

**Preliminary Drainage Report
for Zoning Case at
The Collector's Garages at Westworld
9909 E. McDowell Mountain Ranch Road
Scottsdale, Arizona 85260**

Case # 5-ZN-2024



Case #: 5-ZN-2024

Review Cycle: 4

Reviewed By: GA

Date: 06/03/2025

Status: Accepted

**First submittal: September 2024
Second submittal: November 2024
Third submittal: March 2025
Fourth submittal: May 2025**

Prepared by:
**Hunter Engineering, Inc.
10446 North 74th Street, #140
Scottsdale, AZ 85258**

**Preliminary Drainage Report
for Zoning Case at
The Collector's Garages at Westworld
9909 E. McDowell Mountain Ranch Road
Scottsdale, Arizona 85260**

PREPARED FOR:

LGE DESIGN BUILD
1200 NORTH 52ND STREET
PHOENIX, AZ 85008

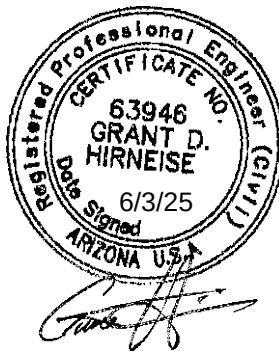
PREPARED BY:

GRANT HIRNEISE
HUNTER ENGINEERING, INC.
10446 NORTH 74TH STREET, #140
SCOTTSDALE, AZ 85258
(480) 991-3985

H.E. PROJECT NO. LGEC324

TABLE OF CONTENTS

<u>SECTION</u>	<u>TITLE</u>	<u>PAGE NO.</u>
1.0	Introduction.....	1
2.0	Existing Drainage Conditions.....	1
3.0	Proposed Conditions Drainage Concept.....	2
4.0	Finish Floor Elevation.....	4
5.0	Environmental Requirements.....	4
6.0	Conclusions.....	5
7.0	References.....	5
<u>FIGURES</u>	<u>TITLE</u>	<u>LOCATION</u>
1	Vicinity Map.....	Appendix A
2	FEMA Flood Map.....	Appendix A
<u>EXHIBITS</u>	<u>TITLE</u>	<u>LOCATION</u>
A	Drainage Exhibit 'A' (Basin Map)	Appendix A
<u>APPENDIX</u>	<u>TITLE</u>	
A	Figures	Appendix A
B	Drainage Calculations	Appendix B
C	Reference Information	Appendix C
D	Offsite Flow Narrative	Appendix D



1.0 INTRODUCTION

This preliminary drainage report has been prepared under a contract from LGE Design Build, developer of The Collector's Garages at Westworld project. The purpose of this report is to provide a preliminary drainage analysis, required by the City of Scottsdale, to support this development. Preparation of this report has been done according to the procedures detailed in the *City of Scottsdale Design Standards & Policies Manual dated January, 2018 (CSDSPM) (Reference 1)*. The offsite and overall drainage conditions and background, including drainage elements associated with the adjacent completed Westworld Sports Fields (now Reata Sports Complex) project, located to the west of this project, are provided by the consultant Huitt-Zollars in a document titled *Offsite Flow Narrative*, placed in Appendix D as an integral part of this overall report.

This development project is located along the south side of McDowell Mountain Ranch Road just northwest of Thompson Peak Pkwy within the City of Scottsdale, Maricopa County, Arizona. The proposed project is currently two undeveloped parcels, 217-14-037A and 217-14-038A, within the Westworld master development, that will ultimately be combined into one parcel.

The ultimate combined parcel is bound by McDowell Mountain Ranch Road to the north, existing development to the west, and a City of Scottsdale park to the south and west. The site is specifically located within a portion of Section 5, Township 3 North, Range 5 East, of the Gila and Salt River Base and Meridian. Figure 1, in Appendix A, illustrates the location of the project site in relation to the City of Scottsdale street system. Access to the site is provided off of McDowell Mountain Ranch Road.

The development proposes the construction of five new auto garage buildings along with a clubhouse. Site improvements will include construction of a driveway entrance, parking lot, sidewalk, landscaping, and supporting infrastructure including storm drain, water, sewer and fire lines. The overall project site is approximately 5 acres.

2.0 EXISTING DRAINAGE CONDITIONS

The current FEMA Flood Insurance Rate Map (FIRM) for this area, map number 04013C1340 L (Revision date October 16, 2013) shows the project site is mostly located in flood hazard Zone X (not shaded) and impacted by flood hazard Zone A (see Figure 2 in Appendix A). Zone A is defined as "*Special Flood Hazard Area, no base flood elevations determined.*" Zone X (not shaded) is defined as "*Areas determined to be outside the 0.2% annual chance floodplain.*"

The proposed site consists of sparse vegetation with shrubs and short grasses. In its unimproved condition, the project site drains as sheet flow primarily to the southwest at an average slope of 2-3%. As described in the *Offsite Flow Narrative*, before the improvements associated with the adjacent sports complex, the site was subject to significant potential flow breakouts as reflected in Appendix D, Appendix B, Figure 2.

3.0 PROPOSED CONDITIONS DRAINAGE CONCEPT

The proposed drainage concept is presented in three parts: onsite drainage conveyance, off-site drainage conveyance, and storm water retention. These three sections make up sections 3.1, 3.2, and 3.3 respectively. Drainage Exhibit A, located Appendix A, provides a graphical illustration of the proposed drainage concept.

3.1 Onsite Drainage Conveyance

Onsite drainage will be conveyed via overland flow to the proposed catch basins and storm drain network, where it will outfall into the proposed underground retention tanks. This system is discussed further in Section 3.3. Drainage Exhibit A, located Appendix A, provides a graphical illustration of the proposed drainage concept. The proposed drainage is modeled utilizing the rational method, with an IDF curve generated from the NOAA 14 values, as found in Appendix C. Rainfall intensities of the 2, 10, 25, 50, and 100-year storms, tied to a time of concentration of 5 minutes, were analyzed. A runoff coefficient of 0.90 was utilized.

Per the Rational Method:

$$Q = C * i * A$$

Where:

Q = Peak Runoff Discharge in CFS

C = Runoff Coefficient (0.90 for onsite, 0.95 for offsite)

i = Rainfall Intensity in inches/hour (for the 5 min t_c)

A = Drainage Area in acres

The Rational Method and drainage inlet calculations can be found in Appendix B. The storm drain analysis of the proposed system will be provided during project final plans.

3.2 Offsite Drainage Conveyance

The *Offsite Flow* Narrative in Appendix D discusses the offsite flow conditions at the project site and an alternative berm across the Old Verde Canal to be constructed as part of this project. Per that narrative, once said berm is constructed, offsite flow impacting the project site is limited to flows along McDowell Mountain Ranch Road. Flows along McDowell Mountain Ranch Road will sheet flow to the proposed curb and gutter along the project frontage where it will flow into curb inlet and be retained in an onsite underground retention tank (see Exhibit A). Note that the Huitt-Zollars report indicates that, “A scupper will be designed to collect and direct the half-street runoff to the existing swale at Off-site CB #1.” This scupper is an alternate design consideration in lieu of the curb opening inlet outletting to the aforementioned underground retention. For either option, underground retention or channelized flow to CB #1, drainage from off-site improvements will be fully accounted for in the final design.

Flows generated near the southern property boundary to the west of the canal will be captured by an existing catch basin within the recently constructed Reata Sports Complex. This

existing catch basin can be found in the *Conceptual Grading, Drainage and Utility Plan* by Hunter Engineering and in Appendix A, Drainage Exhibit A. The existing and proposed conditions can be found on Exhibit 1 in Appendix D, *Offsite Flow Narrative*, prepared by Huitt-Zollars.

3.3 Storm Water Retention

The City of Scottsdale requires that all runoff from the 100-year, 2-hour event generated from the project site and half street improvements be retained within the project site. Developments within the City of Scottsdale must also adhere to “First Flush” requirements. These developments are required to retain onsite stormwater runoff equivalent to the first 0.5 inches of rainfall. As this development has designed a system to retain the 100-year, 2-hour event of 2.36 inches, the “First Flush” requirement will be met.

The volume requirement will be satisfied by the underground retention tanks. The retention required and provided worksheets are located in Appendix B. The underground retention tanks will drain via drywells within the required 36-hours. A drainage easement is required for the underground retention tanks. Additionally, a drainage easement is required for the portion of FEMA Flood Zone A within the project site boundary. These easements will be dedicated through a separate submittal to the City during final plan review.

The required retention volume for the project is calculated as follows:

$$V_R = C * P/12 * A$$

Where:

V_R = Required retention volume in acre-feet

C = 0.90 for on-site

C = 0.95 for off-site (the flow from McDowell Mountain Ranch Road)

P = 2.36 (100-year, 2-hour rainfall intensity)

A = 4.10 ac (onsite), 0.71 ac (off-site)

V_R = 31,611 cu-ft. (onsite), 5,778 cu-ft. (off-site)

Summary Table			
Basin	Volume Required (cf)	Volume Provided (cf)	Excess (cf)
UGRT 1*	23,053	23,093	40
UGRT 2	8,558	8,588	30
UGRT 3	5,778	5,789	11

*Underground Retention Tank (UGRT) 1 are a series of tanks hydraulically connected with a 12-inch pipe.

Underground stormwater storage tanks (USST) must meet all City USST requirements in Section 4-1.202 of the City Design Standards & Policies Manual (DSPM), which includes but not limited to the following (the derived items below are identified by the corresponding section reference number):

- C-3. The owner must dedicate a public drainage easement to the city which meets the standards for all drainage easements. No major vegetation such as trees shall exist within the easement. At a minimum, the easement should extend at a 1:1 slope starting at the bottom of the system, from the outer system's width projected points. Note, the drainage easement shall be shown on the project grading and drainage plan and other applicable sheets. At time of submittal of final plans, the drainage easement shall be dedicated through a separate submittal to the City of Scottsdale.
- C-4-e. The USST must have at least a 75-year life, including the lining and coating.
- C-4-f. The USST shall drain by gravity (surface drainage). Drywells are acceptable when drainage by gravity is not feasible. Pumps are only allowed when no other feasible alternatives exist.
- D-2. When pipes are used, the USST must have a smooth interior floor. Specify MAG supplemental standard detail 2554 for corrugated metal pipes.
- D-4. A minimum of two access points, per MAG standards, must be provided for each USST.
- E-1-b. An Operations and Maintenance (O&M) Manual must be prepared and submitted along with final plans.
- E-3. Final plans must include signs at each end of the USST. The sign should read "Notice-Underground Stormwater Storage Tank".
- E-4. A signed and notarized Ownership and Responsibility Statement, in a form satisfactory to the city Attorney, must be provided prior to approval of final plans.

4.0 FINISH FLOOR ELEVATIONS

As discussed in Section 2.0 the site is in flood hazard Zone A and Zone X. The proposed underground retention tanks will be outside of the Zone A flood plain. The proposed finished floor elevations are more than 14" above the site ultimate outfall.

5.0 ENVIRONMENTAL REQUIREMENTS

As the site will be disturbing more than one acre, an NOI and SWPPP plan and report need to be submitted along with final plans or before any grading or demolition activities can commence onsite.

6.0 CONCLUSIONS

Based on the results of this study, it can be concluded that:

- The site will retain the development retention requirements for the 100-year, 2-hour storm event from the site and from McDowell Mountain Ranch Road.
- The proposed LF88 elevations are more than 14” above the site ultimate outfall.
- The proposed buildings and underground retention stay outside of the portion of the site located in the Zone A flood plain.
- Only the 100-year, 2-hour design storm is being retained as required. Flow from the typical 100-year, 6-hour design storm may overwhelm the underground detention and shall continue to site historical outfalls.
- The construction of a berm within the Old Verde Canal shall act to mitigate any and all northerly flows of the design storm.

7.0 REFERENCES

- 1) City of Scottsdale Design Standards & Policies Manual, January 2018.
- 2) Drainage Design Manual for Maricopa County, Arizona, Hydrology, December 2018.
- 3) Drainage Design Manual for Maricopa County, Arizona, Hydraulics, December 2018.

APPENDIX A **FIGURES**

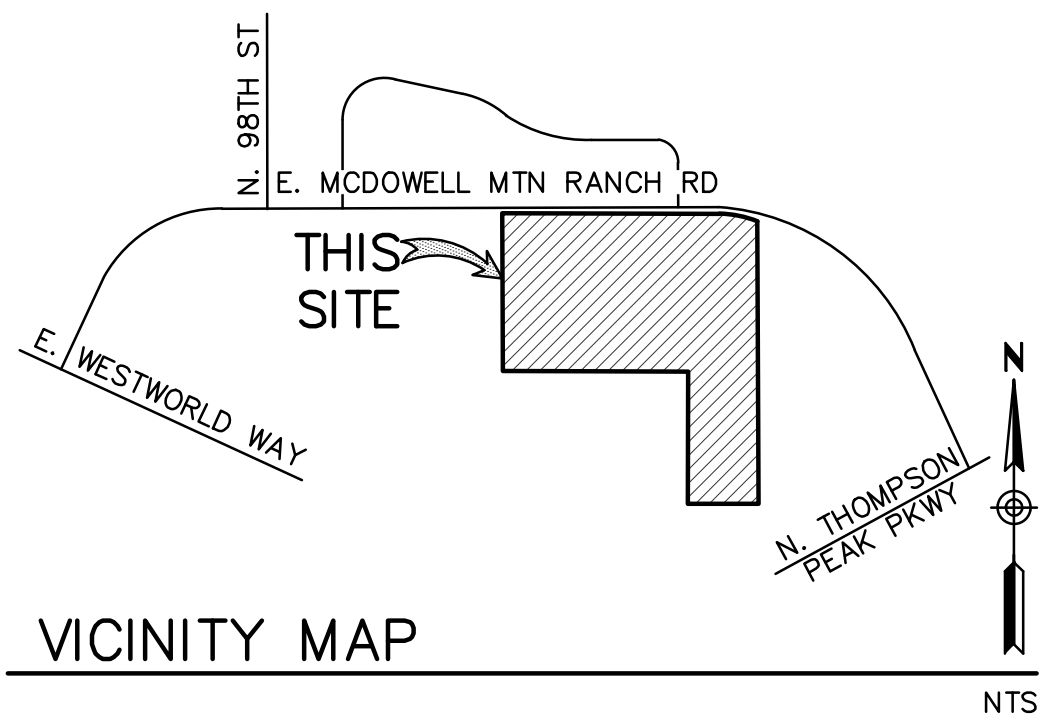
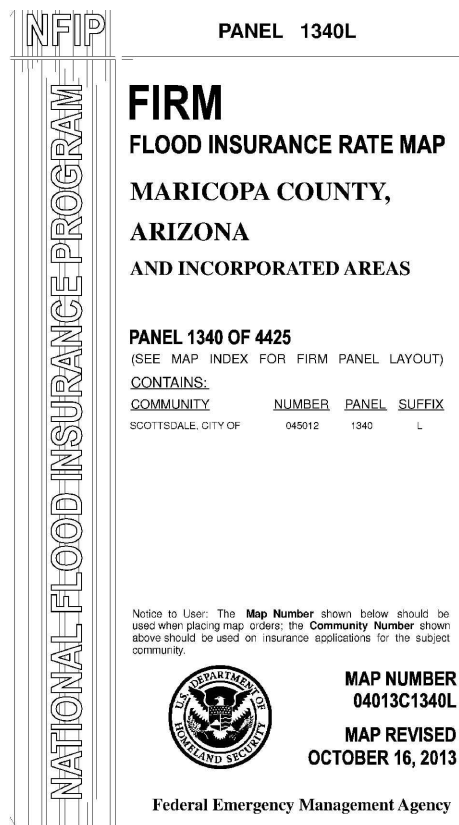
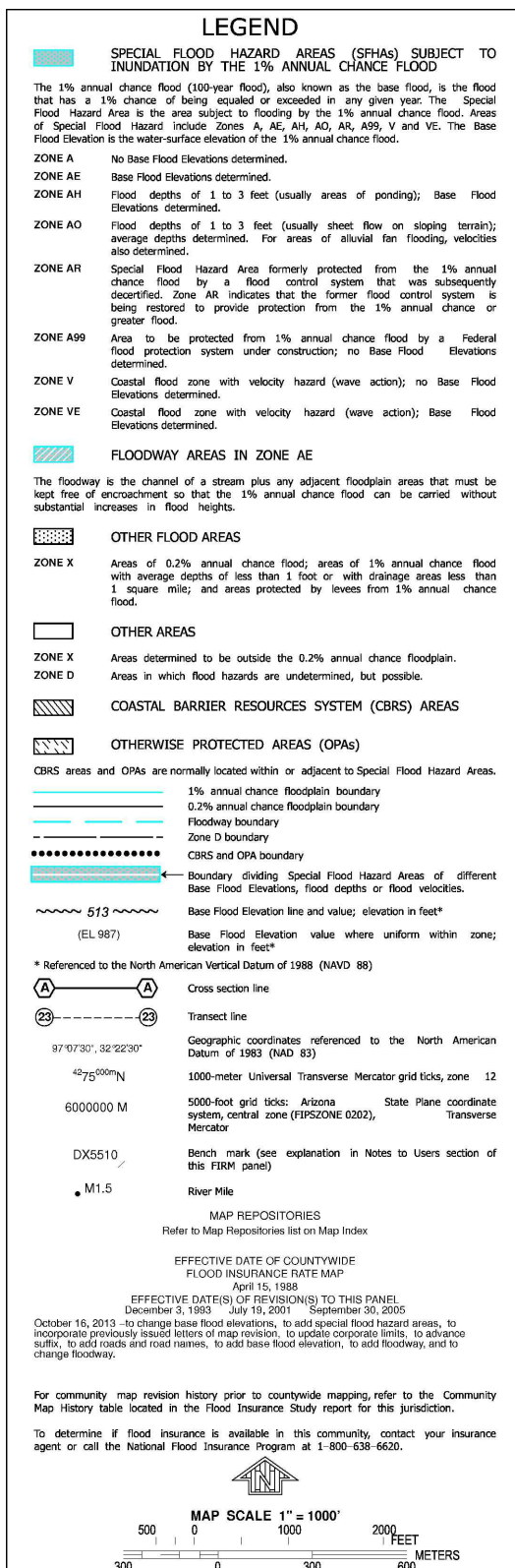


FIGURE 1
VICINITY MAP



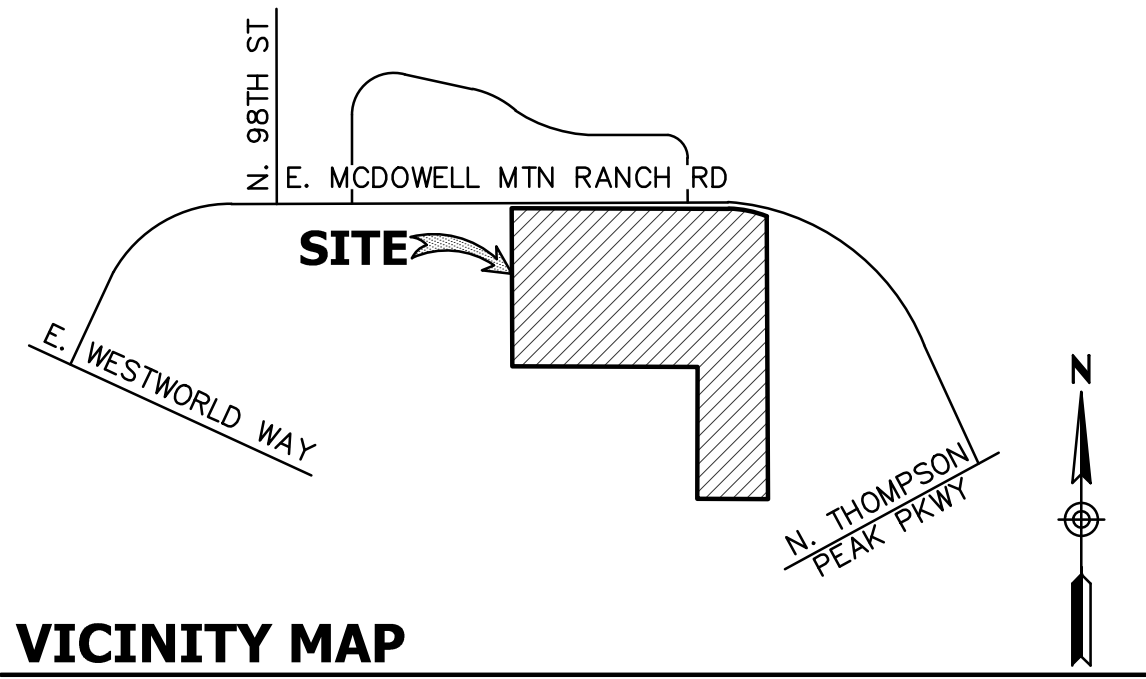
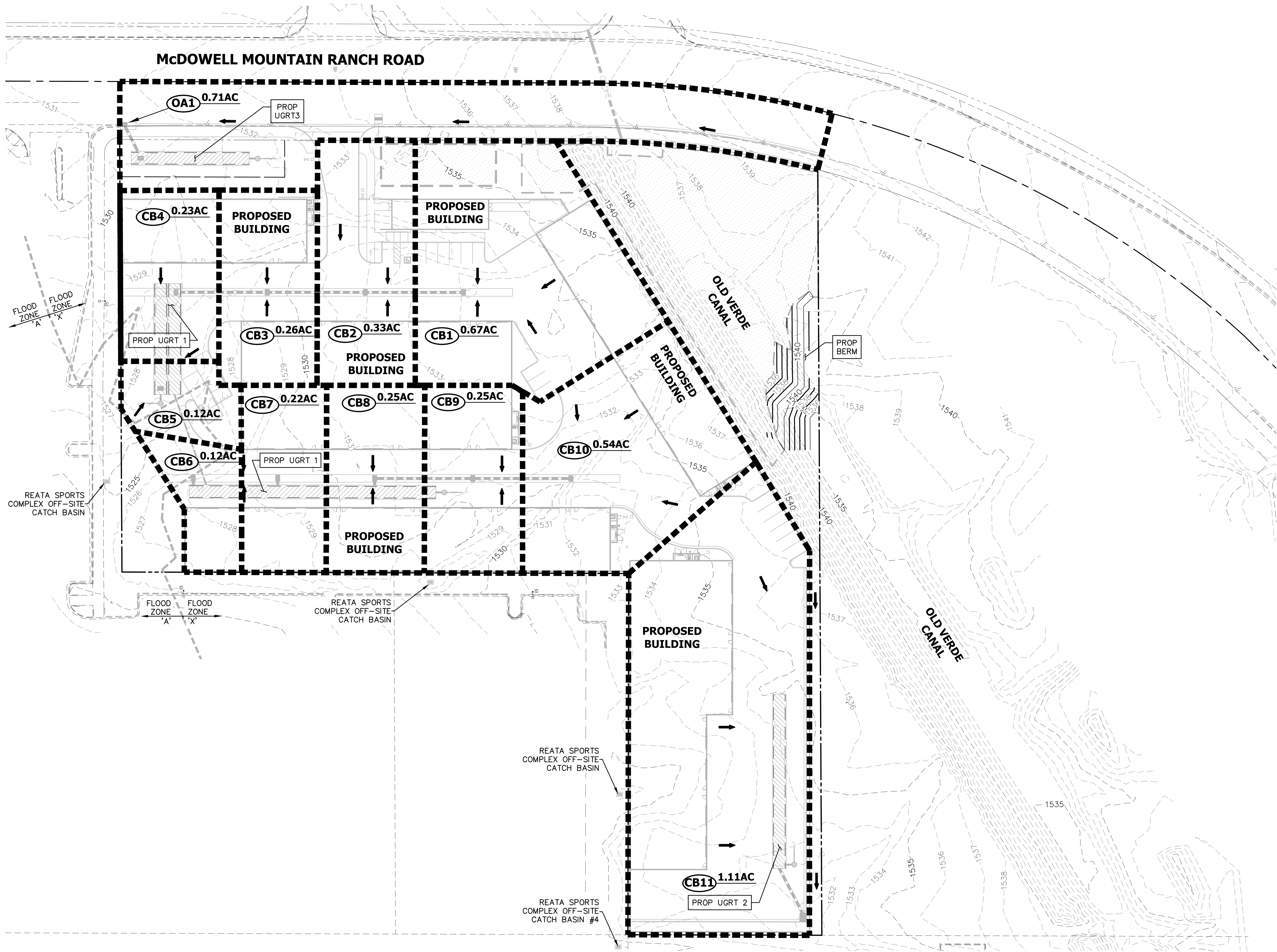
FIGURE 2
PORTION OF APPLICABLE FEMA FIRM
PANEL SHOWING SITE



MAP LEGEND

FIRM PANEL

DRAINAGE EXHIBIT A
FOR
COLLECTOR'S GARAGE AT WESTWORLD
9909 E. MCDOWELL MOUNTAIN RANCH ROAD
SCOTTSDALE, ARIZONA



DEVELOPER
LGE DESIGN BUILD
1200 N 52ND STREET
PHOENIX, ARIZONA 85008
CONTACT: ANTHONY MARTINEZ
PHONE: (480) 966-4001
EMAIL: ANTHONYM@LGEDESIGNBUILD.COM

CIVIL ENGINEER
HUNTER ENGINEERING, INC.
10446 N. 74TH STREET, SUITE #140
SCOTTSDALE, ARIZONA 85258
CONTACT: GRANT HIRNEISE, P.E.
PHONE: (480) 991-3985
EMAIL: GHIRNEISE@HUNTERENGINEERINGPC.COM

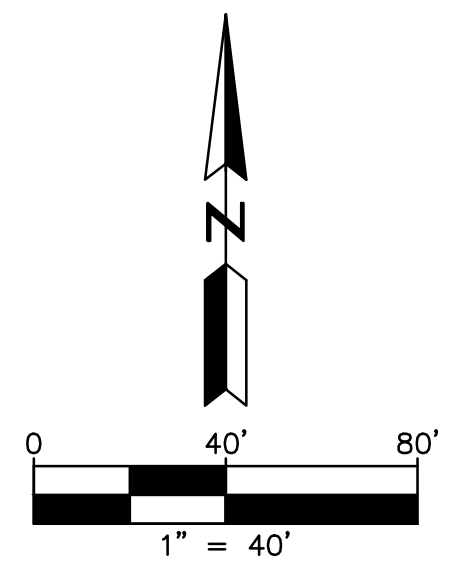
ARCHITECT
LGE DESIGN BUILD
1200 N 52ND STREET
PHOENIX, ARIZONA 85008
CONTACT: ANTHONY MARTINEZ
PHONE: (480) 966-4001
EMAIL: ANTHONYM@LGEDESIGNBUILD.COM

- LEGEND**
- PROPOSED STORM LINE
 - PROPOSED CATCH BASIN
 - PROPOSED FLOW ARROW
 - DRAINAGE AREA BOUNDARY
 - CATCH BASIN CATCHMENT AREA
 - OFFSITE AREA

RETENTION BASINS SUMMARY

DRAINAGE AREA LOCATION	VOLUME REQ'D (CF)	VOLUME PROV'D (CF)	EXCESS (CF)	DRYWELL
UGRT 1*	23,053	23,093	40	2
UGRT 2	8,558	8,588	30	1
UGRT 3	5,778	5,789	11	1

*UGRT 1 IS A SERIES OF TANKS HYDRAULICALLY CONNECTED WITH A 12-INCH PIPE
UGRT - UNDERGROUND RETENTION



NO.	DATE	REVISION	BY

DESIGN BY: GH
DRAWN BY: DS
CHECKED BY: BL

HUNTER ENGINEERING
10446 NORTH 74TH STREET, SUITE 140
SCOTTSDALE, AZ 85258
T 480 991 3985
F 480 991 3986
CIVIL AND SURVEY



DRAINAGE EXHIBIT A
FOR
COLLECTOR'S GARAGES AT WESTWORLD
9909 E. MCDOWELL MOUNTAIN RANCH ROAD
SCOTTSDALE, ARIZONA



THESE PLANS ARE NOT APPROVED FOR CONSTRUCTION WITHOUT AN APPROVED SIGNATURE FROM THE GOVERNING MUNICIPALITY.

PROJECT NAME:
COLLECTOR'S GARAGES WESTWORLD

HE NO.: LGEC324

SCALE: 1"=40'

SHEET:
EXH A

APPENDIX B
DRAINAGE CALCULATIONS

Retention Basin Calculations

Design Storm: 100-year, 2-hour

C = 0.90 Onsite
C = 0.95 Offsite
D = 2.36 inches
V_r = 37,390 cf
V_p = 37,471 cf

Underground Retention 1

Required

Location	Type	Area (ac)	C' Coefficient	Depth (in)	Required (cf)
CB1	Paving	0.67	0.90	2.36	5,166
CB2	Paving	0.33	0.90	2.36	2,544
CB3	Paving	0.26	0.90	2.36	2,005
CB4	Paving	0.23	0.90	2.36	1,773
CB5	Paving	0.12	0.90	2.36	925
CB6	Paving	0.12	0.90	2.36	925
CB7	Paving	0.22	0.90	2.36	1,696
CB8	Paving	0.25	0.90	2.36	1,928
CB9	Paving	0.25	0.90	2.36	1,928
CB10	Paving	0.54	0.90	2.36	4,163
Total		2.99			23,053

Provided

Length	Diameter (ft)	Area (sf)	Volume (cf)
363	9	63.62	23,093

Total UGRT 1
23,093 cf Prov
23,053 cf Req
40 cf Excess

Underground Retention 2

Required

Location	Type	Area (ac)	C' Coefficient	Depth (in)	Required (cf)
CB11	Paving	1.11	0.90	2.36	8,558

Provided

Length	Diameter (ft)	Area (sf)	Volume (cf)
135	9	63.62	8,588

Total UGRT 2
8,588 cf Prov
8,558 cf Req
30 cf Excess

Underground Retention 3 (OA1)

Required

Location	Type	Area (ac)	C' Coefficient	Depth (in)	Required (cf)
OA1	Paving	0.71	0.95	2.36	5,778

Provided

Length	Diameter (ft)	Area (sf)	Volume (cf)
91	9	63.62	5,789

Total UGRT 3
5,789 cf Prov
5,778 cf Req
11 cf Excess

Percolation Calculations

Project: LGEC324
Date: 2/28/2025

Calc'd By: BL
Chck'd By: GH

Drywell Percolation Calculations

Design Percolation Rate 0.10 cfs

(Considered a conservative rate without field test)

Basin ID	Number of Drywells	Drywell Perc. Rate (cfs)	Drywell Perc. Rate (cfh)	Basin Volume (cf)	Dry-Up Time (hr)
Offsite Area 1	1	0.1	360	5,778	16
UGRT 1	2	0.2	720	23,053	32
UGRT 2	1	0.1	360	8,558	24
Total	4				

Hydrologic Design Data Record

Grated Catch Basin Sump Condition

Project: LGEC324
 Date: 2/28/2025

Calc'd By: BL
 Chck'd By: GH

Location:		CB1		Area:		0.67 acres	
Runoff Coefficient:		0.90		Time of Conc, Tc:		5 min	
Frequency	2	10	25	50	100	Years	
Intensity	3.17	5.12	6.25	7.10	7.99	in/hr	
Discharge	1.91	3.09	3.77	4.28	4.82	cf/sec	
Weir Calculations - $Q=C_w \cdot P \cdot d^{1.5}$ - [Eq 3.11 MC Hydraulics Aug 15, 2013 ED.]							
Flow	Clogging Factor, C	Weir Coef, C_w	Allowable Depth, ft	Grate Perimeter P	Ponding (ft)		
Q_{100}	50%	3.00	0.50	11.84	0.42		
Q_{10}	50%	3.00	0.50	11.84	0.31		
Orifice Calculations - $Q=CO \cdot Ag \cdot (2gd)^{0.5}$ - [Eq 3.22 MC Hydraulics Aug 15, 2013 ED.]							
Flow	Clogging Factor, C	Weir Coef, C_o	Allowable Depth, ft	Grate Area, A (ft)	Ponding (ft)		
Q_{100}	50%	0.67	0.50	5.42	0.11		
Q_{10}	50%	0.67	0.50	5.42	0.04		

Location: CB2		Area: 0.33		acres		
Runoff Coefficient: 0.90		Time of Conc, Tc: 5		min		
Frequency	2	10	25	50	100	Years
Intensity	3.17	5.12	6.25	7.10	7.99	in/hr
Discharge	0.94	1.52	1.86	2.11	2.37	cf/sec
Weir Calculations - $Q=C_w \cdot P \cdot d^{1.5}$ - [Eq 3.11 MC Hydraulics Aug 15, 2013 ED.]						
Flow	Clogging Factor, C	Weir Coef, C_w	Allowable Depth, ft	Grate Perimeter P	Ponding (ft)	
Q_{100}	50%	3.00	0.50	11.84	0.26	
Q_{10}	50%	3.00	0.50	11.84	0.19	
Orifice Calculations - $Q=CO \cdot Ag \cdot (2gd)^{0.5}$ - [Eq 3.22 MC Hydraulics Aug 15, 2013 ED.]						
Flow	Clogging Factor, C	Weir Coef, C_o	Allowable Depth, ft	Grate Area, A (ft)	Ponding (ft)	
Q_{100}	50%	0.67	0.50	5.42	0.03	
Q_{10}	50%	0.67	0.50	5.42	0.01	

Hydrologic Design Data Record Grated Catch Basin Sump Condition

Project: LGEC324
Date: 2/28/2025

Calc'd By: BL
Chck'd By: GH

Location: CB3		Area: 0.26			acres	
Runoff Coefficient: 0.90		Time of Conc, Tc: 5			min	
Frequency	2	10	25	50	100	Years
Intensity	3.17	5.12	6.25	7.10	7.99	in/hr
Discharge	0.74	1.20	1.46	1.66	1.87	cf/sec
Weir Calculations - $Q=C_w \cdot P \cdot d^{1.5}$ - [Eq 3.11 MC Hydraulics Aug 15, 2013 ED.]						
Flow	Clogging Factor, C	Weir Coef, C_w	Allowable Depth, ft	Grate Perimeter P	Ponding (ft)	
Q_{100}	50%	3.00	0.50	11.84	0.22	
Q_{10}	50%	3.00	0.50	11.84	0.17	
Orifice Calculations - $Q=CO \cdot Ag \cdot (2gd)^{0.5}$ - [Eq 3.22 MC Hydraulics Aug 15, 2013 ED.]						
Flow	Clogging Factor, C	Weir Coef, C_o	Allowable Depth, ft	Grate Area, A (ft)	Ponding (ft)	
Q_{100}	50%	0.67	0.50	5.42	0.02	
Q_{10}	50%	0.67	0.50	5.42	0.01	

Location:		CB4		Area:		0.23 acres	
Runoff Coefficient:		0.90		Time of Conc, Tc:		5 min	
Frequency	2	10	25	50	100	Years	
Intensity	3.17	5.12	6.25	7.10	7.99	in/hr	
Discharge	0.66	1.06	1.29	1.47	1.65	cf/sec	
Weir Calculations - $Q=C_w \cdot P \cdot d^{1.5}$ - [Eq 3.11 MC Hydraulics Aug 15, 2013 ED.]							
Flow	Clogging Factor, C	Weir Coef, C_w	Allowable Depth, ft	Grate Perimeter P	Ponding (ft)		
Q_{100}	50%	3.00	0.50	11.84	0.21		
Q_{10}	50%	3.00	0.50	11.84	0.15		
Orifice Calculations - $Q=CO \cdot Ag^*(2gd)^{0.5}$ - [Eq 3.22 MC Hydraulics Aug 15, 2013 ED.]							
Flow	Clogging Factor, C	Weir Coef, C_o	Allowable Depth, ft	Grate Area, A (ft)	Ponding (ft)		
Q_{100}	50%	0.67	0.50	5.42	0.01		
Q_{10}	50%	0.67	0.50	5.42	0.01		

Hydrologic Design Data Record Grated Catch Basin Sump Condition

Project: LGEC324
Date: 2/28/2025

Calc'd By: BL
Chck'd By: GH

Location: CB5		Area: 0.12			acres	
Runoff Coefficient: 0.90		Time of Conc, Tc: 5			min	
Frequency	2	10	25	50	100	Years
Intensity	3.17	5.12	6.25	7.10	7.99	in/hr
Discharge	0.34	0.55	0.68	0.77	0.86	cf/sec
Weir Calculations - $Q=C_w \cdot P \cdot d^{1.5}$ - [Eq 3.11 MC Hydraulics Aug 15, 2013 ED.]						
Flow	Clogging Factor, C	Weir Coef, C_w	Allowable Depth, ft	Grate Perimeter P	Ponding (ft)	
Q_{100}	50%	3.00	0.50	11.84	0.13	
Q_{10}	50%	3.00	0.50	11.84	0.10	
Orifice Calculations - $Q=CO \cdot Ag \cdot (2gd)^{0.5}$ - [Eq 3.22 MC Hydraulics Aug 15, 2013 ED.]						
Flow	Clogging Factor, C	Weir Coef, C_o	Allowable Depth, ft	Grate Area, A (ft)	Ponding (ft)	
Q_{100}	50%	0.67	0.50	5.42	0.00	
Q_{10}	50%	0.67	0.50	5.42	0.00	

Location:		CB6		Area:		0.12 acres	
Runoff Coefficient:		0.90		Time of Conc, Tc:		5 min	
Frequency	2	10	25	50	100	Years	
Intensity	3.17	5.12	6.25	7.10	7.99	in/hr	
Discharge	0.34	0.55	0.68	0.77	0.86	cf/sec	
Weir Calculations - $Q=C_w \cdot P \cdot d^{1.5}$ - [Eq 3.11 MC Hydraulics Aug 15, 2013 ED.]							
Flow	Clogging Factor, C	Weir Coef, C_w	Allowable Depth, ft	Grate Perimeter P	Ponding (ft)		
Q_{100}	50%	3.00	0.50	11.84	0.13		
Q_{10}	50%	3.00	0.50	11.84	0.10		
Orifice Calculations - $Q=CO \cdot Ag^*(2gd)^{0.5}$ - [Eq 3.22 MC Hydraulics Aug 15, 2013 ED.]							
Flow	Clogging Factor, C	Weir Coef, C_o	Allowable Depth, ft	Grate Area, A (ft)	Ponding (ft)		
Q_{100}	50%	0.67	0.50	5.42	0.00		
Q_{10}	50%	0.67	0.50	5.42	0.00		

Hydrologic Design Data Record

Grated Catch Basin Sump Condition

Project: LGEC324
 Date: 2/28/2025

Calc'd By: BL
 Chck'd By: GH

Location: CB7		Area: 0.22		acres		
Runoff Coefficient: 0.90		Time of Conc, Tc: 5		min		
Frequency	2	10	25	50	100	Years
Intensity	3.17	5.12	6.25	7.10	7.99	in/hr
Discharge	0.63	1.01	1.24	1.41	1.58	cf/sec
Weir Calculations - $Q=C_w \cdot P \cdot d^{1.5}$ - [Eq 3.11 MC Hydraulics Aug 15, 2013 ED.]						
Flow	Clogging Factor, C	Weir Coef, C_w	Allowable Depth, ft	Grate Perimeter P	Ponding (ft)	
Q_{100}	50%	3.00	0.50	11.84	0.20	
Q_{10}	50%	3.00	0.50	11.84	0.15	
Orifice Calculations - $Q=CO \cdot Ag \cdot (2gd)^{0.5}$ - [Eq 3.22 MC Hydraulics Aug 15, 2013 ED.]						
Flow	Clogging Factor, C	Weir Coef, C_o	Allowable Depth, ft	Grate Area, A (ft)	Ponding (ft)	
Q_{100}	50%	0.67	0.50	5.42	0.01	
Q_{10}	50%	0.67	0.50	5.42	0.00	

Location: CB8		Area: 0.25 acres				
Runoff Coefficient: 0.90		Time of Conc, Tc: 5 min				
Frequency	2	10	25	50	100	Years
Intensity	3.17	5.12	6.25	7.10	7.99	in/hr
Discharge	0.71	1.15	1.41	1.60	1.80	cf/sec
Weir Calculations - $Q=C_w \cdot P \cdot d^{1.5}$ - [Eq 3.11 MC Hydraulics Aug 15, 2013 ED.]						
Flow	Clogging Factor, C	Weir Coef, C_w	Allowable Depth, ft	Grate Perimeter P	Ponding (ft)	
Q_{100}	50%	3.00	0.50	11.84	0.22	
Q_{10}	50%	3.00	0.50	11.84	0.16	
Orifice Calculations - $Q=CO \cdot Ag \cdot (2gd)^{0.5}$ - [Eq 3.22 MC Hydraulics Aug 15, 2013 ED.]						
Flow	Clogging Factor, C	Weir Coef, C_o	Allowable Depth, ft	Grate Area, A (ft)	Ponding (ft)	
Q_{100}	50%	0.67	0.50	5.42	0.02	
Q_{10}	50%	0.67	0.50	5.42	0.01	

Hydrologic Design Data Record Grated Catch Basin Sump Condition

Project: LGEC324
Date: 2/28/2025

Calc'd By: BL
Chck'd By: GH

Location: CB9		Area: 0.25		acres		
Runoff Coefficient: 0.90		Time of Conc, Tc: 5		min		
Frequency	2	10	25	50	100	Years
Intensity	3.17	5.12	6.25	7.10	7.99	in/hr
Discharge	0.71	1.15	1.41	1.60	1.80	cf/sec
Weir Calculations - $Q=C_w \cdot P \cdot d^{1.5}$ - [Eq 3.11 MC Hydraulics Aug 15, 2013 ED.]						
Flow	Clogging Factor, C	Weir Coef, C_w	Allowable Depth, ft	Grate Perimeter P	Ponding (ft)	
Q_{100}	50%	3.00	0.50	11.84	0.22	
Q_{10}	50%	3.00	0.50	11.84	0.16	
Orifice Calculations - $Q=CO \cdot Ag \cdot (2gd)^{0.5}$ - [Eq 3.22 MC Hydraulics Aug 15, 2013 ED.]						
Flow	Clogging Factor, C	Weir Coef, C_o	Allowable Depth, ft	Grate Area, A (ft)	Ponding (ft)	
Q_{100}	50%	0.67	0.50	5.42	0.02	
Q_{10}	50%	0.67	0.50	5.42	0.01	

Location: CB10		Area: 0.54		acres		
Runoff Coefficient: 0.90		Time of Conc, Tc: 5		min		
Frequency	2	10	25	50	100	Years
Intensity	3.17	5.12	6.25	7.10	7.99	in/hr
Discharge	1.54	2.49	3.04	3.45	3.88	cf/sec
Weir Calculations - $Q=C_w \cdot P \cdot d^{1.5}$ - [Eq 3.11 MC Hydraulics Aug 15, 2013 ED.]						
Flow	Clogging Factor, C	Weir Coef, C_w	Allowable Depth, ft	Grate Perimeter P	Ponding (ft)	
Q_{100}	50%	3.00	0.50	11.84	0.36	
Q_{10}	50%	3.00	0.50	11.84	0.27	
Orifice Calculations - $Q=CO \cdot Ag^*(2gd)^{0.5}$ - [Eq 3.22 MC Hydraulics Aug 15, 2013 ED.]						
Flow	Clogging Factor, C	Weir Coef, C_o	Allowable Depth, ft	Grate Area, A (ft)	Ponding (ft)	
Q_{100}	50%	0.67	0.50	5.42	0.07	
Q_{10}	50%	0.67	0.50	5.42	0.03	

Hydrologic Design Data Record Grated Catch Basin Sump Condition

Project: LGEC324
Date: 2/28/2025

Calc'd By: BL
Chck'd By: GH

Location: CB11		Area: 1.11			acres	
Runoff Coefficient: 0.90		Time of Conc, Tc: 5			min	
Frequency	2	10	25	50	100	Years
Intensity	3.17	5.12	6.25	7.10	7.99	in/hr
Discharge	3.17	5.11	6.24	7.09	7.98	cf/sec
Weir Calculations - $Q=C_w \cdot P \cdot d^{1.5}$ - [Eq 3.11 MC Hydraulics Aug 15, 2013 ED.]						
Flow	Clogging Factor, C	Weir Coef, C_w	Allowable Depth, ft	Grate Perimeter P	Ponding (ft)	
Q_{100}	50%	3.00	0.50	16.83	0.46	
Q_{10}	50%	3.00	0.50	16.83	0.34	
Orifice Calculations - $Q=CO \cdot Ag \cdot (2gd)^{0.5}$ - [Eq 3.22 MC Hydraulics Aug 15, 2013 ED.]						
Flow	Clogging Factor, C	Weir Coef, C_o	Allowable Depth, ft	Grate Area, A (ft)	Ponding (ft)	
Q_{100}	50%	0.67	0.50	10.84	0.08	
Q_{10}	50%	0.67	0.50	10.84	0.03	

Hydrologic Design Data Record

Curb Inlet/Scupper Flow By Condition

Project: LGEC324
 Date: 2/28/2025

Calc'd By: BL
 Chck'd By: GH

Location:	OA1					Area:	0.71	acres
Runoff Coefficient:	0.95		Time of Conc, Tc:	5			5	min
Frequency	2	10	25	50	100	Years		
Intensity	3.17	5.12	6.25	7.10	7.99	in/hr		
Discharge	2.14	3.45	4.22	4.79	5.39	cf/sec		

E_o = Ratio of frontal flow to gutter flow

$$E_o = 1 / (1 + ((S_w / S_x) / (((1 + ((S_w / S_x) / ((T / W) - 1)))^{2.67}) - 1)) \quad [\text{Eq 3.4 MC Hydraulics Aug 15, 2013ED.}]$$

Roadway Spread, T = **12.86** ft

Width of Gutter, W = **1.42** ft

Pavement Cross Slope, S_x = **0.02** ft/ft

E_o = **0.32**

Gutter Cross Slope, S_w = **0.0787** ft/ft

Roadway

Gutter Cross Slope, S_w = **0.1561** ft/ft

At Inlet

$$S_e = S_x + S'_w * E_o \quad [\text{Equation 3.9 MC Hydraulics August 15, 2013ED.}]$$

Equivalent Cross Slope, S_e = **0.071** ft/ft

L_t = Length of Catch Basin Curb Opening Required for Total Interception

$$L_t = 0.6 * Q^{0.42} * S^{0.3} * (1 / (n * S_e))^{0.6} \quad [\text{Equation 3.10 MC Hydraulics August 15, 2013ED.}]$$

Longitudinal Slope, S = **0.012** ft/ft

Mannings, n =

0.015

Clogging Factor = **80%**

100yr L_t = **24.60** ft

Q_{100_{cap}} = **4.59** cfs

10yr L_t = **20.40** ft

Q₁₀₀ = **5.39** cfs

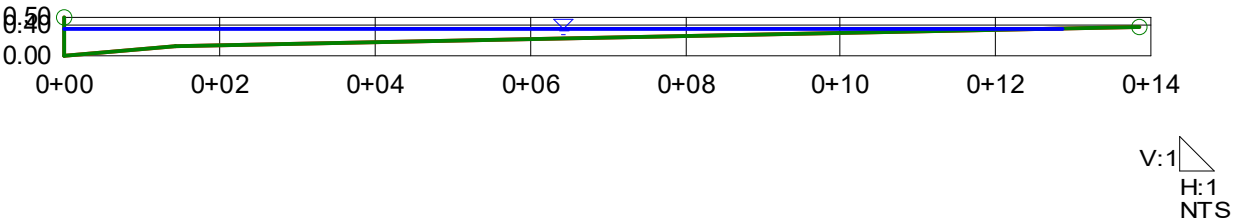
Length Provided = **23** ft

Excess = **-0.80** cfs

Cross Section
Cross Section for Gutter Section

Project Description	
Worksheet	Roadway Sp
Type	Gutter Secti
Solve For	Spread

Section Data	
Channel Slope	010000 ft/ft
Discharge	5.39 cfs
Gutter Width	1.42 ft
Gutter Cross Slope	0.079 ft/ft
Road Cross Slope	0.020 ft/ft
Spread	12.86 ft
Mannings Coeffic	0.015



APPENDIX C
REFERENCE INFORMATION



NOAA Atlas 14, Volume 1, Version 5
Location name: Scottsdale, Arizona, USA*
Latitude: 33.6307°, Longitude: -111.8684°
Elevation: 1525 ft**
* source: ESRI Maps
** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aeriels](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.202 (0.168-0.249)	0.264 (0.221-0.325)	0.356 (0.294-0.437)	0.427 (0.351-0.521)	0.521 (0.421-0.634)	0.592 (0.474-0.716)	0.666 (0.523-0.803)	0.739 (0.571-0.890)	0.838 (0.631-1.01)	0.913 (0.673-1.10)
10-min	0.308 (0.256-0.379)	0.402 (0.336-0.494)	0.543 (0.448-0.665)	0.650 (0.533-0.793)	0.793 (0.641-0.964)	0.902 (0.721-1.09)	1.01 (0.796-1.22)	1.12 (0.869-1.36)	1.28 (0.960-1.54)	1.39 (1.02-1.68)
15-min	0.381 (0.317-0.469)	0.498 (0.416-0.613)	0.672 (0.555-0.824)	0.805 (0.661-0.983)	0.983 (0.794-1.20)	1.12 (0.893-1.35)	1.26 (0.987-1.52)	1.40 (1.08-1.68)	1.58 (1.19-1.90)	1.72 (1.27-2.08)
30-min	0.514 (0.426-0.632)	0.671 (0.561-0.826)	0.906 (0.748-1.11)	1.08 (0.890-1.32)	1.32 (1.07-1.61)	1.51 (1.20-1.82)	1.69 (1.33-2.04)	1.88 (1.45-2.26)	2.13 (1.60-2.56)	2.32 (1.71-2.80)
60-min	0.636 (0.528-0.782)	0.831 (0.694-1.02)	1.12 (0.925-1.37)	1.34 (1.10-1.64)	1.64 (1.32-1.99)	1.86 (1.49-2.25)	2.10 (1.64-2.52)	2.32 (1.80-2.80)	2.63 (1.98-3.17)	2.87 (2.12-3.47)
2-hr	0.744 (0.625-0.893)	0.963 (0.812-1.16)	1.28 (1.07-1.54)	1.52 (1.26-1.82)	1.85 (1.52-2.21)	2.10 (1.70-2.50)	2.36 (1.88-2.80)	2.61 (2.05-3.10)	2.96 (2.27-3.51)	3.22 (2.42-3.84)
3-hr	0.815 (0.684-0.999)	1.04 (0.880-1.29)	1.36 (1.14-1.67)	1.62 (1.34-1.97)	1.97 (1.61-2.38)	2.25 (1.81-2.71)	2.54 (2.01-3.06)	2.84 (2.21-3.41)	3.26 (2.46-3.91)	3.59 (2.65-4.31)
6-hr	0.980 (0.841-1.17)	1.24 (1.06-1.47)	1.58 (1.34-1.87)	1.85 (1.56-2.18)	2.22 (1.85-2.60)	2.50 (2.06-2.93)	2.80 (2.27-3.28)	3.11 (2.47-3.64)	3.52 (2.72-4.12)	3.84 (2.91-4.50)
12-hr	1.12 (0.968-1.32)	1.41 (1.22-1.66)	1.78 (1.53-2.08)	2.07 (1.77-2.42)	2.46 (2.08-2.87)	2.77 (2.31-3.21)	3.08 (2.53-3.57)	3.39 (2.75-3.93)	3.80 (3.01-4.43)	4.13 (3.20-4.84)
24-hr	1.32 (1.17-1.51)	1.68 (1.48-1.92)	2.17 (1.91-2.49)	2.57 (2.25-2.94)	3.12 (2.71-3.56)	3.56 (3.07-4.05)	4.01 (3.43-4.59)	4.49 (3.80-5.13)	5.16 (4.28-5.90)	5.68 (4.66-6.54)
2-day	1.45 (1.28-1.67)	1.86 (1.63-2.13)	2.44 (2.14-2.79)	2.91 (2.54-3.32)	3.56 (3.09-4.07)	4.09 (3.51-4.67)	4.65 (3.96-5.31)	5.22 (4.41-6.00)	6.04 (5.02-6.95)	6.70 (5.48-7.74)
3-day	1.57 (1.38-1.79)	2.01 (1.77-2.30)	2.66 (2.33-3.03)	3.18 (2.78-3.62)	3.93 (3.41-4.47)	4.53 (3.90-5.15)	5.17 (4.42-5.89)	5.85 (4.95-6.69)	6.81 (5.67-7.81)	7.59 (6.24-8.75)
4-day	1.68 (1.49-1.92)	2.16 (1.90-2.46)	2.88 (2.53-3.27)	3.46 (3.03-3.92)	4.29 (3.73-4.86)	4.96 (4.29-5.63)	5.69 (4.88-6.47)	6.47 (5.49-7.38)	7.58 (6.33-8.66)	8.49 (7.01-9.75)
7-day	1.91 (1.67-2.19)	2.44 (2.15-2.80)	3.26 (2.86-3.74)	3.93 (3.42-4.49)	4.88 (4.23-5.58)	5.66 (4.87-6.46)	6.50 (5.54-7.43)	7.39 (6.24-8.49)	8.67 (7.21-9.98)	9.72 (7.98-11.3)
10-day	2.08 (1.83-2.38)	2.67 (2.35-3.05)	3.56 (3.12-4.05)	4.27 (3.73-4.86)	5.29 (4.59-6.00)	6.12 (5.27-6.94)	7.00 (5.98-7.96)	7.94 (6.72-9.06)	9.28 (7.74-10.6)	10.4 (8.54-11.9)
20-day	2.59 (2.28-2.95)	3.35 (2.95-3.80)	4.44 (3.90-5.04)	5.27 (4.62-5.98)	6.42 (5.60-7.28)	7.30 (6.34-8.29)	8.22 (7.09-9.35)	9.16 (7.84-10.5)	10.4 (8.85-12.0)	11.5 (9.61-13.2)
30-day	3.05 (2.68-3.46)	3.94 (3.48-4.47)	5.22 (4.59-5.91)	6.20 (5.45-7.01)	7.54 (6.58-8.52)	8.57 (7.45-9.69)	9.64 (8.33-10.9)	10.7 (9.22-12.2)	12.2 (10.4-13.9)	13.4 (11.3-15.3)
45-day	3.59 (3.18-4.07)	4.64 (4.11-5.26)	6.16 (5.44-6.97)	7.29 (6.42-8.26)	8.82 (7.72-9.98)	9.98 (8.70-11.3)	11.2 (9.68-12.7)	12.4 (10.7-14.1)	14.1 (12.0-16.1)	15.4 (12.9-17.7)
60-day	4.02 (3.56-4.54)	5.21 (4.62-5.89)	6.89 (6.10-7.79)	8.13 (7.17-9.19)	9.76 (8.58-11.0)	11.0 (9.61-12.4)	12.2 (10.6-13.9)	13.5 (11.7-15.3)	15.2 (13.0-17.4)	16.5 (14.0-18.9)

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

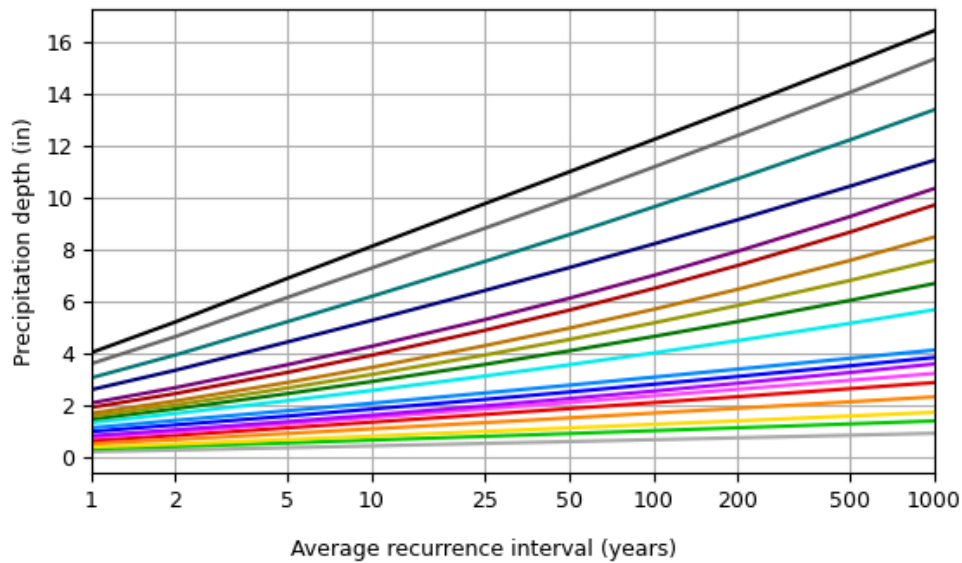
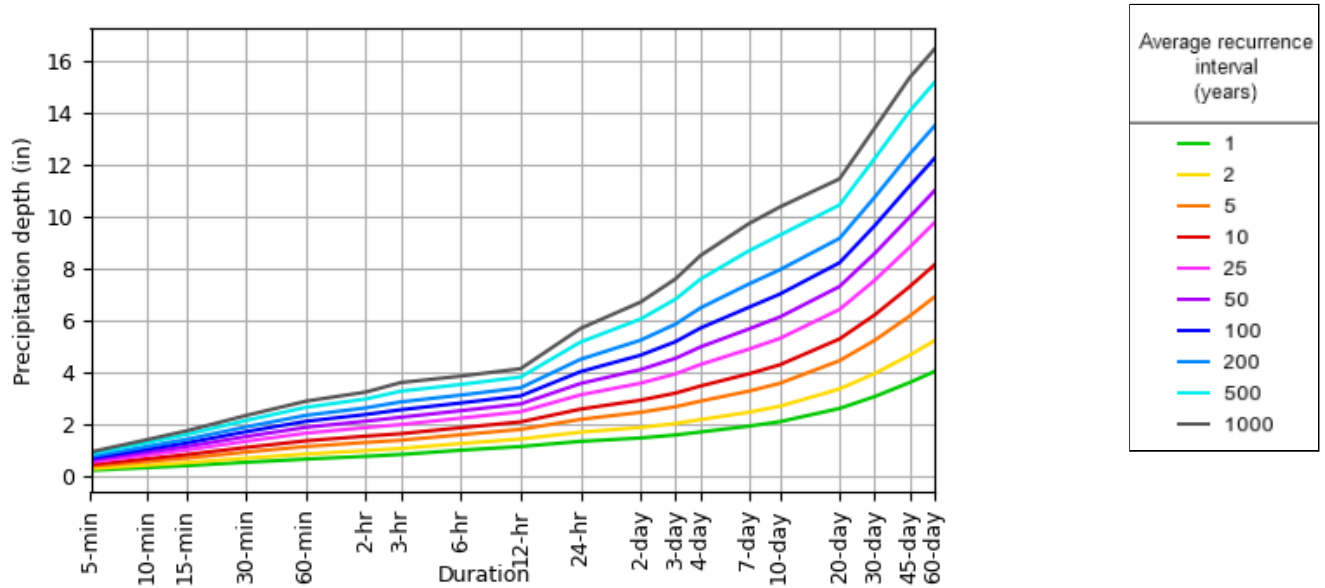
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper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

Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

PF graphical

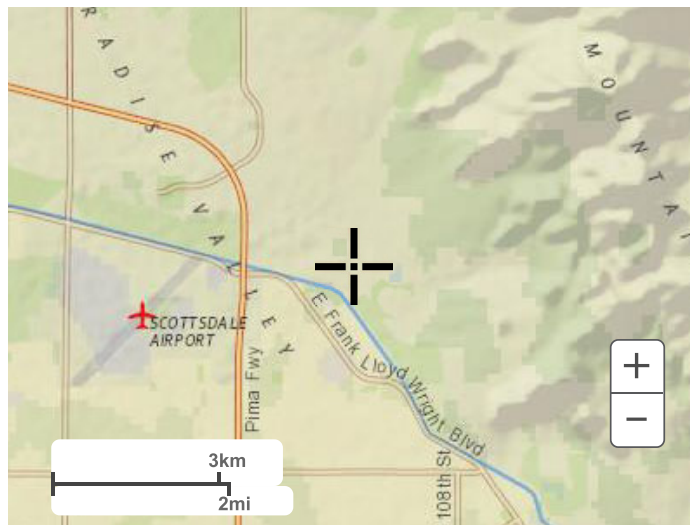
PDS-based depth-duration-frequency (DDF) curves
Latitude: 33.6307°, Longitude: -111.8684°



[Back to Top](#)

Maps & aerials

Small scale terrain



Large scale terrain



Large scale map



Large scale aerial



[Back to Top](#)

[US Department of Commerce](#)
[National Oceanic and Atmospheric Administration](#)
[National Weather Service](#)
[National Water Center](#)
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

[Disclaimer](#)



NOAA Atlas 14, Volume 1, Version 5
Location name: Scottsdale, Arizona, USA*
Latitude: 33.6307°, Longitude: -111.8684°
Elevation: 1525 ft**
* source: ESRI Maps
** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aeriels](#)

PF tabular

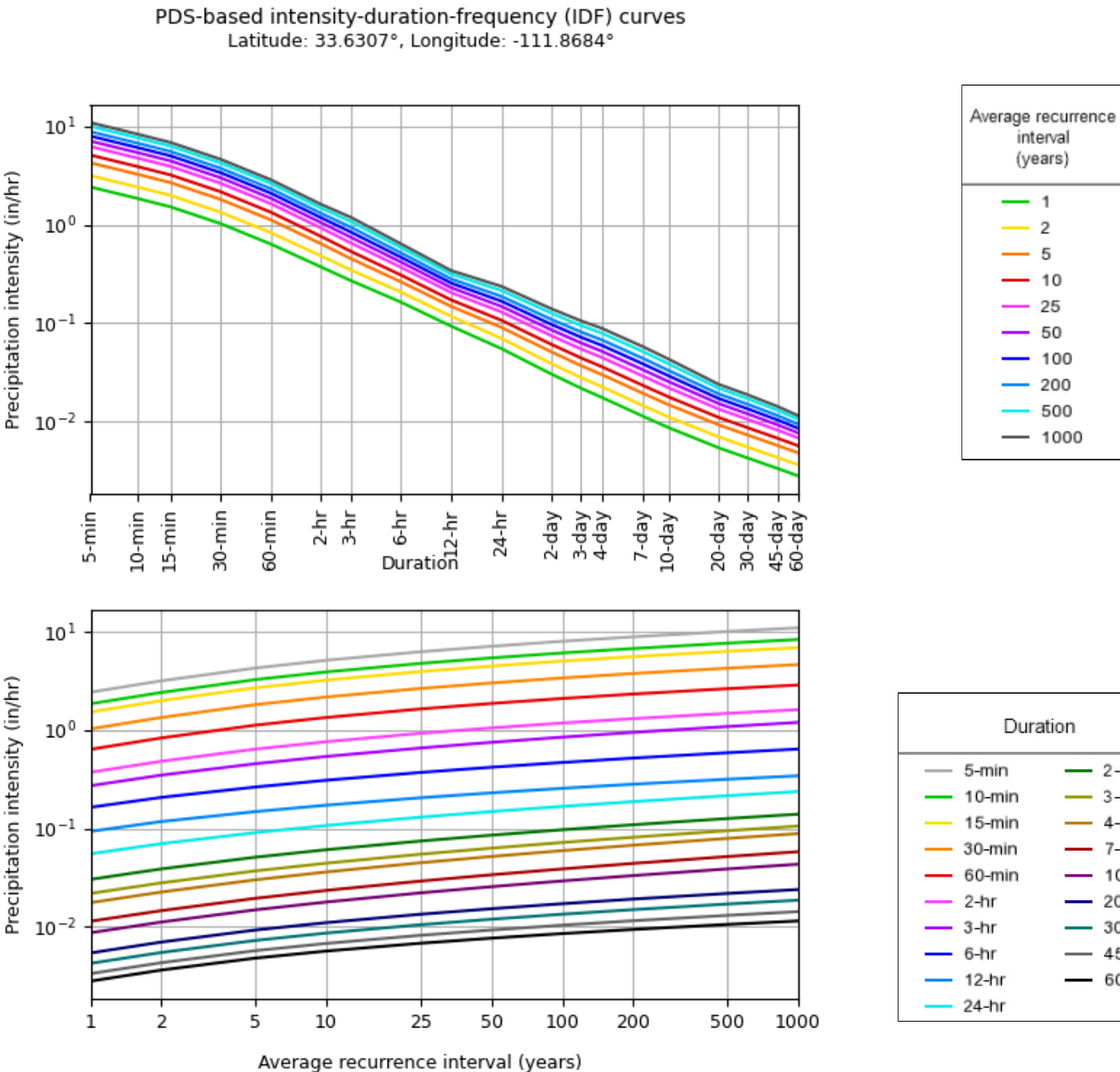
PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	2.42 (2.02-2.99)	3.17 (2.65-3.90)	4.27 (3.53-5.24)	5.12 (4.21-6.25)	6.25 (5.05-7.61)	7.10 (5.69-8.59)	7.99 (6.28-9.64)	8.87 (6.85-10.7)	10.1 (7.57-12.1)	11.0 (8.08-13.2)
10-min	1.85 (1.54-2.27)	2.41 (2.02-2.96)	3.26 (2.69-3.99)	3.90 (3.20-4.76)	4.76 (3.85-5.78)	5.41 (4.33-6.54)	6.08 (4.78-7.33)	6.75 (5.21-8.13)	7.65 (5.76-9.22)	8.34 (6.15-10.1)
15-min	1.52 (1.27-1.88)	1.99 (1.66-2.45)	2.69 (2.22-3.30)	3.22 (2.64-3.93)	3.93 (3.18-4.78)	4.47 (3.57-5.40)	5.03 (3.95-6.06)	5.58 (4.31-6.72)	6.32 (4.76-7.62)	6.89 (5.08-8.32)
30-min	1.03 (0.852-1.26)	1.34 (1.12-1.65)	1.81 (1.50-2.22)	2.17 (1.78-2.65)	2.65 (2.14-3.22)	3.01 (2.41-3.64)	3.39 (2.66-4.08)	3.76 (2.90-4.52)	4.26 (3.21-5.13)	4.64 (3.42-5.60)
60-min	0.636 (0.528-0.782)	0.831 (0.694-1.02)	1.12 (0.925-1.37)	1.34 (1.10-1.64)	1.64 (1.32-1.99)	1.86 (1.49-2.25)	2.10 (1.64-2.52)	2.32 (1.80-2.80)	2.63 (1.98-3.17)	2.87 (2.12-3.47)
2-hr	0.372 (0.312-0.446)	0.481 (0.406-0.579)	0.640 (0.536-0.768)	0.761 (0.631-0.912)	0.926 (0.760-1.10)	1.05 (0.851-1.25)	1.18 (0.939-1.40)	1.31 (1.02-1.55)	1.48 (1.13-1.75)	1.61 (1.21-1.92)
3-hr	0.271 (0.227-0.332)	0.347 (0.293-0.428)	0.454 (0.380-0.556)	0.538 (0.446-0.656)	0.656 (0.535-0.793)	0.749 (0.603-0.902)	0.846 (0.669-1.02)	0.947 (0.736-1.14)	1.08 (0.818-1.30)	1.20 (0.881-1.44)
6-hr	0.163 (0.140-0.194)	0.206 (0.177-0.245)	0.263 (0.224-0.312)	0.308 (0.260-0.364)	0.370 (0.308-0.435)	0.418 (0.343-0.489)	0.468 (0.379-0.547)	0.518 (0.412-0.608)	0.587 (0.455-0.687)	0.641 (0.485-0.751)
12-hr	0.093 (0.080-0.109)	0.117 (0.101-0.137)	0.147 (0.126-0.172)	0.172 (0.146-0.200)	0.204 (0.172-0.238)	0.229 (0.191-0.266)	0.255 (0.209-0.296)	0.281 (0.228-0.326)	0.315 (0.249-0.367)	0.342 (0.265-0.401)
24-hr	0.055 (0.048-0.063)	0.069 (0.061-0.080)	0.090 (0.079-0.103)	0.106 (0.093-0.122)	0.129 (0.113-0.148)	0.148 (0.127-0.168)	0.167 (0.142-0.191)	0.187 (0.158-0.213)	0.214 (0.178-0.245)	0.236 (0.194-0.272)
2-day	0.030 (0.026-0.034)	0.038 (0.033-0.044)	0.050 (0.044-0.058)	0.060 (0.052-0.069)	0.074 (0.064-0.084)	0.085 (0.073-0.097)	0.096 (0.082-0.110)	0.108 (0.091-0.124)	0.125 (0.104-0.144)	0.139 (0.114-0.161)
3-day	0.021 (0.019-0.024)	0.027 (0.024-0.031)	0.036 (0.032-0.042)	0.044 (0.038-0.050)	0.054 (0.047-0.062)	0.062 (0.054-0.071)	0.071 (0.061-0.081)	0.081 (0.068-0.092)	0.094 (0.078-0.108)	0.105 (0.086-0.121)
4-day	0.017 (0.015-0.020)	0.022 (0.019-0.025)	0.029 (0.026-0.034)	0.036 (0.031-0.040)	0.044 (0.038-0.050)	0.051 (0.044-0.058)	0.059 (0.050-0.067)	0.067 (0.057-0.076)	0.078 (0.065-0.090)	0.088 (0.072-0.101)
7-day	0.011 (0.009-0.013)	0.014 (0.012-0.016)	0.019 (0.016-0.022)	0.023 (0.020-0.026)	0.029 (0.025-0.033)	0.033 (0.028-0.038)	0.038 (0.032-0.044)	0.044 (0.037-0.050)	0.051 (0.042-0.059)	0.057 (0.047-0.066)
10-day	0.008 (0.007-0.009)	0.011 (0.009-0.012)	0.014 (0.012-0.016)	0.017 (0.015-0.020)	0.022 (0.019-0.025)	0.025 (0.021-0.028)	0.029 (0.024-0.033)	0.033 (0.028-0.037)	0.038 (0.032-0.044)	0.043 (0.035-0.049)
20-day	0.005 (0.004-0.006)	0.006 (0.006-0.007)	0.009 (0.008-0.010)	0.010 (0.009-0.012)	0.013 (0.011-0.015)	0.015 (0.013-0.017)	0.017 (0.014-0.019)	0.019 (0.016-0.021)	0.021 (0.018-0.024)	0.023 (0.020-0.027)
30-day	0.004 (0.003-0.004)	0.005 (0.004-0.006)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.010 (0.009-0.011)	0.011 (0.010-0.013)	0.013 (0.011-0.015)	0.014 (0.012-0.016)	0.016 (0.014-0.019)	0.018 (0.015-0.021)
45-day	0.003 (0.002-0.003)	0.004 (0.003-0.004)	0.005 (0.005-0.006)	0.006 (0.005-0.007)	0.008 (0.007-0.009)	0.009 (0.008-0.010)	0.010 (0.008-0.011)	0.011 (0.009-0.013)	0.013 (0.011-0.014)	0.014 (0.011-0.016)
60-day	0.002 (0.002-0.003)	0.003 (0.003-0.004)	0.004 (0.004-0.005)	0.005 (0.004-0.006)	0.006 (0.005-0.007)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.009 (0.008-0.010)	0.010 (0.009-0.012)	0.011 (0.009-0.013)

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

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

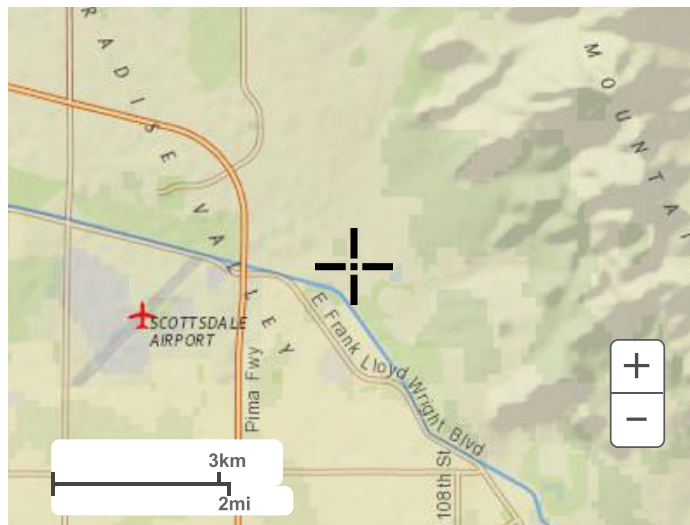
Please refer to NOAA Atlas 14 document for more information.

PF graphical



Maps & aerials

Small scale terrain



Large scale terrain



Large scale map



Large scale aerial



[Back to Top](#)

[US Department of Commerce](#)
[National Oceanic and Atmospheric Administration](#)
[National Weather Service](#)
[National Water Center](#)
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

[Disclaimer](#)

APPENDIX D
OFFSITE FLOW NARRATIVE

May 30, 2025

Collector's Garage at Westworld

Off-site Hydrologic and Hydraulics Investigation Memorandum

PROJECT: Collector's Garage at Westworld LOCATION: Scottsdale, Arizona

PROJECT NO.: R317601.01 DATE: May 30, 2025

PURPOSE: Off-site Hydrologic and Hydraulics Analysis

APPENDICES:

- A. Off-site Drainage Map
- B. Excerpts from Westworld Sports Fields Drainage Report



INTRODUCTION:

Huitt-Zollars is under contract with LGE Design Build on the off-site drainage investigation of the Collector's Garage at Westworld (Site). The Site is located south of East McDowell Mountain Ranch Road and east of North 98th Street in Scottsdale, Arizona. More specifically, the Site is located within parcels APNs 217-14-037A and 218-14-038A, within Section 5, Township 3 North, and Range 5 East of the Gila and Salt River Meridian. The Site is currently undeveloped desert land and is planned for a new commercial site of approximately 5.1-acres.

PURPOSE:

The purpose of this memorandum is to summarize the off-site drainage investigation, including the review of previous studies, assessing the off-site flows, and providing support for mitigation infrastructure for design.

FEMA FLOOD ZONE CLASSIFICATION:

The Site is shown on FEMA published Flood Insurance Rate Maps (FIRM) panel 04013C1340L, effective since October 16, 2013 (Ref.1). The Site is located within FEMA Flood Zone "A" and Zone "X". The Zone "A" lies in a small portion of the Site on the west boundary. FEMA Flood Zone "A" and "X" are defined as:

May 30, 2025

Collector's Garage at Westworld

Off-site Hydrologic and Hydraulics Investigation Memorandum

- Zone "A" is defined as "Special Flood Hazard Areas Subject to Inundation by the 1% Annual Chance Flood – No Base Flood Elevations determined."
- Zone "X" is defined as "Areas determined to be outside the 500-year flood and protected by levee from 100-year flood."

DATA COLLECTION:

Pinnacle Peak South ADMS (Ref. 2)

The Pinnacle Peak South (PPS) ADMS was prepared in 2013 to identify and quantify the known and potential flooding hazards within an area of approximately 43-square-miles in the northern portion of the City of Scottsdale. The study includes hydrologic analysis using HEC-1 model on the eastern portion of the watershed, and FLO-2D model with 30-foot grids on the western portion of the watershed. The 2007 topographic mapping was used for the studies. The 10-year and 100-year, 6-hour and 24-hour storms were simulated. The Site is located within this study area but since the completion of this study, there has been significant changes to the watershed.

Westworld Sports Fields Drainage Report (Ref. 3)

This report documents the drainage analysis of the infrastructure design associated with the Westworld Sports Fields (now Reata Sports Complex), west of the Site, prepared by Gavan & Barker in March 2022. The PPS ADMS 100-year 6-hour and 24-hour FLO-2D models were modified to better represent pre/post Sport Complex flow conditions by adjusting grid elevations and adding hydraulic structures for the upstream watershed analysis. As part of the Reata Sports Complex study, a more detailed HEC-RAS 2D model was developed to better estimate the hydraulic impact of the Old Verde Canal and the flows entering the Westworld. This hydraulic model was used as a base model for the off-site watershed analysis. An off-site analysis using HEC-1 is also included in the report. This study will be referenced in the following sections of this report.

Drainage Project Agreement/ Drainage and Flood Control Easement (Ref. 4)

Drainage Project Agreement with the City of Scottsdale was signed in April 2022. This agreement between the three adjacent landowners and the City of Scottsdale (City) was initiated to develop a flow

May 30, 2025

Collector's Garage at Westworld

Off-site Hydrologic and Hydraulics Investigation Memorandum

management diversion for the Old Verde Canal (Canal) at its southernmost portion, north of Thompson Peak Parkway. Pre Sport Complex conditions, the Canal had no outfall, leading to significant ponding and potential breakouts for adjacent properties and the Reata Sports Complex.

The Final Drainage Report prepared by Gavan & Barker, Inc. dated March 2022 is used to support their site-specific engineering proposals. As part of this 2022 agreement, section 8 states:

"8. Fill of Old Verde Canal. Upon development of the Winstar Pro or Thomas Parcels, Winstar Pro or Thomas may fill portions of the Old Verde Canal on the respective Parcels to prevent ponding or backwater from infiltrating such Parcels; provided, however, any such fill shall be subject to compliance with all City building, native plant, cultural resource, stormwater and floodplain regulations."

Additional agreements as part of this document include:

"4. Storage Waiver Credits. This Agreement shall not restrict any Owner from asserting to City regulatory authorities that amounts or value contributed to the Enhanced Drainage Project should be considered for any future drainage or stormwater' waiver or credit in accordance with City regulations set forth in Chapter 37 of the Scottsdale Revised Code. Upon completion of the Enhanced Drainage Project and the City Project, the Thomas Parcels and Winstar Pro Parcels may include in any respective development application the demonstrated additional runoff capacity resulting from such Parcels being adjacent to a conveyance facility that an engineering analysis shows can handle additional runoff front the Thomas Parcels and the Winstar Pro Parcels; and Thomas and Winstar Pro may rely upon and utilize the final Drainage Report prepared by Gavan & Barker, Inc. dated Maich 2022 to support their site specific engineering proposals."

5. In Lieu Fee. If through its regulatory processes including review, documentation, and approval as set forth in Chapter 37, City grants a stormwater waiver to any parcel, the amount paid by any of the Parcels shall be considered as a qualifying contribution for the respective Parcel toward an in-lieu fee for the cost to the City in providing a conveyance facility in the form of the Enhanced Drainage Project."

6. Reclassification of Old Verde Canal. Following completion of the Base Drainage Project, the Enhanced Drainage Project, and City Project, City agrees that the Old Verde Canal will not be a wash conveying water in excess of 50 cubic feet per second, and therefore will not be subject to City's regulatory process for approval of wash modifications; provided, however, the Parties acknowledge that other regulatory entities such as the Any Corp of Engineers may have jurisdictional authority over the wash and City cannot waive such authority."

May 30, 2025

Collector's Garage at Westworld

Off-site Hydrologic and Hydraulics Investigation Memorandum

EXISTING SITE CONDITIONS:

Before the construction of the Reata Sports Complex (pre-Sports Complex conditions), stormwater runoff in the Old Verde Canal flows in a northwesterly direction and had the potential to allow flows to enter the Site, just south of McDowell Mountain Ranch Road.

The Reata Sports Complex project includes the design and construction of several off-site catch basins to collect the off-site runoff from the adjacent undeveloped watershed. As part of this study, a regional solution was proposed recommending the construction of a drainage conveyance system to capture the flow entering the southern end of the Old Verde Canal and conveying the flow westerly to outfall into Reata Wash. Additionally, the regional solution includes the construction of a future berm in the southern limits of the adjacent site to the east (APN 21714039A). This berm would eliminate any remaining minor flow in the canal and backwater ponding conditions along the Canal from Thompson Peak Parkway to McDowell Mountain Road (see Appendix B).

A field visit was conducted in September 2024 to assess the existing conditions (see Figures 1 to 4). During this field investigation, it was confirmed that, except for the future berm, the flow diversion system for the Old Verde Canal flow was implemented as part of the construction of the Reata Sport Complex per the *Drainage Project Agreement/ Drainage and Flood Control Easement*, creating reduction in water surface elevation along the Canal, eliminating all potential breakout into the project Site.

Updates were made to the Reata Sports Complex HEC-RAS model to reflect current conditions. These minor updates included the revise upstream invert elevation of the 2-30-inch pipe crossing along McDowell Mountain Ranch Road to the newly acquired survey elevations. Per those improvements, only a 100-year flow of 12 cfs continues to flow northwesterly in the canal and no flows overtop the Old Verde Canal; therefore, no washes trigger the City's regulatory process for wash modifications within the Site that convey more than 50-cfs (See Figure 5). No flow or volume travel from north to south along the existing culvert during current conditions.

May 30, 2025

Collector's Garage at Westworld

Off-site Hydrologic and Hydraulics Investigation Memorandum



Figure 1: Existing Off-site Catch Basins in Westworld Sports Field



Figure 2: Existing Old Verde Canal Berm

May 30, 2025

Collector's Garage at Westworld

Off-site Hydrologic and Hydraulics Investigation Memorandum



Figure 3: The Site's Existing Condition



Figure 4: McDowell Mountain Ranch Road

May 30, 2025

Collector's Garage at Westworld

Off-site Hydrologic and Hydraulics Investigation Memorandum

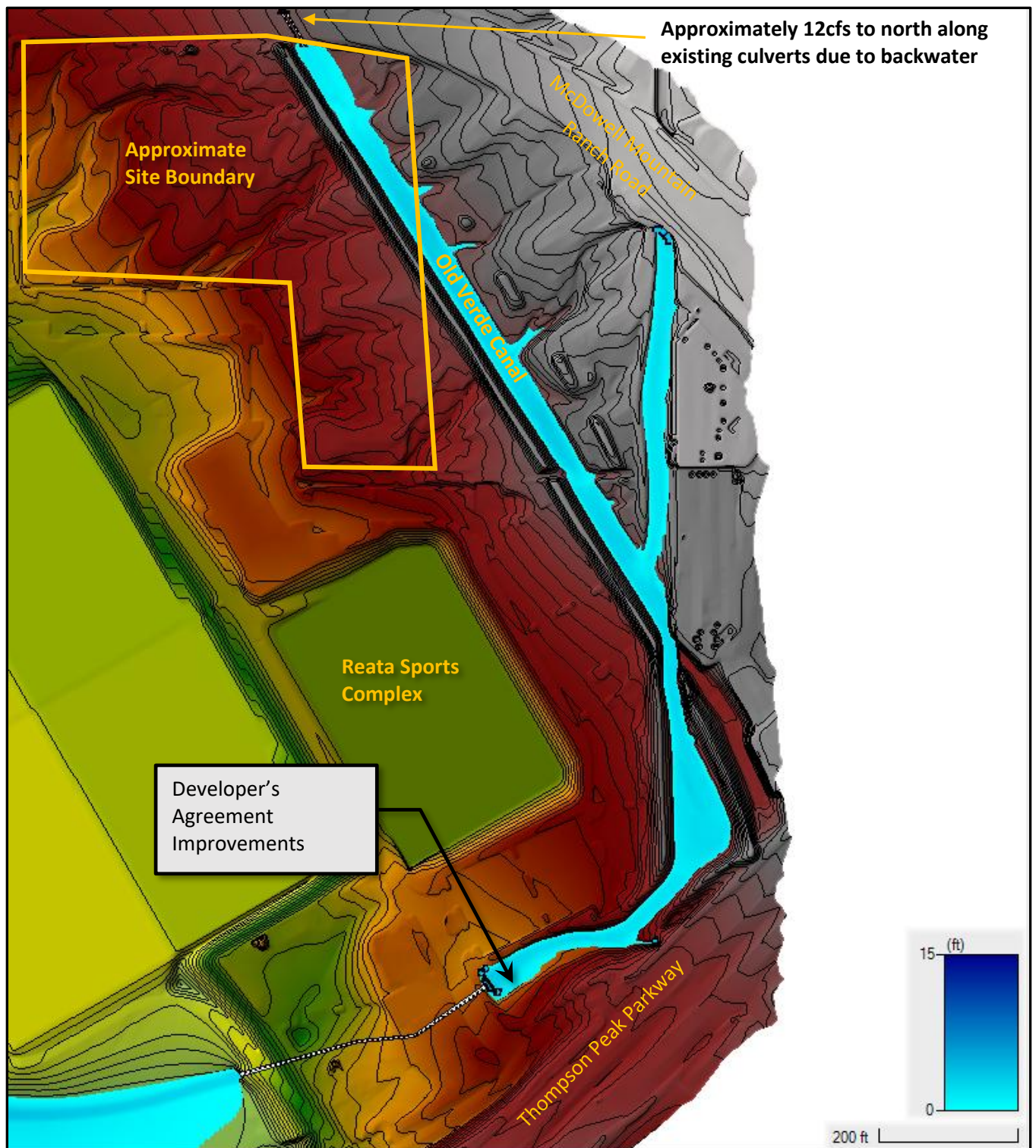


Figure 5: Current Conditions HEC-RAS Results

Collector's Garage at Westworld

Off-site Hydrologic and Hydraulics Investigation Memorandum

OFF-SITE HYDROLOGY AND HYDRAULICS:

The Site's terrain generally slopes from northeast towards southwest. The Reata Sports Complex study includes provisions that accommodate the potential that the Old Verde Canal will be blocked by the future development of the parcel to the east. The east parcel is currently undeveloped, and therefore, there will be backwater from south wash to the Old Verde Canal that approaches the Site. As outlined in the Drainage Project Agreement (Ref. 4), modifications to the Old Verde Canal are permitted. The proposed plan is to follow the design concept of the Westworld Sports Fields, which involves block the canal to prevent backwater and ponding at the Site. A berm will be designed with a top elevation higher than the water surface elevation established in the Westworld Sports Fields Drainage Report (Ref. 3). Further investigation will be performed during final design.

As previously mentioned, the Reata Sports Complex design included the implementation of a berm on the adjacent property to eliminate ponding water adjacent to the Site. The Reata Sports Complex study proposed berm location is outside of the Site boundary and no permission has been granted to build the berm in the intended location. Multiple alternative berm locations have been evaluated, and it was found that a berm location on the eastern portion of the property eliminates ponding adjacent to the Site and has no rise in existing water surface elevation (approximately 1237-feet) therefore, no negative impacts to adjacent properties. This alternative location is reflected in Figure 6, Appendix A, and proposed civil plans.

The existing Old Verde Canal's west bank is assumed to protect the Site from backwater remaining along the Old Verde Canal. Although this is not a FEMA certified structure, the Old Verde Canal west bank is approximately 8-feet to 12-feet high, 45-feet wide and shows no sign of potential failure. Further analysis will be performed to evaluate the resilience of the Old Verde Canal's west bank during final design. A wall is proposed on the eastern portion of the site for resilience if the berm ever fails. A preliminary HEC-RAS model was developed using current conditions topography, the proposed alternative berm location, and the removal of the Old Verde Canal's west bank (see Figure 7). Preliminary results show that there is a potential of approximately 1-cfs of flows can break out to the east during current conditions, bypass most of the site, and be conveyed by exiting washes towards the Reata Sports Complex infrastructure. More detailed analysis will be performed during final design with the proposed layout.

Collector's Garage at Westworld

Off-site Hydrologic and Hydraulics Investigation Memorandum

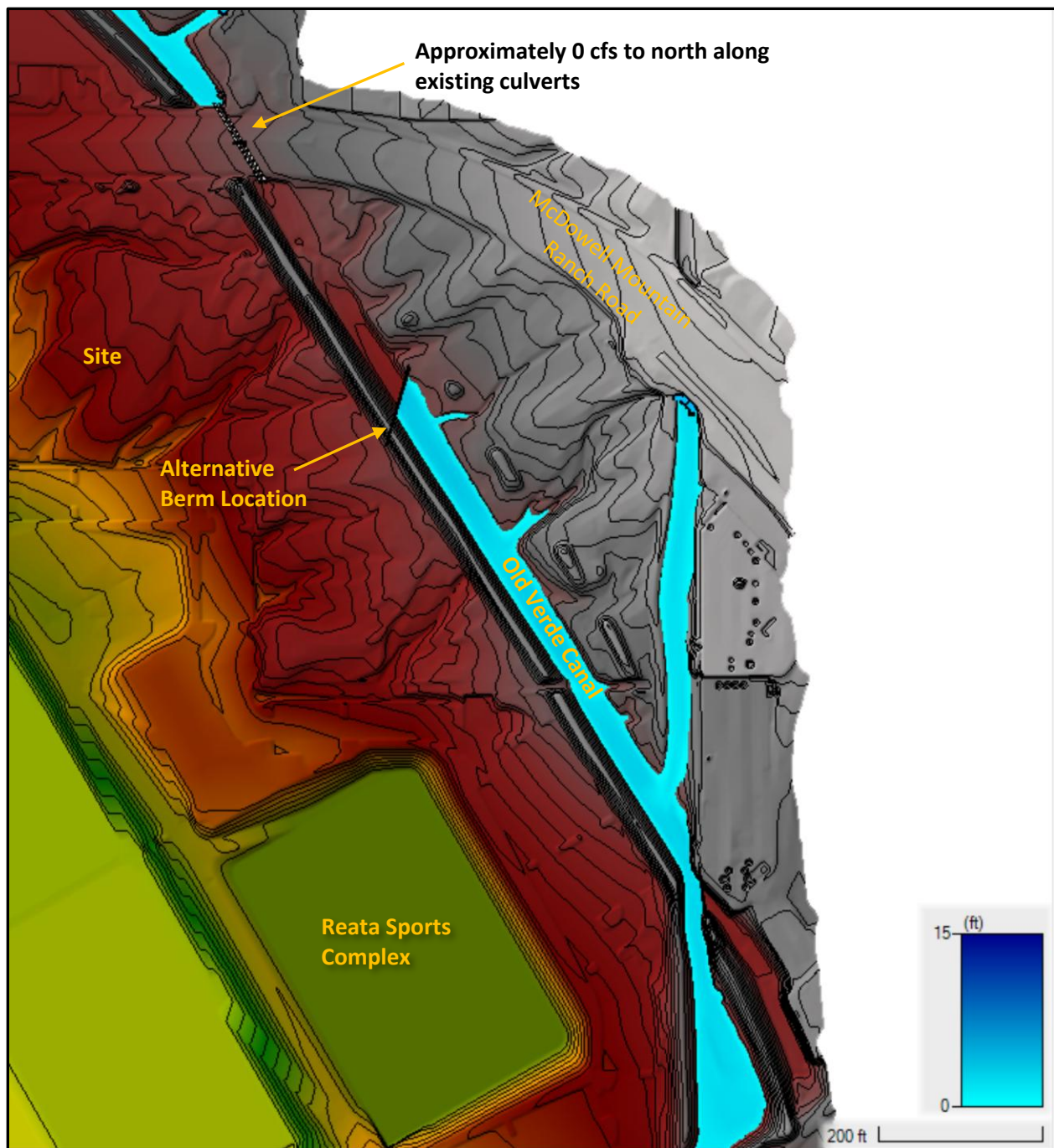


Figure 6: Preliminary Results - Proposed Conditions HEC-RAS Model

Collector's Garage at Westworld

Off-site Hydrologic and Hydraulics Investigation Memorandum

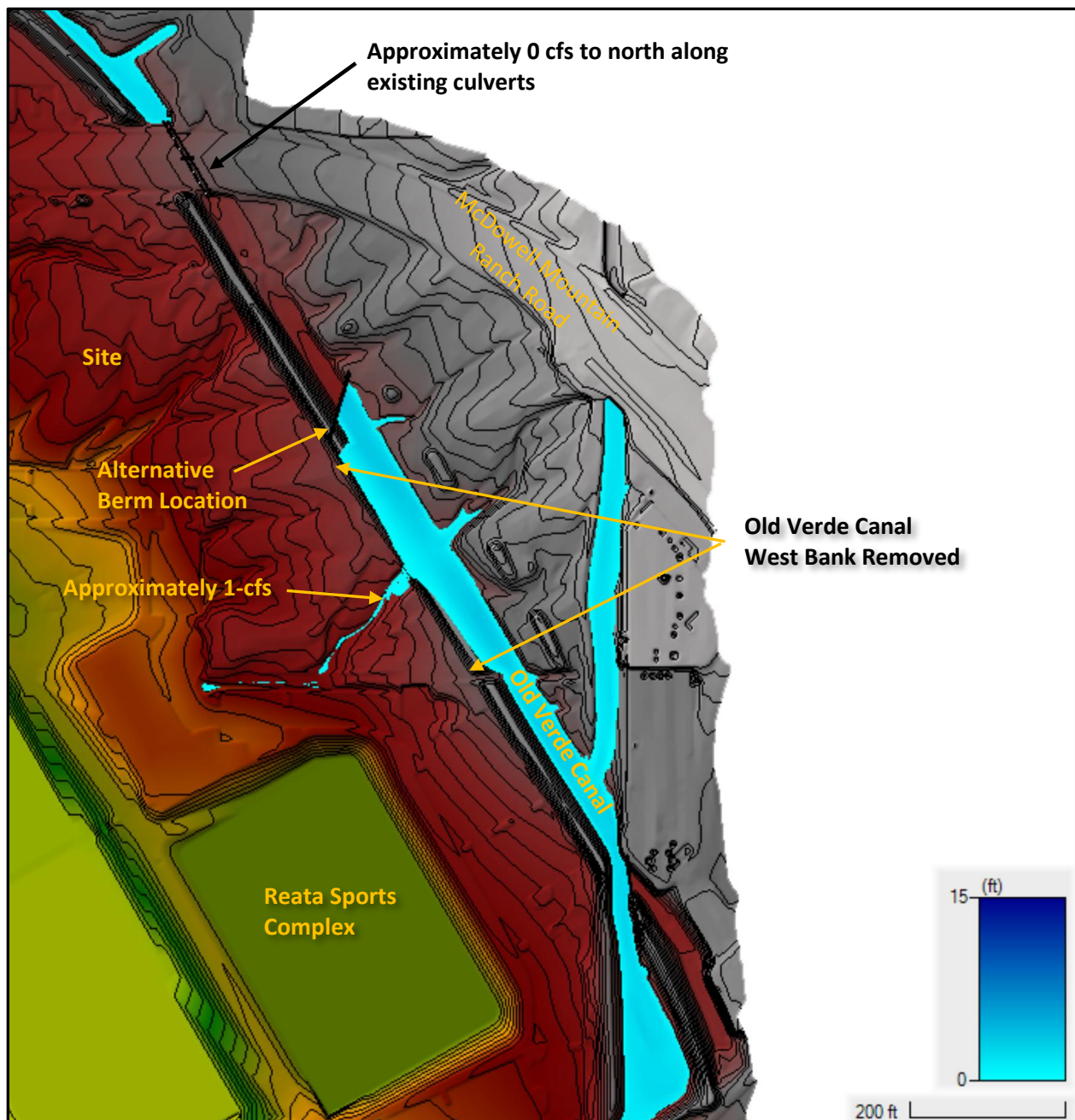


Figure 7: Preliminary Results - Proposed Conditions HEC-RAS Model, Old Verde Canal West Bank Removed

Collector's Garage at Westworld

Off-site Hydrologic and Hydraulics Investigation Memorandum

Once the proposed berm is constructed, the remaining off-site flows from the north will be limited to the half street McDowell Mountain Ranch Road. These flows have been designed to be collected by the off-site catch basin (off-site CB #1, Appendix B) in the Reata Sports Fields. Off-site CB #1 was designed to convey the existing conditions flows from the half street McDowell Mountain Ranch Road and approximately 2.85-ac of on-site flows. Curbs and gutters are proposed along the south side of McDowell Mountain Ranch Road, and thus, collects additional street run-off along the road. A prorated method was conducted to evaluate the existing and proposed conditions drainage areas. Although the proposed condition runoff coefficient will be higher than the existing condition, the proposed condition drainage area is only 30-percent of the existing condition drainage area. The overall peak discharge will not exceed the existing condition. The existing catch basin has sufficient capacity to convey the flows from the proposed off-site half street McDowell Mountain Ranch Road. A scupper will be designed to collect and direct the half-street runoff to the existing swale at Off-site CB #1. Further investigation will be performed during final design.

The remaining local off-site flows reaching the southern portion of the Site are from a small undeveloped desert area west of the Old Verde Canal's west bank (see Exhibit 1 in Appendix A). Infrastructure is in place as part of the Reata Sports Complex infrastructure to accommodate these flows. The proposed conditions will collect the flows and direct them to Reata Sports Complex Off-site CB #4, following the existing condition.

Collector's Garage at Westworld

Off-site Hydrologic and Hydraulics Investigation Memorandum

CONCLUSIONS:

1. The proposed structures are to be outside of FEMA special flood zones.
2. Off-site flows from McDowell Mountain Ranch Road will be collected and directed to their historic outfall. The existing catch basins in Reata Sport Complex Field have sufficient capacity to handle the proposed peak discharges, which do not exceed current levels.
3. The southern portion of the site will be protected via a drainage swale that will convey flows south to its historic outfall location. The existing catch basins in Westworld Sports Field have sufficient capacity to handle the proposed peak discharges, which do not exceed current levels.
4. Minor modifications will be proposed on the Old Verde Canal to follow previously approved studies and reduce potential backwater impacts.
5. The proposed off-site flows drainage infrastructure of the Site will be sized to convey the 100-year peak discharge.

REFERENCES:

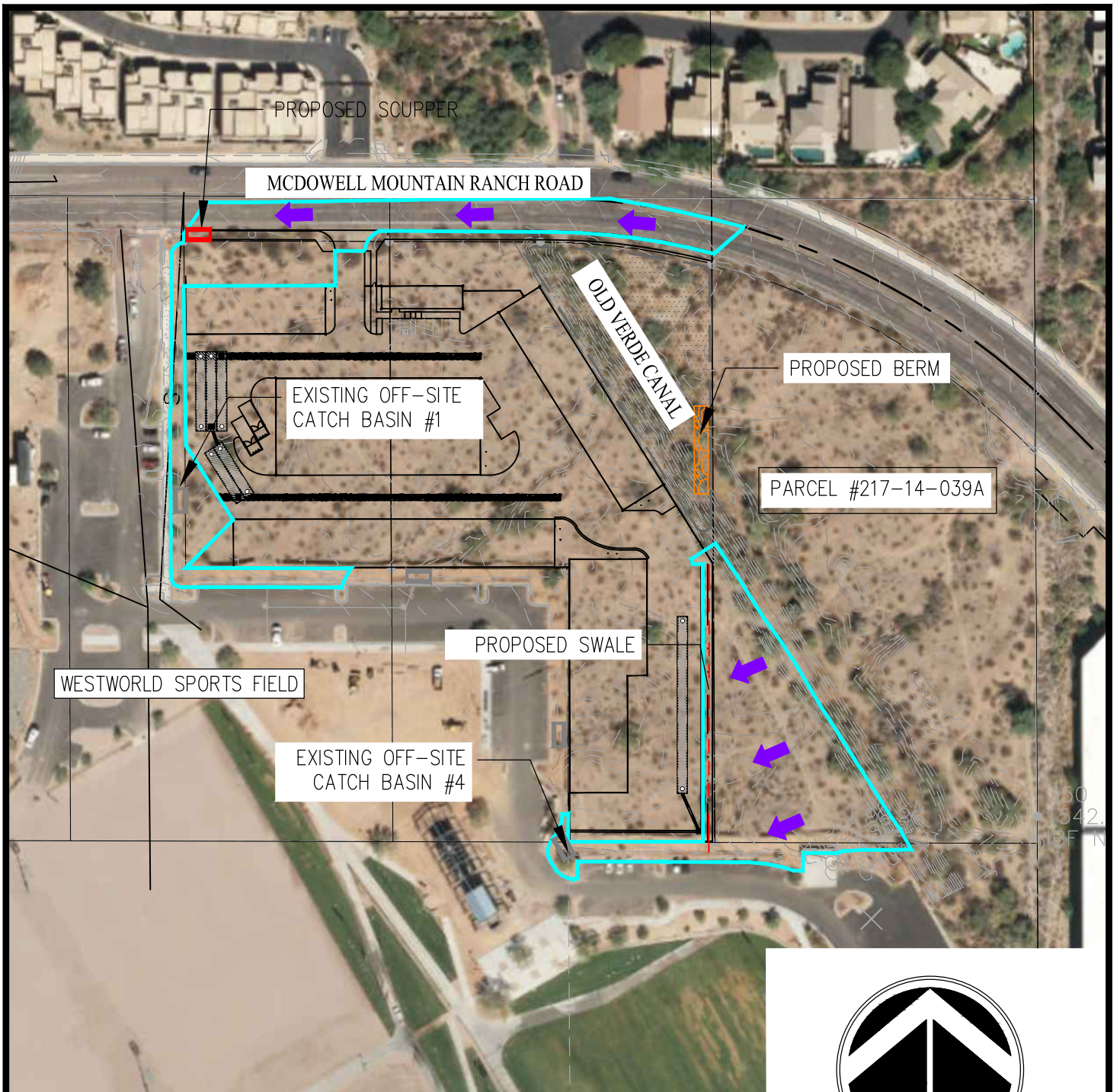
1. Federal Emergency Management Agency, Flood Insurance Rate Maps (FIRM) panel 04013C1340L, effective October 16, 2013.
2. TYLin, Pinnacle Peak South Area Drainage Master Study, July 2013.
3. Gavan & Barker, Westworld Sports Fields Drainage Report, March 2022.
4. Official Records of Maricopa County Recorder, Drainage Project Agreement / Drainage and Flood Control Easement C.O.S. Contract No. 2022-059-COS, May 18, 2022.

May 5, 2025

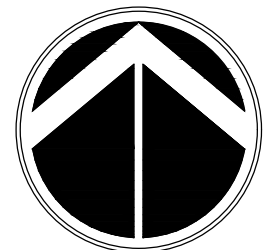
Collector's Garage at Westworld
Off-site Hydrologic and Hydraulics Investigation Memorandum

APPENDIX A

Off-site Drainage Map



- OFF-SITE SUB-BASIN BOUNDARY
- ← OFF-SITE FLOW ARROW
-  EXISTING CATCH BASIN
-  PROPOSED SCUPPER
- EXISTING SWALE
- PROPOSED SWALE
-  PROPOSED BERM



0 75' 150' 300'

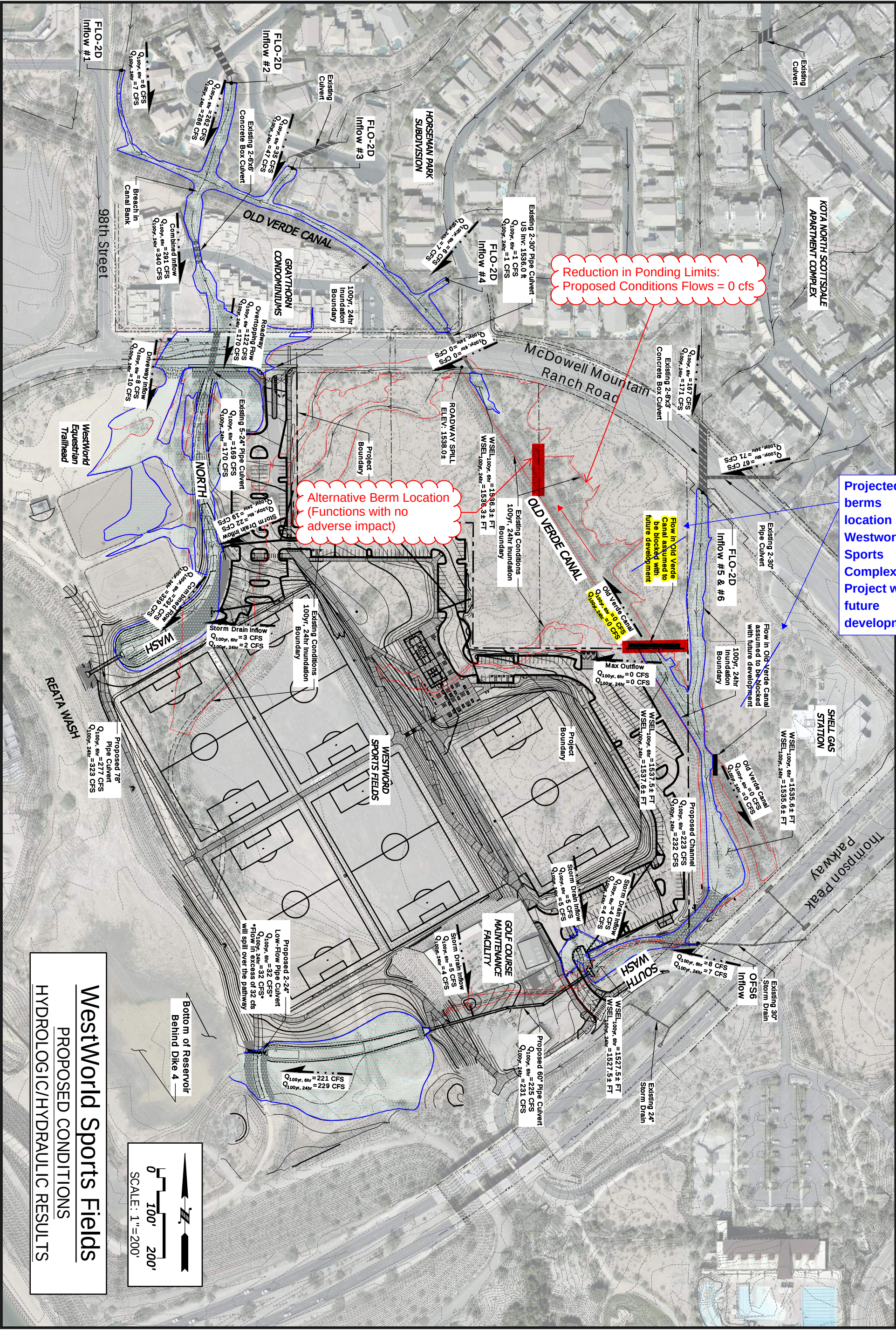
SCALE: 1"= 150'

HUITT
HZ ZOLLARS

5050 N. 40th Street Suite #100 | Phoenix, Arizona 85018
Office (602) 252-8384 | Fax (602) 252-8385
www.huitt-zollars.com

COLLECTOR'S GARAGE
OFF-SITE
DRAINAGE MAP

EXHIBIT 1



Reduction in Ponding Limits:
Proposed Conditions Flows = 0 cfs

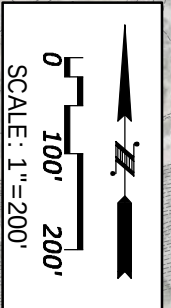
Alternative Berm Location
(Functions with no
adverse impact)

Projected berms
location in the
Westworld
Sports
Complex
Project with
future
developments

Westworld Sports Fields

PROPOSED CONDITIONS

HYDROLOGIC/HYDRAULIC RESULTS



May 5, 2025

Collector's Garage at Westworld
Off-site Hydrologic and Hydraulics Investigation Memorandum

APPENDIX B

Excerpts from Westworld Sports Fields Drainage Report



CITY OF SCOTTSDALE

WESTWORLD SPORTS FIELDS

DRAINAGE REPORT

Project No.: PG09

MARCH 2022

Prepared For:

City of Scottsdale
7447 East Indian School Road
Scottsdale, Arizona 85251

Prepared By:

Gavan & Barker, Inc.
3030 North Central Avenue, Suite 700
Phoenix, Arizona 85012
Phone: (602) 200-0031
Fax: (602) 200-0032

Job No. 2101



5.0 STORM DRAIN DESIGN AND ANALYSIS

New storm drains were designed to collect and convey onsite flows from the proposed parking lot. These storm drains also capture small offsite flows from the adjacent properties. A new storm drain is also proposed that captures runoff from the Golf Course maintenance yard and the filled in portion of the South Wash. The storm drains include seven new grated catch basins located in shallow sumps within the new parking lot intercepting flows from the new office/restroom hardscaped areas as well as the paved parking lot. Four of the grated catch basins are connected to the new parking lot storm drain that runs westerly through the northern portion of the parking lot. The three other catch basins drain directly into either the North or South Wash through single connector pipes.

Four new grated catch basins were designed to intercept the offsite flows from the adjacent properties. To limit the number of offsite catch basins, shallow collection ditches were graded within the landscaped area behind the parking lot curb to capture the offsite flows and convey them to the nearest offsite catch basin which are also positioned behind the parking lot curbs. Since the offsite flows originate from undeveloped desert lands, they can be expected to carry significant debris. Therefore, they were designed with raised grates that are 4-inches above the top of the catch basin wall. This provides a 4" high opening around the perimeter of the grate that is less susceptible to clogging. A fifth catch basin was designed to intercept the offsite flows from the existing golf course maintenance yard as well as surface runoff from the filled in portion of the South Wash. The South Wash will be filled downstream of the driveway entrance. The new catch basin is in a sump to prevent flows from spilling over the Reata Wash embankment and eroding the new multi-use pathway. Refer to the Storm Drain and Culvert Design Location Exhibit in Appendix D for the location of the proposed offsite catch basins.

The storm drains were designed to intercept the governing 100-year, 6-hour peak discharges from the parking lot, hardscape areas and the adjacent, undeveloped offsite parcels. The grading plan includes shallow sumps in the parking lot at the catch basin locations as well behind the curb where the offsite catch basins are situated. These sumps allow the entire the 100-year, 6-hour runoff to be captured without overtopping. This approach ensures that all the runoff generated in the both the parking lot and the offsite watersheds will be intercepted and routed to either the North Wash

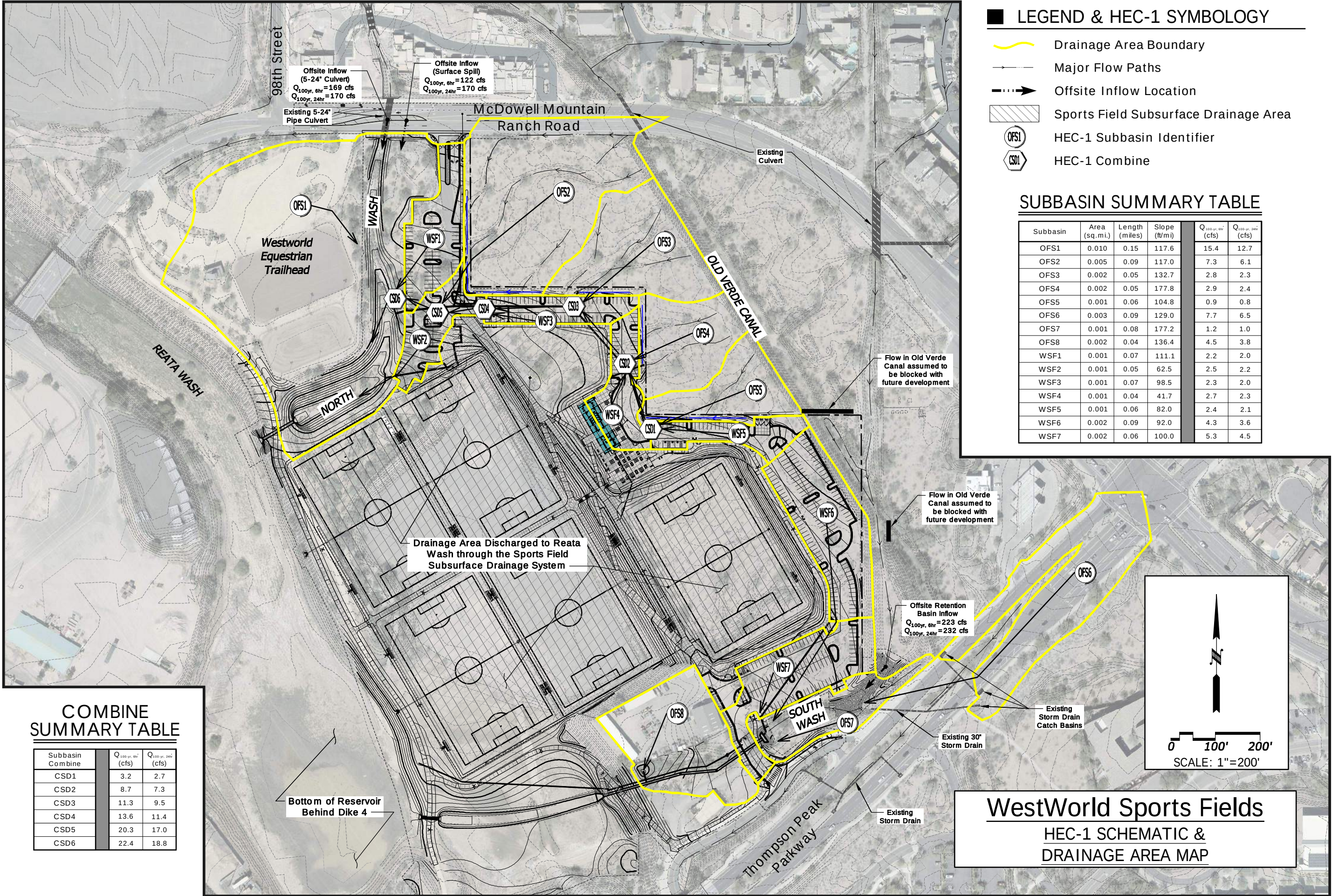
condominium complex north of McDowell Mountain Ranch Road. This flow is conveyed under McDowell Mountain Ranch Road in five 24-inch culverts. But they only have enough capacity for about 163cfs during the 100-year, 24-hour storm event. The remaining 211cfs spills over the roadway. Refer to the Digital Data in Appendix G for the existing conditions HEC-RAS model.

4.2 DESIGN CONDITIONS HEC-RAS MODEL

The design conditions HEC-RAS model was developed by incorporating the proposed drainage features for the Westworld Sports Fields into the existing conditions HEC-RAS model. These features include several new culverts within the project area, realignment of the North Wash, and revising the roadway spillover geometry where flow in the North Wash spills over McDowell Mountain Ranch Road. The spillover geometry had to be revised to account for the new sidewalk that will be installed with the project. The design conditions model was run for both the 100-year, 6- and 24-hour storms to analyze the proposed drainage infrastructure for the worst-case scenario.

The proposed improvements include a new channel that diverts the 100-year flow from the Old Verde Canal into the South Wash. This revision also included the addition of artificial levees in the HEC-RAS model to block flow from entering the Old Verde Canal, thereby removing the effect of Canal storage. This resulted in a higher design flow for the proposed South Wash channel. The flow was blocked to allow the upstream property owners to fill in the Old Verde Canal, if they choose to do so with future development of their property. A 60-inch pipe culvert and drop inlet structure were added to the design conditions model that conveys flow in the South Wash, under the southern driveway entrance and out to Reata Wash. In addition, a 78-inch pipe culvert was added that conveys the North Wash under the multi-use pathway into Reata Wash. Refer to Figure 3 for the location of the proposed pipe culverts and the location of the artificial levees used to prevent flow from entering the Old Verde Canal.

The design conditions HEC-RAS model also includes the HEC-1 hydrographs for the contributing area outside of the FLO-2D boundary. These include inflow hydrographs for the new parking lot storm drains and the existing storm drain in Thompson Peak Parkway. These storm drain flows discharge to the North and South Washes. See Figure 3 for the Proposed Conditions Hydrologic/Hydraulic Results and refer to the Digital Data in Appendix G for the HEC-RAS model. Section 6.0 provides a more complete discussion of the proposed drainage infrastructure.



LEGEND & HEC-1 SYMBOLOGY

- Drainage Area Boundary
- Major Flow Paths
- Offsite Inflow Location
- Sports Field Subsurface Drainage Area
- HEC-1 Subbasin Identifier
- HEC-1 Combine

SUBBASIN SUMMARY TABLE

Subbasin	Area (sq. mi.)	Length (miles)	Slope (ft/mi)	$Q_{100-yr, 6hr}$ (cfs)	$Q_{100-yr, 24hr}$ (cfs)
OFS1	0.010	0.15	117.6	15.4	12.7
OFS2	0.005	0.09	117.0	7.3	6.1
OFS3	0.002	0.05	132.7	2.8	2.3
OFS4	0.002	0.05	177.8	2.9	2.4
OFS5	0.001	0.06	104.8	0.9	0.8
OFS6	0.003	0.09	129.0	7.7	6.5
OFS7	0.001	0.08	177.2	1.2	1.0
OFS8	0.002	0.04	136.4	4.5	3.8
WSF1	0.001	0.07	111.1	2.2	2.0
WSF2	0.001	0.05	62.5	2.5	2.2
WSF3	0.001	0.07	98.5	2.3	2.0
WSF4	0.001	0.04	41.7	2.7	2.3
WSF5	0.001	0.06	82.0	2.4	2.1
WSF6	0.002	0.09	92.0	4.3	3.6
WSF7	0.002	0.06	100.0	5.3	4.5

COMBINE SUMMARY TABLE

Subbasin Combine	$Q_{100-yr, 6hr}$ (cfs)	$Q_{100-yr, 24hr}$ (cfs)
CSD1	3.2	2.7
CSD2	8.7	7.3
CSD3	11.3	9.5
CSD4	13.6	11.4
CSD5	20.3	17.0
CSD6	22.4	18.8

