CITY OF SCOTTSDALE

Drainage Reports

SOLUTIONS

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PRELIMINARY DRAINAGE REPORT

For

Goldwater Development

Located in:
70TH & 4TH Street
Scottsdale, Arizona

C.O.S. CASE NO. 4-ZN-2018

This day of: November 2018

Engineer of Record:

Joseph Hassell P.E.

Ace Job #: 17-096

Prepared By:
Ace Solutions, LLC
609 N Calgary Ct. Ste. 7
Post Falls, ID 83854
208-777-1854

Prepared For:
Goldwater Boulevard, LLC
Robert Ballard
480-203-8661

Registered Professional Engineer (Civil)
CERTIFICATE NO
31787
JOSEPH E
HASSELL
Date Signed
11/2/18
ARIZONA U.S.A.

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INTRODUCTION

This Storm Water Management report is being developed at the request of the City of Scottsdale to verify that runoff from the Goldwater Development site property under developed conditions will be less than equivalent to that of existing conditions. Site location is the corner of 70th and Goldwater Blvd. Old Town Scottsdale, Arizona. Total lot area is 1.19 Ac. The lot currently has a city owned 24-inch diameter stormwater drain from the end of 4th street to a storm drain manhole in Goldwater Boulevard. The storm drain will need to be relocated and proper easement will be given. See plan set for location and description of easement. This submittal is considered preliminary not for construction. A final plan set and certifications will be submitted at a later date. The final submittal will reflect the current city code requirements.

Previous Drainage Studies or Master Plan

The city of Scottsdale has provided as built drawings of the stormwater system for the area and has notified us of a maximum discharge rate into the existing storm system of 1.0 cfs. The existing lot does not have stormwater detention of outfall point at this time.

Location

The proposed development site contains approximately 1.19 acres located between Goldwater Boulevard and 4th street, Scottsdale. Access to the property is from 4th street.

Description of Property

The property is located between Goldwater Boulevard and 4th Street in Old Town Scottsdale, Arizona. Access to the property is from 4th Street. The property is currently undeveloped. All street front improvements are in place. The property owners have requested a 10 foot in width right of way abandonment adjacent to 4th street.

The property is currently zoned for commercial development.

This project is not near a floodplain area and there are no visible wetlands in the area. See attached FEMA map for Scottsdale community number 045012.

Vicinity Map

General Project Description

The purpose of the proposed development is to construct a new 5 story residential condominium with parking in the basement and ground level. The project will also include grading, curb and gutter, paving, stormwater treatment area, landscaping and sidewalks, building, parking, and relocation of the existing stormwater drains, pipes and easements.

Construction schedule

Construction is anticipated to begin in late summer of 2019.

Applicant information

Owner: Goldwater Boulevard LLC

Scottsdale, Arizona

Engineer Information

ACE Solutions LLC

Project Engineer: Joseph Hassell, PE

609 N. Calgary Ct. Ste. 7

Post Falls, Idaho 83854

Telephone: 208-777-1854

Email: joeh@acesolutions.pro

STORMWATER DESIGN CRITERIA

Regulations: Preliminary Report

City of Scottsdale 2018 DSPM was used for this report. A final report will use the current DSPM.

Analysis Methods

Our hydrological analysis is based on the Rational Method. This method utilizes rainfall frequencies and runoff characteristics from a watershed to predict peak discharges during storm events. This method is suitable for storm analysis on site 160 ac. or less. The storm event for 100-year frequency was analyzed. Storm event data was collected for the NOAA Atlas 14, volume 1 Version 5.0 of Western United States.

The analysis uses sheet flow across the surfaces for pre-developed conditions as well as post-developed conditions. Time of concentration was calculated using the existing and proposed surface runoff coefficients and the length of basin was from the further reaches on site to the average distance to the proposed detention area.

Hydrologic Criteria

At the requirement of the City of Scottsdale Stormwater Manual, hydrologic modeling was completed using the 100-year frequency rainfall events as reported in NOAA Atlas 14, Volume 1 Rainfall Frequency Atlas of the Western United States. The runoff response from the 2-hour duration storm event has been predicted for a type II rainfall distribution.

Table 1 provided below summarizes the rainfall amounts for each of the analyzed storm events.

TABLE 1: RAINFALL DEPTHS

Rainfall Duration	10-Year	25-Year	50-Year	100-Year
2 Hour	1.38"	1.69"	1.92"	2.16"

A weighted C factor has been calculated for each sub-basin based on the existing and developed conditions using coefficients from the DSPM. Table 2 gives runoff coefficients used to calculate the weighted C value for various HSGs and land usage.

TABLE 2: RUNOFF COEFFICIENTS

Land Cover	Specific/Composite	Storm Freq. (years)			
		2-25	50	100	
Lawns, golf courses & parks	Specific Surface Values	0.20	0.25	0.30	
Paved Streets, Parking Lots, roofs, driveways, etc.	Specific Surface Value	0.90	0.93	0.95	
Apartments & Condominiums	Composite Area Values	0.76	0.83	0.94	

Datum

All elevations listed in this report refer to the NAVD-88 GEOID 09 datum. Upon final submittal We will provide equation and location for conversion to the City of Scottsdale datum and local bench mark.

STORM WATER MANAGEMENT PLAN

General Description

All stormwater runoff will be collected and piped to a detention vault which will outfall into the city storm system. The city will only allow 1.0 cfs discharge at any one time. A drywell will also be designed to contain flows over the 100-year flood and to speed up outflow from the detention vault.

The proposed detention vault will be constructed to maintain runoff rates under Developed Conditions at or below the allowed rate of discharge (1.0 cfs.) from the property. A Drywell is proposed to capture any overflow. All stormwater will collected and directed into the stormwater detention vault. All flows will be detained in the underground facility with outflows to the city

system and to the drywell. For flows above the 100-year event overflow will go directly to the drywell. The drywell will be sized later.

The underground detention vault must be constructed to comply with the criteria in the 2018 Design Standards and Policy Manual (DSPM), Chapter 4, Section 4-1.202.

There is also a basement level to the building accessible via a ramp down to the level. This must include drains for the inevitable stormwater that will run down the ramp and water that will run off the cars parked there.

An existing 24-inch diameter storm drain line runs through a section of what will become the ramp down to the lower level. This drain line will be relocated to the east end of the cul-de-sac as shown on C2. Additional drain pipe will need to be installed to re-route the line towards the existing city drain.

A pool is designed to be on site. The design of this pool is by other firms, but the drains and backwash systems must be connected to the sanitary sewer system.

Hydrological Analysis

For sites that have not been previously developed, the standard formula is shown below:

Vr = C(R/12)A

See City of Scottsdale DSPM for more information regarding this formula.

The provided spread sheet calculates a weighted "C" to apply over the entire site. All stormwater from the 100-year, 2-hour precipitation event must be contained on site.

Additional calculations are shown using data from NOAA Atlas 14, Volume 1 to determine historical flows for 2, 10, 25, and 100-year storms.

Hydraulic Analysis and Design

Retention/Detention

Table 3 provided below summarizes the water surface elevations, inflow, outflow, depth and storage required within the proposed detention vault. The detention ponds have been broken up into cells when combined hold a minimum of 7750 cf (100 yr.). The outfall weir allows a maximum of 1.0 cfs. Of outfall directly into the city system. Overflow will be directed into an onsite drywell.

TABLE 3: DETENTION POND SUMMARY

Event	Max WSEL (ft.) AVG	Freeboard (ft.) At outfall	Max Q_{in} (cfs)	Max Q_{out} (cfs)	Depth(ft.)	Storage Requirement (cft.)
10-Year	TBD	TBD	4.49	1.0	9.10	4544

25-Year	TBD	TBD	5.62	1.0	9.10	5565
100-Year	TBD	1.00	8.41	1.0	9.10	7750

WSEL= Water Surface Elevation from bottom of vault at outfall location for indicated storm event

Detention will be provided to control developed runoff release to rates as allowed by the city (1.0 cfs). The Existing Conditions have a greater discharge then allowed. Freeboard will be provided during all analyzed storm events. However, if overtopping were to occur, overflow from the detention vault will be piped to an area drywell. Drywell to be sized at a later date.

Using the city system, provided 1cfs outflow, the storage can drain in a little over 2 hours. However, we will place the outflow to the drywell to assist in the drainage to not stress the city system during times of high flow.

UNDERGROUND STORAGE TANK DESIGN

Per the DSPM Chapter 4, Section 4-1.202 the storage tank must meet the following criteria, with comments following showing how we plan to meet the criteria:

C. GENERAL CRITERIA FOR UNDERGROUND STORMWATER STORAGE SYSTEM DESIGN

1. Underground stormwater storage systems must demonstrate protection of public health, safety, and welfare as established by the SRC and related policies.

The final design will incorporate these aspects.

2. Storage systems must not be located under structures, parking garages, or significant landscaping such as trees or sizable cactus that would preclude access to or replacement of the facilities.

Please see attached Stormwater Control Plan for storage location

3.The owner must dedicate a public drainage easement to the city which meets the standards for all drainage easements.

This will be comped prior to construction completion.

4. Design must address:

a. Water quality protection measures to protect underground and surface water resources to meet applicable water quality standards.
b. Vector control within storage system.
c. Redundancy in case of storage system failure, with attention to the possibility of structure or street flooding, sediment accumulation, or storm events that are greater than the 100-year, 2-hour event.
d. Initial suspended sediment load removal.
e. At least a 75-year life of entire system, including the lining and coating of the underground storage tank.

f. Drainage by gravity. Pumped systems will only be considered if no other reasonable alternative exists with dry wells as a preferred alternative if drainage by gravity is not feasible.

These points will be addressed prior to the final design. We anticipate that the storage system will be able to drain to the adjacent drywell and to the city system via the outflow piping. If the structure should become overtopped, overflow will be piped to an adjacent drywell.

D. SPECIFIC CRITERIA FOR UNDERGROUND STORMWATER STORAGE DESIGN

1. Outfall—underground storage systems must have some sort of outfall, such as gravity drains or pumps.

See above notes. The structure will outflow via outflow piping.

2. Pipes—underground storage system pipes must have a smooth interior floor. The city's Maricopa Association of Governments (MAG) supplemental standard detail 2554 shall be used to meet the smooth interior floor requirement for the use of corrugated metal pipes in underground stormwater storage facilities.

These types of pipes will be used.

3. Installation—excavation, bedding, and backfill procedures and materials must be in accordance with MAG standards.

These standards will be followed.

4. Access—a minimum of two access points must be provided for each underground storage system unless waived in advance by stormwater staff to enable inspections and access for removal of accumulated sediment and debris. Access must be in accordance with MAG standards and be placed to maximize the ability to maintain the underground system.

The final detention vault design will follow these standards.

E. CRITERIA FOR OPERATIONS, MAINTENANCE AND LIABILITY

1. Operations and maintenance generally—owner must provide:

a. Maintenance staff with expertise in operating, inspecting, and maintaining an underground stormwater storage system;

b. An Operations and Maintenance Manual on site for the system that includes:

i. a schedule for inspections and maintenance, and

ii. provisions for emergency operations due to power failure, pump failure, and clogged outlet structures;

iii. A log of the inspections and required maintenance services.

We will insure the owner provides this information.

2. Inspections and maintenance required—In addition to maintenance required by the SRC and other applicable requirements, owner shall:

a. Inspect system after each storm event of 0.6 inch or more, and semiannually, preferably before summer and winter rains.

b. Remove accumulated trash and debris from inlet and outlet structures as needed to ensure free flow of stormwater.

c. Inspect all other elements of the drainage system (pipes, geotextiles, and stone) and repair/replace elements as needed for the storage system to operate at peak efficiency.

The owner will provide this.

3. Signage—before receiving a C of O, the owner must install signs at each end of the underground storage tank that read "Notice—Underground Stormwater Storage Tank." The size, color, and locations of signs are subject to city staff approval.

This will be provided.

4. Ownership Responsibility Statement – The owner shall provide and sign a statement of responsibility for the system stating and acknowledging the owner is responsible for the maintenance, repair, and potential replacement of the system. Prior to final plan approval, the owner must provide a signed and notarized document to this effect, in a form satisfactory to the City Attorney, for recordation by the city in the Maricopa County Recorder's Office.

This will be provided.

UNDERGROUND LEVEL DESIGNS

The Underground level must be accounted for in the stormwater design. There is one level underground, accessible from a ramp that meets the existing cul-de-sac. An existing storm pipe runs through this area and will have to be moved.

The ramp to the lower level will have a roof over preventing most of the rainwater from running down the ramp. Also, there will be a small rise in elevation from the cul-de-sac trapping water from the street from getting to the ramp. At the top of this rise we will place a grate drain across all lanes of traffic to catch most water that may try to overflow into the basement level.

At the bottom of the ramp a grate drain will be placed across all lanes of traffic. Catch Basins will be placed within the parking area and the parking sloped slightly to drain the water towards the basins. All the water from the drain and from the basins will be conveyed to a sump pump location. From there the water will be pumped up to the surface level where it will drain to the underground storage tank.

Erosion Control

Description

Construction of the project shall include erosion and sediment control. Perimeter erosion controls shall be installed prior to any soil disturbance on site. Interior erosion controls shall be installed after rough grading. The contractor shall install additional erosion control measures as need and shall be responsible for installing and maintaining all erosion control measures. The owner is responsible for erosion control for all contractors working on the site, including

minimizing tracking of soil and debris onto adjacent properties and roadways and wind erosion control.

Areas not being developed or planned to be developed for a period of greater than 14 days shall be stabilized to minimize wind and water erosion. This includes periods of winter shut down. Wind erosion protection shall be accomplished by mulching/crimping until 70% vegetation is established. Permanent erosion control shall be achieved by permanent seeding of slopes, disturbed ditch sections and disturbed pond areas. The seed mix shall be a sustainable perennial variety. Further, the contractor is responsible for all clean-up resulting from site erosion and soil tracking. Tracking must be removed by the end of each work day. Erosion control structures shall be in place prior to any land-disturbing activities. Maintaining erosion control structures, site clean-up, and re-evaluation of the erosion plan shall be done on a regular basis, particularly after any storm water event.

See attached development plans for graphical representation of the erosion control plan.

Stormwater Pollution Prevention- General Permit

If the project requires that a General Permit be obtained by the Arizona State Department of Ecology or EPA, an application package with all related and subsequent requirements may be acquired by contacting the Engineer of Record. The forms and requirements outline in the package are also available on the Scottsdale City website.

CONCLUSIONS

Runoff from developed conditions was compared against the runoff rates modeled for existing conditions. The analysis shows that, with the addition of the proposed detention vault, runoff from all analyzed areas under developed conditions, will be retained during the analyzed storm events when compared to existing conditions. The property outfall location will remain the same.

Warning and Disclaimer of Liability

For this preliminary, conceptual, design we have shown that is feasible to control the stormwater runoff on site and meet the city requirements for discharge into their system. We do not recommend the stormwater facilities be built without further engineering and design and full approval from the city.

References

The site plan has been analyzed using Atlas 14, volume 1 rainfall rates and soils information provided by onsite inspection. The City of Scottsdale 2018 DSPM has been used for this submittal.

Please feel free to contact Joe Hassell P.E. at 208-777-1854 with any questions or comments regarding this SWMP.

NOAA Atlas 14, Volume 1, Version 5
Location name: Scottsdale, Arizona, USA*
Latitude: 33.4897°, Longitude: -111.9299°
Elevation: 1253.07 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_&_aerials

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	0.183 (0.154-0.223)	0.240 (0.202-0.291)	0.326 (0.273-0.395)	0.392 (0.326-0.472)	0.481 (0.394-0.577)	0.550 (0.444-0.657)	0.620 (0.492-0.739)	0.692 (0.540-0.824)	0.788 (0.598-0.940)	0.862 (0.641-1.03)
10-min	0.279 (0.234-0.339)	0.364 (0.307-0.443)	0.495 (0.415-0.600)	0.596 (0.496-0.719)	0.732 (0.599-0.878)	0.837 (0.676-1.00)	0.944 (0.748-1.12)	1.05 (0.821-1.25)	1.20 (0.911-1.43)	1.31 (0.976-1.57)
15-min	0.345 (0.290-0.420)	0.452 (0.381-0.549)	0.614 (0.514-0.744)	0.739 (0.614-0.891)	0.907 (0.743-1.09)	1.04 (0.838-1.24)	1.17 (0.928-1.39)	1.31 (1.02-1.55)	1.49 (1.13-1.77)	1.63 (1.21-1.94)
30-min	0.465 (0.390-0.565)	0.608 (0.513-0.740)	0.827 (0.692-1.00)	0.995 (0.827-1.20)	1.22 (1.00-1.47)	1.40 (1.13-1.67)	1.58 (1.25-1.88)	1.76 (1.37-2.09)	2.00 (1.52-2.39)	2.19 (1.63-2.61)
60-min	0.575 (0.483-0.700)	0.753 (0.635-0.915)	1.02 (0.857-1.24)	1.23 (1.02-1.49)	1.51 (1.24-1.82)	1.73 (1.40-2.07)	1.95 (1.55-2.32)	2.18 (1.70-2.59)	2.48 (1.88-2.95)	2.71 (2.02-3.24)
2-hr	0.666 (0.569-0.795)	0.863 (0.736-1.03)	1.16 (0.983-1.37)	1.38 (1.16-1.64)	1.69 (1.40-1.99)	1.92 (1.57-2.26)	2.16 (1.75-2.54)	2.41 (1.91-2.82)	2.74 (2.12-3.21)	2.99 (2.27-3.54)
3-hr	0.724 (0.614-0.870)	0.929 (0.793-1.12)	1.22 (1.04-1.47)	1.45 (1.22-1.74)	1.78 (1.47-2.11)	2.04 (1.66-2.41)	2.31 (1.85-2.73)	2.59 (2.04-3.06)	2.98 (2.28-3.52)	3.29 (2.46-3.91)
6-hr	0.873 (0.756-1.03)	1.11 (0.962-1.30)	1.42 (1.23-1.66)	1.67 (1.43-1.95)	2.01 (1.70-2.33)	2.28 (1.90-2.63)	2.56 (2.10-2.95)	2.84 (2.28-3.28)	3.23 (2.53-3.74)	3.53 (2.71-4.11)
12-hr	0.977 (0.855-1.13)	1.23 (1.08-1.44)	1.57 (1.36-1.81)	1.82 (1.58-2.11)	2.17 (1.86-2.50)	2.44 (2.07-2.81)	2.72 (2.27-3.13)	3.00 (2.47-3.45)	3.37 (2.71-3.91)	3.67 (2.89-4.28)
24-hr	1.17 (1.05-1.32)	1.49 (1.33-1.68)	1.93 (1.72-2.18)	2.28 (2.02-2.56)	2.76 (2.43-3.11)	3.14 (2.75-3.53)	3.54 (3.08-3.97)	3.95 (3.41-4.44)	4.53 (3.86-5.08)	4.98 (4.20-5.60)
2-day	1.26 (1.13-1.43)	1.62 (1.44-1.82)	2.12 (1.89-2.39)	2.53 (2.24-2.84)	3.09 (2.73-3.47)	3.54 (3.11-3.98)	4.02 (3.50-4.52)	4.51 (3.90-5.08)	5.21 (4.45-5.87)	5.76 (4.88-6.51)
3-day	1.34 (1.19-1.51)	1.71 (1.52-1.93)	2.25 (2.00-2.53)	2.69 (2.38-3.02)	3.30 (2.91-3.70)	3.79 (3.32-4.25)	4.32 (3.75-4.84)	4.87 (4.20-5.47)	5.64 (4.80-6.34)	6.26 (5.28-7.06)
4-day	1.41 (1.25-1.59)	1.80 (1.60-2.04)	2.38 (2.11-2.68)	2.85 (2.52-3.20)	3.51 (3.08-3.94)	4.04 (3.53-4.53)	4.61 (4.00-5.17)	5.22 (4.49-5.86)	6.07 (5.16-6.82)	6.77 (5.69-7.61)
7-day	1.57 (1.39-1.77)	2.00 (1.78-2.26)	2.64 (2.34-2.98)	3.16 (2.80-3.56)	3.90 (3.43-4.38)	4.49 (3.92-5.04)	5.12 (4.44-5.75)	5.79 (4.98-6.51)	6.73 (5.72-7.57)	7.49 (6.30-8.45)
10-day	1.70 (1.51-1.92)	2.18 (1.94-2.45)	2.87 (2.55-3.23)	3.44 (3.04-3.86)	4.22 (3.71-4.73)	4.85 (4.24-5.43)	5.52 (4.79-6.18)	6.22 (5.36-6.98)	7.21 (6.14-8.08)	8.00 (6.74-8.99)
20-day	2.09 (1.87-2.34)	2.69 (2.40-3.01)	3.55 (3.17-3.97)	4.20 (3.74-4.69)	5.08 (4.50-5.67)	5.76 (5.08-6.42)	6.44 (5.65-7.19)	7.14 (6.23-7.98)	8.08 (6.99-9.05)	8.81 (7.56-9.88)
30-day	2.44 (2.17-2.74)	3.14 (2.80-3.52)	4.14 (3.68-4.63)	4.90 (4.35-5.47)	5.92 (5.23-6.60)	6.70 (5.89-7.47)	7.51 (6.57-8.36)	8.32 (7.25-9.27)	9.42 (8.14-10.5)	10.3 (8.81-11.5)
45-day	2.83 (2.53-3.16)	3.64 (3.26-4.07)	4.80 (4.29-5.36)	5.66 (5.04-6.32)	6.78 (6.02-7.57)	7.63 (6.76-8.52)	8.49 (7.49-9.49)	9.35 (8.21-10.5)	10.5 (9.13-11.8)	11.3 (9.82-12.7)
60-day	3.13 (2.81-3.49)	4.04 (3.63-4.51)	5.32 (4.76-5.92)	6.24 (5.58-6.95)	7.45 (6.64-8.29)	8.34 (7.41-9.29)	9.24 (8.17-10.3)	10.1 (8.91-11.3)	11.3 (9.87-12.6)	12.1 (10.6-13.6)

[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.

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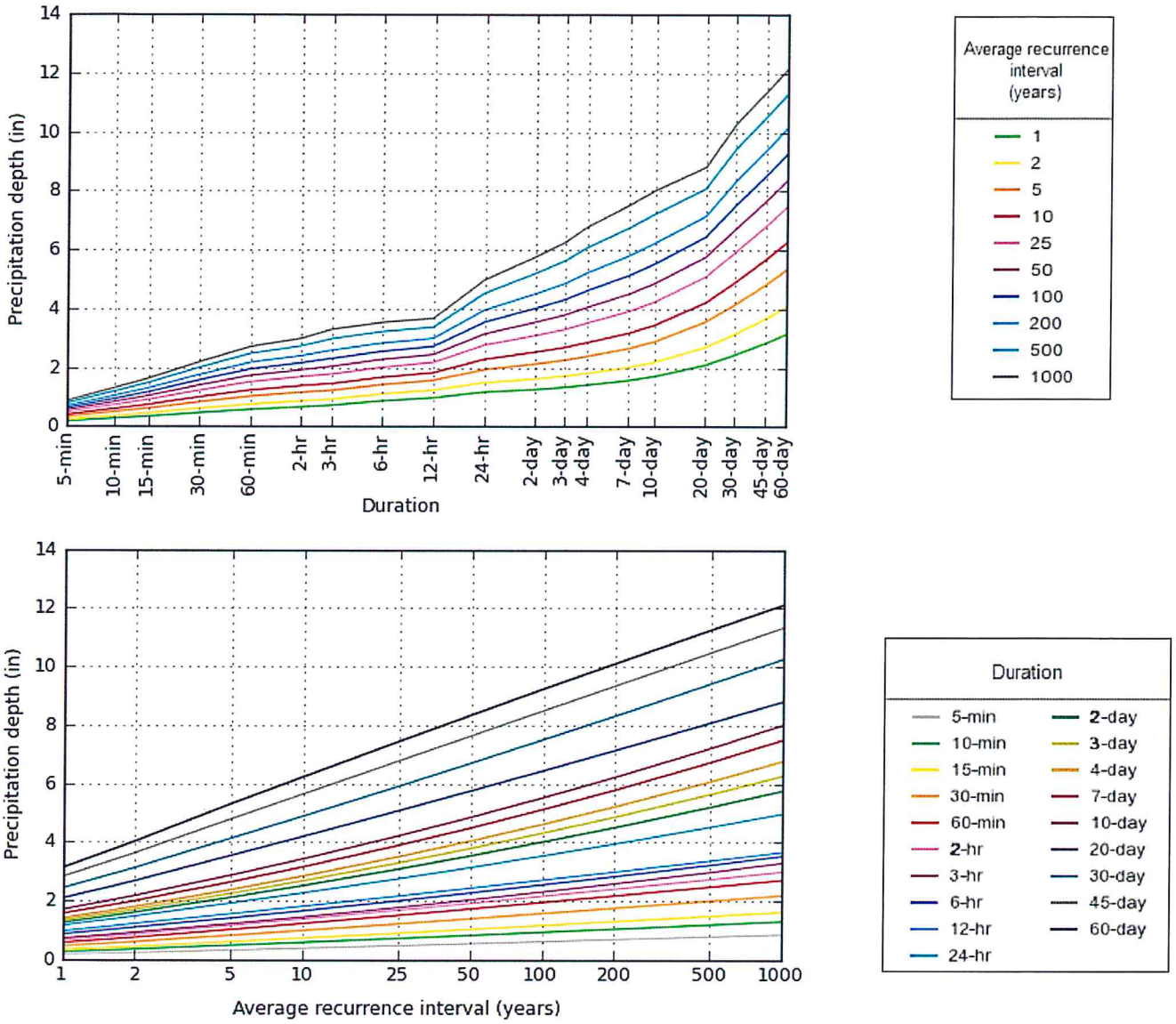
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 33.4897°, Longitude: -111.9299°



NOAA Atlas 14, Volume 1, Version 5

Created (GMT): Fri Nov 2 16:49:47 2018

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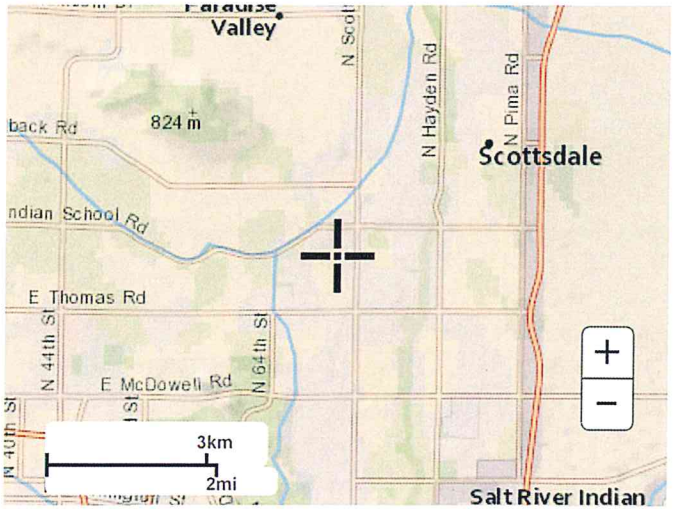
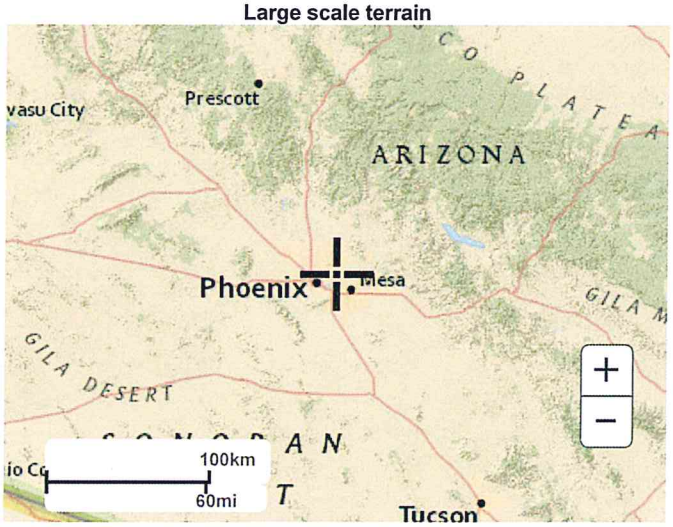
Maps & aerials

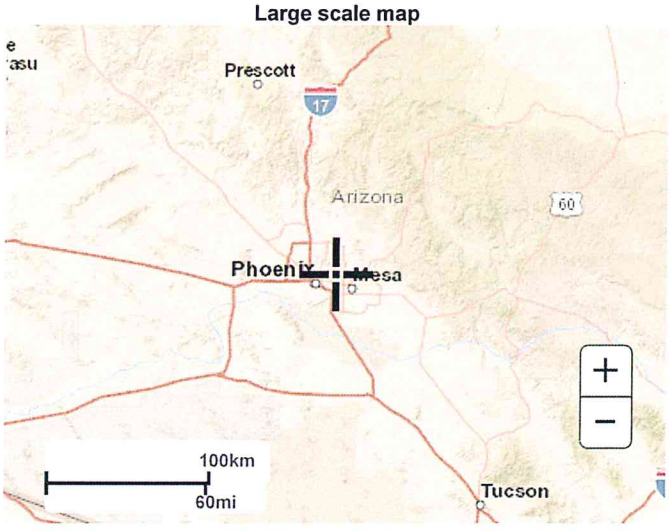
Small scale terrain



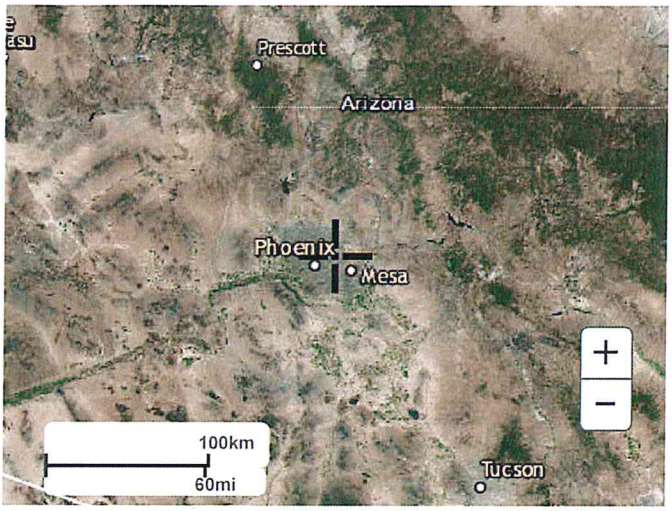
Large scale terrain



Large scale map



Large scale aerial



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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

Entire building area basin 1
Preliminary

Two Year Storm Event

Rational Method Determine historical flows

Pre-Developed Condition

Area (acres)	1.24
Pre-Developed "C" Factor	0.68
Time Increment (min)	5.00
Design Storm Intensity (in/hr)	3.31
Pre-Developed Outflow (c.f.s.)	2.78
Time Increment (min)	11.11

Developed Condition

Design Storm Intensity (2 hr) (in/hr)	0.86
# of 600 Gallon Dry Wells	0
# of 1000 Gallon Dry Wells	0
Post-Developed Outflow (cfs)	1.00
Design Year Flow (yr)	2.00
Area (acres)	1.24
Developed "C" Factor	0.73
Area x "C"	0.91
Soil infiltration rate (in/hr)	0.00

Flow Calcs:

Qout	0.00	CFS
$Q_{DRYWELL}$	0.00	CFS

Pre-Development:
Tributary Area:

Description:	Area (ft^2)	Area (Ac.)	CN	Runoff Coefficients
Grass	0.00	0.00	50	0.2
Gravel	53,852.00	1.24	76	0.68
Pavement	0.00	0.00	98	0.9
Trees/Brush	0.00	0.00	36	0.2
0	0.00	0.00	0	0
Totals:	53,852.00	1.24	76	0.68

CN values not used with the rational method
Runoff Coefficients from DSPM

Post-Development:
Tributary Area:

Description:	Area (ft^2)	Area (Ac.)	CN	Runoff Coefficients
Asphalt Pavement	2,886.00	0.07	98	0.9
Buildings/atrium	38,174.00	0.88	98	0.9
Grass/Lawn	12,792.00	0.29	50	0.2
Gravel	0.00	0.00	76	0.95
0	0.00	0.00	0	0
0	0.00	0.00	0	0
0	0.00	0.00	0	0
Totals:	53,852.00	1.24	87	0.73

Impervious Area:
Tributary Area:

Description:	Area (ft^2)	Area (Ac.)
Asphalt	0.00	0.07
Buildings	38,174.00	0.88
Grass	0.00	0
Totals:	41,060.00	0.94

Storm Attenuation: Vr = C(R/12)A

Stormwater Detention Basin Area (ft^2)	775
Detention Basin Depth (ft)	10
Detention Basin Storage Volume (ft^3)	7750

Pre-Developed Flow (cfs)	2.78	
Post-Developed Flow (cfs)	1.00	
Required Storage Volume (ft^3)	2842	} Capacity is Adequate
Storage Volume (ft^3)	7750	

provide minimum detention vault size to hold 7750 cf for maximum 100 yr storm event

Entire building area basin 1
Preliminary

Ten Year Storm Event

Rational Method Determine historical flows

Pre-Developed Condition

Area (acres)	1.24
Pre-Developed "C" Factor	0.68
Time Increment (min)	5.00
Design Storm Intensity (in/hr)	5.85
Pre-Developed Outflow (c.f.s.)	4.92

Developed Condition

Design Storm Intensity (2 hr) (in/hr)	1.38
# of 600 Gallon Dry Wells	0
# of 1000 Gallon Dry Wells	0
Post-Developed Outflow (cfs)	1.00
Design Year Flow (yr)	10.00
Area (acres)	1.24
Developed "C" Factor	0.73
Area x "C"	0.91
Soil infiltration rate (in/hr)	0.00

Flow Calcs:

Qout	0.00	CFS
$Q_{DRYWELL}$	0.00	CFS

Qout is outfall to city maximum allowed

Pre-Development:
Tributary Area:

Description:	Area (ft^2)	Area (Ac.)	CN	Runoff Coefficients
Grass	0.00	0.00	50	0.2
Gravel	53,852.00	1.24	76	0.68
Pavement	0.00	0.00	98	0.9
Trees/Brush	0.00	0.00	36	0.2
0	0.00	0.00	0	0
Totals:	53,852.00	1.24	76	0.68

CN values not used with the rational method
Runoff Coefficients from DSPM

Post-Development:
Tributary Area:

Description:	Area (ft^2)	Area (Ac.)	CN	Runoff Coefficients
Asphalt Pavement	2,886.00	0.07	98	0.9
Buildings/atrium	38,174.00	0.88	98	0.9
Grass/Lawn	12,792.00	0.29	50	0.2
Gravel	0.00	0.00	76	0.95
0	0.00	0.00	0	0
0	0.00	0.00	0	0
0	0.00	0.00	0	0
Totals:	53,852.00	1.24	87	0.73

Impervious Area:
Tributary Area:

Description:	Area (ft^2)	Area (Ac.)
Asphalt	2,886.00	0.07
Buildings	38,174.00	0.88
Grass	0.00	0
Totals:	43,946.00	1.01

Storm Attenuation: $Vr = C(R/12)A$

Stormwater Detention Basin Area (ft^2)	775
Detention Basin Depth (ft)	10
Detention Basin Storage Volume (ft^3)	7750

Pre-Developed Flow (cfs)	4.92
Post-Developed Flow (cfs)	1.00
Required Storage Volume (ft^3)	4544
Storage Volume (ft^3)	7750

} Capacity is Adequate

provide minimum detention vault size to hold 7750 cf for maximum 100 yr storm event

Entire building area basin 1
Preliminary

Twenty Five Year Storm Event

Rational Method Determine historical flows

Pre-Developed Condition

Area (acres)	1.24
Pre-Developed "C" Factor	0.68
Time Increment (min)	5.00
Design Storm Intensity (in/hr)	6.68
Pre-Developed Outflow (c.f.s.)	5.62
Time Increment (min)	11.11

Developed Condition

Design Storm Intensity (2hr) (in/hr)	1.69
# of 600 Gallon Dry Wells	0
# of 1000 Gallon Dry Wells	0
Post-Developed Outflow (cfs)	1.00
Design Year Flow (yr)	25.00
Area (acres)	1.24
Developed "C" Factor	0.73
Area x "C"	0.91
Soil infiltration rate (in/hr)	0.04

Flow Calcs:

Qout	0.00	CFS
$Q_{DRYWELL}$	0.00	CFS

Pre-Development:
Tributary Area:

Description:	Area (ft^2)	Area (Ac.)	CN	Runoff Coefficients
Grass	0.00	0.00	50	0.2
Gravel	53,852.00	1.24	76	0.68
Pavement	0.00	0.00	98	0.9
Trees/Brush	0.00	0.00	36	0.2
0	0.00	0.00	0	0
Totals:	53,852.00	1.24	76	0.68

CN values not used with the rational method
Runoff Coefficients from DSPM

Post-Development:
Tributary Area:

Description:	Area (ft^2)	Area (Ac.)	CN	Runoff Coefficients
Asphalt Pavement	2,886.00	0.07	98	0.9
Buildings/atrium	38,174.00	0.88	98	0.9
Grass/Lawn	12,792.00	0.29	50	0.2
Gravel	0.00	0.00	76	0.55
0	0.00	0.00	0	0
0	0.00	0.00	0	0
0	0.00	0.00	0	0
Totals:	53,852.00	1.24	87	0.73

Impervious Area:
Tributary Area:

Description:	Area (ft^2)	Area (Ac.)
Asphalt	2,886.00	0.07
Buildings	38,174.00	0.88
Grass	0.00	0
Totals:	43,946.00	1.01

Storm Attenuation: $Vr = C(R/12)A$

Stormwater Detention Basin Area (ft^2)	775
Detention Basin Depth (ft)	10
Detention Basin Storage Volume (ft^3)	7750

Pre-Developed Flow (cfs)	5.62
Post-Developed Flow (cfs)	1.00
Required Storage Volume (ft^3)	5565
Storage Volume (ft^3)	7750

} Capacity is Adequate

provide minimum detention vault size to hold 7750 cf for maximum 100 yr storm event

Entire building area basin 1
Preliminary

One Hundred Year Storm Event

Rational Method Determine historical flows

Pre-Developed Condition

Area (acres)	1.24
Pre-Developed "C" Factor	0.82
Time Increment (min)	5.00
Design Storm Intensity (in/hr)	8.30
Pre-Developed Outflow (c.f.s.)	8.41

Developed Condition

Design Storm Intensity (2hr) (in/hr)	2.16
# of 600 Gallon Dry Wells	0
# of 1000 Gallon Dry Wells	0
Post-Developed Outflow (cfs)	1.00
Design Year Flow (yr)	100.00
Area (acres)	1.24
Developed "C" Factor	0.80
Area x "C"	0.98
Soil infiltration rate (in/hr)	0.04

Flow Calcs:

Qout	0.00	CFS
$Q_{DRYWELL}$	0.00	CFS

Pre-Development:
Tributary Area:

Description:	Area (ft^2)	Area (Ac.)	CN	Runoff Coefficients
Grass	0.00	0.00	50	0.2
Gravel	53,852.00	1.24	76	0.82
Pavement	0.00	0.00	98	0.9
Trees/Brush	0.00	0.00	36	0.2
0	0.00	0.00	0	0
Totals:	53,852.00	1.24	76	0.82

CN values not used with the rational method

Post-Development:
Tributary Area:

Description:	Area (ft^2)	Area (Ac.)	CN	Runoff Coefficients
Asphalt Pavement	2,886.00	0.07	98	0.95
Buildings/atrium	38,174.00	0.88	98	0.95
Grass/Lawn	12,792.00	0.29	50	0.3
Gravel	0.00	0.00	76	0.82
0	0.00	0.00	0	0
0	0.00	0.00	0	0
0	0.00	0.00	0	0
Totals:	53,852.00	1.24	87	0.80

Impervious Area:
Tributary Area:

Description:	Area (ft^2)	Area (Ac.)
Asphalt	2,886.00	0.07
Buildings	38,174.00	0.88
Grass	0.00	0
Totals:	43,946.00	1.01

Storm Attenuation: $Vr = C(R/12)A$

Stormwater Detention Basin Area (ft^2)	775
Detention Basin Depth (ft)	10
Detention Basin Storage Volume (ft^3)	7750

Pre-Developed Flow (cfs)	8.41
Post-Developed Flow (cfs)	1.00
Required Storage Volume (ft^3)	7712
Storage Volume (ft^3)	7750

} Capacity is Adequate

provide minimum detention vault size to hold 7750 cf for maximum 100 yr storm event

Entire building area basin 1
Preliminary

One Hundred Year Storm Event

DSPM Chapter 4, Section -1.201.C. Storage facilities volume

Pre-Developed Condition

Area (square feet)	53,852
Pre-Developed "C" Factor	0.82
Design Storm Intensity (in/hr)	2.16
Pre-Developed Outflow (c.f.s.)	2.19
Time Increment (min)	11.11

Developed Condition

Time Increment (min)	2 hr	
Design Storm Intensity (in/hr)	2.16	R
Post-Developed Outflow (cfs)	0.00	
Design Year Flow (yr)	100.00	
Area (sq. ft)	53,852	A
Developed "C" Factor	0.80	C
Soil infiltration rate (in/hr)	0.00	

Flow Calcs:

Qout	0.00	CFS
$Q_{DRYWELL}$	0.00	CFS

Storm Attenuation: Vr = C(R/12)A

Required Storage Volume (ft^3)	7712
Storage Volume (ft^3)	7750

} Capacity is Adequate

provide minimum detention vault size to hold 7750 cf for maximum 100 yr storm event