Drainage Reports

CAVASSON

LOCATED NEAR THE SOUTHWEST CORNER OF NORTH HAYDEN ROAD AND EAST LEGACY BOULEVARD

PRELIMINARY DRAINAGE REPORT- CAVASSON RETAIL

Basis of Design

Stormwater Review By:
Nerijus Baronas, PE
Phone 480-312-7072 Fax 480-312-9187
E-mail: nbaronas@ScottsdaleAZ.gov
Review Cycle #1 Date 3/2/20

November 1, 2019

Project No.: 18114-503

PREPARED FOR:

NATIONWIDE REALTY INVESTORS
375 N. FRONT STREET
COLUMBUS, OH 43215
(614) 221-2012

PREPARED BY:

HUBBARD ENGINEERING
1201 S. ALMA SCHOOL ROAD, SUITE 12000
MESA, AZ 85210
(480) 892-3313
MICHAEL S. WOLF, PE

HUBBARD ENGINEERING

TABLE OF CONTENTS

FIGURES

APPENDICES

EXHIBITS

1. INTRODUCTION

1.1 Project Scope

This report presents the results of a *Final Drainage Study* conducted by Hubbard Engineering at the request of Nationwide Realty Investors ("client"), for The Cavasson Retail of the Cavasson master development ("site"). The purpose of this report is to provide a hydrologic evaluation for the site as required for Design Review through the City of Scottsdale per the City of Scottsdale Ordinances 4346 and 4347. This report addresses off-site and on-site conditions as well as storm water runoff storage requirements for the Hayden Road improvements. Drainage calculations and methodologies conform to the City of Scottsdale requirements and standards and to Hubbard Engineering's submitted *Master Drainage Report* for the Cavasson development.

This report is focused on providing practical design information, evaluation, and calculations for statistical flood events up to and including the 100-year frequency flood. The procedures used herein are derived from and performed with currently accepted engineering methodologies and practices. Additionally, the criteria for this evaluation are designed to conform to currently applicable ordinances, regulations and policies affected by the appropriate jurisdictional regulatory authorities for the site.

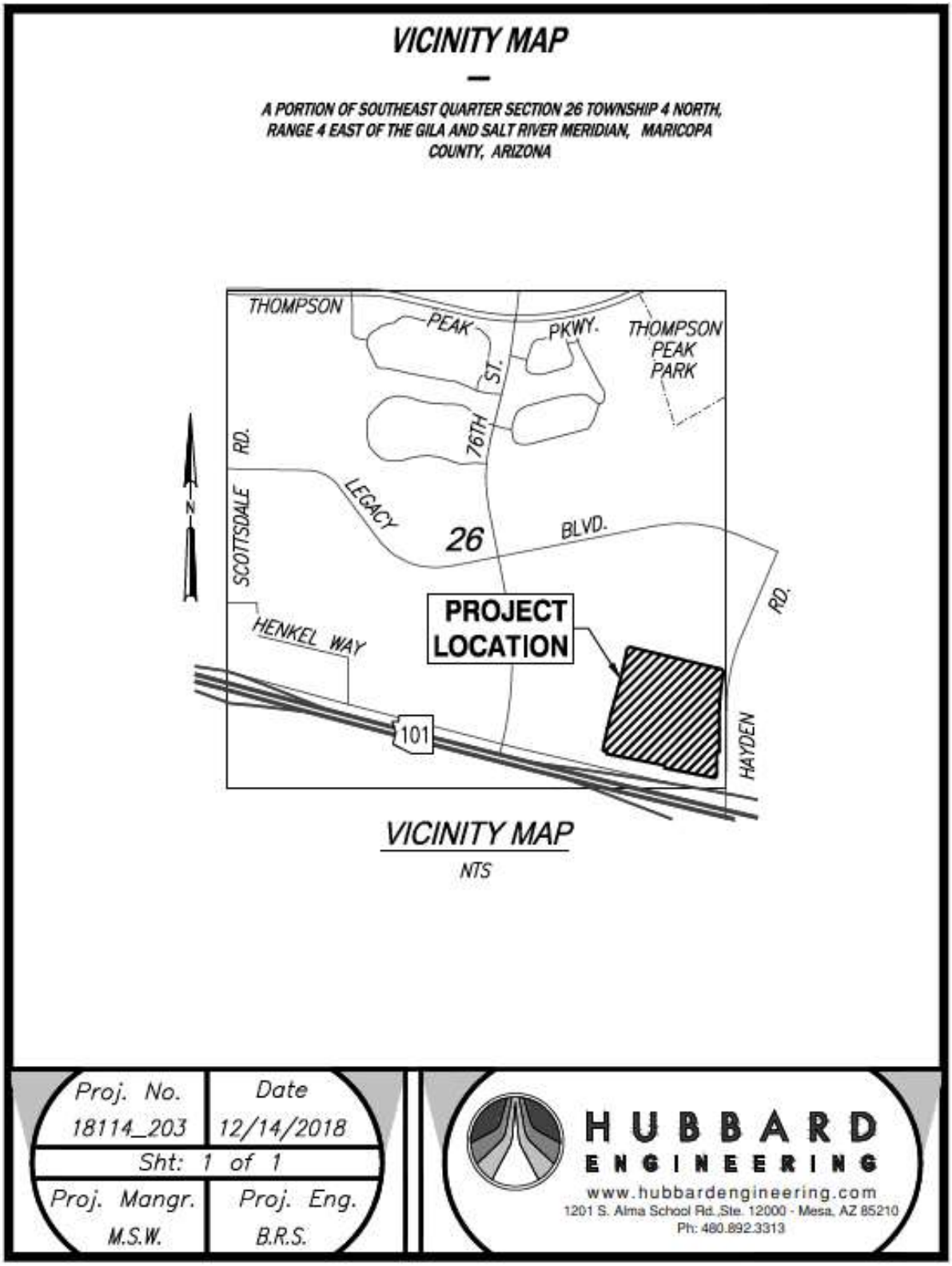
The analysis presented herein focuses on developing design estimates of storm water runoff resulting from a statistical evaluation of storm events of a particular duration and frequency, up to and including a 100-year frequency event. A storm event exceeding the 100-year frequency event may cause or create the risk of greater flood impact than is addressed and presented herein. The scope of this assessment does not include evaluation of storm water runoff resulting from storm events exceeding the 100-year frequency event. Hubbard assumes no responsibility for actual flood damage, increased risks of flood damage, or increased construction or development costs resulting from or related to any such events. Nor shall Hubbard be responsible for any changes in, or additions to, regulatory requirements which may result from, or be related to, any such events or changes in hydrologic or hydraulic conditions within the watershed.

1.2 Site Description

The site is located in the southeast quarter of Section 26, Township 4N, Range 4E of the Gila and Salt River Base and Meridian, Maricopa County, Arizona. The site is currently undeveloped, and prior to Nationwide Reality Investor's acquisition, was held in trust by the Arizona State Land Department (ASLD) as a portion of the overall Crossroads East development, which encompasses approximately 883 gross acres. The topography of the undeveloped land shows an alluvial fan, indicating a significant amount of surface water is conveyed over the land. Phase I of the Cavasson site development is in the southwest corner of the overall development, near the Hayden Road and Loop 101 frontage 101 intersection. The land naturally falls northeast to southwest. The site is located within the Zone AO (1' Depth) flood zone.

Phase I of Cavasson is bounded by the Loop 101 Freeway to the south, North Hayden Road to the east, and undeveloped land to the west and north. The site location is shown in **Figure 1.1** on the *Vicinity Map*. The Retail is specifically located in the northeast corner of the site.

Figure 1.1 – Vicinity Map



1.3 Project Type

The Cavasson development is being developed by Nationwide Reality Investors as a master planned mixed use development with office, retail, hotels, and multifamily residential parcels with public and private roadways that run adjacent and through the development. The Phase I Retail of the improvements includes construction of a new 14,000 sf retail building. Improvements will include surrounding access drives and utilities through the property to provide domestic water, fire, and sewer services to the proposed building and garage. The analyses of pre-development and post-development peak discharges were addressed in Hubbard's *Master Drainage Report* and will be referenced and further discussed as it applies to the Phase I improvements.

1.4 Special Conditions- 404 Washes

Located throughout the project site are waters of the United States 404 washes. The handling of the 404 washes will be coordinated with engineering consultants and the City of Scottsdale as the project develops. The Section 404 Certification form will be completed by consultants. As discussed in the *Master Drainage Report*, a Hubbard has met with the Army Corps of Engineer (USACE) and is currently working with consultants and the Corps to complete a mitigation plan. Approval of the 404 permit was granted on April 2, 2019. That permit number is SPL-2018-00704. ADEQ has issued the 401 permit.

1.5 Regulatory Criteria

The criterion used in the drainage design and analysis of the site was established using the guidelines as described in the following:

- City of Scottsdale, *Design Standards & Policies Manual*, January 18, 2018.
- City of Scottsdale, *Ordinance No. 4346,* June 17, 2018.
- *Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology*.
- *Drainage Design Manual for Maricopa County, Arizona, Volume II, Hydraulics*.

2. EXISTING DRAINAGE CONDITIONS

2.1 Existing Off-Site Conditions Characteristics

Development in the surrounding area has increased in the last decade and many of the surrounding properties which sit in the Reata Pass basin, part of the Pinnacle Peak South Area, have installed infrastructure to route the offsite flows through their developments. As-built plans for the developments show that channels and culverts have been constructed to divert and route off-site flows. Historical runoff for the areas on and surrounding the project site flow south towards collections points (i.e. existing culverts) where the off-site storm runoff is ultimately conveyed to the TPC golf course just north of the Central Arizona Project canal. Existing culverts located at the edges of Hayden Road are currently utilized to route off-site runoff. Off-site routing for the developed surrounding areas has been verified with their corresponding as-builts, including Hayden Road Improvement Plans, 76th Street & Infrastructure Design, Center Drive (now Legacy Boulevard) Improvements, and One Scottsdale Civic Center Improvement Plans.

Hubbard Engineering completed a *Master Drainage Report* which included an extensive analysis of the off-site flow conditions affecting the entire Crossroads East area, including Cavasson and Hayden Road, for the existing site and proposed development. Results from the study indicate that the storm event affecting Hayden Road is a 100-year, 6-hour storm event. Since the submittal of the *Master Drainage Report,* Hubbard has met with the City of Scottsdale and the developers south of the Cavasson development. It was determined in the meeting that the HEC-1 models be adjusted to reflect a time interval of 15 minutes rather than 3 minutes, as was originally modeled in TY Lin's report. The flows affecting Hayden Road will be discussed in section 3.1. Details on Hubbard's HEC-1 methodology and analyses, in addition to the modeling results, can be referenced in the approved *Cavasson Master Drainage Report* dated December 18, 2018.

2.2 On-site Drainage

As the Cavasson project site is currently undeveloped, there are no on-site drainage structures. The project site was included in two previous studies, Bob Ward's *Core North/ Core South Drainage Study* and TY Lin's *Pinnacle Peak South Area Drainage Master Study.* The TY Lin report analyzed the Crossroads East area and included FLO2d models combined with HEC-1 analyses on localized basins. The TY Lin report provided a basis on which Hubbard completed its hydrologic studies for the Cavasson project development.

The project site naturally falls from north to south at approximately 1.2% and approximately 0.7% east to west. There is currently no ultimate outfall.

2.2.1 HEC-1 Analysis

The TY-Lin *Pinnacle Peak South Area Drainage Master Study* report provides an analysis of the entire Pinnacle Peak South Area, which covers an approximate area of 40 square miles. According to the report, the project site is located within the Dobson Wash Watershed, which includes inflow from the southwestern flow split of the Reata Pass Wash. Hubbard replicated TY-Lin's model in application to the approximate nine square miles including and surrounding the project site and included the inflow hydrographs from TY Lin's Master Drainage study to account

for run-off affecting the project site from the 76th Street Channel and the Powerline for both the 100-year, 6-hour and 100-year, 24-hour storm events. Data collected for the model includes the precipitation, soil, and land use for the existing site conditions in application to the delineated sub-basins. All data Hubbard obtained and used in the model was compared to the existing TY Lin model for accuracy and adjusted accordingly based on current site conditions at maximum densities per approved zoning cases. Precipitation data was obtained from the NOAA Atlas 14 precipitation database. The map index used in DDMSW is 64, cells 687-689. Existing soil data was obtained from the United States Department of Agriculture's Natural Resources Conservation Service. Additionally, land use data was determined based on current zoning of the project site.

Hubbard has met with the City of Scottsdale and the developers south of the Cavasson development in order to coordinate the analyses for the Crossroads East development. It was determined in the meeting that the HEC-1 models be adjusted to reflect a time interval of 15 minutes rather than 3 minutes, as was originally modeled in TY Lin's report. Thus, the inflow hydrographs provided by TY Lin were convoluted to accurately represent this change in time interval resulting in more accurate time to peak values. In addition, it was also decided in the meeting that Hubbard's analysis for the existing, proposed, and ultimate conditions will be used by developers south of Hayden Road. Hubbard's sub-basin delineation deviates from TY Lin's analysis in that Hubbard added collection points at existing culverts along Legacy Boulevard and Hayden road to model the peak flows coming through each infrastructure for utilization in routing design. Additionally, detailed analysis of the existing topography and as-builts along Hayden road and Legacy Boulevard revealed that the basins were not segmented by Hayden Road or Legacy Boulevard, in the TY Lin Report. These larger basins were subdivided in the Hubbard analysis and a similar naming convention was used to compare baseline flows.

Hubbard's analysis split the original TY Lin sub-basins 7 and 8 into east and west components to more accurately model the conveyance of the flows on either side of Hayden Road. An additional basin, SB09N was also added per the city's request as this was not included in the TY Lin analysis. In Hubbard's routing, flows from SB07E and SB08E are routed east, following the topography. Since the TY-Lin model does not delineate a SB-08W, the TY-Lin model shows the flow from SB08 flowing from the southwest corner of the basin east across Hayden Road. This analysis is not correct considering that the eastern elevation is approximately 20 feet higher than the western elevation (CP-08 in TY-Lin's exhibit). This routing also neglects the flow being conveyed across the Loop 101 from SB07W and SB08W. Hubbard therefore routed the flow from SB07W and SB08W to the existing ADOT culvert along Frontage road and across the Loop 101, thus affecting the developments south of the Loop 101, a condition not represented in the TY-Lin report.

In TY-Lin's analysis, the 100-year, 24-hour storm event controlled for the entire area, with the 100-year, 6-hour storm event controlling the localized flows. TY-Lin recommended the creation of the Powerline Channel to intercept and route the 100-year, 24-hour flows to Basin 53R. Since it was determined in meetings with the City of Scottsdale that the channel will be built during construction of the Cavasson development, Hubbard's existing model includes this channel. The Existing 100-year, 6-hour flows prior to the offsite channel being constructed were 196 cfs entering the site and an Existing condition 100-Year, 6-hour discharge exiting the site at the Loop 101 of 740 cfs. With the addition of the channel and routing to Basin 53R, a significant amount of flow is being diverted from the affected study area to Basin 53R. The addition of the channel results in higher peak flows for the Crossroads East development from the 100-year, 6-hour storm event rather than the 100-year, 24-hour storm.

In addition to the existing model post-channel and proposed model, Hubbard completed an ultimate condition model considering the surrounding lots will be developed. In the model, this was represented by increasing the imperviousness of SB01-B, SB01-C, and SB07W to reflect maximum assumed densities per the zoning stipulations pertinent to the Cavasson development and Cross Roads East approved zoning cases.

2.3 Flood Zone Information

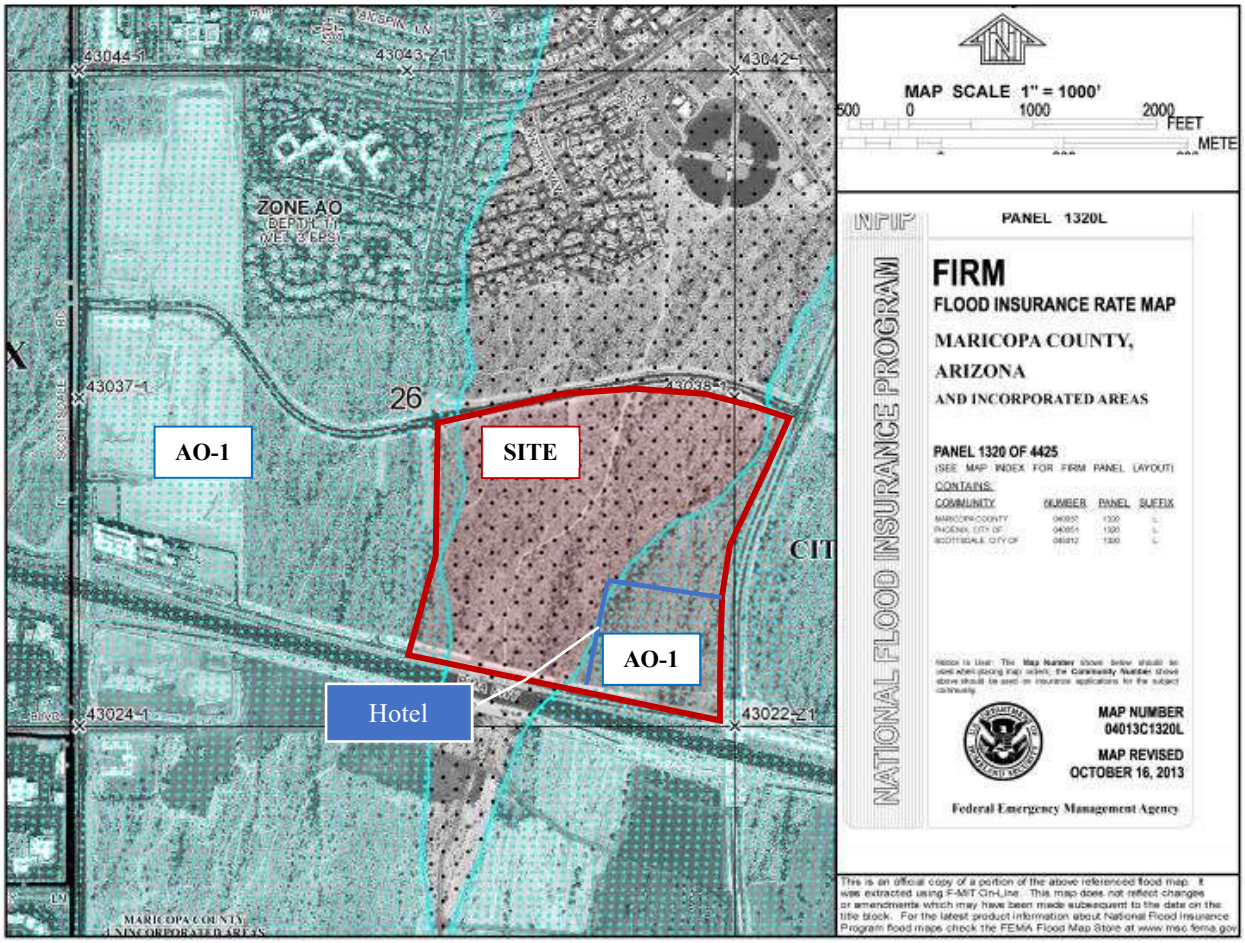
The Maricopa County, Arizona and Incorporated Areas Flood Insurance Rate Map (F.I.R.M.) number 04013C1320L, Panel number 1320 of 4425, dated October 16, 2013 indicates that Phase I falls within Zone AO (Depth 1 foot).

Zone AO is defined as:

"*Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet. Average flood depths derived from detailed hydraulic analyses are shown in this zone. Mandatory flood insurance purchase requirements and floodplain management standards apply.*"

Refer to FEMA Firmette in **Figure 2.1.**

Figure 2.1 – FIRM 04013C1320L



3. PROPOSED DRAINAGE PLAN

3.1 Off-Site Flows

Off-site flows for the site were analyzed and addressed in Hubbard's *Master Drainage Report.* The historical *existing conditions* discharge from the site at the Loop 101 were *740 cfs* for the 100-Year, 6-hour event. Results from the analysis show that after the powerline Channel is constructed 62 cfs is currently being conveyed across Legacy from the existing box culvert located at the Legacy Boulevard and Hayden Road intersection. According to the original analysis results for the existing site conditions, an additional 54 cfs is shown to be crossing Hayden Road through two 30-inch pipe culverts, approximately 695 feet north of the Hayden Road and Loop 101 Frontage Road intersection. However, upon inspection of the culverts after major storm events, it was noted from the accumulated sediment at the culvert entrance and the sandy wash bottoms of the flow paths that the velocity of the flow is too great to exit through these culverts and that the flow instead conveys southeast via an existing channel toward Basin 53R. Hubbard thus proposes filling the existing 30" culverts with concrete. Therefore, the total flow exiting the Cavasson site pre-development, and post-Powerline Channel is *193 cfs*. Since Hayden Road will be widening, the existing channel will be moved nine feet, at most, to the east to accommodate the new road. The channel capacity and overall routing will otherwise remain unchanged. Post development, the flow exiting the site is 82 cfs after the first flush detention is taken into account. Developers downstream of this collection point and the City of Scottsdale have been notified of the flow affecting their project developments and will coordinate their analyses and results based on Hubbard's results. Capacity calculations for the existing culverts were completed and addressed in Hubbard's *Master Drainage Report*.

A channel was designed on the west side of Hayden Road along the eastern edge of the Cavasson development to convey the flow originating from north of Legacy Boulevard (SB07W), through proposed culverts under each proposed driveway coming off Hayden Road, and to the existing culverts along the Loop 101. The proposed culverts are single barreled 36-inch pipes. Calculations for the proposed culverts can be found in the Hayden Rd. Final Drainage Report.

With the proposed Cavasson Blvd. and Claret Dr. alignments, all off-site water from the north will be collected into culverts and storm drain pipe in order to mitigate the 100-yr 6-hr impacts to Phase 1. A portion of the undeveloped property north of Cavasson Blvd, along with a portion of Cavasson Blvd and all of Claret Dr. will be collected in a 36" storm drain and directed to a first flush retention basin at the southwest of Phase 1 where it ultimately outfalls to an existing culvert crossing to the south of the US 101. As a part of the Phase 1 development, this roadway first flush retention has been provided on-site in 10' CMP retention.

3.2 On-Site Hydraulics

The storm event affecting the site was determined to be a 100-year, 6-hour storm, as discussed in Hubbard's *Master Drainage Report.* The Phase 1 Retail will include the installation of the retail building in the north-east corner of the site as well as the private road along the frontage.

See **Exhibit 1** for the drainage map. The flows from the building roof and surrounding areas will drain directly into the existing channel located to the east of the site. This channel will convey the storm water run-off to the first flush retention at the south end of Phase 1. The greater storm events will outfall into the existing culvert at the US 101. Details about the channel can be found in the Phase 1 Drainage Basis of Design Report. The remaining flow will enter the existing storm

drain network for Phase 1 by sheet flowing into the existing inlets. These inlets were previously sized in order to accept the full flow from this site. In this way, the site will ultimately drain to the existing retention tanks located to the south of Phase 1. The greater storm events will outfall into the existing culvert at the US 101. Details about the channel can be found in the Phase 1 Drainage Basis of Design Report.

3.3 Storm Water Storage

The project development is required to provide detention for the first flush storm event. The required first flush volume determined for each drainage area site will be designed per City of Scottsdale *Drainage Policies & Standards for Maricopa County, Arizona* (Reference 1). 750 lf of 10' CMP that was built with phase one will provide the required 2,026 cf of first flush retention. The tanks were initially designed to account for 2,233 cf of first flush retention from the site. The first flush calculations can be found in **Appendix A**. The calculations are based on the ultimate build-out of Phase 1.

3.3.1 Time to Drain

Each site will be required to dewater the required storm water detention through natural percolation and/or drywells. The City of Scottsdale allows each drywell to dissipate 43,560 cubic feet in the 36-hour period for each drywell installed. All drywells will be dual chamber drywell systems to meet both environmental and dissipation criteria. The overall first flush retention for the complete build out of the parcel will be 5 drywells which were constructed with Phase 1. See **Appendix A** for drywell calculations.

4. SUMMARY AND CONCLUSION

- The site is located in Section 26 of Township 4N, Range 4E of the Gila and Salt River Base and Meridian, Maricopa County, Arizona.
- The site is located in the Flood Plain Zone AO-1.
- The Finish Floor Elevations of the proposed buildings meet the requirement of 2 feet higher than the natural grade (HAG).
- The storm event affecting the site was modeled as a 100-yr, 6-hour event in Hubbard's *Master Drainage Report*.
- All off-site drainage has been mitigated through the improvements of Hayden Rd., and the construction of Cavasson Blvd. and Claret Dr.
- The site will be required to provide retention for the first flush storm event.
- 750 lf of 10' CMP retention will provide 58,875 cf of retention, for the required retention of 58,336 cf that includes the roadway drainage.

5. REFERENCES

1) City of Scottsdale. *Drainage Policies & Standards for Maricopa County, Arizona.* January 18, 2018.

2) Flood Control District of Maricopa County. *Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology*. November 2003.

3) Flood Control District of Maricopa County. *Drainage Design Manual for Maricopa County, Arizona, Volume II, Hydraulics*. November 2003.

4) City of Scottsdale. *Ordinance No. 4346.* June 17, 2018.

5) TY Lin, *Pinnacle Peak South Area Drainage Master Study,* 2014.

6) City of Scottsdale, *Ordinance No. 4346,* June 17, 2018.

6. LIMITATIONS

This report is focused on providing practical design information, evaluation, and calculations for statistical flood events up to and including the 100-year frequency flood. The procedures used herein are derived from, and performed with, currently accepted engineering methodologies and practices. Additionally, the criteria for this evaluation is designed to conform to currently applicable ordinances, regulations and policies effected by the appropriate jurisdictional regulatory authorities for the site.

The analysis presented herein focuses on developing design estimates of storm water runoff resulting from a statistical evaluation of storm events of particular duration and frequency up to and including a 100-year frequency event. A storm event exceeding the 100-year frequency event may cause or create the risk of greater flood impact than is addressed and presented herein. However, the scope of this assessment does not include evaluation of storm water runoff resulting from storm events exceeding the 100-year frequency event. Hubbard Engineering assumes no responsibility for actual flood damage, increased risks of flood damage, or increased construction or development cost resulting from or related to any such events.

Nor shall Hubbard Engineering be responsible for any changes in, or additions to, regulatory requirements which may result from, or be related to, any such events or changes in hydrologic or hydraulic conditions within the watershed.

In performing the services contained herein, Hubbard Engineering has received or will receive information prepared or compiled by others. Hubbard Engineering, as engineering professionals, are not required to verify the information, but may rely on the information unless actual knowledge concerning the validity of the information is known or is obvious to the professional. Therefore, Hubbard Engineering is entitled to rely upon the accuracy and completeness of this information without independent evaluation or verification.

Appendix A
Hydrology Calculations
Cavasson-Retail

HYRDRAULIC CALCULATION SHEET
RETENTION BASIN DRAIN TIME CALCULATIONS
HUBBARD ENGINEERING
PROJECT NO.18114-203

Project Name: Cavasson- Phase I

Prepared By: SDH **Date:** 5/20/2019
Revised By: **Date:**

Purpose: Calculate the number of drywells required to facilitate drainage of the required volume within 36 hours.

Methodology: Calculate the number of drywells necessary to drain the retention basin and undeground storage tanks within 36 hours.

Criteria: 1. The combination of natural infiltration and drywell drainage capacity must discharge the retention volume provided within 36 hours.
2. Percolation rates obtained were by Speedie and Associates Double Ring Infiltrometer percolation Test, 08/18/17.

References: 1.Design Standards & Policies Manual, City of Scottsdale, January 2017

Number of Drywells Required = V_{DW}/ (Drywell Infiltration Rate * 3600 * 36 hours)
Drywell Infiltration Rate = 0.1 [cfs] (*Reference 1*)

Results:
Percolation Rate= 0.062 [$ft^3/hr/ft^2$] *(Location to south of site)*
Percolation Rate= 0.083 [$ft^3/hr/ft^2$] *(Location to west of site)*

Infiltration Drainage Capacity Calculations

Identifiers Retention Basin ID	Volume Provided [ft^3]	Bottom Area [ft^2]	Percolation Rate Test Location	Percolation Rate [$ft^3/hr/ft^2$]^2	Infiltration Drain Capacity [ft^3]	V_{DW} [ft^3]	Drain Time *w/ Surface infiltration* [hrs]	Drain Time *w/ No Surface infiltration* [hrs]
RB-01	58337	0	na	0	0	58336.58	0.0	32.4

Identifiers Retention Basin ID	Number of Drywells Required
RB-01	5

Conclusions: The number of dywells computed is sufficient to discharge the provided volume within 36 hours.

6-DR-2020
2/6/2020

HYDRAULIC CALCULATION SHEET
Retention Calculations
Hubbard Engineering
Project No. 18114-301

Project Name: Cavasson Hotel | **Prepared by:** TSW | **Date:** 06/11/19
Project No.: 18114-301 | **Revised By:** | **Date:**

Purpose: Evaluate the required and provided retention volumes in order to assess conformance to project criteria.

Methodology: Calculate the volume of stormwater required to be retained using City of Scottsdale criteria. Calculate the estimated volume of stormwater retained using retention basin geometry.

Criteria: Retain the calculated stormwater run-off for the 100-YEAR 2-HOUR duration storm event.

References: 1. Town of Gilbert Public Works And Engineering Standards, September 21,2015

Calculations: Volume Required = $C_{Composite}$ *D/12* A [ft^3] (Reference 1)

D = 0.5 [in] (Reference 1)
C = 0.90 (Paved Parking) (Reference 1)

Composite C= (C1*A1 + C2*A2…+….)/(A1+A2+….)

Volume Required = Composite C*P/12*A

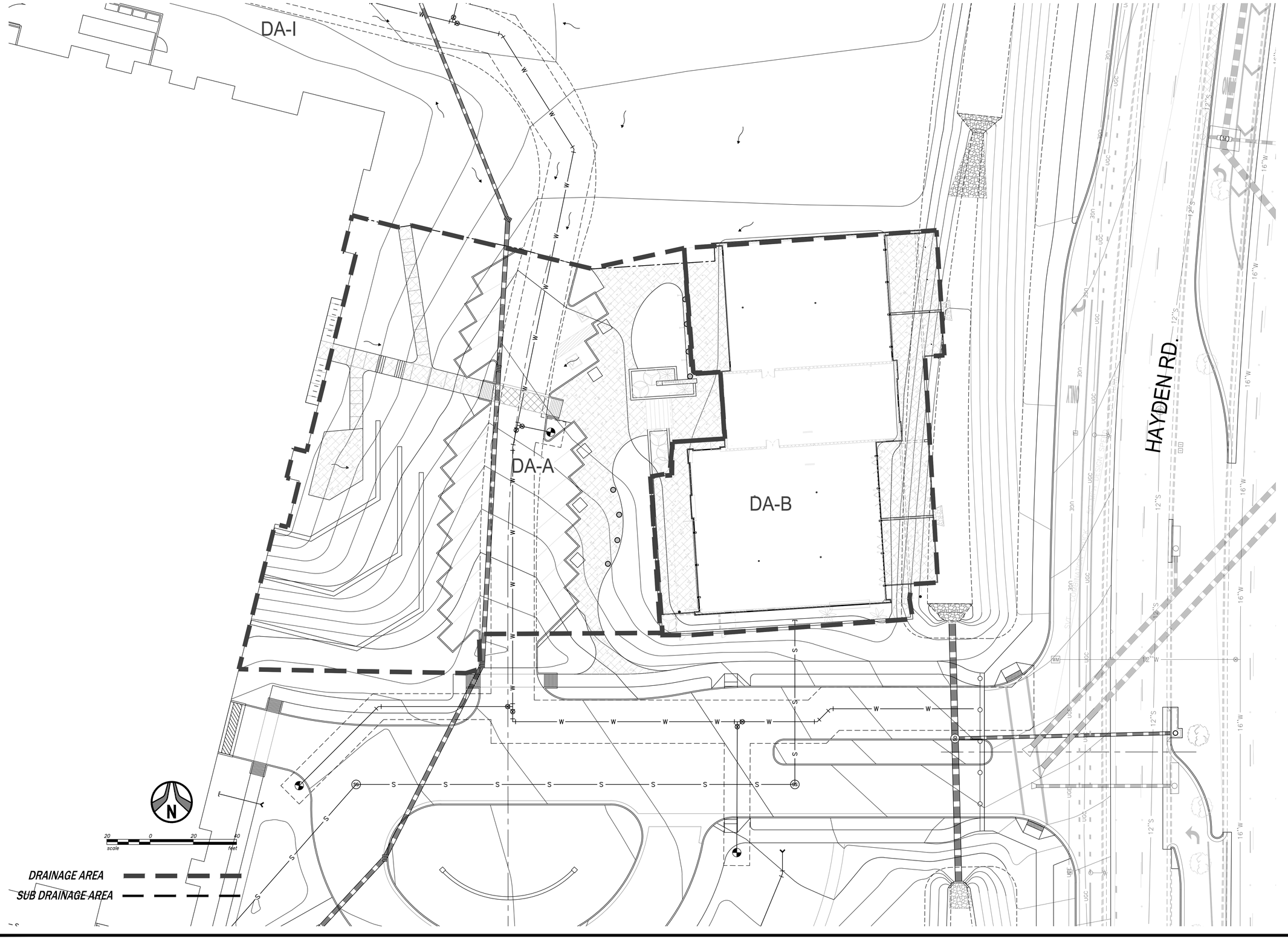
Results:

Identifiers	CALCULATE RETENTION VOLUME REQUIRED		Volume Required		
Contributory Area ID	Area [acres]	C	[acre-ft]	[ft^3]	[yd^3]
DA-A	0.76	0.90	0.03	1,240	46
DA-B	0.48	0.90	0.02	787	29
Total Area:	**1.24**	**TOTAL VOLUME REQUIRED:**	**0.05**	**2,026.59**	**75.06**

6-DR-2020
2/6/2020

Exhibits
Cavasson-Retail

CAVASSON HOTEL DRAINAGE EXHIBIT



HUBBARD ENGINEERING
1201 S. Alma School Rd.
Suite 12000
Mesa, AZ 85210
Ph: 480.892.3313
www.hubbardengineering.com

DRAINAGE AREA MAP

CAVASSON HOTEL

A PORTION OF THE SOUTHEAST QUARTER OF SECTION 26
TOWNSHIP 2 NORTH, RANGE 4 EAST OF THE GILA AND SALT RIVER
MERIDIAN, MARICOPA COUNTY, ARIZONA

Date 09/30/2019	Project Eng. G. BROWN
Project No. 18114-301	Project Mgr. M.S.W.

Call before you dig.
1.800.STAKE.IT
602.263.1100

P:\2018\18114\Design-Reports\18114-503\Drainage\Preliminr\Drainage\Sub 1\Civil3d\18114-301-DRAINAGEEXHIBIT.dwg Oct 30, 2019 - 1:20pm TWolf