

**Preliminary Drainage Report
For
Fruita RV Resort
Fruita, Colorado**

Date: November 21, 2016

Prepared by: Vortex Engineering, Inc.
2394 Patterson Road, Suite 201
Grand Junction, CO 81505
970-245-9051
VEI# F13-023

Submitted to: City of Fruita
250 N. 5th Street
Grand Junction, CO 81501

Type of Design: Conditional Use Permit

Owners: 1235 Greenway Dr., LLC
Attn: Janice Burtis
120 W Park Drive #200
Grand Junction, CO 81505

Property Address: 1235 Greenway Drive
Fruita, CO 81521

Tax Schedule No.: 2697-181-18-012

"I hereby certify that this Preliminary Drainage Report for the design Fruita RV Resort 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 that City of Fruita does not and will not assume liability for drainage facilities designed by others.

 11-21-16
James C. Atkinson, P.E. Date

As an authorized signing representative of Fruita RV Resort, I hereby certify that the drainage facilities shall be constructed according to the design presented in this report. I understand that City of Fruita does not and will not assume liability for the drainage facilities designed and/or certified by my engineer. I understand that City of Fruita reviews drainage plan but cannot, on behalf of Fruita RV Resort, guarantee that final drainage design review will absolve Fruita RV Resort and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the Construction Plans does not imply approval of my engineer's drainage design.

Date

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1.0 Introduction

A. Background

This Preliminary Drainage Report has been prepared by Vortex Engineering, Inc., and is required as part of the Fruita RV Resort submittal. The property being studied is part of the previously approved drainage study for the Fruita Industrial Park Subdivision. This Final Drainage report has been created in accordance with Mesa County/City of Fruita Stormwater Management Manual.

B. Project Location

The Fruita RV Resort is approximately 15.493-acres located in the political boundary of The City of Fruita, Colorado. It is located south of Greenway Drive and north of I-70. The site is adjacent to Little Salt Wash to the east, and is surrounded by existing light industrial properties. A drainage map is provided in Appendix A for reference.

C. Property Description

The site slopes from the northeast to the south and southwest at grades varying between 0.7% and 1.3%. The site is currently undeveloped and vegetated with native grass. With the development of the project site, it is planned for irrigation from Little Salt Wash to irrigate the property.

The Natural Resources Conservation Service (NRCS) classifies the soils within the RV Resort site predominantly of Sagers silty clay loam (Bc), 0 to 2 percent slopes; Fruitland sandy clay loam (Rc), 0 to 2 percent slopes; and Oxyaquic Torrfluvents (Rs), 0 to 2 percent slopes. The hydrologic class of these soil group Type B.

The NRCS reports that this soil has a low infiltration rate that indicates a moderate surface runoff rate. This soil composition has a slight potential for erosion.

2.0 Drainage System Description

A. Existing conditions Hydrology analysis

Currently, runoff drains via overland flows and shallow concentrated flows in the south and southwest direction to the discharge points described above.

We understand that there is LOMR being prepared to fulfill the conditions from the 2009 CLOMR for CITY OF FRUITA, and as suggested we are willing to supply the LOMR consultants with the grading plan, for it to be implemented in the LOMR.

For this drainage plan the following facilities are proposed; storm sewer, drainage ditches and v-pans and the detention pond. The detention pond is designed to provide water quality volume and 10 year detention volume. For the 100 year detention volume the developer is proposing to pay a reduced “fee in lieu of detention”, based on a ratio of volume provided to volume required, as presented in the attachments. The runoff from the Greenway Drive is treated as by-pass in this report.

B. Hydrologic Criteria

The hydrologic and hydraulic analysis proposed is to use procedures per the Mesa County Stormwater Management Manual (SWMM) guidelines, dated December 2007.

A Computer Aided Design program (HydroCAD) was used for modeling the hydrology and hydraulics of stormwater runoff. HydroCAD is based largely on hydrology techniques developed by the Soil Conservation Service (now the Natural Resources Conservation Service), combined with other hydrology and hydraulic calculations. The storm selected for analysis is the Mesa County 3 hour storm recommended by the SWMM.

3.0 Conclusions

This report discusses the information requirements for a Preliminary Drainage Report and Plan as defined by the SWMM, Section 300. The proposed development of the Fruita RV Resort property will effectively convey runoff from the site per the SWMM best recommendations and discharge to Little Salt Wash.

The proposed drainage facilities are designed to accept the WQCV and 10 year runoff and continue the conveyance to the ultimate discharge in the Colorado River. Erosion control BMP's will be implemented during construction in an effort to prevent adverse impacts on downstream properties and drainage facilities. The proposed development will not adversely affect the surrounding properties or existing storm drainage systems.

A. Compliance with Manual

This report discusses the information requirements for a Final Drainage Report and Plan per the Mesa County/City of Grand Junction Stormwater Management Manual. The proposed drainage facilities are designed to collect and detain the WQCV and 10-year event runoff rates from the site along with offsite contributory flows and release at/or below the allowed rates. The proposed development will not adversely affect the surrounding properties or existing drainage systems. No variances from the Stormwater Management Manual criteria are requested.

4.0 References

Mesa County/City of Fruita Stormwater Management Manual, adopted March 20, 2008.

“Soil Survey of Mesa County Area, Colorado”, prepared by United States Department of Agriculture, Soil Conservation Service, issued September 1993.

“Urban Storm Drainage Criteria Manual, Volume 1”, prepared by the Urban Drainage and Flood Control District, effective September 1999.

Federal Emergency Management Agency, Flood Insurance Rate Map, Mesa County, Colorado unincorporated Areas, Map No.08077 C0436F.

Appendix A

Runoff Calculations

**Fruita RV Park
Area Imperviousness
Proposed Conditions**

**Vortex Engineering, Inc.
August 30, 2016**

	TOTAL AREA (ft²)	BASIN AREA (ac)	PERV. AREA (ft²)	PERV. AREA (ac)	Pavement AREA (ft²)	Pavement AREA (ac)	Pavement Imperviousness (%)	Grave Drive Area (sf)	Gravel Drive Area (ac)	Gravel Imperviousness (%)	Weighted Imperviousness (%)
South Basin											
South	644,176	14.79	379,093	8.70	103,407	2.37	100%	161,676	3.71	40%	27.3%
North	331,644	7.61	331,644					331,644	7.61	40%	40.0%
Total On-Site Area =		22.40	16.32			2.37					

Overall development Imperviousness: 31.6%

Fruita RV Park
 Drainage Area C calculations - 2yr and 100yr Events

Vortex Engineering, Inc.
 November 21, 2016

BASIN	TOTAL AREA (ft ²)	BASIN AREA (ac)	LOT/PERV. AREA (ft ²)	LOT AREA C _{2 year}	LOT AREA C _{100-year}	STREET IMP. AREA (ft ²)	IMPREVIOUS AREA (ac)	STREET AREA C _{2 year}	STREET AREA C _{100 year}	2 yr WEIGHTED C VALUE	100 yr WEIGHTED C VALUE	
100	176,837	4.06	176,837	0.29	0.40	0	0.00	0.89	0.96	0.29	0.40	
101	97,113	2.23	87,807	0.29	0.40	9,306	0.21	0.89	0.96	0.35	0.45	
102	35,996	0.83	23,038	0.29	0.40	12,958	0.30	0.89	0.96	0.51	0.60	
103	93,513	2.15	84,273	0.29	0.40	9,240	0.21	0.89	0.96	0.35	0.46	
104	25,697	0.59	16,457	0.29	0.40	9,240	0.21	0.89	0.96	0.51	0.60	
105	73,446	1.69	62,666	0.29	0.40	10,780	0.25	0.89	0.96	0.38	0.48	
106	29,623	0.68	18,843	0.29	0.40	10,780	0.25	0.89	0.96	0.51	0.60	
107	42,081	0.97	17,199	0.29	0.40	24,882	0.57	0.89	0.96	0.64	0.73	
108	308,724	7.09	294,050	0.29	0.40	14,674	0.34	0.89	0.96	0.32	0.43	
109	53,044	1.22	38,370	0.29	0.40	14,674	0.34	0.89	0.96	0.46	0.55	
OS	99,043	2.27	84,369	0.29	0.40	14,674	0.34	0.89	0.96	0.38	0.48	
Total On-Site Area =		23.76	20.75									3.01

Detention Pond Calculations

Elevation [ft.]	Area [ft ²]	Stage Volume [cf]	Change in Elevation [ft]	Cumulative Volume [cf]	Cumulative Volume [acre-ft]
4472.80	0	0.00	0.0	0.0	0.000
4473.00	510	34.00	0.2	34.0	0.001
4474.00	1736	1062.31	1.0	1096.3	0.025
4475.00	2800	2246.91	1.0	3343.2	0.077
4476.00	4032	3397.33	1.0	6740.6	0.155
4477.00	5240	4622.83	1.0	11363.4	0.261
4478.00	6544	5879.94	1.0	17243.3	0.396
4479.00	7945	7233.18	1.0	24476.5	0.562

$$WQCV = K(a(0.91 \cdot I^3 - 1.19 \cdot I^2 + 0.78 \cdot I))$$

Where:

- K = adjustment to equation for Mesa County = $d_6/0.43 = 0.65$
- a = Adjustment for BMP's drain Time (for 40hrs a=1.0) = 1.00
- I = watershed Imperviousness in decimal = 0.32
- d_6 = Depth of average producing storm $d_6 = 0.28$
- Watershed area = 22.40

$$\begin{aligned} WQCV &= 0.102 \text{ in} \\ \text{Req'd storage WQCV} &= 8279 \text{ cf} \quad 4,476.33^* \end{aligned}$$

Req'd 10 yr Volume:

$$\begin{aligned} K_{10} &= (0.95P - 1.90)(X_{10}/1000) = 0.0073 \\ V_{10} &= K_{10}A = 0.164 \text{ ac-ft} \\ V_{10} &= 7157 \text{ cf} \end{aligned}$$

Where:

- P = Developed Basin Impreviuousness (%)
- X = Mesa Co. adjustment factor $X_{10} = 0.26$, $X_{100} = 0.42$
- for impreviuousness <50% (SWMM Table 1401)
- A = Tributary Area (ac)
- V = Volume (ac-ft)

Req'd 100 yr Volume:

$$\begin{aligned} K_{100} &= (1.78P - 0.002P^2 - 3.56)(X_{100}/900) = 0.0237 \\ V_{100} &= K_{100}A = 0.530 \text{ ac-ft} \\ V_{100} &= 23080 \text{ cf} \end{aligned}$$

$$\begin{aligned} 10 \text{ yr Runoff} + WQCV &= 15437 \text{ cf} \quad \text{WSEL (ft)} \quad 4,477.69^* \\ 100 \text{ yr Runoff} &= 23080 \text{ cf} \quad \text{na} \end{aligned}$$

* Water surface elevation thru linear interpolation

Allowable Pond Discharge:

Hydrologic Soil Group B (SWMM Table 1402)

- 10 yr = 2.02 cfs
- 100 yr = 9.63 cfs

Title FRUITA RV PARK - FEE IN LIEU DEFERMENT
 Date 11/21/13 Job No. FIG-051
 By SSM

$$Fee = B(C_D - C_H)A^{0.7}$$

B = \$17,058 - BASE FEE
 C_D = 0.5 Developed
 C_H = 0.4 Existing
 A = 22.4 ac

$$Fee = 17,058 (0.5 - 0.4) 22.4^{0.7} =$$

≈ 15,034.94 → Drainage Impact Fee

Fee adjusted for WQCV & 10yr volume

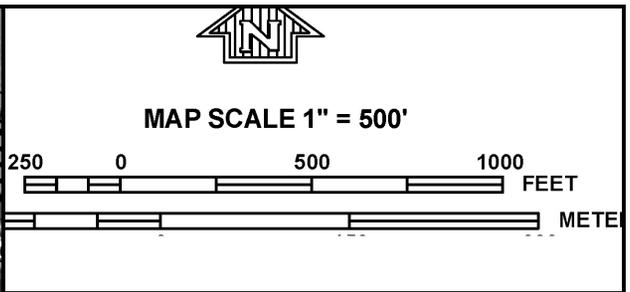
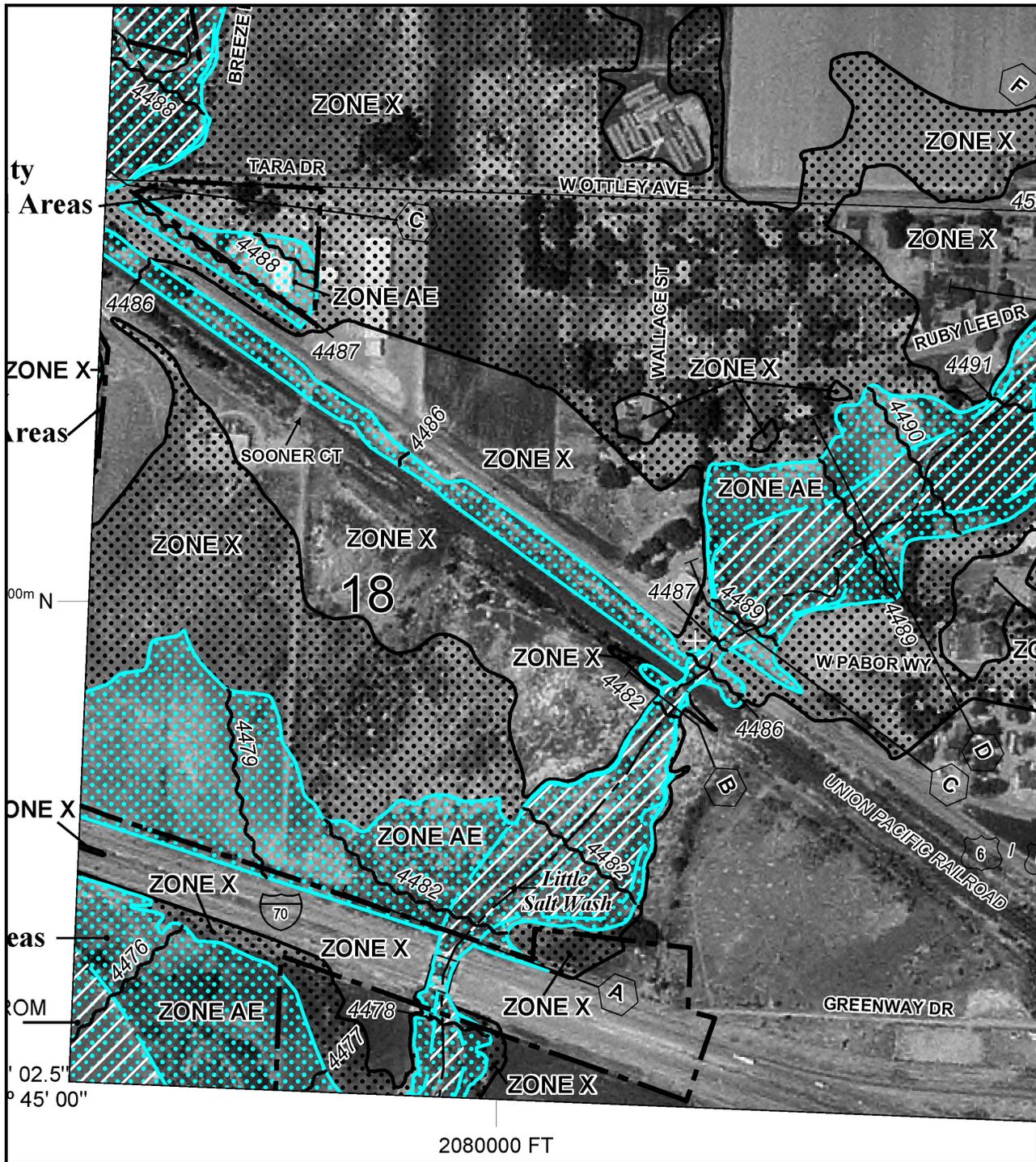
$$\frac{WQCV + 10yr}{100yr \text{ volume}} = \frac{8279 + 7157}{23080} = 0.669$$

$$(1 - 0.669) 100\% = 33.12\%$$

$$15,034.94 \times 33.12\% = \boxed{\$4979.50}$$

DRAINAGE
 IMPACT FEE
 ADJUSTED FOR
 VOLUME PROVIDED

Appendix B
FEMA FIRM Maps



NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0436F

FIRM

FLOOD INSURANCE RATE MAP
MESA COUNTY,
COLORADO
AND INCORPORATED AREAS

PANEL 436 OF 1725

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
FRUITA, CITY OF	080194	0436	F
MESA COUNTY	080115	0436	F

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

MAP NUMBER
08077C0436F

EFFECTIVE DATE
JULY 6, 2010

Federal Emergency Management Agency

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Areas

ZONE X
Areas

00m N

ONE X

reas

OM

02.5"
45' 00"

2080000 FT

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Appendix C

Drainage Map

STANDARD NOTES:

1. 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 CITY.

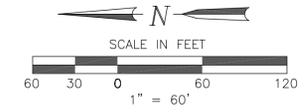
2. MAINTENANCE AND OPERATION OF THE DETENTION AND WATER QUALITY AREAS IS THE RESPONSIBILITY OF PROPERTY OWNER. IF OWNER FAILS IN THIS RESPONSIBILITY, THE CITY HAS THE RIGHT TO ENTER THE PROPERTY, MAINTAIN THE DETENTION AREAS, AND BE REIMBURSED FOR COSTS INCURRED.

3. 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.

4. PERMISSION TO REPRODUCE THESE PLANS IS HEREBY GIVEN TO THE CITY OF GRAND JUNCTION FOR CITY'S PURPOSES ASSOCIATED WITH PLAN REVIEW, APPROVAL, PERMITTING, INSPECTION AND CONSTRUCTION OF WORK.

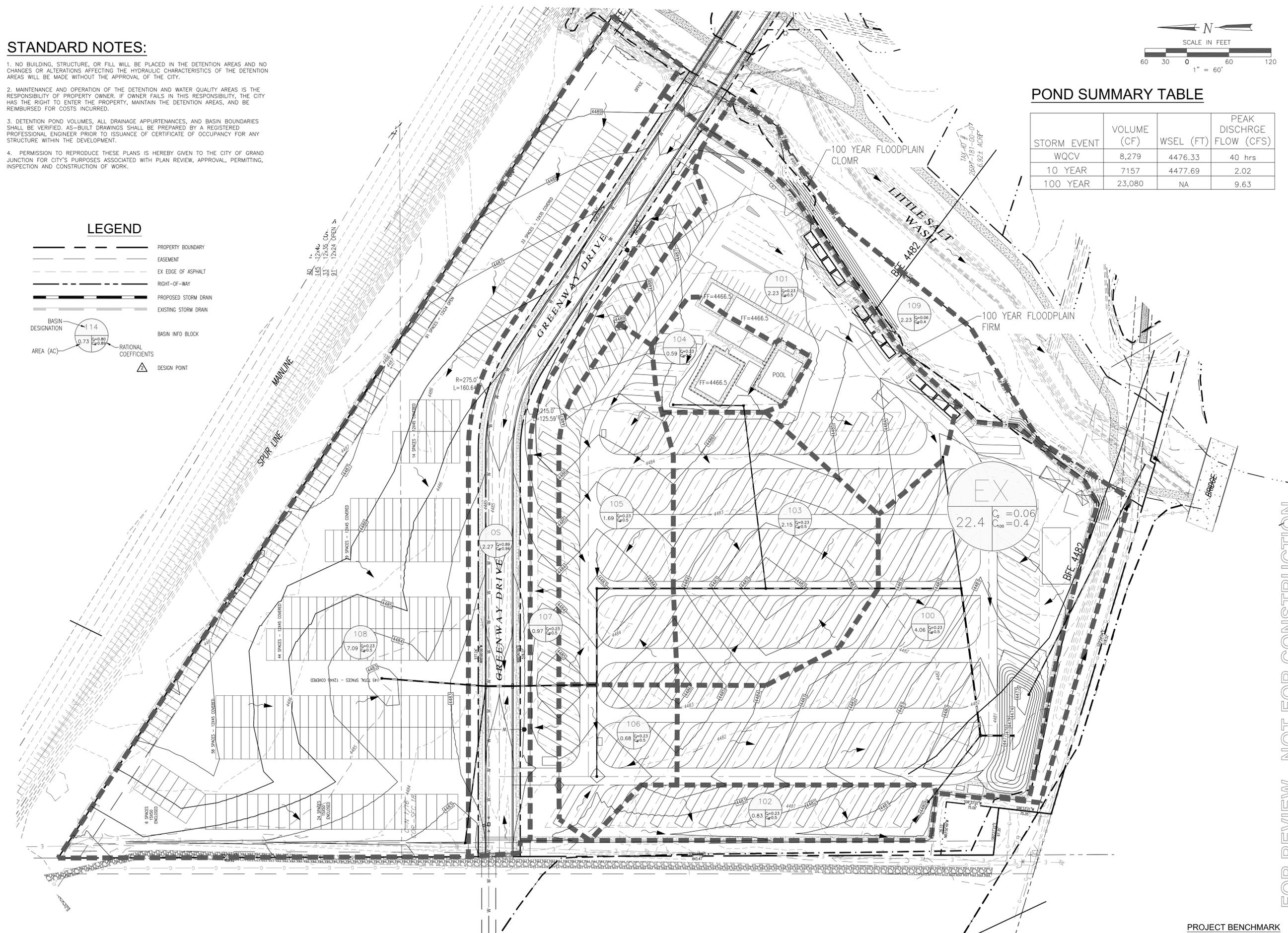
LEGEND

- PROPERTY BOUNDARY
- EASEMENT
- EX EDGE OF ASPHALT
- RIGHT-OF-WAY
- PROPOSED STORM DRAIN
- EXISTING STORM DRAIN
- BASIN DESIGNATION
- AREA (AC)
- RATIONAL COEFFICIENTS
- DESIGN POINT
- BASIN INFO BLOCK



POND SUMMARY TABLE

STORM EVENT	VOLUME (CF)	WSEL (FT)	PEAK DISCHRG (CFS)
WQCV	8,279	4476.33	40 hrs
10 YEAR	7157	4477.69	2.02
100 YEAR	23,080	NA	9.63



James C. Atkinson
PROFESSIONAL ENGINEER
COLORADO LICENSE No. 19828

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REV.	DATE	COMMENT	BY

FOR REVIEW - NOT FOR CONSTRUCTION

Drainage Map - Proposed Conditions
Fruita RV Park
1235 Greenway Drive
Fruita, Colorado

PROJECT NO: F16-051
DATE: 11/17/16
SCALE: see plan
CAD ID: kokodrainagemap.dwg

~SHEET~
1/1

PROJECT BENCHMARK
PROJECT BENCHMARK TBD
ELEVATION=XXXX.XX

K:\kocodrain\RV Park_F16-051\Drainage\KokoDrainagemap.dwg, 11/21/2016 1:40:09 PM, 11