoff storage volume would drain in roughly the prescribed drain time (±10%). All of the modeling was done using a 72-hour drain time, and the final equation was adapted to allow other drainage times.

This simplified method can serve as a substitute for a more detailed reservoir routing design approach when UDFCD standards regarding the detention basin parameters described above have been met.

The design parameters that influence the area of the individual orifices in the orifice plate are:

- The storage volume to be drained,
- The prescribed drain time,
- The design depth of the storage volume,
- The slope of the bottom of the detention basin (i.e., the trickle channel slope).

The drain time is particularly sensitive to the slope parameter as it has a strong effect on the stage-storage relationship. For each slope, the calculated orifice areas for each of the eight volumes were plotted vs. the design depth, as shown in Figure 1.

A power regression was applied to the data. The equation for this regression takes the form:

$$A_O = \alpha Vol^{\beta} \qquad \textit{Equation 1}$$

Where A_O is the required orifice area per row in the orifice column (in square inches), *Vol* is the storage volume (in acre-feet), α is the leading coefficient, and β is the exponent of the power regression function.

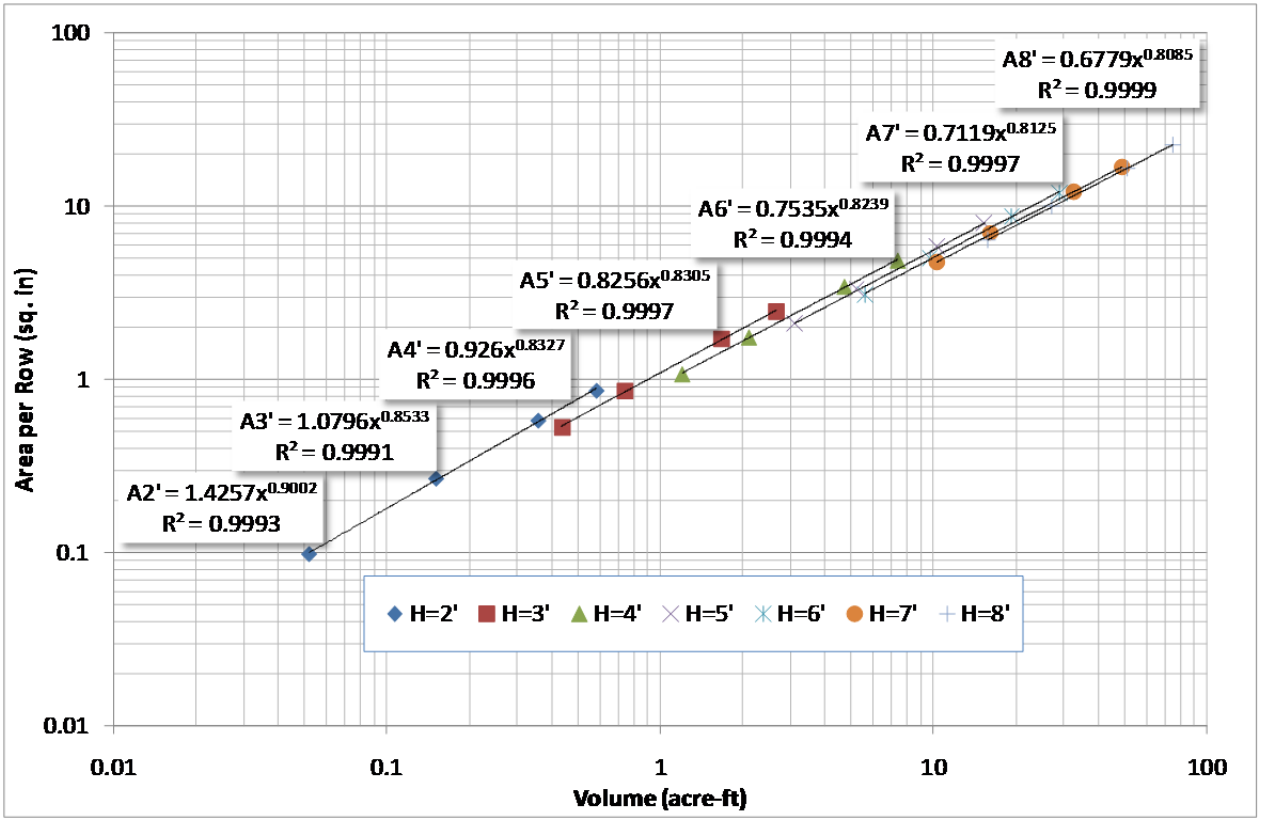


Figure 1: Orifice area vs. storage volume was plotted for each of the storage depths and each of the five trickle channel slopes. This figure shows the equations for the 0.5% slope.

For each storage depth, the leading coefficient α and the exponent β from Equation 1 were plotted as a function of that depth, as shown in Figures 2 and 3.

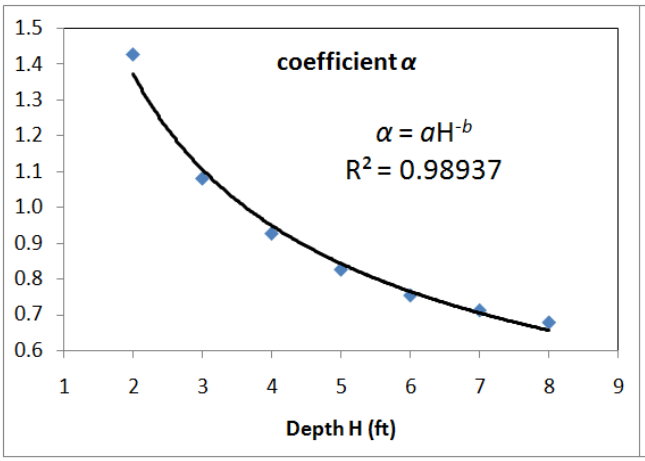


Figure 2: Orifice area sizing power regression coefficient α vs. storage depth

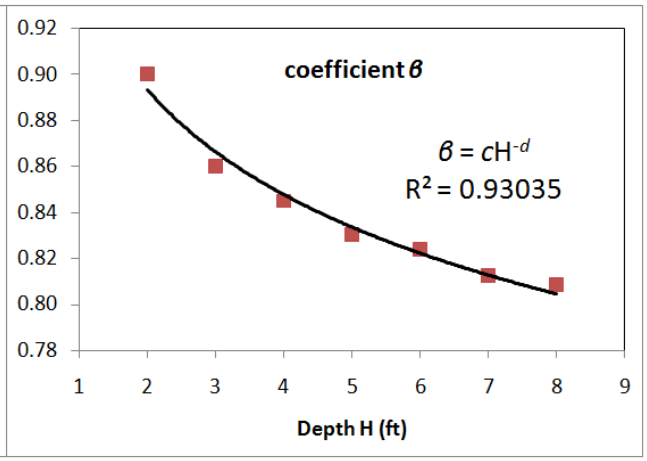


Figure 3: Orifice area sizing power regression exponent β vs. storage depth

A power regression fits the data for both α and β. By substitution, the general equation becomes:

$$A_O = aH^{-b}Vol^{c(H^{-d})} \qquad \textit{Equation 2}$$

Where *Vol* is the storage volume to be drained (in acre-ft), *a* and *b* are the coefficient and exponent (respectively) of the power regression of coefficient α from Equation 1, and *c* and *d* are the coefficient and exponent (respectively) of the power regression of exponent β, also from Equation 1.

Because all modeling was performed using a 72-hour drain time, coefficient *a* was multiplied by 72 in order to normalize the final equation so that it could be used with other drain times. The general orifice sizing equation was then rearranged as:

$$A_O = \frac{72aVol^{(c/H^d)}}{T_D H^b} \qquad \textit{Equation 3}$$

Where T_D is the prescribed drain time (in hours). The coefficients *a, b, c,* and *d* are all dependent on the trickle channel slope. These coefficients were plotted vs. trickle channel slope and power regression expressions were developed for each, as shown in Figure 4.

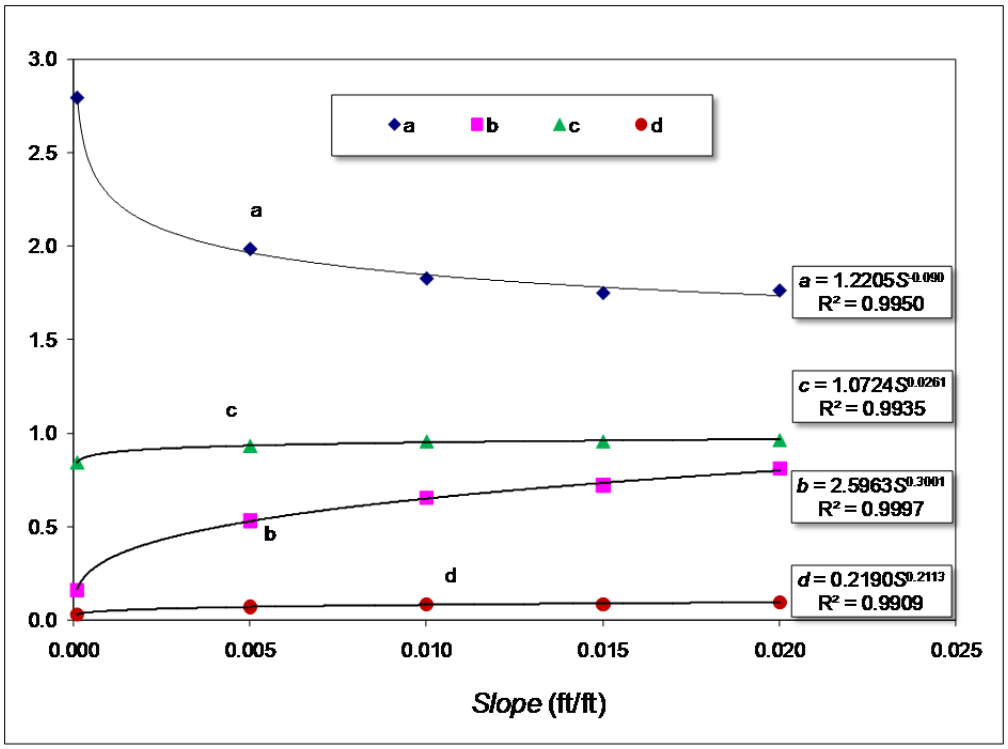


Figure 4: Sizing coefficients a, b, c, and d plotted vs. trickle channel slope.

The regression equations for the coefficients *a*, *b*, *c* and *d* are power functions, expressed as:

$$a = 1.22(S^{-0.09}) \qquad \textit{Equation 4}$$

$$b = 2.6(S^{0.3}) \qquad \textit{Equation 5}$$

$$c = 1.07(S^{0.026}), \text{ or } 0.95 \qquad \textit{Equation 6}$$

$$d = 0.219(S^{0.211}), \text{ or } 0.085 \qquad \textit{Equation 7}$$

It was determined through sensitivity testing on these coefficients that coefficient *c* could be substituted with the constant 0.95 and coefficient *d* could be substituted with the constant 0.085 without noticeably affecting the result. The orifice sizing equation therefore becomes:

$$A_O = \frac{72a\left[Vol^{(0.95/H^{0.085})}\right]}{T_D(H^b)} \qquad \textit{Equation 8}$$

A minimum trickle channel slope of 0.0001 feet vertical / feet horizontal was selected to represent the flat bottomed basin, the retention pond, and the constructed wetland pond as a best fit to match the prescribed drain time since a zero percent slope would result in A_O being undefined. The equations presented here were developed by modeling storage volumes from 0.0082 acre-feet to 75.5 acre-feet, slopes from 0.0001 to 0.02 feet vertical / feet horizontal, depths from two feet to eight feet, and an orifice coefficient of 0.60. These equations are valid for this range of input parameters but have not been tested outside this range.

Combining Equations 4, 5, and 8 gives the final form of the orifice sizing equation:

$$A_O = \frac{88Vol^{(0.95/H^{0.085})}}{T_D S^{0.09} H^{2.6(S^{0.3})}} \qquad \textit{Equation 9}$$

Where:

- A_O is the required orifice area per row in square inches,
- S is slope in feet vertical / feet horizontal (substitute 0.0001 for zero),
- Vol is the storage volume in acre-feet,
- T_D is the prescribed drain time in hours, and
- H is the storage depth at the outlet above the lowest orifice, in feet.

For a storage volume with a flat bottom (e.g. retention pond or constructed wetland pond), this equation can be simplified to:

$$A_O = \frac{201Vol^{(0.95/H^{0.085})}}{T_D H^{0.164}} \qquad \textit{Equation 10}$$

Example 1: A full spectrum detention basin is designed to drain a runoff volume of 0.25 acre-feet of stormwater in 72 hours. The design depth of the storage volume is 3 feet and the basin has a trickle channel slope of 1%. Find the total orifice area for each row of orifices in the orifice plate.

Analysis: The orifice plate will have orifices at 0, 4, 8, 12, 16, 20, 24, 28, and 32 inches from the bottom of the storage volume. The values for *a*, *b*, *c* and *d* are:

$$a = 1.22(0.01^{-0.09}) = 1.85$$

$$b = 2.6(0.01^{0.3}) = 0.65$$

$$c = 0.95$$

$$d = 0.085$$

Substituting these values into Equation 3 gives:

$$A_O = \frac{72a\left[Vol^{\left(c/H^d\right)}\right]}{T_D\left(H^b\right)} = \frac{72(1.85)\left(0.25^{(0.95/3^{0.085})}\right)}{72(3^{0.65})} = 0.27 \text{ inch}^2$$

Solution: Each of the nine orifices must have an area of 0.27 inch^2, or a diameter of 0.6 inch (5/8").

Example 2: A water quality retention pond is designed to drain the volume from the previous example in 12 hours. This volume has the same depth as the previous example and is stored above the permanent pool. Find the correct orifice area for each orifice in the orifice plate vertical column.

Analysis: The bottom of the surcharge volume is the permanent pool water surface which has a slope of zero toward the outlet. A zero slope will result in A_O being undefined. Through modeling, we know that substituting a slope of 0.0001 will produce acceptable drain time results. The values for coefficients *a*, *b*, *c* and *d* are:

$$a = 1.22(0.0001^{-0.09}) = 2.8$$

$$b = 2.6(0.0001^{0.3}) = 0.1633$$

$$c = 0.95$$

$$d = 0.085$$

Substituting these values into Equation 3 gives:

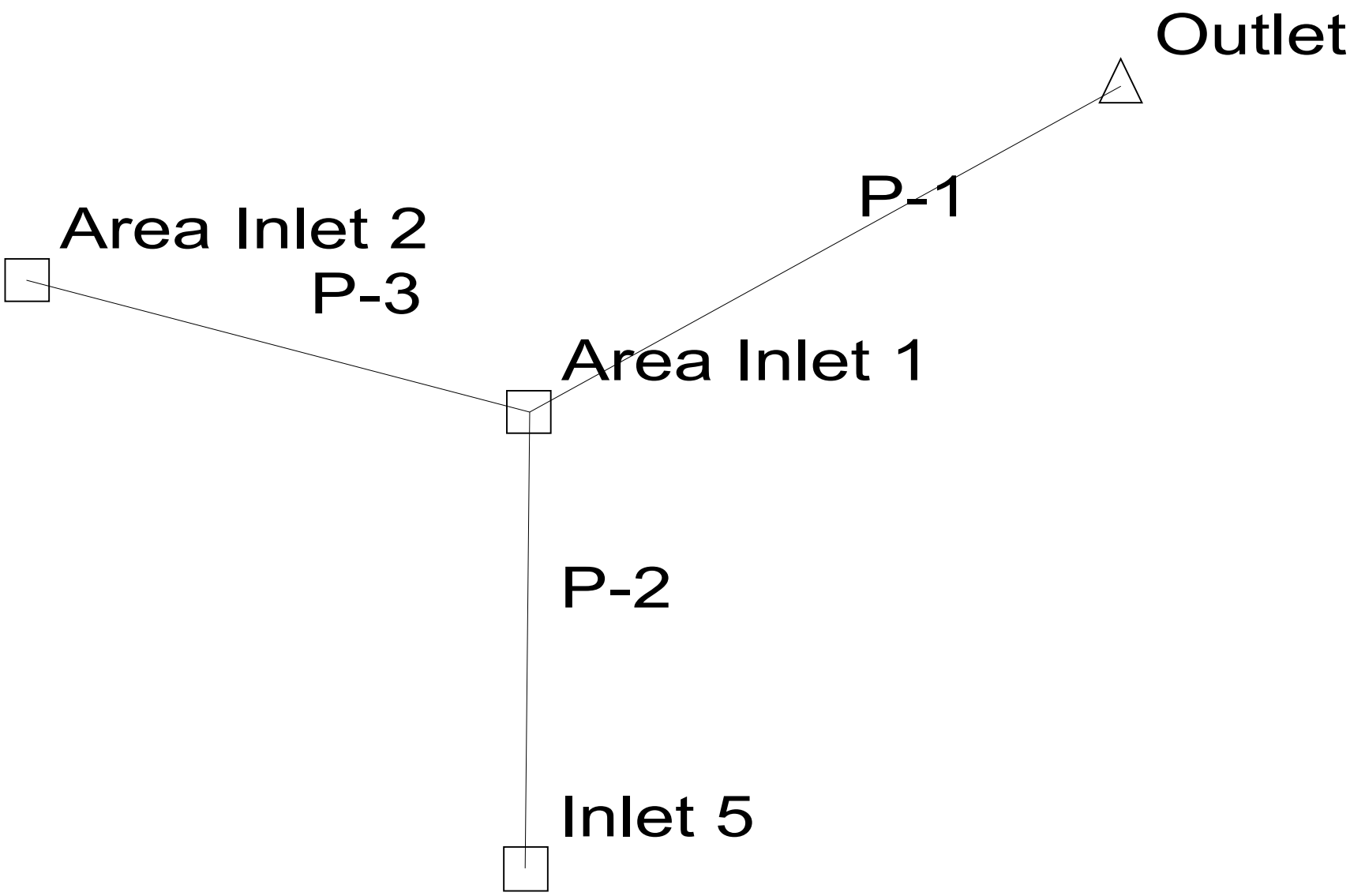
$$A_O = \frac{72a\left[Vol^{\left(c/H^d\right)}\right]}{T_D\left(H^b\right)} = \frac{72(2.8)\left(0.25^{\left(0.95/3^{0.085}\right)}\right)}{12(3^{0.1633})} = 4.2 \text{ inch}^2$$

Solution: Each of the nine orifices must have an area of 4.2 inch^2, or 2" high rectangular orifices having a width of 2.1 inch.

APPENDIX H

StormCAD Analysis

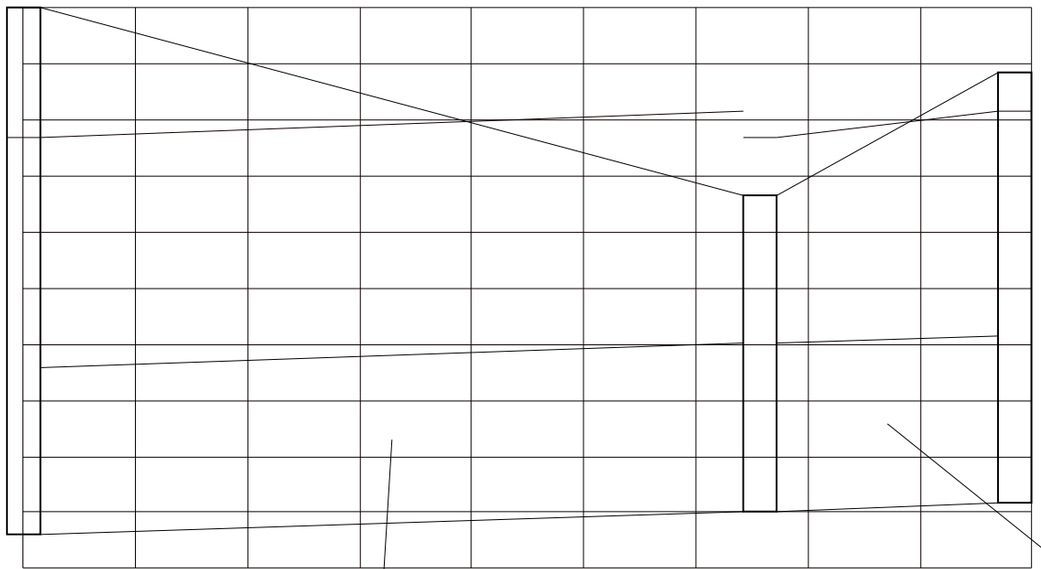
WILDCAT RESIDENCE MAIN STORM SEWER



Outlet: Outlet
Rim: 4,517.00 ft
Sump: 4,512.30 ft

Inlet: Area Inlet 1
Rim: 4,515.33 ft
Sump: 4,512.51 ft

Inlet: Area Inlet 2
Rim: 4,516.43 ft
Sump: 4,512.58 ft



4,517.00
4,516.50
4,516.00
4,515.50
4,515.00
4,514.50
4,514.00
4,513.50
4,513.00
4,512.50
4,512.00

Elevation ft

0+00 0+10 0+20 0+30 0+40 0+50 0+60 0+70 0+80 0+90

Station ft

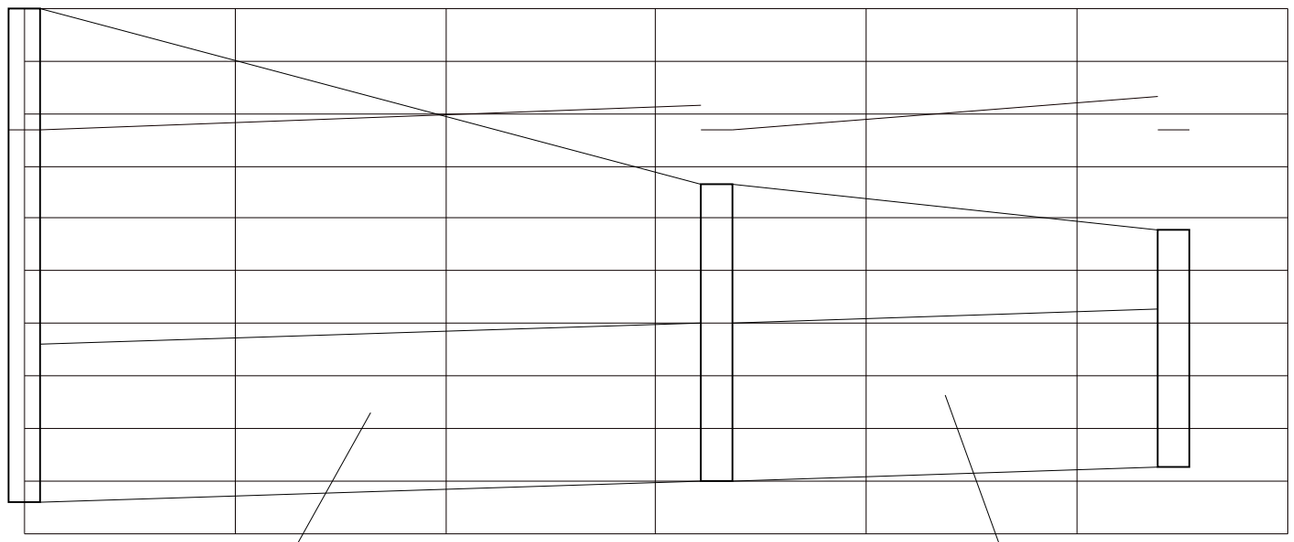
Pipe: P-1
Up Invert: 4,512.51 ft
Dn Invert: 4,512.30 ft
Length: 65.72 ft
Size: 18 inch

Pipe: P-3
Up Invert: 4,512.58 ft
Dn Invert: 4,512.51 ft
Length: 22.73 ft
Size: 18 inch

Outlet: Outlet
Rim: 4,517.00 ft
Sump: 4,512.30 ft

Inlet: Area Inlet 1
Rim: 4,515.33 ft
Sump: 4,512.51 ft

Inlet: Inlet 5
Rim: 4,514.89 ft
Sump: 4,512.64 ft



Pipe: P-1
Up Invert: 4,512.51 ft
Dn Invert: 4,512.30 ft
Length: 65.72 ft
Size: 18 inch

Pipe: P-2
Up Invert: 4,512.64 ft
Dn Invert: 4,512.51 ft
Length: 43.44 ft
Size: 18 inch

Combined Pipe/Node Report

Pipe	Upstream Node	Downstream Node	Length (ft)	Inlet Area (acres)	Weighted Roughness Coefficient	Inlet CA (acres)	Total CA (acres)	Inlet Discharge (cfs)	Section Size	Capacity (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Description
P-2	Inlet 5	Area Inlet 1	43.44	1.72	0.79	1.36	1.36	4.81	18 inch	5.75	2.72	4,512.64	4,512.51	0.002993	
P-3	Area Inlet 2	Area Inlet 1	22.73	0.52	0.83	0.43	0.43	1.92	18 inch	5.83	1.09	4,512.58	4,512.51	0.003080	
P-1	Area Inlet 1	Outlet	65.72	0.00	0.00	0.00	1.79	0.00	18 inch	5.94	3.55	4,512.51	4,512.30	0.003195	

DOT Report

Pipe	-Node- Upstream Downstream	Inlet Area (acres)	Inlet CA (acres)	Total CA (acres)	-Ground- Upstream Downstream (ft)	-HGL- Upstream Downstream (ft)	-Slope- Energy Constructed (ft/ft)	-Section- Discharge Capacity (cfs)	-Section- Shape Size	Length (ft)	Average Velocity (ft/s)	Description
P-2	Inlet 5	1.72	1.36	1.36	4,514.89	4,516.17	0.007506	4.81	Circular	43.44	2.72	
	Area Inlet 1				4,515.33	4,515.84	0.002993	5.75	18 inch			
P-3	Area Inlet 2	0.52	0.43	0.43	4,516.43	4,516.08	0.010676	1.92	Circular	22.73	1.09	
	Area Inlet 1				4,515.33	4,515.84	0.003080	5.83	18 inch			
P-1	Area Inlet 1	0.00	0.00	1.79	4,515.33	4,516.08	0.003576	6.28	Circular	65.72	3.55	
	Outlet				4,517.00	4,515.84	0.003195	5.94	18 inch			

Node Report

Node	Inlet Area (acres)	Weighted Roughness Coefficient	Inlet CA (acres)	External CA (acres)	Total CA (acres)	Inlet TC (min)	External TC (min)	Upstream Flow Time (min)	System Flow Time (min)	System Intensity (in/hr)	Total Watershed (CIA) (cfs)	Additional Flow (cfs)	Carryover (cfs)	Known Flow (cfs)	Total Upstream Added (cfs)	Discharge (cfs)	Ground Elevation (ft)	Rim Elevation (ft)	HGL In (ft)	HGL Out (ft)	Inlet Intensity (in/hr)	Inlet Discharge (cfs)	Description
Inlet 5	1.72	0.79	1.36	0.00	1.36	10.80	0.00	0.00	10.80	3.51	4.81	0.00	0.00	0.00	0.00	4.81	4,514.89	4,514.89	4,515.84	4,515.84	3.51	4.81	
Area Inlet 2	0.52	0.83	0.43	0.00	0.43	6.20	0.00	0.00	6.20	4.42	1.92	0.00	0.00	0.00	0.00	1.92	4,516.43	4,516.43	4,516.08	4,516.08	4.42	1.92	
Area Inlet 1	0.00	0.00	0.00	0.00	1.79	0.00	0.00	11.07	11.07	3.48	6.28	0.00	0.00	0.00	0.00	6.28	4,515.33	4,515.33	4,515.84	4,515.84	5.76	0.00	
Outlet	N/A	N/A	N/A	N/A	1.79	N/A	0.00	11.37	11.37	3.45	6.22	N/A	N/A	N/A	0.00	N/A	4,517.00	4,517.00	4,515.84	4,515.84	N/A	N/A	

Pipe Report

Pipe	Upstream Node	Downstream Node	Inlet Area (acres)	Weighted Roughness Coefficient	Inlet CA (acres)	Total CA (acres)	System Intensity (in/hr)	Discharge (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Roughness	Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Cover (ft)	Downstream Cover (ft)	Upstream HGL (ft)	Downstream HGL (ft)	Description
P-2	Inlet 5	Area Inlet 1	1.72	0.79	1.36	1.36	3.51	4.81	43.44	0.002993	18 inch	0.013	5.75	4,512.64	4,512.51	4,514.89	4,515.33	0.75	1.32	4,516.17	4,515.84	
P-3	Area Inlet 2	Area Inlet 1	0.52	0.83	0.43	0.43	4.42	1.92	22.73	0.003080	18 inch	0.013	5.83	4,512.58	4,512.51	4,516.43	4,515.33	2.35	1.32	4,516.08	4,515.84	
P-1	Area Inlet 1	Outlet	0.00	0.00	0.00	1.79	3.48	6.28	65.72	0.003195	18 inch	0.013	5.94	4,512.51	4,512.30	4,515.33	4,517.00	1.32	3.20	4,516.08	4,515.84	

APPENDIX I

Drainage Checklist

Table 302
Stormwater Management Manual
Drainage Report Checklist

Instructions:
1. Applicant to identify with a "check-mark" if information is provided with report. If applicant believes information is not required, indicate with "n/a" and attach separate sheet with explanation
2. The reviewer will determine if information labeled "n/a" is required and whether information must be submitted.
3. Those items noted with an "asterisk" are not typically required for conceptual/ preliminary report. Applicant shall confirm this with local jurisdiction.
4. Submit three (3) copies of report and include copy of check list bound with report.

TITLE PAGE

A. Type of report (Conceptual/Preliminary or Final Drainage Report).
B. Project Name.
C. Preparer name, firm, address, number, and date.
D. Professional Engineer's seal of preparer.
E. Certifications (see SWMM Section 303.1)

I. INTRODUCTION

A. Background
   1. Identify report preparer and purpose.
   2. Identify date of letter with previous County comments.
B. Project Location
   1. Identify Township, Range, and Section.
   2. Identify adjacent street and subdivision names.
   3. Reference to General Location Map.
C. Property Description
   1. Identify area in acres of entire contiguous ownership.
   2. Describe existing ground cover, vegetation, soils, topography and slopes.
   3. Describe existing drainage facilities, such as channels, detention areas, or structures.
   4. Describe existing irrigation facilities, such as ditches, head-gates, or diversions.
   5. Identify proposed types of land use and encumbrances.
D. Previous Investigations
   1. Identify drainage master plans that include the project area, including floodplain studies.
   2. Identify drainage reports for adjacent development.

II. DRAINAGE SYSTEM DESCRIPTION

A. Existing Drainage Conditions
   1. Describe existing topography and provide map with contours extending a minimum of 100 feet beyond property limits.
   2. Identify major drainageway or outfall drainageway and describe map showing location of proposed development within the drainageways.
   3. Identify pre-developed drainage patterns and describe map showing pre-developed sub-basins and concentrated discharge locations. Provide calculations of pre-developed peak flows entering and leaving the site.
B. Master Drainage Plan
   1. Describe location of the project relative to a previously prepared master drainage plan, including drainage plans prepared for adjacent development.
C. Offsite Tributary Area

1. Identify all offsite drainage basins that are tributary to the project.
2. Identify assumptions regarding existing and future land use and effects of offsite detention on peak flows.

D. Proposed Drainage System Description
1. Identify how offisite stormwater is collected and conveyed through the site and ultimately to the receiving water(s).
2. Identify sub-basins and describe, in general terms, how onsite stormwater is collected and conveyed through the site for each location where stormwater is discharged from the site.
3. Describe detention volumes, release rates and pool elevations.
4. Identify the difference in elevation between pond invert and the groundwater table.
5. Describe how stormwater is discharged from the site, including both concentrated and dispersed discharges and rates.
6. Describe stormwater quality facilities.
7. Describe maintenance access aspects of design.
8. Describe easements and tracts for drainage purposes, including limitation on use.

E. Drainage Facility Maintenance
1. Identify responsible parties for maintenance of each drainage and water quality facility.
2. Identify general maintenance activities and schedules.

III. DRAINAGE ANALYSIS AND DESIGN CRITERIA

A. Regulations
1. Identify that analysis and design was prepared in accordance with the provisions of the Manual.
2. Identify other regulations or criteria which have been used to prepare analysis and design.

B. Development Criteria
1. Identify drainage constraints placed on the project, such as by a major drainage study, floodplain study or other drainage reports relevant to the project.
2. Identify drainage constraints placed on the project, such as from major street alignments, utilities, existing structures, and other developments.

C. Hydrologic Criteria

(If Manual was followed without deviation, then a statement to that effect is all that is required. Otherwise provide the following information where the criteria used deviates from the Manual.)
1. Identify developed storm runoff peak flows and volumes and how they were determined, including rainfall intensity or design storm.
2. Identify which storm events were used for minor and major flood analysis and design.
3. Identify how and why any other deviations from the Manual occurred.

D. Hydraulic Criteria

(If Manual was followed without deviation, then a statement to that effect is all that is required. Otherwise provide the following information where the criteria used deviates from the Manual.)
1. Identify type(s) of streets within and adjacent to development and source for allowable street capacity.
2. Identify which type(s) of storm inlets were analyzed or designed and source for allowable capacity.
3. Identify which type of storm sewers which were analyzed or designed and

Manning's n-values used.

4. Identify which method was used to determine detention volume requirements and how allowable release rates were determined.
5. Identify how the capacity of open channels and culverts were determined.
6. Identify any special analysis or design requirements not contained with the Manual.
7. Identify how and why any other deviations from the Manual occurred.

E. Variance from Criteria

1. Identify any provisions of the Manual for which a variance is requested.
2. Identify pre-existing conditions which cause the variance request.

***IV. POST CONSTRUCTION STORMWATER MANAGEMENT. See Manual Section 1600 for requirements.**

Note: This section of the Final Drainage Report identifies additional information required by Mesa County's, City of Grand Junction's, and Town of Palisade's, Permit for Stormwater Discharges Associated with Municipal Separate Storm Sewer Systems (MS4s), permit No. COR-090000. The Final Drainage Plan and the Construction SWMP (see SWMM Section 1500) meets the requirements of the MS4s Permit. In general, this section identifies permanent BMP practices to control the discharge of pollutants after construction is complete.

*A. Stormwater Quality Control Measures

1. Describe the post-construction BMPs to control discharge of pollutants from the project site.
2. If compensating detention is provided, discuss practices to address water quality from area not tributary to detention area.
3. If underground detention is proposed, discuss how water quality facilities will be provided on the surface.
4. If proprietary BMPs are proposed, provide the justification and sizing requirements (see SWMM Section 1603.3).

*B. Calculations

1. Provide methods and calculations for WQCV, sediment storage, and water quality outlet structure.

V. CONCLUSIONS

A. Compliance with Manual

Compliance with Manual and other approved documents, such as drainage plans and floodplain studies.

B. Design Effectiveness

Effectiveness of drainage design to control impacts of storm runoff.

C. Areas in Flood Hazard Zone

Meet requirements of Floodplain Regulations: Mesa County Land Development Code, Section 7.13; City of Grand Junction Zoning and Development Code, Section 7.1.

D. Variances from Manual

Applicant shall identify any requested variances and provide basis for approving variance. If no variances are requested, applicant shall state that none are requested.

VII. REFERENCES

Provide a reference list of all criteria, master plans, drainage reports, and technical information used.

TABLES

Include copy of all tables prepared for report.

FIGURES

A. General Location Map (See Section 303.2a)

B. Flood Plain Information
C. Drainage Plan (See Section 303.2b)
D. Other pertinent figures.

APPENDICIES

A. DESIGN CHARTS
   1. Provide copy of all design charts (i.e.: tables, figures, charts from other criteria) used for the report.

B. HYDROLOGIC CALCULATIONS (see Manual Sections 600 and 700)
   1. Land use assumptions for off-site runoff calculations.
   2. Time of concentration and runoff coefficients for pre-existing and post development conditions.
   3. Pre-developed hydrologic computations.
   4. Developed conditions hydrologic computations.

C. HYDRAULIC CALCULATIONS
   1. Capacity of existing channels, streets, storm sewers, inlets, culverts and other facilities.
   2. Calculations for existing storm sewer and open channel.
   3. Irrigation ditch flows and ditch system capacity.
   4. Detention pond design (see Manual, Section 1400 for requirements).
      a. Storage volume, release rates, and pool elevations for 10-year and 100-year storm.
      b. Outlet structure dimensions, orifice diameter, weir lengths, pipe headwater and other data.
      c. Outlet velocity and energy dissipation requirements.
      d. Routing of outlet flows and emergency spillway flows.
   5. Street capacity calculations, if data in Manual not used (see Section 1100).
   6. Storm inlet capacity calculations, if data in Manual not used (see Section 1100).
   7. Storm sewer capacity calculations, if data in Manual not used (see Section 1000).
   8. Channel capacity calculations, if data in Manual not used (see Section 800).
   9. Culvert capacity calculations (see Manual, Section 1200).
   10. Other hydraulic structure calculations (see Manual, Section 900).

D. STORMWATER QUALITY CALCULATIONS
   1. Water Quality Capture Volume (WQCV).
   2. Storage volume for sediment volume and pool elevations for WQCV.
   3. Outlet calculations for required area per row, diameter of individual holes, number of holes per row, and number of holes per column.

CERTIFICATION – PROFESSIONAL ENGINEER'S SEAL AND SIGNATURE

ACKNOWLEDGEMENTS

Drainage Report checklist was prepared by: Mark Austin

Table 303
Stormwater Management Manual

Drainage Plan Checklist

Instructions:
1. Applicant to identify with a "check-mark" if information is provided. If applicant believes information is not required, indicate with "n/a".
2. County will determine if information labeled "n/a" is required and whether information must be submitted.

I. EXISTING FACILITIES

A. Contours at two foot intervals, based on USGS datum. Contours to extend at least 50 feet past property line.
B. Location and elevation of USGS benchmarks or benchmarks referenced to USGS.
C. Property lines.
D. Drainage easements.
E. Street names.
F. Major and minor channels and floodplains.
G. A historic drainage plan including historic basin boundaries and flow paths.

II. PROPOSED FACILITIES

A. Contours at two-foot intervals, based on USGS datum.
B. Property lines.
C. Drainage easements.
D. Street names and grades.
E. Right of way and easement.
F. Finished floor elevations for protection from major storm run-off.
G. Detention pond information:
   1. Location of each detention pond with site at 1"=50' scale or larger with 2-foot contour intervals.
   2. Inlet and outlet structure, and trickle channel design details.
   3. Details of emergency spillway and channel.
   4. Landscape information, including side slopes, vegetation and planting requirements.
   5. Details of water quality outlet structure.
H. Channel Information:
   1. Profiles with existing and proposed grades.
   2. Cross sections on 100-foot stations showing existing and proposed topography and required rights of way.
   3. Locations and size of all existing and proposed structures.
   4. Locations and profiles of adjacent utilities.
   5. Typical channel section and lining details.
I. Storm sewer information:
   1. Alignment and location of manholes, inlets, and outlet structures.
   2. Profile of invert and pipe crown.
   3. Invert elevations at manholes and inlets.
   4. Lengths and grades between manholes and inlets.
   5. Locations and elevations of utilities adjacent to and crossing storm sewer.
   6. Easement and other O&M access geometry.
   7. Outlet details, such as end sections, headwall and wingwalls, erosion control, and vegetation.
J. Street cross sections with design 100-year flood depth.
K. Other drainage related structures and facilities, including underdrains and sump pump discharge lines.
L. Other permanent BMP measures to control pollutant discharges to the County's MS4 system.

III. HYDRAULIC AND HYDROLOGIC INFORMATION

A. Routing and accumulative runoff peaks at upstream and downstream ends of the site and at various critical points onsite for initial and major storms. Inflow and outflow from each subbasin shall be shown for both initial and major storms.
B. Street cross sections showing 100-year flood levels.
C. Major and minor channels and floodplains.
D. Detention pond data:
   1. Release rates for 10- and 100-year storm events.
   2. Required and provided volumes for 10- and 100-year storm events.
   3. Design depths for 10- and 100-year storm events.
   4. Water quality capture volume and pool elevation.
E. Channel data:
   1. Water surface profiles.
   2. Representative 100-year flow velocity and Froude number.
F. Storm sewer data:
   1. Profile of water surface for design flow rate.
   2. Peak flows for design flow, 2-year and 100-year storm events.

IV. STANDARD NOTES

A. No building, structure, or fill will be placed in the detention areas and no changes or alterations affecting the hydraulic characteristics of the detention areas will be made without the approval of the County.
B. Maintenance and operation of the detention and water quality areas is the responsibility of property owner. If owner fails in this responsibility, the County has the right to enter the property, maintain the detention areas, and be reimbursed for costs incurred.
C. Detention pond volumes, all drainage appurtenances, and basin boundaries shall be verified. As-built drawings shall be prepared by a registered professional engineer prior to issuance of certificate of occupancy for any structure within the development.
D. Permission to reproduce these plans is hereby given to Mesa County for County purposes associated with plan review, approval, permitting, inspection and construction of work.

V. PROFESSIONAL ENGINEER'S SEAL AND SIGNATURE

VI. OTHER

A. Horizontal and vertical control information and ties to existing and proposed features.

ACKNOWLEDGEMENTS

Drainage Plan checklist was prepared by: MARK AUSTIN