Drainage Reports

Abbreveated Water & Sewer Need Reports

Water Study

Wastewater Study

Stormwater Waiver Application

# WATER DISTRIBUTION SYSTEM
# FINAL BASIS OF DESIGN REPORT
# FOR
# WESTWORLD 15

December 21, 2016
Job # 16CHI104

*Prepared For:*

**Camelot Homes**
6607 N. Scottsdale Rd.
Scottsdale, Arizona 85250
*(480) 367-4326*

*Submitted To:*

**City of Scottsdale**
Water Resources Division
9379 East San Salvador Drive
Scottsdale, AZ 85258

**Accepted For:**
City of Scottsdale
Water Resources Department
9379 E. San Salvador
Scottsdale, Arizona
By: Scott Anderson
Date: 1/17/2017

*Prepared By:*

**Land Development Team, LLC**
Gordon Wark, P.E.
3420 E. Shea Boulevard
Suite 156
Phoenix, Arizona 85028
*Phone: (602)396-5702*
*Fax: (602) 396-5701*


EXPIRES: 12-31-2016

LD·Team
LAND DEVELOPMENT

6-PP-2016
12/22/2016

LD-Team
LAND DEVELOPMENT

December 21, 2016

Water Resources Division
City of Scottsdale
9379 East San Salvador Drive
Scottsdale, AZ 85258

Re: Westworld 15
Water Distribution System, Final Basis of Design Report

Westworld 15 is a 7.5 acre single family residential subdivision that is zoned for R1-10 and is located at the end of 102nd Street, immediately south of the McDowell Mountain Ranch Aquatic Center in North Scottsdale. Exhibit 1 presents a vicinity map for the project. The overall proposed development will consist of 15 single family residential units.

Potable water service will be provided by a water line connection to the existing zone 4 water line in 102nd Street.

The water demand and system criteria established for the Westworld 15 project will be consistent with the requirements established by the Scottsdale Design Standards and Policies Manual.

The following is a summary of the major criteria utilized:

- Average- Day Consumption, Residential product 2.5 to 3 du/acre: 248.2 gpupd
  Maximum-Day Demand: 2.0 x Average-Day
- Peak Hour Demand: 3.0 x Average-Day
- Required Fire Flow (assuming floor areas> 4000 sq.ft.) 1000 gpm
- Minimum Residual Pressure: 55 psi
- Minimum Residual Pressure, Maximum-Day + Fire Flow: 30 psi
- Maximum Pipe Head Loss, Peak-Hour Demand: 10 ft / 1,000 ft.
- Minimum Pipe Diameter: 8 inches
- Pipe Material: Ductile Iron

December 21, 2016

Water Resources Division
City of Scottsdale
9379 East San Salvador Drive
Scottsdale, AZ 85258



The projected water demands for the Project are included in Appendix A. A head loss calculation has been provided for project, based on the hydraulic grade line for Water Pressure zone 4, the highest proposed finished floor elevation and a fire hydrant flow test (included in Appendix B). Due to the residual water pressures being around 87 psi in the zone 4 water system and considering a single water line feed, a head loss calculation was completed in lieu of a hydraulic computer model because of these water pressures and system configuration. Based on the hydraulic calculation the residual water pressures during average day flow will range from 85 psi and 87 psi. The residual water pressures with 1000 gpm fire flows range from 75 psi to 78 psi

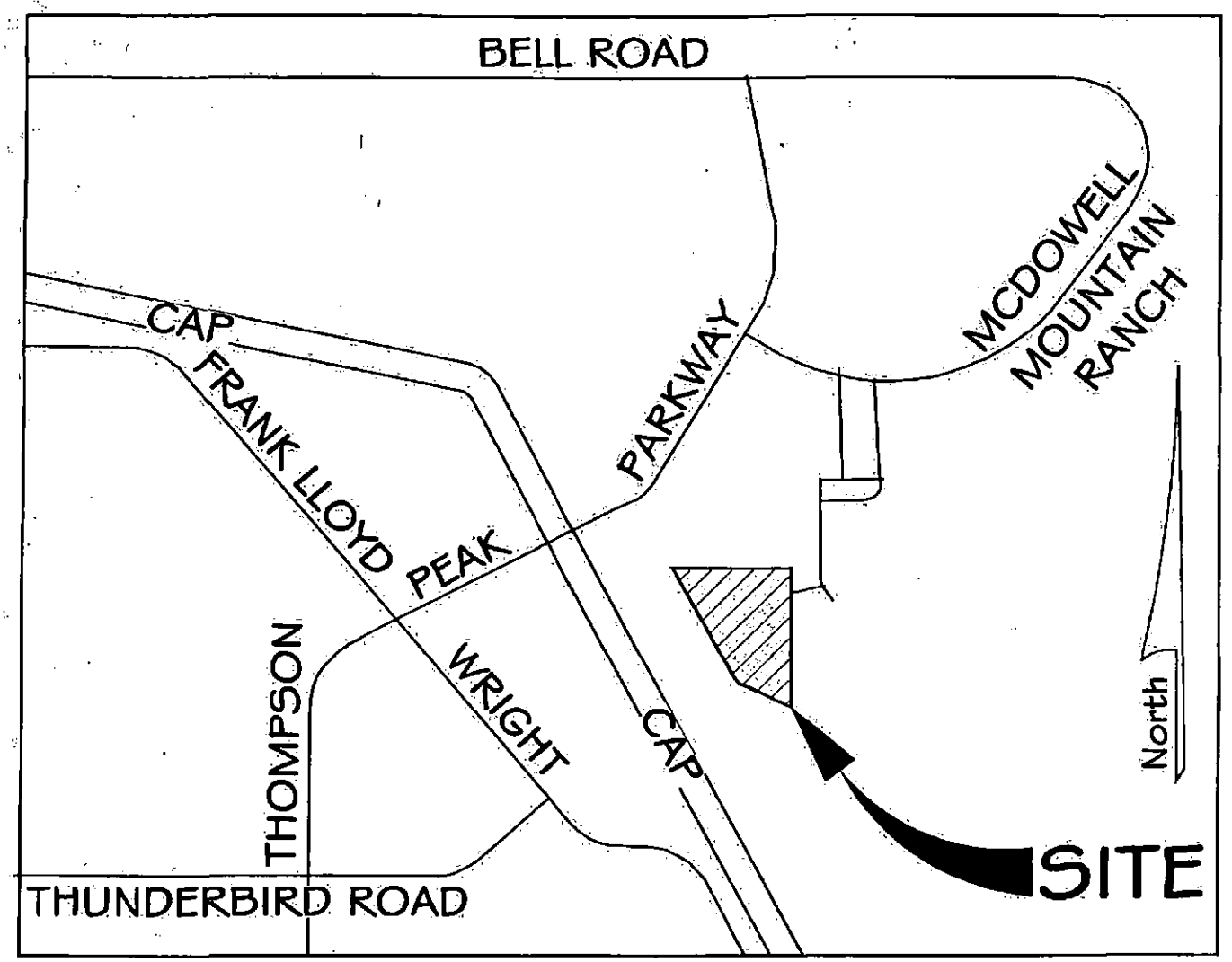
Please contact us if you have any questions.

Sincerely,

**Land Development Team, LLC**

Gordon Wark, P.E.


EXPIRES: 12-31-2016




# VICINITY MAP

NOT TO SCALE

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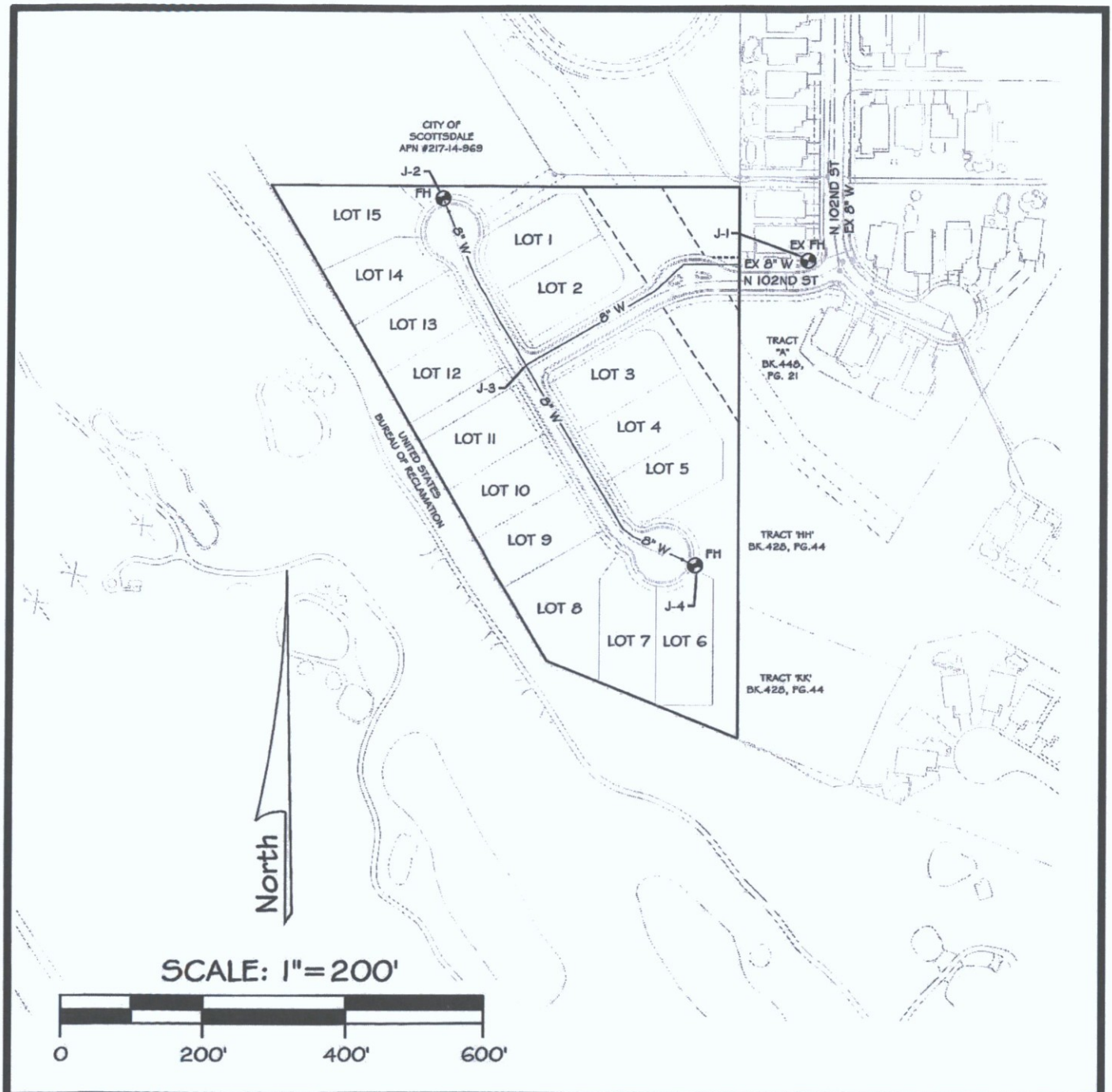
PH 602-396-5700 · Fax 602-396-5701 · www.LD-Team.com

**WESTWORLD 15**
SCOTTSDALE, ARIZONA
PLATE 1
VICINITY MAP

PROJECT No: 16CH1104
DATE: 12/16/2016

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# WESTWORLD 15
## SCOTTSDALE, ARIZONA
## WATER PLAN EXHIBIT 2
## DEC 15, 2016

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# WESTWORLD 15
# WATER DEMANDS

| NODE | RESIDENTIAL | | AVERAGE DAY DEMAND | | MAXIMUM DAY DEMAND | | PEAK HOUR DEMAND | |
|---|---|---|---|---|---|---|---|---|
| | DWELLING UNITS <2du/ac. | USAGE/ UNIT (GPD) | (GPD) | (GPM) | (GPD) | (GPM) | (GPD) | (GPM) |
| J-1 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| J-2 | 4 | 248.2 | 992.8 | 0.7 | 1,985.6 | 1.4 | 3,474.8 | 2.4 |
| J-3 | 6 | 248.2 | 1,489.2 | 1.0 | 2,978.4 | 2.1 | 5,212.2 | 3.6 |
| J-4 | 5 | 248.2 | 1,241.0 | 0.9 | 2,482.0 | 1.7 | 4,343.5 | 3.0 |
| **TOTALS** | **15** | | **3,723.0** | **2.6** | **7,446.0** | **5.2** | **13,030.5** | **9.0** |

Note: Zoning is R1-10

**WESTERN STATES FIRE PROTECTION CO.**
2026 West Lone Cactus Drive
Phoenix, AZ 85027
Phone (602) 272-2200
Fax (602) 272-7972

LOCATION **West World #15 Project**
14960 N. 102 Street
Scottsdale, Arizona
85255-8590

DATE: 12/21/16
TIME: 9:00am
Report#
Tech: ML/OG

Static Hydrant Number:
Elevation: 0

Flowing Hydrant Number: 0
Elevation: 0

Dist. Between Hydrants: 1056

Diameter of Main: 6

Type of Supply: CITY WATER

Outlet Diameter: 2.5

Number flowing: 1
Coeff. of Discharge: 0.90

Static Pressure: 89.00

Residual Pressure: 87

Pitot Reading: 24.00

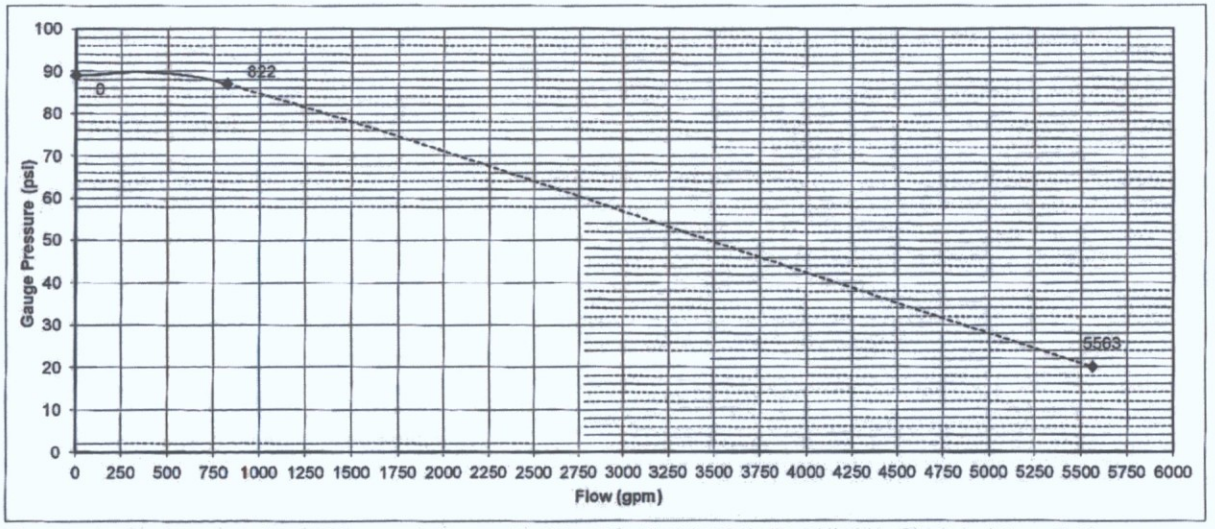
Flow: 822.0 gpm

Pump Present: N/A

Tank Present: N/A

Flow at 20 psi: 5562.9 gpm

| | | | | |
|---|---|---|---|---|
| Static pressure of | 89 | psi @ | 0 | gpm |
| Residual pressure of | 87 | psi @ | 822.0 | gpm |
| Available flow @ | 20 | psi -- | 5562.9 | gpm |




**Comments:** Test conducted at 0900 am and witnessed by City of Scottsdale Water Department. Chart depicts available GPM at time of flow test.
Please let me know if you have any questions. Thank you,
Mike Lister Western States Fire Protection.

NOTES:

1. Flowing hydrant is assumed to be on a circulating main or downstream of the pressure test hydrant on a dead-end system.
2. Flow analysis assumes a gravity flow system with no distribution pumps and having no demand, other than the test
3. The distance between hydrants, elevations & main diameters are for information only.

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## Table 1: Watermain Head Loss Calculations

Project: *Westworld 15*
Location: City of Scottsdale
Date: 12/21/2016

References: Hazen-Williams formula

**Known Values:**

| | | |
|---|---|---|
| Hazen-Williams coefficient, C = | **120** | |
| Hydraulic Grade Line= | **1,738** | Based on 1000 gpm fire flow |
| Highest Finished Floor Elevation= | **1,542** | |
| Watermain Length (ft) = | **805** | |
| Minor Loss Equivalent Length (10% of Length) = | **81** | |

**Calculated Values:**

Referenced Equations:

$v = Q / A$ (1 cfs = 449 gpm)

$A = pi * [(D / 12) ^2] / 4$

$H_f = 3022 * [(v / C) ^1.85] / [(D / 12) ^1.165]$

where: v = velocity, feet per second (fps)
Q = flow rate, gallons per minute (gpm)
A = conveyance area, square feet
D = inside pipe diameter, inches
$H_f$ = head loss, feet per thousand feet of pipe

| Peak Flow (gpd) | Peak Flow (gpm) | Pipe Dia. (in.) | Velocity (fps) | Head Loss per 1,000 ft (ft) | Total Friction Head Loss (ft) | Static Pressure at Highest Lot (ft) | Static Pressure at Highest Lot (psi) | Pressure Loss (psi) |
|---|---|---|---|---|---|---|---|---|
| 1,447,488 | 1,005.20 | 8 | 6.42 | 21.50 | 19.0 | 1719.0 | 76.7 | 8 |

**Design Pipe Size =** **8**

Watermain Length is longest length to highest Finished Floor & assumes single feed only

# WASTE WATER COLLECTION SYSTEM
# FINAL BASIS OF DESIGN REPORT
# FOR
# WESTWORLD 15

December 13, 2016
Job # 16CHI104

*Prepared For:*

**Camelot Homes**
6607 N. Scottsdale Rd.
Scottsdale, Arizona 85250
*(480) 367-4326*

*Submitted To:*

**City of Scottsdale**
Water Resources Division
9379 East San Salvador Drive
Scottsdale, AZ 85258

**Accepted For:**
City of Scottsdale
Water Resources Department
9379 E. San Salvador
Scottsdale, Arizona
By: SCOTT ANDERSON
Date: 1/17/2017

*Prepared By:*

**Land Development Team, LLC**
Gordon Wark, P.E.
3420 E. Shea Boulevard
Suite 156
Phoenix, Arizona 85028
*Phone: (602)396-5702*
*Fax: (602) 396-5701*


EXPIRES: 12-31-2016

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December 13, 2016

City of Scottsdale
Water Resources Department
9379 E. San Salvador Drive
Scottsdale, Arizona 85258

Re: Westworld 15
Wastewater Collection System, Basis of Design Report

Westworld 15 is a 7.5 acre single family residential subdivision that is zoned for R1-10 and is located at the end of 102nd Street, immediately south of the McDowell Mountain Ranch Aquatic Center in North Scottsdale. Exhibit 1 presents a vicinity map for the project. The overall proposed development will consist of 15 single family residential units.

The majority of wastewater from the proposed development will be conveyed through a network of proposed 8-inch gravity sewer lines that will drain to an existing sewer located along the north side of the proposed subdivision, within the McDowell Mountain Ranch Aquatic Center. This sewer was installed to serve portions of McDowell Mountain Ranch (See Exhibit 2 – *Sewer Plan Exhibit*). This Basis of Design Report is for the entire project as there is no phasing proposed.

The wastewater generation and system criteria are consistent with the requirements established by Design Standards and Policy Manual.

| | |
|---|---|
| • Average Wastewater flow, Residential | 100 gpcd |
| • Population per Unit: | 2.5 ppu |
| • Design Flow (Q Peak): | 4.0 x Average-Day flow |
| • Minimum Pipe Diameter: | 8 inches, other than service taps |
| • Minimum Full-Flow Velocity: | 2.5 ft/s for 8-inch pipe |
| • Manning's Coefficient: | n = 0.013 |
| • Maximum Depth / Diameter Ratio, Peak Dry Weather Flow: | d/D = 0.65 |
| • Minimum Slope: | 0.0052 ft/ft |

Please see Appendix A for sewer demand calculations and a summary of the proposed system design and capacity calculations

3420 E. Shea Boulevard, Suite #156 I Phoenix, Arizona 85028 I Phone: 602.396.5700 I Fax: 602.396.5701 I www.LD-Team.com

Water Resources Division
City of Scottsdale
9379 East San Salvador Drive
Scottsdale, AZ 85258

December 13, 2016



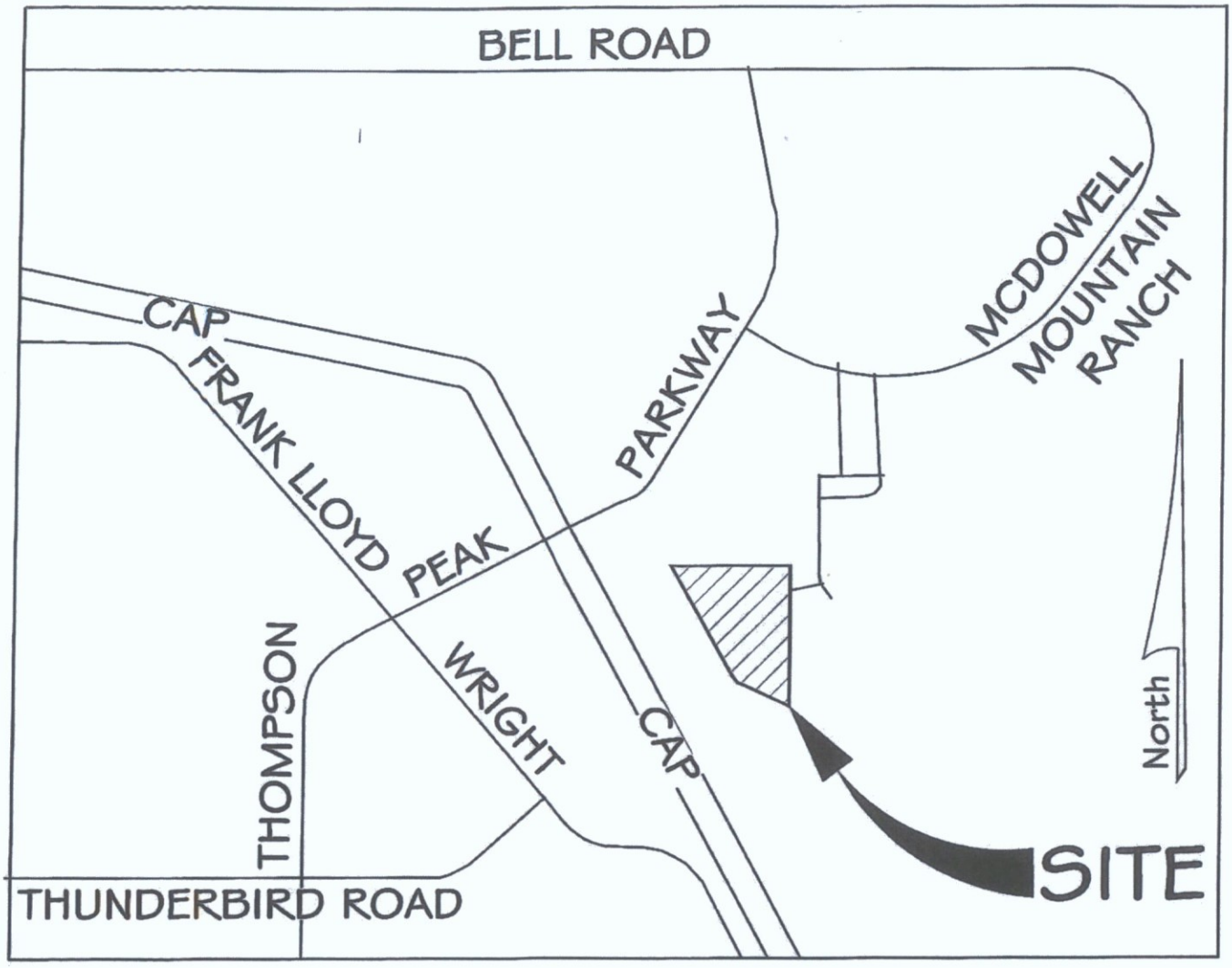
Please contact us if you have any questions.

Sincerely,

**Land Development Team, LLC**

Gordon Wark, P.E.


EXPIRES 12-31-2016




# VICINITY MAP

NOT TO SCALE

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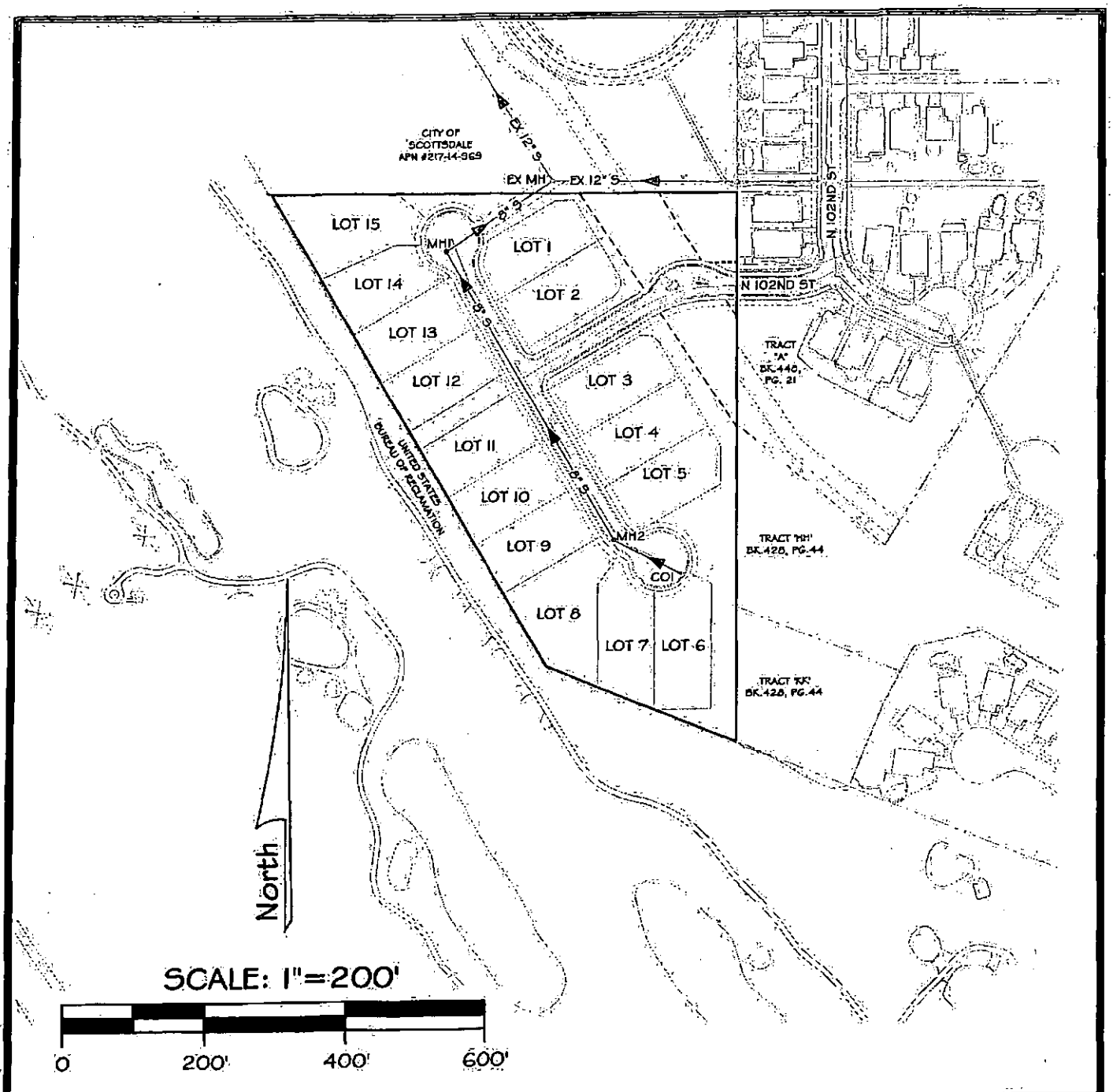
Ph 602-396-5700 · Fax 602-396-5701 · www.LD-Team.com

**WESTWORLD 15**
SCOTTSDALE, ARIZONA
PLATE 1
VICINITY MAP

PROJECT No: 16CH1104
DATE: 12/16/2016

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# WESTWORLD 15
## SCOTTSDALE, ARIZONA
## SEWER PLAN EXHIBIT 2
## DEC 15, 2016

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LAND DEVELOPMENT

## Table 1: Estimated Flow Calculations

Project: *Westworld 15*
Location: Scottsdale
Date: December 13, 2016
References:

Project Numl 16CHI104
Project Engineer: Gordon Wark, P.E.

| FROM SEWER NODE | TO SEWER NODE | LAND USE | DWELLING UNITS | Population (2.5 persons per unit) | ADF/ Person (GPD) | ADF SUB-TOTAL (GPD) | ADF TOTAL (GPD) | PEAKING FACTOR | PEAK Day FLOW (GPD) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| CO1 | MH2 | SFR | 1 | 2.5 | 100 | 250 | 250 | 4.00 | 1,000 |
| MH2 | MH1 | SFR | 12 | 30.0 | 100 | 3,000 | 3,250 | 4.00 | 13,000 |
| MH1 | Exist. MH #1 | SFR | 1 | 2.5 | 100 | 250 | 3,500 | 4.00 | 14,000 |
| | | | | | | | | | |

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LAND DEVELOPMENT

## Table 2: Estimated Pipe Capacities

Project: *Westworld 15*
Location: Scottsdale
Date: December 13, 2016
References:

Project Number: 16CHI104
Project Engineer: Gordon Wark, P.E.

| FROM NODE | TO NODE | PIPE SIZE (IN) | PEAK FLOW (GPD) | DESIGN PIPE SLOPE (FT / FT) | FULL FLOW VELOCITY, $V_0$ (FPS) | PARTIAL FLOW VELOCITY, $V_1$ (FPS) | PIPE CAPACITY (GPD) | SURPLUS CAPACITY (GPD) | d / D Ratio |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| CO1 | MH2 | 8 | 1,000 | 0.0052 | 2.5 | 0.47 | 564,339 | 563,339 | 0.031 |
| MH2 | MH1 | 8 | 13,000 | 0.0052 | 2.5 | 1.03 | 564,339 | 551,339 | 0.104 |
| MH1 | Exist. MH #1 | 8 | 14,000 | 0.0052 | 2.5 | 1.05 | 564,339 | 550,339 | 0.107 |
| | | | | | | | | | |

# PRELIMINARY DRAINAGE REPORT

# Lanes End

Prepared for:

***Camelot Homes, Inc.***
6607 N. Scottsdale Road
Suite H-100
Scottsdale, Arizona 85250

Submitted to:

***City of Scottsdale***
*Capital Project Management*
7447 E. Indian School Road
Scottsdale, Arizona 85251

Prepared by:

***Kimley-Horn***
7740 N. 16th Street
Suite 300
Phoenix, Arizona 85020

Kimley»Horn

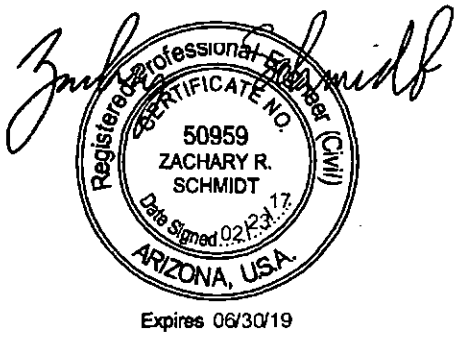
Plan # _____
Case # 6-PP-2016
Q-S # _____
☑ Accepted
☐ Corrections
N. Baronas 3/20/17
Reviewed By Date

291104000
February 2017

**6-PP-2016**
**2/28/17**

# PRELIMINARY DRAINAGE REPORT

## LANES END




Expires 06/30/19

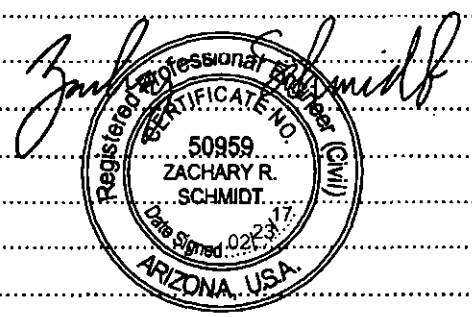
**FEBRUARY 2017**

Prepared By:

Kimley»Horn

## Contents






## Appendices



## Plates

# INTRODUCTION

## PURPOSE

This Preliminary Drainage Report for Lanes End (Site) has been prepared to meet the drainage plan requirements outlined in Chapter 4 of the *City of Scottsdale Design Standards and Policies Manual* (*DS&PM*). This report presents a description of the hydrologic and hydraulic modeling of the proposed drainage systems.

The main purposes of this report are the following:

- Illustrate compliance with the *DS&PM*.
- Establish drainage parameters and criteria for preliminary design.
- Provide a hydrologic plan for the development of the site.
- Provide a preliminary hydraulic analysis for the wash adjacent to the Site.

## PROJECT LOCATION AND DESCRIPTION

The Site is located at the end of 102nd Street adjacent to the McDowell Mountain Golf Course. It lies within a portion of Section 8, Township 3 North, Range 5 East of the Gila and Salt River Base and Meridian. The Site is located within the City of Scottsdale (City) and falls under the City's Environmentally Sensitive Lands Overlay (ESLO). The proposed Preliminary Plat consists of 15 lots, within the 7.6-acre site. It is currently zoned R1-10 ESL. See **Plate 1** for the Vicinity Map.

The Flood Insurance Rate Map (FIRM) for Maricopa County, Arizona and incorporated areas, Panel Number 04013C1780L, effective date October 16, 2013, indicates the Site is within Zone "X" (shaded).

Zone "X" (shaded) is defined by FEMA as follows:

> Areas of 0.2% annual flood chance,500-year flood; areas of 1% annual flood chance with average depths of less than 1 foot or with drainage areas 1 square mile; and areas protected by levees from 1% annual chance flood.

The FIRM Panel is included as **Plate 2**.

# DESCRIPTION OF EXISTING DRAINAGE CONDITIONS AND CHARACTERISTICS

## EXISTING OFFSITE DRAINAGE CONDITIONS

There are no offsite areas impacting the Site. The Old Verde Canal is located on the north side of the project and it intercepts any offsite runoff. Based on available Drainage Reports, the canal conveys less than 5 cfs in this reach.

A significant wash is located southeast of the Site. Water surface elevations for the 100-year storm were modelled for both base case and worst case scenarios. The base case shows the existing condition. The worst-case assumes the existing berm failing and runoff encroaching closer to the Site. Results can be found in **Appendix C.**

## EXISTING ONSITE DRAINAGE CONDITIONS

The regional retention basin on McDowell Mountain Golf Course is located southwest of the Site. Runoff sheet flows from northeast to southwest onto the course into the basin. Refer to **Plate 3** for the Existing Conditions Drainage Map. Peak flows were determined for both the 10-year and 100-year events using the Rational Method. Refer to **Appendix A** for supporting calculations.

Vegetation is typical Sonoran Desert type with creosote bush, jumping cholla, saguaro cacti, Palo Verde, ironwood, and mesquite trees. Land use for the onsite areas is currently open desert and is proposed to be zoned R1-10.

There are no washes on the Site that are categorized as a 'Vista Corridor' or 50-cfs ESL wash.

# PROPOSED PRELIMINARY DRAINAGE PLAN

## PROPOSED ONSITE DRAINAGE PLAN

Proposed onsite sub-basin boundaries were identified from the proposed overall grading concept. On lot drainage is directed to the streets and conveyed to catch basins and a storm drain. The storm drain is proposed to discharge to the adjacent golf course. The street section will be cross-sloped at 2% and will include 4-inch roll curb and gutter on the high side of the street and 6-inch vertical curb along portions of the low side of the street to facilitate the conveyance of stormwater. Refer to **Plate 4** for proposed sub-basins.

Roadway runoff will be conveyed along the street. The hydraulic capacity of the street will be in accordance with Figure 4.1-2 – "Hydraulic Design Criteria" of the *DS&PM*. The street runoff is released through a catch basin located along the street and conveyed to the golf course. Inlet calculations are provided in **Appendix D**.

Because of the topographic conditions and adjacent regional retention basin, a Stormwater Storage Waiver is being applied for as part of this submission. The regional retention basin includes a Bureau of Reclamation impoundment dike, which provides stormwater protection to the Central Arizona Project canal. The increase in runoff from the Site will not affect the storage capacity of the impoundment area. Site runoff will discharge to the golf course similar to the existing condition. However, the new condition will be a concentrated outfall instead of overland sheet flow. The new condition will improve the impacts on the golf course by removing sheet flow across the cart paths. Refer to **Plate 5** for the Onsite Drainage Map.

The proposed roadway will cross the Old Verde Canal. A culvert will be used to pass runoff across the new roadway.

An existing wash is located southeast of the project site. Finished floor elevations are at least two (2) feet above the 100-year water surface elevation of the wash in both the base case and the worst-case scenarios. **Appendix C** contains the offsite wash water surface modelling results.

Lateral erosion setbacks were determined for the existing wash southeast of the Site. A Level I Analysis was completed per the Arizona Department of Water Resources (ADWR) State Standard for Watercourse System Sediment Balance (SS5-96). Refer to **Plate 5** for lateral erosion setbacks.

## PROPOSED ONSITE STORMWATER STORAGE

Pre- versus post-development runoff volumes have been calculated for the 100-year, 2-hour storm. Refer to **Appendix B** for the completed "Request for Stormwater Storage Waiver" form.

First flush treatments will use either a retention basin or a Stormceptor. A treatment plan will be determined prior to the final design.

## PROPOSED ONSITE HYDROLOGY

The Rational Method was used to calculate the onsite stormwater runoff. Runoff is conveyed in the streets to a low-point where they enter the storm-drain system. Supporting hydrologic calculations are provided in **Appendix A**. **Plate 4** provides the drainage sub-basins onsite.

## PROPOSED ONSITE HYDRAULICS

Roadways have been designed to convey runoff between the curbs for the 10-year storm event and a maximum depth of eight (8) inches during the 100-year storm event. Onsite runoff generated by the residential roadways exits the street system via a catch basin and storm drain pipe at the low point. The storm drain discharges into the golf course. A MAG Standard Detail 533-1 Double Catch Basin Type 'D', L=10 feet, is being used to capture runoff. **Appendix D** contains the catch basin hydraulic calculations. Riprap apron and storm drain calculations will be provided in the Final Drainage Report. **Plate 5** provides the locations of this infrastructure.

## PROPOSED OFFSITE DRAINAGE PLAN

No offsite runoff will be affected by the improvements. The finished floor elevations near the wash at the southeast corner of the Site are elevated a minimum of two (2) feet above the wash water surface elevation.

## PROPOSED PROJECT PHASING

The project will be constructed in one phase.

# SPECIAL CONDITIONS

No special conditions exist for this project.

# DATA ANALYSIS METHODS

## HYDROLOGY

Onsite hydrologic calculations were performed using the Rational Method. These calculations support the design of onsite drainage structures such as catch basins and storm-drains. The Rational Method calculations were used to compute peak discharges at key locations within the proposed development, per Section 4-1.806 of the *DS&PM*. The precipitation values for the calculations were obtained from the *NOAA Atlas 14 Volume I, Version 5.* A minimum time of concentration of five (5) minutes was used, per the *DS&PM*. The Rational Coefficients were taken from Figure 4.1-4 of the *DS&PM*. "Undisturbed natural desert or desert landscaping" was used for existing conditions, and zoning category R1-10 was used for proposed conditions. Refer to **Appendix A** for detailed hydrologic calculations. Refer to Plate 3 for the Existing Conditions Map and **Plate 4** for the Proposed Subbasin Map.

## HYDRAULICS

Various hydraulic calculations were used in this analysis. Bentley FlowMaster V8i (FlowMaster) was used to evaluate the water surface elevations in the existing wash. Representative cross sections adjacent to the site were modelled in both the existing condition and a worst-case scenario. The worst-case scenario includes the berm failing, and runoff encroaches closer to the Site. The 100-year peak discharge from City Case No. 3-PP-2007 Drainage Report was used. Refer to **Appendix E** for the drainage report. The FlowMaster results can be found in **Appendix C** and **Plate 5**.

Lateral erosion setbacks were determined using ADWR SS5-96 Level I analysis. Refer to **Plate 5** for a depiction of the setback.

Onsite pavement drainage design utilized FlowMaster to estimate street capacity and inlet efficiency. Clogging factors of 1.25 and 2 were applied to the curb opening and grate, respectively per the *Flood Control District of Maricopa County Policies and Standards* Table 6.8. These calculations can be found in **Appendix D**.

# CONCLUSIONS

- There are no 50 cfs – ESL washes traversing through the project. The existing wash southeast of the Site does not impact the Site. The finished floor elevations for the lots at the southeast corner of the Site are set a minimum of two (2) feet above the wash water surface elevation.
- The design of hydraulic structures was based on generally accepted engineering practices and in accordance with City requirements. A storm drain is designed to capture onsite runoff and convey it to the golf course. Discharging to the golf course is similar to existing conditions. However, the concentrated runoff from the storm drain will improve the existing condition by removing the sheet flow across cart paths.
- Due to the proximity of the regional retention basin, a Stormwater Storage Waiver is being utilized. The regional retention basin is designed to store runoff for storms in excess of the 100-year event. Therefore, impacts to the basin from the increased runoff from the Site are negligible.

# REFERENCES


Arizona Department of Water Resources, *State Standard for Watercourse System Sediment Balance*, September 1996.

Bentley Systems, Inc., *FlowMaster*, V8i, 2009.

City of Scottsdale, *Design Standards and Policies Manual*, January 2010.

Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Arizona – Hydrology*, revised 2013.

Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Arizona – Hydraulics*, revised 2013.

Flood Control District of Maricopa County, *Drainage Policies and Standards for Maricopa County, Arizona*, revised 2016.

Wilcox Professional Services, *Drainage Report for Montalcino Estates*, 2007.

Kimley»Horn

Rainfall Information

| General Project Information | | | |
|---|---|---|---|
| Project | Lanes End | | |
| Project # | 291104000 | | |
| Designed by | CEO | Date | 1/31/2017 |

| NOAA 14 Rainfall Depth Data [in] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Storm Event [yr] | | | | | | | | | |
| Duration | 1 | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 | 1000 |
| 5-min: | 0.20 | 0.27 | 0.36 | 0.43 | 0.52 | 0.60 | 0.67 | 0.74 | 0.84 | 0.92 |
| 10-min: | 0.31 | 0.41 | 0.55 | 0.65 | 0.80 | 0.91 | 1.02 | 1.13 | 1.28 | 1.40 |
| 15-min: | 0.38 | 0.50 | 0.68 | 0.81 | 0.99 | 1.12 | 1.26 | 1.40 | 1.59 | 1.73 |
| 30-min: | 0.52 | 0.68 | 0.91 | 1.09 | 1.33 | 1.51 | 1.70 | 1.89 | 2.14 | 2.33 |
| 60-min: | 0.64 | 0.84 | 1.13 | 1.35 | 1.65 | 1.87 | 2.10 | 2.34 | 2.65 | 2.88 |
| 2-hr: | 0.75 | 0.97 | 1.29 | 1.53 | 1.86 | 2.11 | 2.37 | 2.62 | 2.97 | 3.24 |
| 3-hr: | 0.82 | 1.05 | 1.37 | 1.62 | 1.97 | 2.25 | 2.55 | 2.85 | 3.26 | 3.60 |
| 6-hr: | 0.98 | 1.24 | 1.58 | 1.85 | 2.22 | 2.51 | 2.81 | 3.11 | 3.52 | 3.85 |
| 12-hr: | 1.12 | 1.42 | 1.79 | 2.08 | 2.47 | 2.77 | 3.09 | 3.40 | 3.82 | 4.14 |
| 24-hr: | 1.33 | 1.69 | 2.18 | 2.58 | 3.13 | 3.57 | 4.03 | 4.51 | 5.17 | 5.70 |
| 2-day: | 1.46 | 1.87 | 2.46 | 2.93 | 3.60 | 4.12 | 4.69 | 5.27 | 6.10 | 6.76 |
| 3-day: | 1.58 | 2.02 | 2.68 | 3.21 | 3.96 | 4.57 | 5.22 | 5.90 | 6.88 | 7.67 |
| 4-day: | 1.70 | 2.18 | 2.90 | 3.49 | 4.33 | 5.01 | 5.75 | 6.53 | 7.65 | 8.57 |
| 7-day: | 1.92 | 2.46 | 3.29 | 3.96 | 4.92 | 5.71 | 6.55 | 7.46 | 8.76 | 9.81 |
| 10-day: | 2.10 | 2.70 | 3.59 | 4.31 | 5.34 | 6.17 | 7.07 | 8.02 | 9.37 | 10.47 |
| 20-day: | 2.61 | 3.37 | 4.47 | 5.32 | 6.47 | 7.37 | 8.29 | 9.24 | 10.54 | 11.56 |
| 30-day: | 3.08 | 3.97 | 5.27 | 6.26 | 7.61 | 8.66 | 9.74 | 10.85 | 12.36 | 13.54 |
| 45-day: | 3.63 | 4.69 | 6.22 | 7.37 | 8.91 | 10.10 | 11.31 | 12.56 | 14.24 | 15.56 |
| 60-day: | 4.06 | 5.27 | 6.97 | 8.23 | 9.88 | 11.13 | 12.39 | 13.66 | 15.37 | 16.68 |

| NOAA 14 Rainfall Intensity [in/hr] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Storm Event | | | | | | | | | |
| Duration | 1 | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 | 1000 |
| 5-min: | 2.40 | 3.24 | 4.32 | 5.16 | 6.24 | 7.20 | 8.04 | 8.88 | 10.08 | 11.04 |
| 10-min: | 1.86 | 2.46 | 3.30 | 3.90 | 4.80 | 5.46 | 6.12 | 6.78 | 7.68 | 8.40 |
| 15-min: | 1.52 | 2.00 | 2.72 | 3.24 | 3.96 | 4.48 | 5.04 | 5.60 | 6.36 | 6.92 |
| 30-min: | 1.04 | 1.36 | 1.82 | 2.18 | 2.66 | 3.02 | 3.40 | 3.78 | 4.28 | 4.66 |
| 60-min: | 0.64 | 0.84 | 1.13 | 1.35 | 1.65 | 1.87 | 2.10 | 2.34 | 2.65 | 2.88 |
| 2-hr: | 0.38 | 0.49 | 0.65 | 0.77 | 0.93 | 1.06 | 1.19 | 1.31 | 1.49 | 1.62 |
| 3-hr: | 0.27 | 0.35 | 0.46 | 0.54 | 0.66 | 0.75 | 0.85 | 0.95 | 1.09 | 1.20 |
| 6-hr: | 0.16 | 0.21 | 0.26 | 0.31 | 0.37 | 0.42 | 0.47 | 0.52 | 0.59 | 0.64 |
| 12-hr: | 0.093 | 0.118 | 0.149 | 0.173 | 0.206 | 0.231 | 0.258 | 0.283 | 0.318 | 0.345 |
| 24-hr: | 0.055 | 0.070 | 0.091 | 0.108 | 0.130 | 0.149 | 0.168 | 0.188 | 0.215 | 0.238 |
| 2-day: | 0.030 | 0.039 | 0.051 | 0.061 | 0.075 | 0.086 | 0.098 | 0.110 | 0.127 | 0.141 |
| 3-day: | 0.022 | 0.028 | 0.037 | 0.045 | 0.055 | 0.063 | 0.073 | 0.082 | 0.096 | 0.107 |
| 4-day: | 0.018 | 0.023 | 0.031 | 0.037 | 0.046 | 0.053 | 0.061 | 0.069 | 0.081 | 0.090 |
| 7-day: | 0.011 | 0.015 | 0.020 | 0.024 | 0.029 | 0.034 | 0.039 | 0.044 | 0.052 | 0.058 |
| 10-day: | 0.009 | 0.011 | 0.015 | 0.018 | 0.022 | 0.026 | 0.029 | 0.033 | 0.039 | 0.044 |
| 20-day: | 0.005 | 0.007 | 0.009 | 0.011 | 0.013 | 0.015 | 0.017 | 0.019 | 0.022 | 0.024 |
| 30-day: | 0.004 | 0.006 | 0.007 | 0.009 | 0.011 | 0.012 | 0.014 | 0.015 | 0.017 | 0.019 |
| 45-day: | 0.003 | 0.004 | 0.006 | 0.007 | 0.008 | 0.009 | 0.010 | 0.012 | 0.013 | 0.014 |
| 60-day: | 0.003 | 0.004 | 0.005 | 0.006 | 0.007 | 0.008 | 0.009 | 0.009 | 0.011 | 0.012 |

Kimley»Horn

Existing Condition Peak Discharge Calculations

| General Project Information | | | |
|---|---|---|---|
| Project # | 291104000 | | |
| Designed by | CEO | Date | 2/7/2017 |
| Design Storm Event | 10 | | |
| Minimum $T_c$ [min] | 5 | | |

| Basin Information | | Hydrology | | | | | |
|---|---|---|---|---|---|---|---|
| Basin ID or Combination Point | Slope, $S_l$ [ft/ft] | Rational Coefficient | Flowpath Length [ft] | Area [ac] | I [in/hr] | $T_c$ [min] | Q [cfs] |
| EX1 | 0.022 | 0.45 | 536 | 3.4 | *5.2* | *5.0* | *7.9* |
| EX2 | 0.031 | 0.45 | 488 | 2.8 | *5.2* | *5.0* | *6.4* |
| EX3 | 0.023 | 0.45 | 417 | 1.2 | *5.2* | *5.0* | *2.8* |
| EX4 | 0.036 | 0.45 | 452 | 1.7 | *5.2* | *5.0* | *3.9* |

Kimley»Horn

Existing Condition Peak Discharge Calculations

| General Project Information | | | |
|---|---|---|---|
| Project # | 291104000 | | |
| Designed by | CEO | Date | 2/7/2017 |
| Design Storm Event | | 100 | |
| Minimum $T_c$ [min] | | 5 | |

| Basin Information | | Hydrology | | | | | |
|---|---|---|---|---|---|---|---|
| Basin ID or Combination Point | Slope, $S_l$ [ft/ft] | Rational Coefficient | Flowpath Length [ft] | Area [ac] | I [in/hr] | $T_c$ [min] | Q [cfs] |
| EX1 | 0.022 | 0.45 | 536 | 3.4 | *8.0* | *5.0* | *12.3* |
| EX2 | 0.031 | 0.45 | 488 | 2.8 | *8.0* | *5.0* | *9.9* |
| EX3 | 0.023 | 0.45 | 417 | 1.2 | *8.0* | *5.0* | *4.4* |
| EX4 | 0.036 | 0.45 | 452 | 1.7 | *8.0* | *5.0* | *6.0* |

Kimley»Horn

Proposed Condition Peak Discharge Calculations

| General Project Information | | | |
|---|---|---|---|
| Project # | 291104000 | | |
| Designed by | CEO | Date | 1/31/2017 |
| Design Storm Event | | 10 | |
| Minimum $T_c$ [min] | | 5 | |

| Basin Information | | Hydrology | | | | | |
|---|---|---|---|---|---|---|---|
| Basin ID or Combination Point | Slope, $S_l$ [ft/ft] | Rational Coefficient | Flowpath Length [ft] | Area [ac] | I [in/hr] | $T_c$ [min] | Q [cfs] |
| A1 | 0.020 | 0.67 | 265 | 0.4 | *5.2* | *5.0* | *1.2* |
| A2 | 0.034 | 0.67 | 330 | 0.9 | *5.2* | *5.0* | *2.9* |
| A3 | 0.009 | 0.67 | 268 | 0.2 | *5.2* | *5.0* | *0.8* |
| A4-1 | 0.009 | 0.67 | 281 | 0.6 | *5.2* | *5.0* | *2.1* |
| A4-2 | 0.044 | 0.67 | 90 | 0.7 | *5.2* | *5.0* | *2.3* |
| A5 | 0.011 | 0.67 | 173 | 0.6 | *5.2* | *5.0* | *2.2* |
| A6 | 0.007 | 0.67 | 166 | 0.1 | *5.2* | *5.0* | *0.4* |
| A7 | 0.032 | 0.67 | 381 | 0.3 | *5.2* | *5.0* | *1.0* |
| A8 | 0.035 | 0.67 | 356 | 0.3 | *5.2* | *5.0* | *0.9* |
| A9-1 | 0.024 | 0.67 | 404 | 0.9 | *5.2* | *5.0* | *3.0* |
| A9-2 | 0.022 | 0.67 | 90 | 1.1 | *5.2* | *5.0* | *3.9* |
| A10 | 0.018 | 0.67 | 235 | 1.0 | *5.2* | *5.0* | *3.3* |
| A11 | 0.028 | 0.67 | 342 | 0.3 | *5.2* | *5.0* | *1.1* |
| A12 | 0.019 | 0.67 | 553 | 0.8 | *5.2* | *5.4* | *2.6* |
| A13 | 0.034 | 0.67 | 452 | 1.2 | *5.2* | *5.0* | *4.0* |
| CPA | 0.028 | 0.67 | 404 | 5.2 | *5.2* | *5.0* | *17.8* |
| CPB | 0.024 | 0.67 | 553 | 1.9 | *5.2* | *5.0* | *6.6* |

Kimley»Horn

Proposed Condition Peak Discharge Calculations

| General Project Information | | | |
|---|---|---|---|
| Project # | 291104000 | | |
| Designed by | CEO | Date | 1/31/2017 |
| Design Storm Event | | 100 | |
| Minimum $T_c$ [min] | | 5 | |

| Basin Information | | Hydrology | | | | | |
|---|---|---|---|---|---|---|---|
| Basin ID or Combination Point | Slope, $S_l$ [ft/ft] | Rational Coefficient | Flowpath Length [ft] | Area [ac] | I [in/hr] | $T_c$ [min] | Q [cfs] |
| A1 | 0.020 | 0.67 | 265 | 0.4 | *8.0* | *5.0* | *1.9* |
| A2 | 0.034 | 0.67 | 330 | 0.9 | *8.0* | *5.0* | *4.6* |
| A3 | 0.009 | 0.67 | 268 | 0.2 | *8.0* | *5.0* | *1.3* |
| A4-1 | 0.009 | 0.67 | 281 | 0.6 | *8.0* | *5.0* | *3.3* |
| A4-2 | 0.044 | 0.67 | 90 | 0.7 | *8.0* | *5.0* | *3.6* |
| A5 | 0.011 | 0.67 | 173 | 0.6 | *8.0* | *5.0* | *3.4* |
| A6 | 0.007 | 0.67 | 166 | 0.1 | *8.0* | *5.0* | *0.6* |
| A7 | 0.032 | 0.67 | 381 | 0.3 | *8.0* | *5.0* | *1.6* |
| A8 | 0.035 | 0.67 | 356 | 0.3 | *8.0* | *5.0* | *1.3* |
| A9-1 | 0.024 | 0.67 | 404 | 0.9 | *8.0* | *5.0* | *4.7* |
| A9-2 | 0.022 | 0.67 | 90 | 1.1 | *8.0* | *5.0* | *6.1* |
| A10 | 0.018 | 0.67 | 235 | 1.0 | *8.0* | *5.0* | *5.1* |
| A11 | 0.028 | 0.67 | 342 | 0.3 | *8.0* | *5.0* | *1.7* |
| A12 | 0.019 | 0.67 | 553 | 0.8 | *8.0* | *5.0* | *4.0* |
| A13 | 0.034 | 0.67 | 452 | 1.2 | *8.0* | *5.0* | *6.3* |
| CPA | 0.028 | 0.67 | 404 | 5.2 | *8.0* | *5.0* | *27.7* |
| CPB | 0.024 | 0.67 | 553 | 1.9 | *8.0* | *5.0* | *10.3* |

# XS-1, Base

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Channel Slope | 0.01277 | ft/ft |
| Discharge | 4175.00 | ft³/s |

Section Definitions

| Station (ft) | Elevation (ft) |
|---|---|
| 0+01 | 1540.58 |
| 0+02 | 1540.51 |
| 0+05 | 1540.34 |
| 0+11 | 1538.14 |
| 0+12 | 1537.80 |
| 0+13 | 1537.55 |
| 0+13 | 1537.43 |
| 0+14 | 1537.04 |
| 0+24 | 1533.76 |
| 0+29 | 1532.36 |
| 0+29 | 1532.25 |
| 0+31 | 1531.77 |
| 0+34 | 1531.58 |
| 0+35 | 1531.52 |
| 0+35 | 1531.51 |
| 0+37 | 1531.53 |
| 0+41 | 1531.61 |
| 0+43 | 1531.53 |
| 0+43 | 1531.54 |
| 0+47 | 1532.10 |
| 0+54 | 1532.01 |
| 0+55 | 1532.01 |
| 0+57 | 1532.34 |
| 0+61 | 1533.08 |
| 0+63 | 1533.27 |
| 0+65 | 1533.41 |
| 0+67 | 1533.56 |

# XS-1, Base

## Input Data

| Station (ft) | Elevation (ft) |
|---|---|
| 0+69 | 1533.85 |
| 0+71 | 1534.30 |
| 0+72 | 1534.34 |
| 0+79 | 1535.54 |
| 0+80 | 1536.00 |
| 0+84 | 1536.19 |
| 0+88 | 1536.85 |
| 0+89 | 1537.06 |
| 0+94 | 1538.32 |
| 0+97 | 1539.17 |
| 0+99 | 1539.56 |
| 1+02 | 1540.37 |
| 1+07 | 1540.41 |

## Options

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

## Results

| | | | |
|---|---|---|---|
| Normal Depth | | 5.67 | ft |
| Elevation Range | 1531.51 to 1540.58 ft | | |
| Flow Area | | 269.02 | ft² |
| Wetted Perimeter | | 76.57 | ft |
| Hydraulic Radius | | 3.51 | ft |
| Top Width | | 75.23 | ft |
| Normal Depth | | 5.67 | ft |
| Critical Depth | | 6.76 | ft |
| Critical Slope | | 0.00575 | ft/ft |
| Velocity | | 15.52 | ft/s |
| Velocity Head | | 3.74 | ft |
| Specific Energy | | 9.41 | ft |

## XS-1, Base

### Results

| | | | |
|---|---|---|---|
| Froude Number | | 1.45 | |
| Flow Type | Supercritical | | |

### GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.00 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

### GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.00 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Downstream Velocity | Infinity | ft/s |
| Upstream Velocity | Infinity | ft/s |
| Normal Depth | 5.67 | ft |
| Critical Depth | 6.76 | ft |
| Channel Slope | 0.01277 | ft/ft |
| Critical Slope | 0.00575 | ft/ft |

# XS-1, Worst-Case

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Channel Slope | 0.01277 | ft/ft |
| Discharge | 4175.00 | ft³/s |

Section Definitions

| Station (ft) | Elevation (ft) |
|---|---|
| 0+01 | 1540.58 |
| 0+02 | 1540.51 |
| 0+05 | 1540.34 |
| 0+11 | 1538.14 |
| 0+12 | 1537.80 |
| 0+13 | 1537.55 |
| 0+13 | 1537.43 |
| 0+14 | 1537.04 |
| 0+24 | 1533.76 |
| 0+29 | 1532.36 |
| 0+29 | 1532.25 |
| 0+31 | 1531.77 |
| 0+34 | 1531.58 |
| 0+35 | 1531.52 |
| 0+35 | 1531.51 |
| 0+37 | 1531.53 |
| 0+41 | 1531.61 |
| 0+43 | 1531.53 |
| 0+43 | 1531.54 |
| 0+47 | 1532.10 |
| 0+54 | 1532.01 |
| 0+55 | 1532.01 |
| 0+57 | 1532.34 |
| 0+61 | 1533.08 |
| 0+63 | 1533.27 |
| 0+65 | 1533.41 |
| 0+67 | 1533.56 |

# XS-2, Base

## Input Data

| Station (ft) | Elevation (ft) |
|---|---|
| 0+91 | 1531.71 |
| 0+91 | 1531.83 |
| 0+92 | 1532.14 |
| 0+99 | 1535.04 |
| 1+04 | 1536.20 |
| 1+08 | 1537.26 |
| 1+13 | 1536.81 |
| 1+14 | 1536.81 |
| 1+14 | 1536.83 |

## Options

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

## Results

| | | | |
|---|---|---|---|
| Normal Depth | | 5.62 | ft |
| Elevation Range | 1528.55 to 1539.40 ft | | |
| Flow Area | | 271.97 | ft² |
| Wetted Perimeter | | 70.12 | ft |
| Hydraulic Radius | | 3.88 | ft |
| Top Width | | 68.21 | ft |
| Normal Depth | | 5.62 | ft |
| Critical Depth | | 6.70 | ft |
| Critical Slope | | 0.00577 | ft/ft |
| Velocity | | 15.35 | ft/s |
| Velocity Head | | 3.66 | ft |
| Specific Energy | | 9.28 | ft |
| Froude Number | | 1.36 | |
| Flow Type | Supercritical | | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.00 | ft |

# XS-2, Worst-Case

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Channel Slope | 0.01095 | ft/ft |
| Discharge | 4175.00 | ft³/s |

Section Definitions

| Station (ft) | Elevation (ft) |
|---|---|
| 0+07 | 1539.40 |
| 0+07 | 1538.79 |
| 0+07 | 1537.96 |
| 0+10 | 1537.71 |
| 0+11 | 1537.62 |
| 0+15 | 1536.50 |
| 0+20 | 1535.23 |
| 0+27 | 1534.59 |
| 0+28 | 1534.52 |
| 0+31 | 1532.84 |
| 0+33 | 1531.79 |
| 0+34 | 1531.39 |
| 0+37 | 1530.09 |
| 0+41 | 1528.72 |
| 0+41 | 1528.72 |
| 0+46 | 1528.67 |
| 0+47 | 1528.66 |
| 0+49 | 1528.55 |
| 0+52 | 1528.82 |
| 0+55 | 1528.70 |
| 0+58 | 1528.67 |
| 0+63 | 1529.24 |
| 0+68 | 1529.70 |
| 0+74 | 1529.99 |
| 0+79 | 1530.22 |
| 0+87 | 1531.14 |
| 0+89 | 1531.45 |

# XS-2, Worst-Case

## Input Data

| Station (ft) | Elevation (ft) |
|---|---|
| 0+91 | 1531.71 |
| 0+91 | 1531.83 |
| 0+92 | 1532.14 |
| 0+95 | 1533.00 |
| 1+79 | 1533.00 |
| 1+86 | 1532.00 |
| 2+14 | 1532.00 |
| 2+95 | 1532.00 |
| 3+10 | 1532.00 |
| 3+16 | 1533.00 |
| 3+21 | 1534.00 |
| 3+27 | 1535.00 |

## Options

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

## Results

| | | | |
|---|---|---|---|
| Normal Depth | | 4.99 | ft |
| Elevation Range | 1528.55 to 1539.40 ft | | |
| Flow Area | | 480.07 | ft² |
| Wetted Perimeter | | 290.25 | ft |
| Hydraulic Radius | | 1.65 | ft |
| Top Width | | 288.56 | ft |
| Normal Depth | | 4.99 | ft |
| Critical Depth | | 5.19 | ft |
| Critical Slope | | 0.00746 | ft/ft |
| Velocity | | 8.70 | ft/s |
| Velocity Head | | 1.18 | ft |
| Specific Energy | | 6.16 | ft |
| Froude Number | | 1.19 | |

# XS-2, Worst-Case

## Results

| | |
|---|---|
| Flow Type | Supercritical |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.00 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.00 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Downstream Velocity | Infinity | ft/s |
| Upstream Velocity | Infinity | ft/s |
| Normal Depth | 4.99 | ft |
| Critical Depth | 5.19 | ft |
| Channel Slope | 0.01095 | ft/ft |
| Critical Slope | 0.00746 | ft/ft |

# 100-year

## Project Description

| | |
|---|---|
| Solve For | Spread |

## Input Data

| | | | |
|---|---|---|---|
| Discharge | | 27.70 | ft³/s |
| Gutter Width | | 1.42 | ft |
| Gutter Cross Slope | | 0.04 | ft/ft |
| Road Cross Slope | | 0.02 | ft/ft |
| Local Depression | | 2.00 | in |
| Local Depression Width | | 1.42 | ft |
| Grate Width | | 1.42 | ft |
| Grate Length | | 3.00 | ft |
| Grate Type | P-50 mm x 100 mm (P-1-7/8"-4") | | |
| Clogging | | 50.00 | % |
| Curb Opening Length | | 16.00 | ft |
| Opening Height | | 0.50 | ft |
| Curb Throat Type | Horizontal | | |
| Throat Incline Angle | | 90.00 | degrees |

## Options

| | |
|---|---|
| Calculation Option | Use Both |

## Results

| | | |
|---|---|---|
| Spread | 32.55 | ft |
| Depth | 0.68 | ft |
| Gutter Depression | 0.03 | ft |
| Total Depression | 0.20 | ft |
| Open Grate Area | 1.70 | ft² |
| Active Grate Weir Length | 4.42 | ft |

Wilcox
PROFESSIONAL
SERVICES

# Drainage Report
# Montalcino Estates
# City of Scottsdale

Project No.: 31189.00001
913-PA-2005
February 23, 2007
Revised May 3, 2007

480.607.2244 | f. 480.607.2299 | 8502 E. Princess Drive, Suite 100 | Scottsdale, Arizona 85255-5465

LS 5-7-07
2nd Case Drainage
4-11-01-2

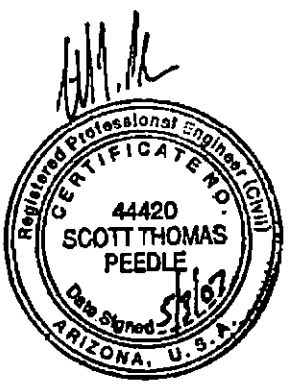
# DRAINAGE REPORT

FOR

# MONTALCINO ESTATES

CITY OF SCOTTSDALE
913-PA-2005

Wilcox Job No. 31189.00001




Prepared by:

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Scottsdale, Arizona 85255

## 1. INTRODUCTION

This report has been prepared to accompany the Preliminary Plat Application for 913-PA-2005, for Montalcino Estates, a 15 lot residential subdivision.

Montalcino Estates is a 7.55 acre site, abutting United States Bureau of Reclamation (USBR) properly to the south. Access to the property will be via 102nd Street. This parcel lies within the City of Scottsdale's Environmentally Sensitive Lands Overlay (ESLO) district. A portion of the Rio Verde Canal occupies the northeast portion of the property. **Figure 1** is a location and aerial map of the land use's in the vicinity of this project.

## 2. EXISTING DRAINAGE CONDITIONS

The watershed upstream of the property is fully developed with single family residential land uses. To the northeast is the master planned community of McDowell Mountain Ranch zoned R4 ESL, and to the north a development designated the Hoffman Property zoned R1-5. These properties contain significant natural drainage corridors that join between 102nd and 103rd Streets west of Buthrus Drive and discharge into the USPR property, a portion being occupied by the Sanctuary Golf Course. The discharge point appears to be a historic natural channel.

Stormwater generated onsite discharges directly into USBR property with topography falling to the southwest at approximately 2%. Offsite stormwater is prevented from entering the site from the north by the berm and channel that comprise the Rio Verde Canal. See **Figure 2** for existing watershed conditions and 100 year peak discharge exiting the property.

Onsite peak discharges were quantified using the Rational Method, see **Appendix I** for calculations. Also included in **Appendix I** are the soils information from the USDA and other salient parameters used in the Rational Model. The runoff coefficient selected was 0.31.

Presented in **Appendix II** are water surface calculations associated with the 4175 cts discharge exiting McDowell Mountain Ranch east of the site. This discharge is documented in the Drainage Plan for McDowell Mountain Ranch Parcel U by Coe & Van Loo dated September 11, 1996.

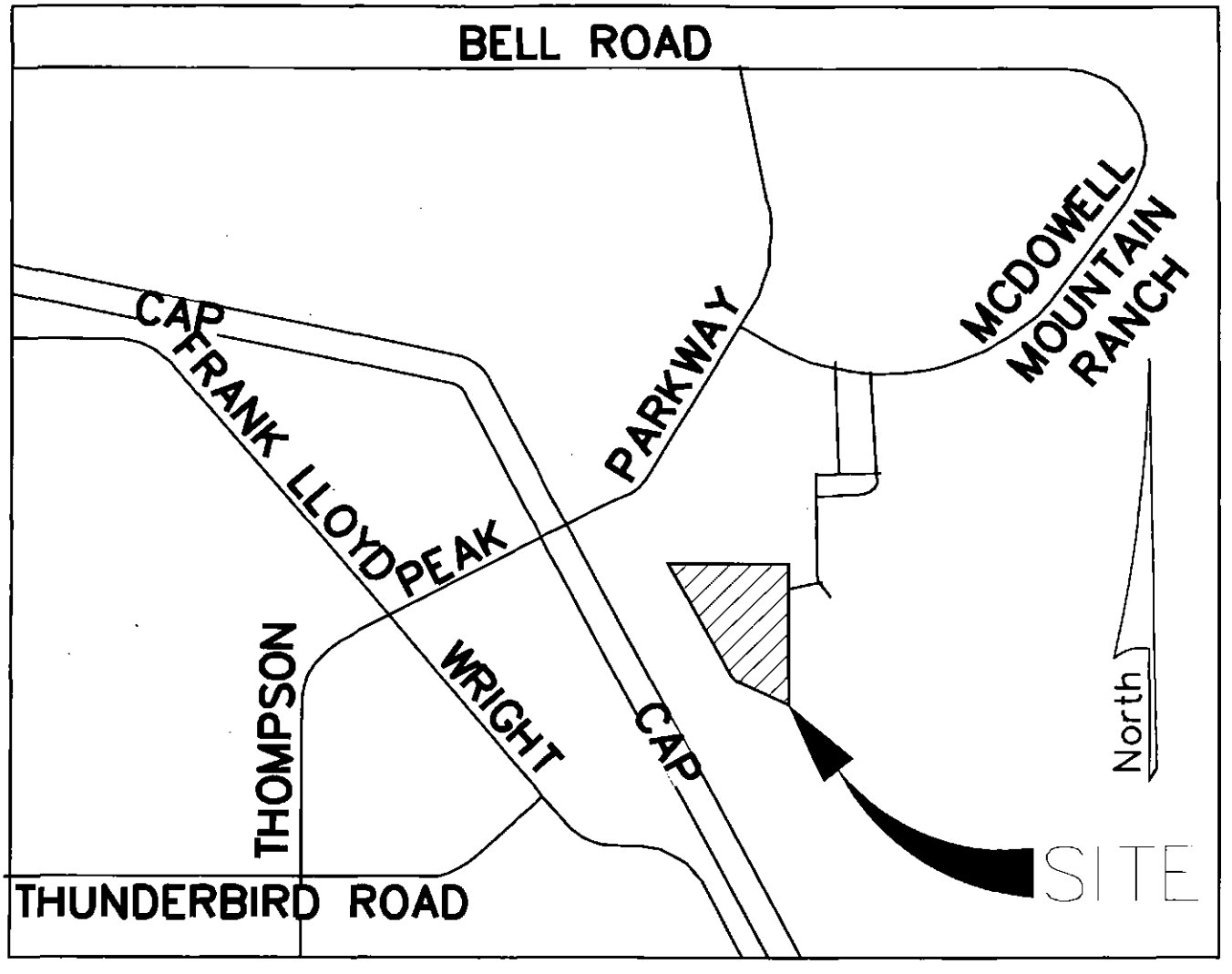
The Federal Emergency Management Agency (FEMA) under the National Flood Insurance Program (NFIP) has issued on September 30, 2005, a Flood Insurance Rate Map (FIRM 04013C1705G) indicating that the project is located in Zone A and X, see **Figure 3**.

Zone A is defined as no base flood elevations determined.

Zone X is defined as areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depth of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

## 3. PROPOSED DRAINAGE PLAN

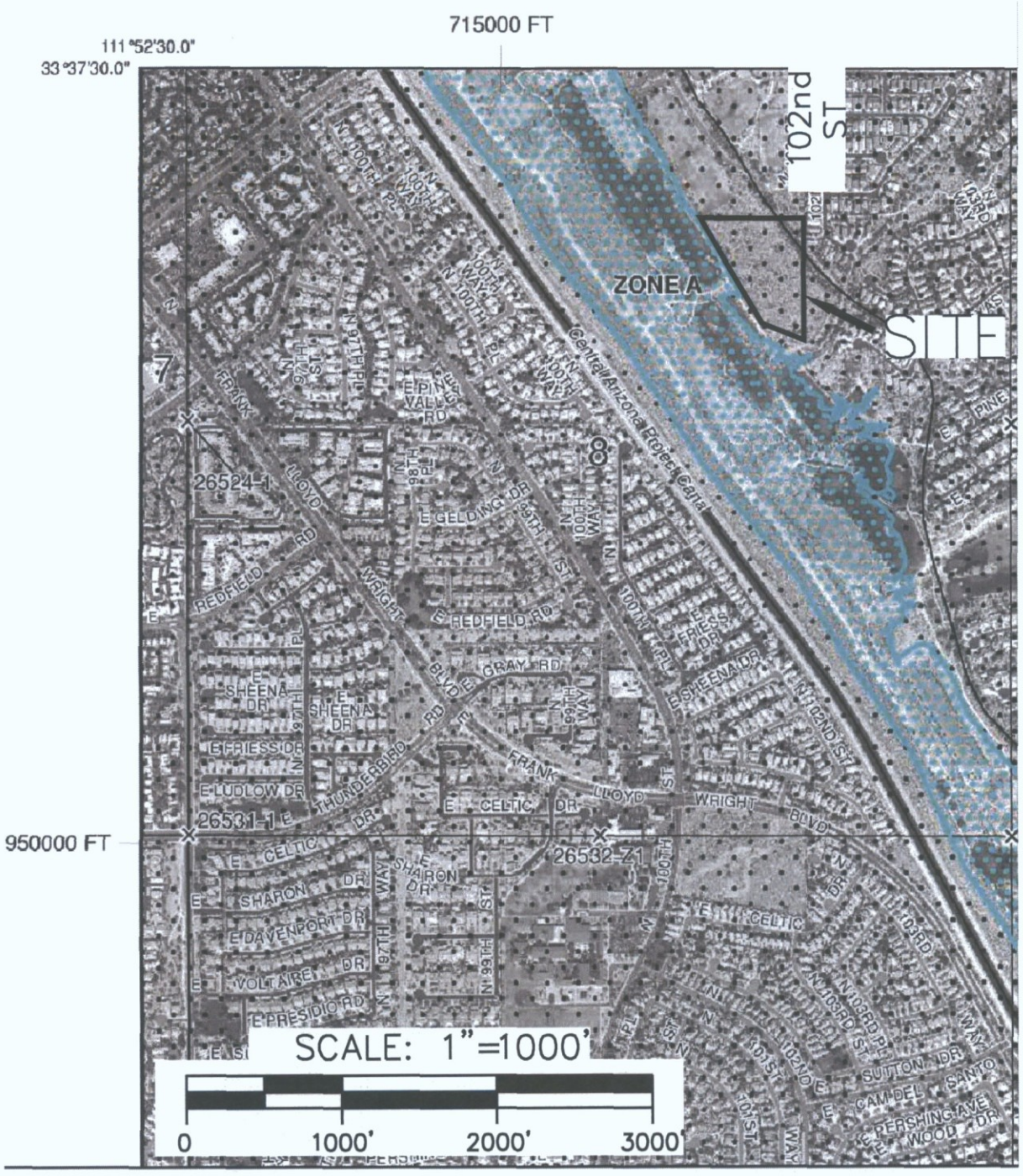
Presented in **Figure 4** is the drainage system proposed for the project. Offsite runoff will be prevented from entering the site by constructing a training wall on the perimeter of Lots 6, 7 and 8. Onsite runoff will be discharged into USBR property. Presented in **Appendix III** is coordination with USBR officials and their concurrence with this basis of drainage design. It is




# VICINITY MAP

NOT TO SCALE

Kimley»Horn




# FIRM

## FLOOD INSURANCE RATE MAP

## MARICOPA COUNTY, ARIZONA

### AND INCORPORATED AREAS

**PANEL 1780 OF 4425**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| MARICOPA COUNTY | 040037 | 1780 | L |
| SCOTTSDALE, CITY OF | 045012 | 1780 | L |

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**
**04013C1780L**

**MAP REVISED**
**OCTOBER 16, 2013**

Federal Emergency Management Agency

Kimley»Horn

SCALE: 1"=120'

0 120' 240' 360'

CITY OF SCOTTSDALE APN #217-14-969

N 102ND ST

PROPOSED CULVERT

A1 A2 A3 A4-1 A4-2 A5 A6 A7 A8 A9-1 A9-2 A10 A11 A12 A13

LOT 15 LOT 14 LOT 13 LOT 12 LOT 11 LOT 10 LOT 9 LOT 8 LOT 7 LOT 6 LOT 5 LOT 4 LOT 3 LOT 2 LOT 1

0.8 cfs 0.6 cfs 0.6cfs 0.6cfs 0.6cfs 0.6cfs 1.5cfs 0.5cfs 0.6cfs

CP-A CP-B

PROPOSED CATCH BASIN

PROPOSED STORM DRAIN

McDOWELL MOUNTAIN GOLF COURSE

UNITED STATES BUREAU OF RECLAMATION

OLD VERDE CANAL

EXISTING BERM

EXISTING WASH 4,175cfs

North

LEGEND

- BASIN BOUNDARY
- A1 BASIN LABEL
- CP-A CONCENTRATION POINT
- FLOW ARROW

Kimley»Horn

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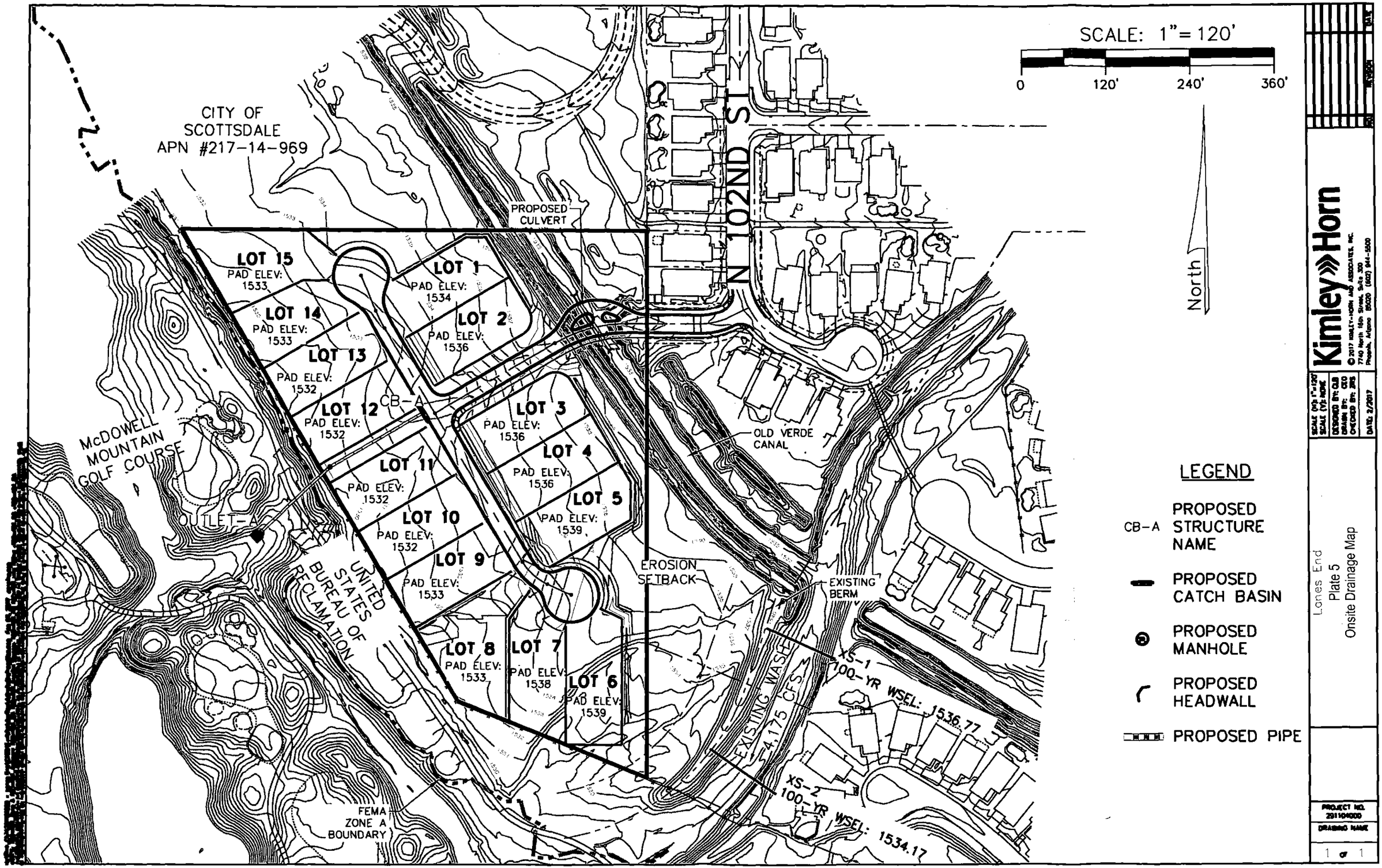
7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

SCALE (H): 1"=120'
SCALE (V): NONE
DESIGNED BY: CLB
DRAWN BY: CEO
CHECKED BY: JRS
DATE: 2/2017

Lanes End
Plate 4
Sub-Basins Map

PROJECT NO. 291104000
DRAWING NAME

1 OF 1

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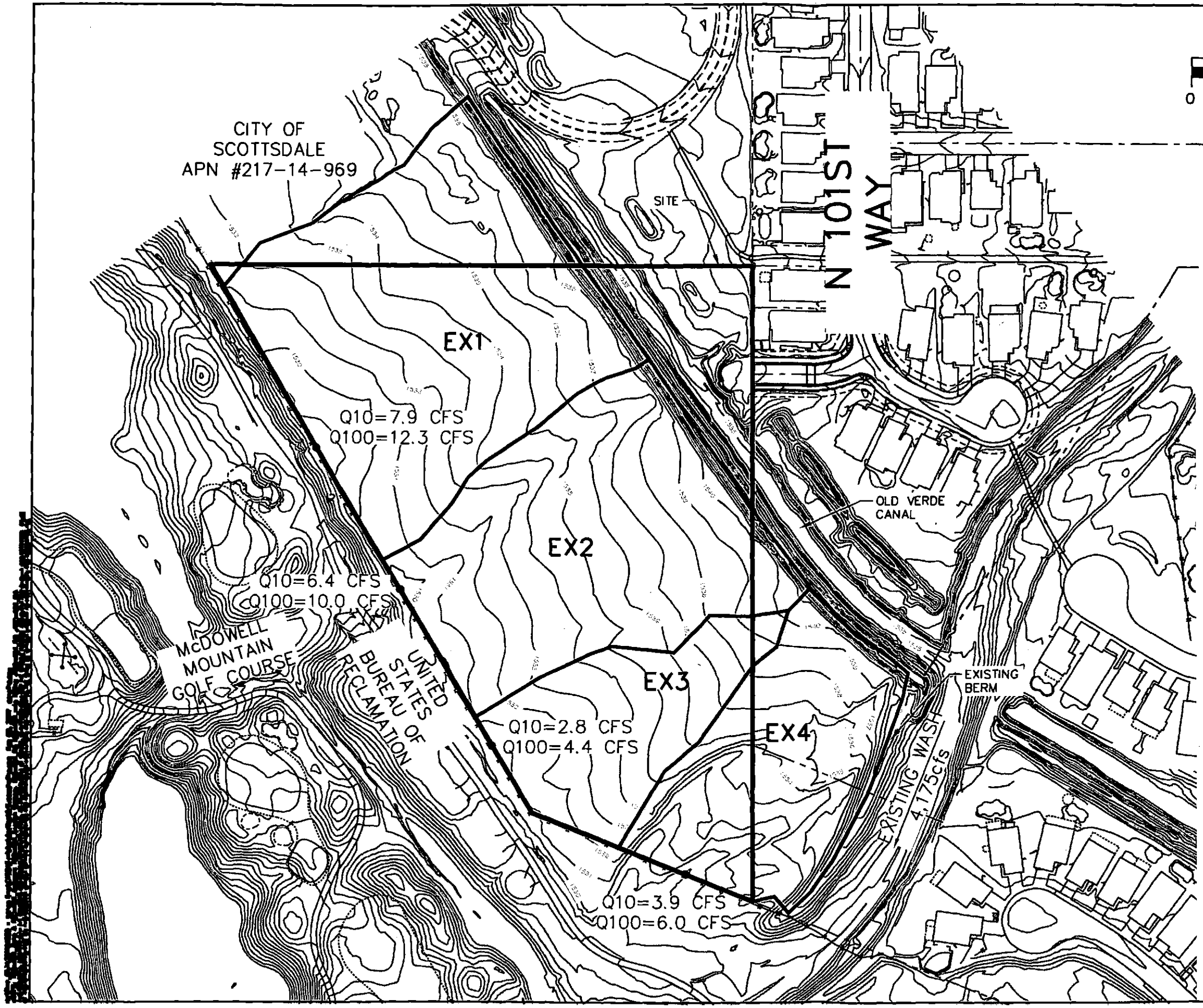
SCALE (H): 1"=120'
SCALE (V): NONE
DESIGNED BY: CLB
DRAWN BY: CEO
CHECKED BY: JRS
DATE: 2/2017

Lanes End
Plate 5
Onsite Drainage Map

PROJECT NO.
291104000
DRAWING NAME

1 of 1




SCALE: 1"=120'

0 120' 240' 360'

North

## LEGEND

- BASIN BOUNDARY
- EX1 BASIN LABEL
- CONCENTRATION POINT
- Q10=XX CFS, Q100=XX CFS PEAK FLOWS

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Phoenix, Arizona 85020 (602) 944-5500

SCALE (HOR.) 1"=120'
SCALE (VER.) NONE
DESIGNED BY: CLB
DRAWN BY: CEO
CHECKED BY: JRS
DATE: 2/2017

Lones End
Plate 3
Existing Conditions

PROJECT NO.
291104000
DRAWING NAME

1 OF 1

# Request for Stormwater Storage Waiver

**City of Scottsdale Case Numbers:**

___ - PA - ___ ___ - ZN - ___ ___ - UP - ___ ___ - DR - ___ 6 - PP - 2016 PC# ___

The applicant/developer must complete and submit this form to the city for processing and obtain approval of waiver request ***before submitting improvement plans***. Denial of the waiver may require the developer to submit a revised site plan to the Development Review Board.

**Date** 2/6/2017 **Project Name** Lanes End

**Project Location** End of 102nd Street adjacent to McDowell Mountain Golf Course

**Applicant Contact** Zach Schmidt, P.E., CFM **Company Name** Kimley-Horn

Phone 602-906-1116 Fax ___ E-mail zach.schmidt@kimley-horn.com

Address 7740 N. 16th Street, Suite 300, Phoenix, AZ 85020

**Waiver Criteria**

A project must meet at least one of three criteria listed below for the city to consider waiving some or all required stormwater storage. **However, regardless of the criteria, a waiver will only be granted if the applicant can demonstrate that the effect of a waiver will not increase the potential for flooding on any property.** Check the applicable box and provide a signed engineering report and supporting engineering analysis that demonstrate the project meets the criteria and that the effect of a waiver will not increase the potential for flooding on any property.

If the runoff for the project has been included in a storage facility at another location, the applicant must demonstrate that the stormwater storage facility was specifically designed to accommodate runoff from the subject property and that the runoff will be conveyed to this location through an adequately designed conveyance facility.

☑ 1. The development is adjacent to a conveyance facility that an engineering analysis shows is designed and constructed to handle the additional runoff from the site as a result of development.

☐ 2. The development is on a parcel less than one-half acre in size.

☐ 3. Stormwater storage requirements conflict with requirements of the Environmentally Sensitive Lands Ordinance (ESLO).

For a full storage waiver, a conflict with ESLO is limited to:

- Property located in the hillside landform as defined in the city Zoning Ordinance
- Property in the upper desert landform that has a land slope steeper than 5% as defined in the city Zoning Ordinance
- Property within the ESL zoning overlay district where the only viable location for a stormwater storage basin requires blasting

This full waiver only applies to those portions of property meeting one of these three requirements.

Partial waivers are available for projects or portions of properties within the Environmentally Sensitive Lands Zoning Overlay District, not meeting any of the three full waiver criteria above, if post-development peak discharge rates do not exceed pre-development conditions, based on the 10- and 100-year storm events.

By signing below, I certify that the stated project meets the waiver criteria selected above as demonstrated by the attached documentation.

Engineer ___ Date ___

**Planning, Neighborhood & Transportation Division**

7447 E Indian School Road, Suite 105, Scottsdale, AZ 85251 • Phone: 480-312-2500 • Fax: 480-312-7781

# Request for Stormwater Storage Waiver

City of Scottsdale Case Numbers:

- PA - ____ - ZN - ____ - UP - ____ - DR - ____ - 6 - PP - 2016 PC# ____

**CITY STAFF TO COMPLETE THIS PAGE**

Project Name _____

Check Appropriate Boxes:

☐ Meets waiver criteria (specify): ☐ 1 ☐ 2 ☐ 3

☐ Recommend approve waiver.

☐ Recommend deny waiver:
- ☐ None of waiver criteria met.
- ☐ Downstream conditions prohibit waiver of any storage.
- ☐ Other:

Explain: _____

☐ Return waiver request:
- ☐ Insufficient data provided.
- ☐ Other: _____

Explain: _____

Recommended Conditions of Waiver:
- ☐ All storage requirements waived.
- ☐ Post-development peak discharge rates do not exceed pre-development conditions.
- ☐ Other:

Explain: _____

☐ **Waiver approved per above conditions.**

☐ **Waiver denied.**

_____ _____

Floodplain Administrator or Designee Date

**Planning, Neighborhood & Transportation Division**
7447 E Indian School Road, Suite 105, Scottsdale, AZ 85251 • Phone: 480-312-2500 • Fax: 480-312-7781

# Request for Stormwater Storage Waiver

City of Scottsdale Case Numbers:

- PA - ____ - ZN - ____ - UP - ____ - DR - ____ 6 - PP - 2016 PC# ____

## In-Lieu Fee and In-Kind Contributions

In-lieu fees are only applicable to projects where post-development peak discharge rates exceed pre-development levels, based on the 10- and 100-year storm events. If the city grants a waiver, the developer is required to calculate and contribute an in-lieu fee based on what it would cost the city to provide a storage basin, sized as described below, including costs such as land acquisition, construction, landscaping, design, construction management, and maintenance over a 75-year design life. The fee for this cost is $1.87 per cubic foot of stormwater storage for a virtual storage basin designed to mitigate the increase in runoff associated with the 100-year/2-hour storm event. The applicant may submit site-specific in-lieu fee calculations subject to the Floodplain Administrator's approval.

The Floodplain Administrator considers in-kind contributions on a case-by-case basis. An in-kind contribution can serve as part of or instead of the calculated in-lieu fee. In-kind contributions must be stormwater related and must constitute a public benefit. *In-lieu fees and in-kind contributions are subject to the approval of the Floodplain Administrator or designee.*

Project Name Lanes End

The waived stormwater storage volume is calculated using a simplified approach as follows:

**$V = \Delta CRA$; where**

V = stormwater storage volume required, in cubic feet,
$\Delta C$ = increase in weighted average runoff coefficient over disturbed area ($C_{post} - C_{pre}$),
R = 100-year/2-hour precipitation depth, in feet (DSPM, Appendix 4-1D, page 11), and
A = area of disturbed ground, in square feet

Furthermore,

$V_w = V - V_p$; where
$V_w$ = volume waived,
V = volume required, and
$V_p$ = volume provided

R = 0.20
$\Delta C$= 0.22
A = 328,878
V = 14,290
$V_p$= 0
$V_w$= 14,290

☑ An in-lieu fee will be paid, based on the following calculations and supporting documentation:
In-lieu fee ($) = $V_w$ (cu. ft.) x $1.87 per cubic foot = $26,722

☐ An in-kind contribution will be made, as follows:

_____

_____

_____

☐ No in-lieu fee is required. Reason:

_____

_____

**Approved by:**

_____ _____

Floodplain Administrator or Designee Date

**Planning, Neighborhood & Transportation Division**
7447 E Indian School Road, Suite 105, Scottsdale, AZ 85251 • Phone: 480-312-2500 • Fax: 480-312-7781