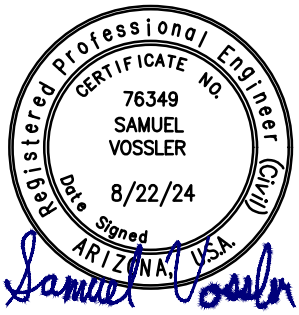
Villas on Shelby
2250 Shelby Drive
Sedona, AZ 86336

Preliminary Drainage Report



Date: August 22, 2024

Prepared for: **HS Development Partners, LLC**
Matt Shoemacher
30 South Oak St
London, Ohio 43140
P: 216-406-3683

Prepared By: **Burgess & Niple, Inc.**
Sam Vossler PE
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Flagstaff, Arizona 86001
P: 928-395-1988

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List of Appendices

100 GENERAL LOCATION AND DESCRIPTION

100.1 Location

The Villas on Shelby (Project) is located at 2250 Shelby Drive in Sedona, Arizona APN 408-28-103F *(see **Figure 1** below and Vicinity Map on the Drainage Map in **Appendix C**)*. More specifically the Project is on Lot 1 Within AAA Industrial Park subdivision located in Section 14, Township 17 North, Range 5 East Gila and Salt River Meridian, Yavapai County, Arizona. The property is currently owned by the City of Sedona and is proposed to be developed by HS Development Partners LLC. Access to the property is located along Shelby Drive which is located within 45-foot-wide City of Sedona right-of-way. Caroll Canyon Wash (CCW) is located on the north and west property lines. The current project zoning is IN (Light Industrial) and all surrounding developments fall into that use, with the exception of the Sunset Park parcel which borders the project on the north.

Figure 1 – Project Parcel Map

100.2 Description of Property

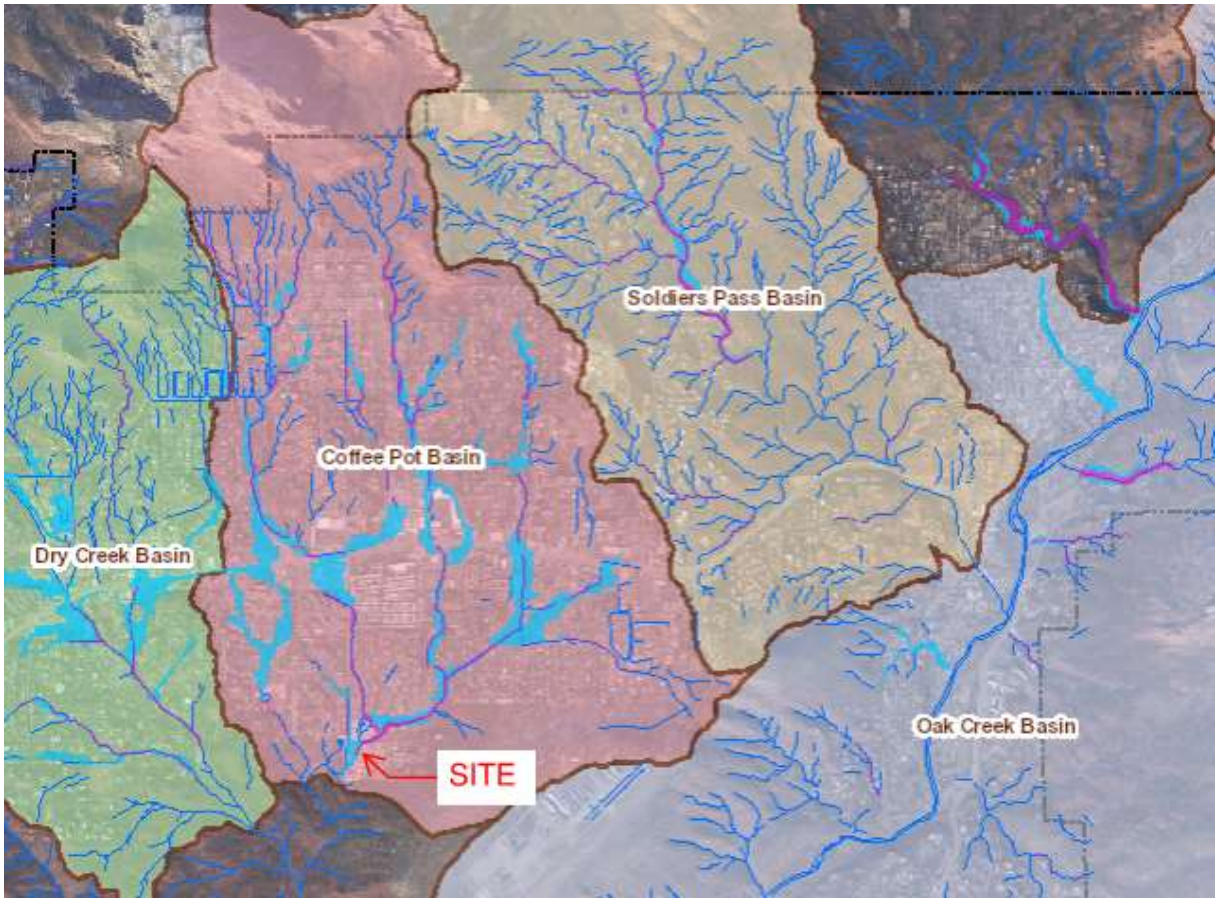
The parcel is 1.1+/- acres and is currently undeveloped and being used for storage and parking. Ground cover consists of aggregate base placed in the parking lot area with native grasses and trees lining the channel slopes of CCW located along the north and west property lines. The soils on site consist of clays and sands sitting on a layer of sandstone 4 to 7 feet below the surface. The project slopes mild to moderately steep from the northeast to the southwest ultimately draining to a large triple box culvert under Shelby Drive. The portion of CCW adjacent to the property is mapped as City of Sedona Regulated Flood Zone and delineated as Floodway and 500-year floodplain. There are no FEMA regulated Special Flood Hazard Zones on the property. The Project will include development of the property as a 30-unit affordable multi-family housing complex. The project will also include bank stabilization improvements along CCW.

200 DRAINAGE BASINS AND SUB-BASINS

200.1 Major Basin Description - Offsite

The Site is located adjacent to the major drainage way Carrol Canyon Wash (CCW) which collects most of the drainage area from the approximately 2.73 square mile Coffee Pot Basin *(see **Figure 2** below)*. The City of Sedona *2022 Storm Water Master Plan Update 2022* (2022 Master Plan) by JE Fuller provides the most recent and complete drainage analysis of this drainageway. The 2022 Master Plan hydrology for CCW will be used for this Project, most notably the 2,986 cubic feet per a second 100-year peak flow rate determined directly upstream of the Site (*Reference Map F6 from study in **Appendix C**).* No additional analysis for offsite hydrology in regard to CCW will be completed as part of this Report. It should be noted that previous studies such as "Flood Plain Management Study of City of Sedona – Main Report" completed by USDA SCS, dated 1994 yielded a peak flow rate as high as 4,225 cubic feet per second. The former smaller number will still be selected for use in designing channel improvements. The upstream areas of this basin are already developed or currently Coconino National Forest Land and so any land use change from current zoning can be expected to have a negligible impact on the wash peak flow rates.

Figure 2 – Coffee Pot Basin



200.2 Sub-Basin Description - Onsite

For onsite drainage design the Project site can be defined as a single sub-basin with an outfall in the southwest corner into the existing box culvert as is in the existing condition. Topographic field survey information was provided by Sunrise Engineering and Surveying collected in May of 2024. The topography shows a drainage pattern from northeast to southwest. Composite runoff 'C' coefficients were calculated from different values selected from the Drainage Design Manual for Yavapai County (DDMYC). The pre-development composite 'C' was determined using a combination of Compacted Gravel (GR) and Undeveloped Desert (NDR). The post-development composite 'C' was determined using a combination of Pavement and Rooftops (P) and Desert Landscaping 2 (L2). To better define the sub-basin, the area of analysis excluded the channel area and the existing public shared use path (*See **Appendix C** for pre and post drainage maps*). A time of concentration of 5 minutes was selected for both pre and post conditions based on engineering judgement. The calculated composite values show a slight increase in runoff volume and peak flow rate potential. However, the increase is less than 1 cubic foot per second for all events which can be considered negligible especially when compared to the adjacent flow rate in the wash. The Project will not provide storage to mitigate the pre vs post change in peak flow rate. The Project will still provide the ½" Runoff capture retention volume per the Drainage Design Manual for Yavapai County (DDMYC).

Table 1 – Summary of 'C' Coefficients and Pre and Post Development Flow Rates

Pre 'C' Summary	Area (sf)	Gravel 'C'	Area (sf)	Undeveloped Desert (NDR) 'C'	Composite
2-Year (Q2)	36,061	0.60	8,875	0.30	0.54
10-Year (Q10)	36,061	0.65	8,875	0.35	0.59
25-Year (Q25)	36,061	0.71	8,875	0.40	0.65
100-Year (Q100)	36,061	0.81	8,875	0.44	0.74

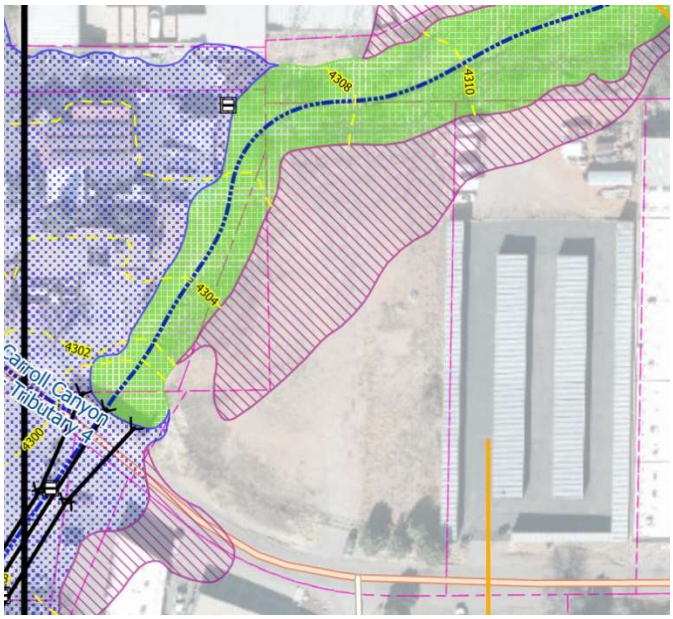
Post 'C' Summary	Area (sf)	Paved 'C'	Area (sf)	Desert Landscaped (L2) 'C'	Composite
2-Year (Q2)	3,2027	0.75	12,909	0.30	0.62
10-Year (Q10)	3,2027	0.85	12,909	0.35	0.71
25-Year (Q25)	3,2027	0.9	12,909	0.40	0.76
100-Year (Q100)	3,2027	0.95	12,909	0.44	0.80

300 DRAINAGE DESIGN CRITERIA

300.1 Regulations, Development Criteria, and Constraints

The projected is not located within a FEMA SFHA however the Project is located within a City of Sedona Regulated Floodway (green hatch) and a 500-Year Flood Plain (pink hatch) that significantly encroaches onto the site. This mapping was completed as part of the 2022 Master Plan and lists several Base Flood Elevations adjacent to the site ranging from 4300 feet near the box culvert outlet to 4310 feet at the high end of the site. By interpolating these sections an equivalent Base Flood Elevation (BFE) 4309.50 was determined and used to set an equivalent Regulatory Flood Elevation (RFE) 1-foot higher of 4310.50. This set a minimum building finished floor of 4310.50. A single finished floor elevation will be used for the Project. Additional maps showing the base flood elevations and proposed improvements can be found in Appendix C. Elevations in the Master Plan and all Project documents are based on the NAVD 88 vertical datum.

Figure 3 – Cropped Image from Master Plan Regulated Flood Zones Map: F6



300.2 Hydrologic Criteria and Results

Hydrologic design for the site was limited to calculating pre and post flow rates for the Project. Using the assumed time of concentration of 5 minutes as stated in section 200.2, the area of analysis acreage of 1.03 and rainfall intensities per DREAM, peak flow rates by design event using the rational method are listed below.

Table 2 – Summary of Pre and Post Development Flow Rates

Storm	i(in/hr)	Area (sf)	Pre 'C'	Pre (cfs)	Post 'C'	Post (cfs)	Delta
2-Year (Q2)	3.36	49658	0.54	2.07	0.62	2.38	0.3
10-Year (Q10)	5.4	49658	0.59	3.64	0.71	4.35	0.7
25-Year (Q25)	6.72	49658	0.65	4.97	0.76	5.79	0.8
100-Year (Q100)	9.12	49658	0.74	7.66	0.80	8.35	0.7

With the negligible increase in peak flow rate leaving the site, no detention will be required, other than what is provided from the first flush retention volume. The calculated First Flush Requirement follows equation 6.1 per DDMYC.

$V_{FF} = C\ (P_{FF} / 12)\ A$

$V_{FF} = 1.00\ (0.5\ in\ / 12)\ 1.03\ ac = 0.0429\ ac\text{-}ft$ or 1,872 cf

V_{FF} = Retention Volume Required = 1,872 cf

300.3 Hydraulic Criteria

Hydraulic design was generally limited to the CCW channel. Bank protection must be in conformance with Arizona State Standard SS7-98. To meet this standard, shotcrete will be placed at or below the existing channel side slope grade. Shotcrete can withstand higher velocities and requires less maintenance than rock rip-rap or gabion mattress applications. The channel improvements will decrease the side friction along the channel effectively improving channel capacity which will either reduce the current water surface elevations or having no impact on the water surface elevations. No additional HEC-RAS modeling or Flow2d modeling was completed for this project on the basis of the channel improvements will only improve drainage conveyance.

300.4 Variances

Due to the CCW velocities the use of concrete channelization is required for use on this project despite being strongly discouraged in the DREAM. The western bank of the wash adjacent to the site and the Shelby Drive Box Culvert inlet protection has already been stabilized with Sedona Red colored shotcrete. The additional Sedona Red shotcrete will not drastically change the visual aesthetic of the area.

400 DRAINAGE FACILITY DESIGN

400.1 General Concept

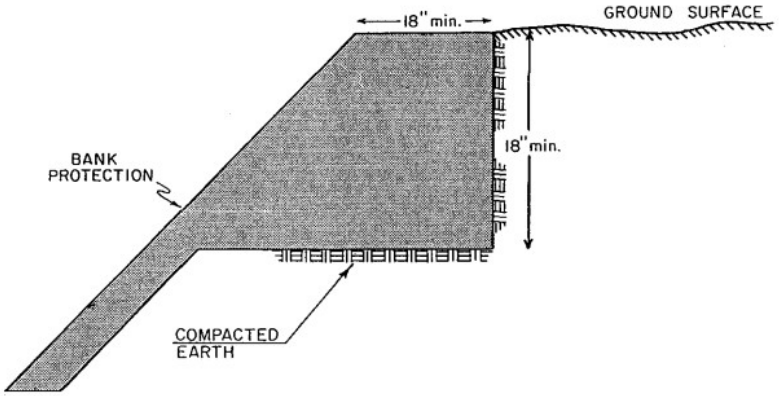
The project will maintain the existing offsite drainage flow of CCW through the outskirts of the site. The Project will provide new bank stabilization along the channel sides on the north and west property lines. The existing channel bottom consists of sandstone and will not be altered as part of the stabilization improvements. Stabilization will consist of shotcrete and the use of existing sandstone shelf where present.

Small First Flush Retention areas will be provided throughout the site to promote rain harvesting for water conservation and improved water quality from discharges leaving the Site. These areas will drain via percolation and evaporation and will be limited to depths of less than 1 foot. Overflow runoff from the retention areas and the rest of the site will ultimately end up in a new catch basin in the southwest corner of the site that will connect into an existing City storm system that quickly connects into the existing box culvert. This drainage pattern mimics the existing drainage pattern and with the additional storage and pervious areas, will have no impact on the city storm system. The catch basin will include a removable trap that will filter oils and trash.

400.2 Specific Details

The new shotcrete will be placed at a 1V:1.5H max slope maintaining existing grade after compaction of subgrade. The top of channel will require 18” minimum top of bank key-ins. Due to the existing sandstone layer maintaining the channel bottom with no erosion cut off walls will not be required where the rock is present. Instead turn downs will be drilled and anchored into the rock channel bottom. Fencing or safety rail will be installed along the channel limits of the project where steep channel slopes occur. Maintenance for the channel will be accessed most easily accessed via upstream through the Sunset Park Property. Maintenance of the channel will ultimately fall with the City of Sedona, but due to the channel design and potential for high velocities, the channel should generally be self-cleaning. The City of Sedona is the current owner of the property and is not planning on selling the property currently. Various existing drainage easements currently cover most of the wash limits.

Figure 4 – Top of Bank Key-In



500 CONCLUSION

500.1 Compliance with Standards

The Project has been designed in conformance with the DDMYC and DREAM. The Project will stabilize the CCW open channel per the Arizona State Standard 7-98. ½" First Flush Retention will be provided onsite. There are not FEMA regulated Flood Hazard Zones present on the project, but all proposed buildings and critical site infrastructure will be elevated 1' above the 100-year Based Flood Elevation as defined by the 2022 Master Plan, or flood proofed per National Flood Insurance Program (NIFP) standards. The project will provide catch basin filters that with proper maintenance will keep oils and debris from entering the wash from the parking lot.

500.2 Drainage Plan

The Project will not negatively impact the adjacent properties or drastically alter existing drainage patterns. Flooding less than one foot may occur within the project parking lot, when 100-year flow rates are exceeded in CCW. This is a condition that would already occur in the existing site condition. The proposed bank stabilization measures and grading design will ensure passage of higher flow rates without damage to buildings or utility infrastructure.

600 REFERENCES

Yavapai County. (2015). Drainage Design Manual for Yavapai County. Prescott, Arizona.

City of Sedona. (2020). Design Review, Engineering and Administrative Manual (DREAM).

JE Fuller. (2022). 2022 Storm Water Master Plan Update Phase 3 – Hydrology & Hydraulics and Floodplain Delineation Technical Support Data Notebook.

Arizona Department of Water Resources Flood Mitigation Section. (1998). Watercourse Bank Stabilization. Phoenix, Arizona.

Appendix A
Hydrologic Computations

Project:	Villas on Shelby	**Date:**	8/22/2024
Designed:	SJV		

Pre and Post Flow Rates & First Flush Calcs

Pre 'C' Summary	Area (sf)	Gravel 'C'	Area (sf)	Undeveloped Desert (NDR) 'C'	Composite
2-Year (Q2)	36061	0.60	8875	0.30	0.54
10-Year (Q10)	36061	0.65	8875	0.35	0.59
25-Year (Q25)	36061	0.71	8875	0.40	0.65
100-Year (Q100)	36061	0.81	8875	0.44	0.74

Post 'C' Summary	Area (sf)	Paved 'C'	Area (sf)	Desert Landscaped (L2) 'C'	Composite
2-Year (Q2)	32027	0.75	12909	0.30	0.62
10-Year (Q10)	32027	0.85	12909	0.35	0.71
25-Year (Q25)	32027	0.9	12909	0.40	0.76
100-Year (Q100)	32027	0.95	12909	0.44	0.80

Flow Rate Summary	i(in/hr)	Area (sf)	Pre 'C'	Pre (cfs)	Post 'C'	Post (cfs)	Delta
2-Year (Q2)	3.36	49658	0.54	2.07	0.62	2.38	0.3
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25-Year (Q25)	6.72	49658	0.65	4.97	0.76	5.79	0.8
100-Year (Q100)	9.12	49658	0.74	7.66	0.80	8.35	0.7

First Flush Volume(cf):

V = C X (D/12) X A

Where C =	1	
D=	0.5	inch
A=	44936	sf
V=	**1872**	**Volume Required (cf)**

Appendix B

Hydraulic Computations

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Jun 12 2024

Manning's Calc

Trapezoidal

Bottom Width (ft)	= 6.00
Side Slopes (z:1)	= 1.50, 1.50
Total Depth (ft)	= 8.00
Invert Elev (ft)	= 4296.00
Slope (%)	= 2.00
N-Value	= 0.025

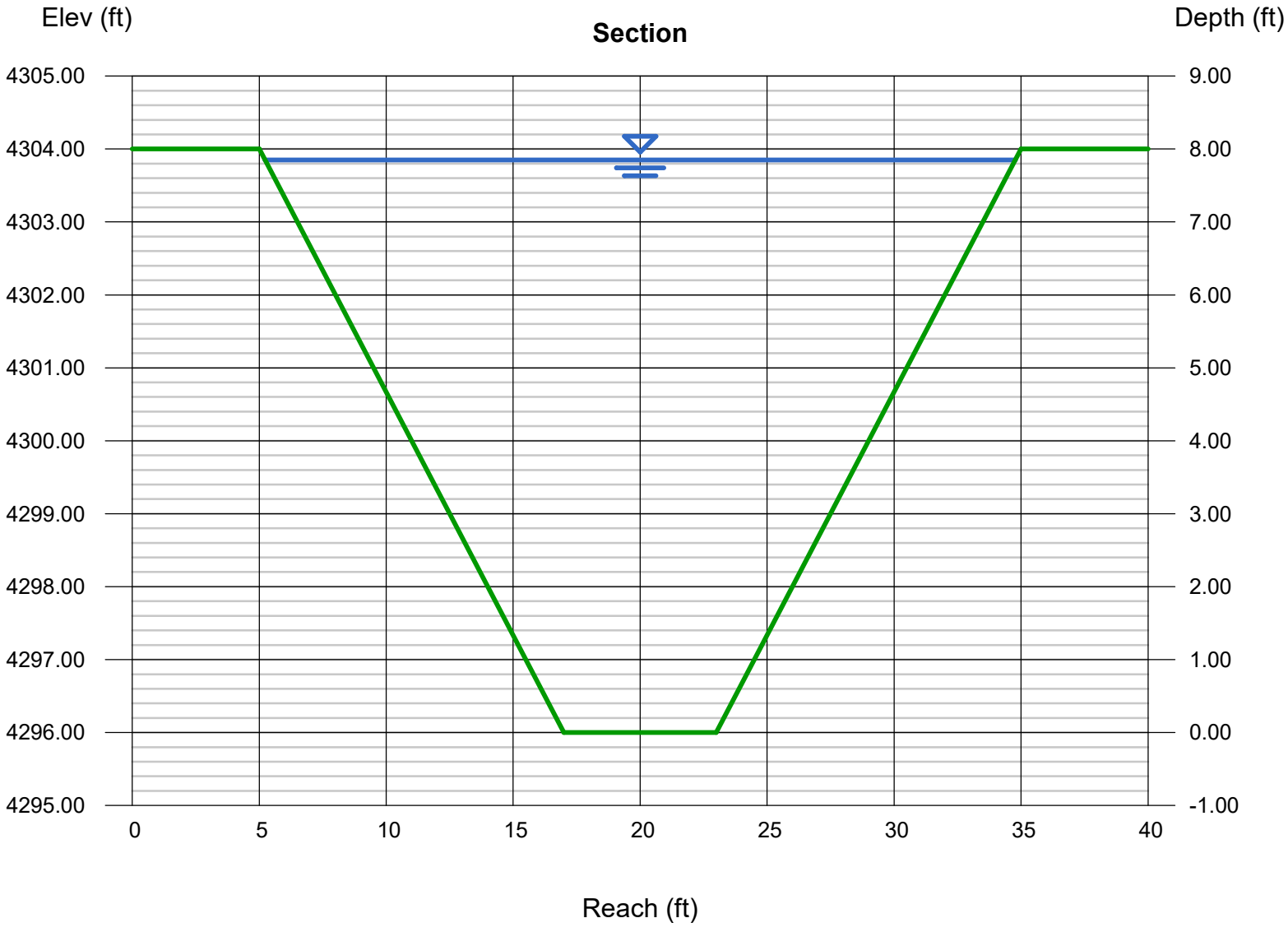
Calculations

Compute by:	Known Q
Known Q (cfs)	= 2986.00

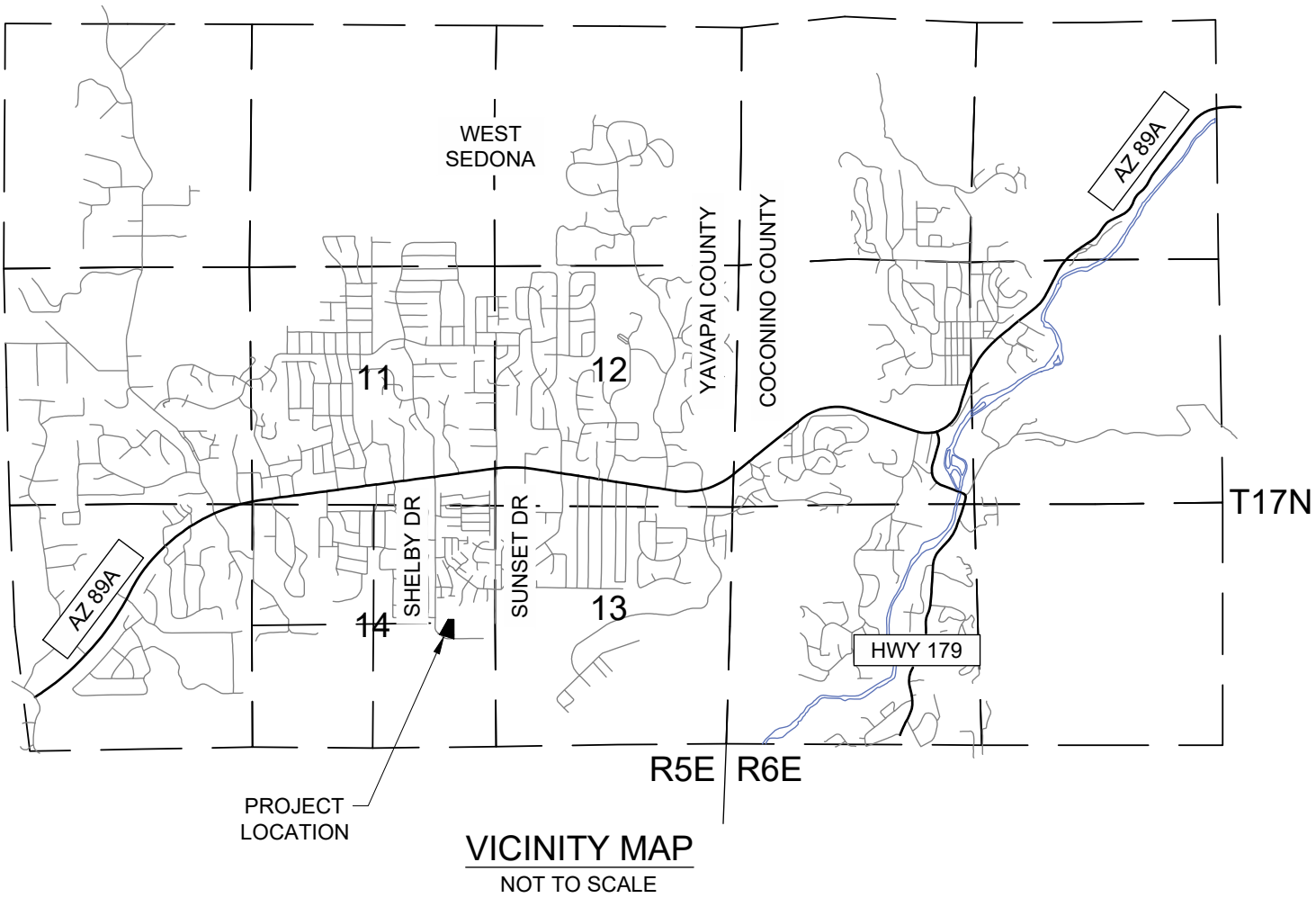
Highlighted

Depth (ft)	= 7.85
Q (cfs)	= 2,986
Area (sqft)	= 139.54
Velocity (ft/s)	= 21.40
Wetted Perim (ft)	= 34.30
Crit Depth, Yc (ft)	= 8.00
Top Width (ft)	= 29.55
EGL (ft)	= 14.97

Note: This calculation is for reference only to demonstrate an approximation of flow rate characteristics seen in the channel. Higher level HEC-RAS modeling has been completed for Carroll Canyon Wash as part of the 2022 Master Plan.

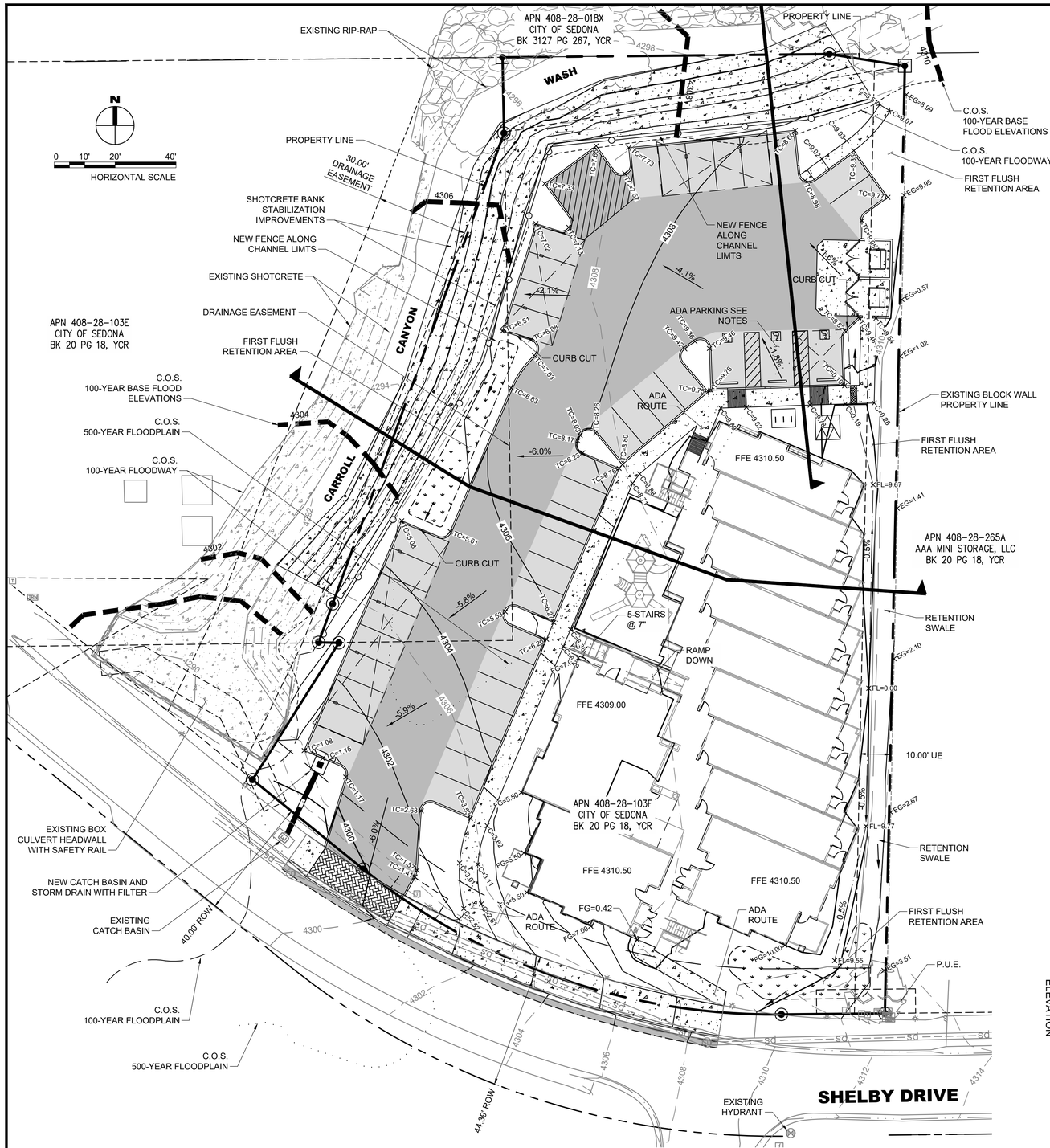


Appendix C
Maps



VICINITY MAP

NOT TO SCALE



LEGEND

× TC55.00	TOP OF CURB SPOT GRADE
× P55.00	TOP OF PAVEMENT SPOT GRADE
× FG55.0	FINISHED GROUND SPOT GRADE
× EG55.0	NATURAL GROUND SPOT GRADE
× TW555.0	TOP OF WALL SPOT GRADE
× BW555.0	BOTTOM OF WALL SPOT GRADE
× EB555.0	EXPOSED BEAM SPOT GRADE
FF = 4300.0	FINISHED FLOOR ELEVATION
	FLOW ARROW
555	PROPOSED CONTOURS
- 555 -	EXISTING CONTOURS

CURB NOTE:
PROJECT USES 4" CURB NOT STANDARD 6"

EARTHWORK NOTE:
EARTHWORK VOLUMES SHOWN ABOVE ARE BASED IN IN-PLACE VOLUMES REQUIRED FOR SITE GRADING. QUANTITIES ARE NOT ADJUSTED FOR SHRINKAGE. THESE RESULTS MAY NOT REFLECT THE FINAL CONSTRUCTED QUANTITIES. THE CONTRACTOR IS RESPONSIBLE FOR MAKING THEIR OWN QUANTITY DETERMINATIONS. ADDITIONAL EARTHWORK QUANTITIES SHALL BE CONSIDERED INCIDENTAL TO BUILDING CONSTRUCTION., ANY WASTE MATERIAL SHALL BE INCIDENTAL TO CONSTRUCTION.

CUT= 1000
FILL= 1200

SEE GEOTECHNICAL REPORT FOR REMOVAL OF UNDOCUMENTED FILL REMOVAL NOT ACCOUNTED FOR IN QUANTITIES.

STORMWATER STORAGE NOTE:
THE PROJECT DOES NOT INCREASE RUNOFF LEAVING THE SITE AND WILL NOT PROVIDE ANY DETENTION VOLUME. THE PROJECT WILL PROVIDE THE 1/2" FIRST FLUSH RETENTION VOLUME.
RETENTION VOLUME REQUIRED = 1,872 CF
RETENTION VOLUME PROVIDED = 1,900 CF

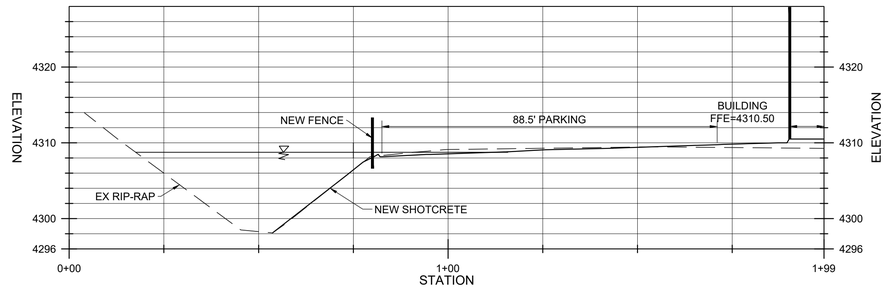
ACCESSIBLE PARKING (ADA) NOTE:
ACCESSIBLE (ADA) PARKING STALLS CONSTRUCTION, SIGNAGE AND STRIPING SHALL CONFORM TO REQUIREMENTS OUTLINED IN CITY OF SEDONA D.R.E.A.M. 3.4 C.

COORDINATE SYSTEM:
NAD83(2011) EPOCH 2010 ARIZONA CENTRAL 0202 INTERNATIONAL FEET.
COMBINED SCALE FACTOR = 1.0003007411

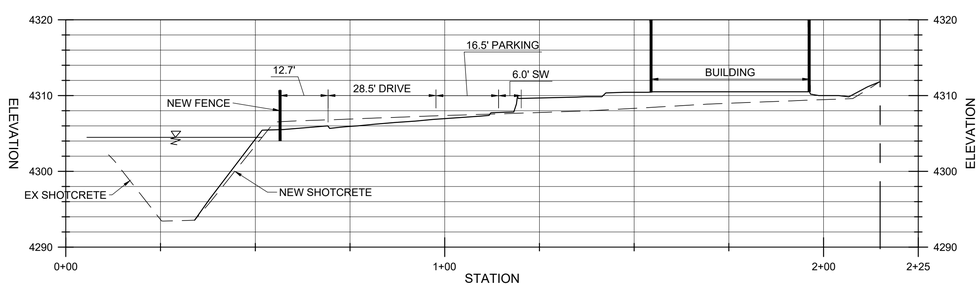
BASIS OF BEARING:
SOUTH 89°25'55" WEST ALONG THE NORTH LINE OF THE SOUTHEAST QUARTER OF SECTION 14, TOWNSHIP 17 NORTH, RANGE 5 EAST OF THE GILA AND SALT RIVER MERIDIAN, YAVAPAI COUNTY, ARIZONA, BETWEEN A 2.5" CITY OF SEDONA BRASS CAP FLUSH MARKING THE EAST QUARTER CORNER OF SAID SECTION 14 AND A 1/2" REBAR WITH RED CAP `` 26925" MARKING THE CENTER QUARTER CORNER THEREOF.

BENCHMARK:
NGS BENCHMARK
DESIGNATION: W 492
PID: ES0654
DESCRIPTION: 2.5" BRASS CAP FLUSH.
ELEVATION: 4378.76 INTERNATIONAL FOOT (NAVD88)

NORTH-SOUTH SECTION PROFILE



WEST-EAST SECTION PROFILE



NO.	REVISIONS	DATE	BY

Call at least two full working days before you begin excavation. ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

JOB:	PR62219
DATE:	AUG 2024
SCALE:	NONE
DRAWN:	JK/SJV
DESIGNED:	JK/SJV
CHECKED:	XXX

PRELIMINARY NOT FOR CONSTRUCTION

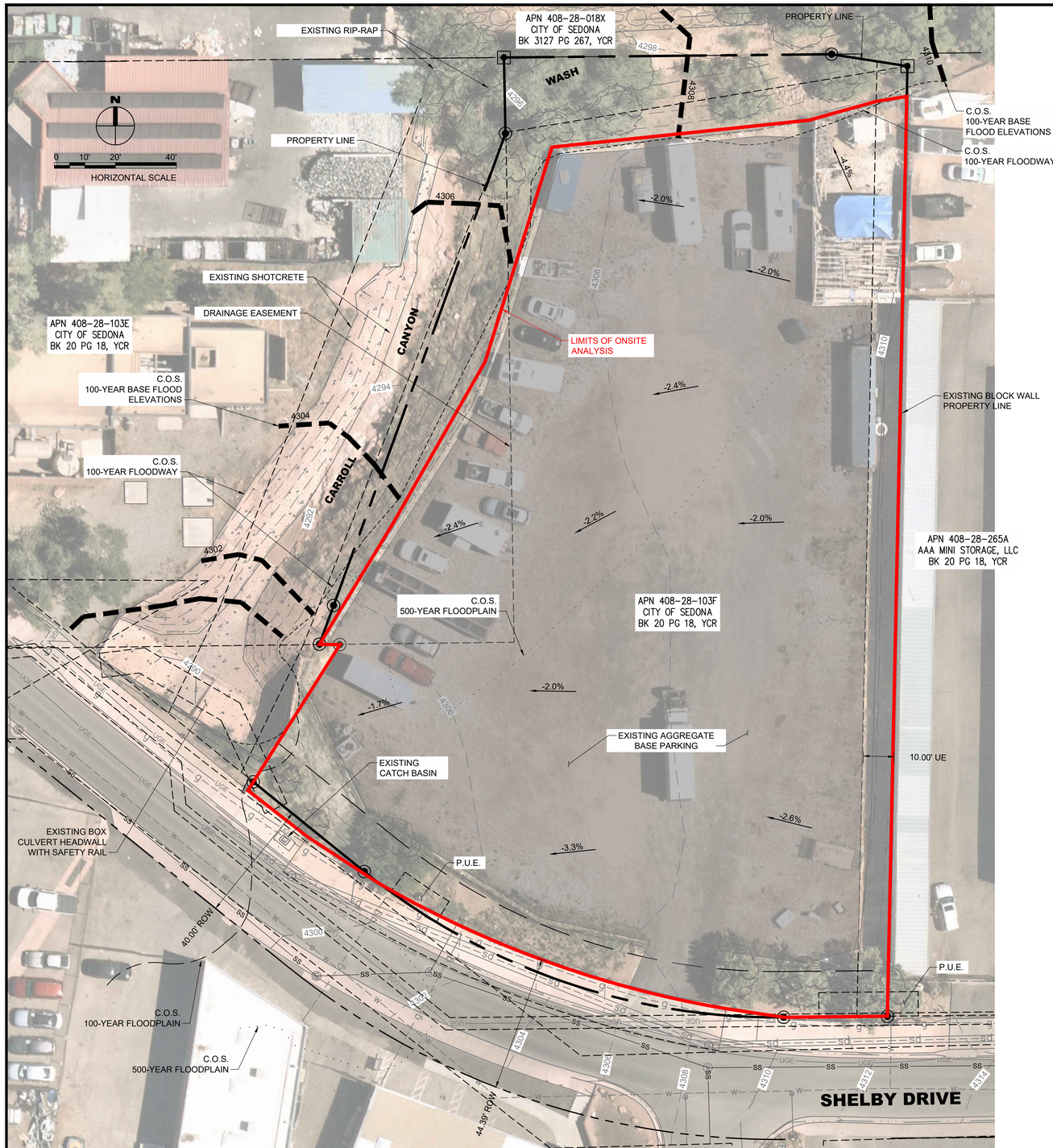
BURGESS & NIPLE INC.
2201 N GEMINI DRIVE, SUITE 116
FLAGSTAFF, ARIZONA 86001
PHONE: (928) 395-1988
BURGESSNIPLE.COM

VILLAS ON SHELBY
SEDONA ARIZONA

PRELIMINARY GRADING & DRAINAGE PLAN

SHEET ID: C1

NUMBER: 1 OF 1



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BURGESSNIPLE.COM

VILLAS ON SHELBY

SEDONA
ARIZONA

PRE-DEVELOPMENT
DRAINAGE PLAN

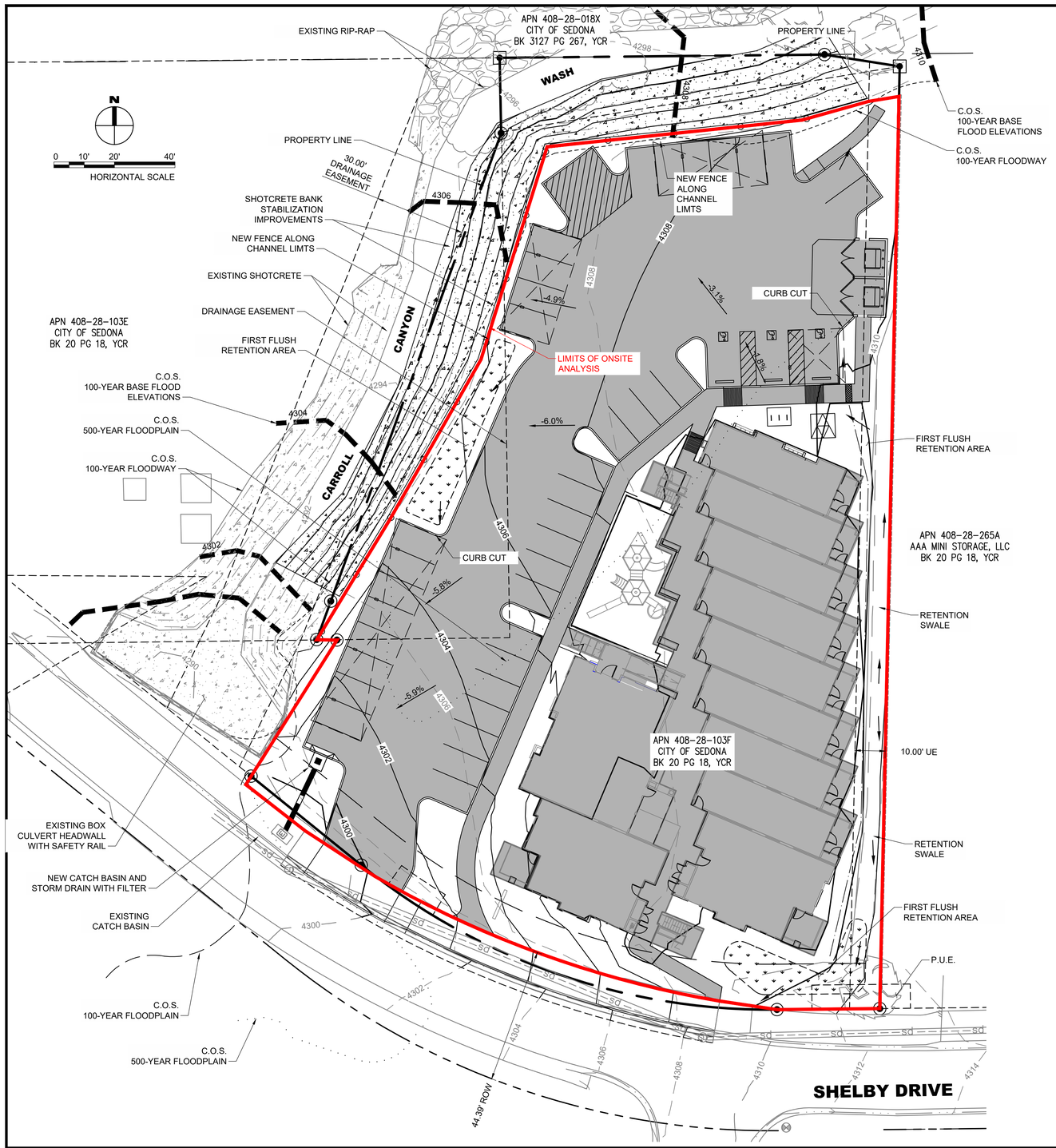
SHEET ID:
DR1

NUMBER: 1 OF 2

ilAcad2024.dwt

ate set with Decimal units for civil site work.

ns BN standard text, dimension and multileader styles.



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DATE: AUG 2024
SCALE: NONE
DRAWN: JK/SJV
DESIGNED: JK/SJV
CHECKED: XXX

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FLAGSTAFF, ARIZONA 86001
PHONE: (928) 395-1988
BURGESSNIPLE.COM

VILLAS ON SHELBY
SEDONA
ARIZONA

POST-DEVELOPMENT DRAINAGE PLAN

SHEET ID: D2

NUMBER: 2 OF 2

2021 Storm Water Master Plan Update

Phase 3:

City of Sedona Regulated Flood Zones

Map: F6

JE FULLER

CITY OF SEDONA

Legend

- Index Map Tiles
- City Limits
- National Forest
- Parcels
- Catch Basin
- Manhole
- Stormdrain
- Culvert
- 100-Year Discharge (cfs)
- Hydraulic Baseline
- Revised Base Flood Elevation
- FEMA Flood Zone, see FEMA maps

Revised Flood Zones

- Floodway
- 100-Year Floodplain
- 500-Year Floodplain

0 100 200 400

Feet

N

Index Map