



**YAVAPAI COUNTY
FLOOD CONTROL DISTRICT**
www.yavapaiaz.gov/ycflood



Memo of Review For Correctness and Completion

The attached FEMA Elevation Certificate has been reviewed by this office.
The items noted below are not correct on the attached form and should read as entered on this page.

SECTION A - PROPERTY INFORMATION

SECTION A - PROPERTY INFORMATION			For Insurance Company Use:
A1. Building Owner's Name Garrett & Diana Cross			Policy Number
A2. Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No. 33150 S. Ha Wa Si Trail			Company NAIC Number
City	State	ZIP Code	
Black Canyon City	AZ	85324	
A3. Property Description (Lot and Block Numbers, Tax Parcel Number, Legal Description, etc.) APN # 502-10-060E			

A4. Building Use (e.g., Residential, Non-Residential, Addition, Accessory, etc.) **Residential - Addition**

A5. Latitude/Longitude: Lat: _____ Long: _____ Horizontal Datum: NAD 1927 NAD 1983

A6. Attach at least 2 photographs of the building if the Certificate is being used to obtain flood insurance.

A7. Building Diagram Number **6**

A8. For a building with a crawlspace or enclosure(s):

a) Square footage of crawlspace or enclosure(s) _____ sq ft

b) No. of permanent flood openings in the crawlspace or enclosure(s) within 1.0 foot above adjacent grade _____

c) Total net area of flood openings in A8.b _____ sq in

d) Engineered flood openings? Yes No

A9. For a building with an attached garage:

a) Square footage of attached garage _____ sq ft

b) No. of permanent flood openings in the attached garage within 1.0 foot above adjacent grade _____

c) Total net area of flood openings in A9.b _____ sq in

d) Engineered flood openings? Yes No

SECTION B - FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

B1. NFIP Community Name & Community Number Yavapai County # 040093		B2. County Name Yavapai, Unincorporated Area		B3. State Arizona	
B4. Map/Panel Number 0425C3609	B5. Suffix H	B6. FIRM Index Date 08-24-2021	B7. FIRM Panel Effective/Revised Date 10-16-2014	B8. Flood Zone(s) AE	B9. Base Flood Elevation(s) (Zone AO, use base flood depth) 2029.41

B10. Indicate the source of the Base Flood Elevation (BFE) data or base flood depth entered in Item B9.
 FIS Profile FIRM Community Determined Other (Describe) **Engineering Analysis - JE Fuller**

B11. Indicate elevation datum used for BFE in Item B9: NGVD 1929 NAVD 1988 Other (Describe) _____

B12. Is the building located in a Coastal Barrier Resources System (CBRS) area or Otherwise Protected Area (OPA)? Yes No
 Designation Date _____ CBRS OPA

Local Official's Name **Ace Patel, CFM** Title **Hydrologist**

Community Name **Yavapai County Flood Control District** Telephone **(928) 771-3197**

Signature *Ace Patel* Date **09/07/2022**

Comments **Corrections in RED.** There are no openings required, as the area below the Manufactured home has vinyl skirting around the perimeter except a small portion on the west side which has a CMU stem wall. Per project engineer this will not create an obstruction to flow of flood waters. This has been field verified by Flood Control staff after the completion of the surveyed Elevation Certificate. See page 13.

ELEVATION CERTIFICATE

Important: Follow the instructions on pages 1–9.

Copy all pages of this Elevation Certificate and all attachments for (1) community official, (2) insurance agent/company, and (3) building owner.

SECTION A – PROPERTY INFORMATION				FOR INSURANCE COMPANY USE	
A1. Building Owner's Name Garrett & Diana Cross				Policy Number:	
A2. Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No. 33150 S. Ha Wa Si Trail				Company NAIC Number:	
City Black Canyon City		State Arizona		ZIP Code 85324	
A3. Property Description (Lot and Block Numbers, Tax Parcel Number, Legal Description, etc.) APN 502-10-060E, N2, N2, SW4, NE4, NW4 SEC. 35, T9N, R2E					
A4. Building Use (e.g., Residential, Non-Residential, Addition, Accessory, etc.) <u>Residential</u>					
A5. Latitude/Longitude: Lat. <u>34-04'-58.40"N</u> Long. <u>112-07-38.45"W</u> Horizontal Datum: <input type="checkbox"/> NAD 1927 <input checked="" type="checkbox"/> NAD 1983					
A6. Attach at least 2 photographs of the building if the Certificate is being used to obtain flood insurance.					
A7. Building Diagram Number <u>5</u>					
A8. For a building with a crawlspace or enclosure(s):					
a) Square footage of crawlspace or enclosure(s) <u>N/A</u> sq ft					
b) Number of permanent flood openings in the crawlspace or enclosure(s) within 1.0 foot above adjacent grade <u>N/A</u>					
c) Total net area of flood openings in A8.b <u>N/A</u> sq in					
d) Engineered flood openings? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					
A9. For a building with an attached garage:					
a) Square footage of attached garage <u>N/A</u> sq ft					
b) Number of permanent flood openings in the attached garage within 1.0 foot above adjacent grade <u>N/A</u>					
c) Total net area of flood openings in A9.b <u>N/A</u> sq in					
d) Engineered flood openings? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					
SECTION B – FLOOD INSURANCE RATE MAP (FIRM) INFORMATION					
B1. NFIP Community Name & Community Number Yavapai County-040093			B2. County Name Yavapai, Unincorporated Area		B3. State Arizona
B4. Map/Panel Number 0425C3609	B5. Suffix H	B6. FIRM Index Date 08-24-2021	B7. FIRM Panel Effective/ Revised Date 10-16-2014	B8. Flood Zone(s) AE	B9. Base Flood Elevation(s) (Zone AO, use Base Flood Depth) 2029.41
B10. Indicate the source of the Base Flood Elevation (BFE) data or base flood depth entered in Item B9: <input type="checkbox"/> FIS Profile <input type="checkbox"/> FIRM <input type="checkbox"/> Community Determined <input checked="" type="checkbox"/> Other/Source: <u>ENGINEERING ANALYSIS - JE FULLER</u>					
B11. Indicate elevation datum used for BFE in Item B9: <input type="checkbox"/> NGVD 1929 <input checked="" type="checkbox"/> NAVD 1988 <input type="checkbox"/> Other/Source: _____					
B12. Is the building located in a Coastal Barrier Resources System (CBRS) area or Otherwise Protected Area (OPA)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Designation Date: _____ <input type="checkbox"/> CBRS <input type="checkbox"/> OPA					

ELEVATION CERTIFICATE

OMB No. 1660-0008
Expiration Date: November 30, 2022

IMPORTANT: In these spaces, copy the corresponding information from Section A.			FOR INSURANCE COMPANY USE
Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No. 33150 S. Ha Wa Si Trail			Policy Number:
City Black Canyon City	State Arizona	ZIP Code 85324	Company NAIC Number

SECTION C – BUILDING ELEVATION INFORMATION (SURVEY REQUIRED)

C1. Building elevations are based on: Construction Drawings* Building Under Construction* Finished Construction
*A new Elevation Certificate will be required when construction of the building is complete.

C2. Elevations – Zones A1–A30, AE, AH, A (with BFE), VE, V1–V30, V (with BFE), AR, AR/A, AR/AE, AR/A1–A30, AR/AH, AR/AO. Complete Items C2.a–h below according to the building diagram specified in Item A7. In Puerto Rico only, enter meters.

Benchmark Utilized: NGS PID ET0268 (Elevation= 2054.7 ft) Vertical Datum: NAVD1988

Indicate elevation datum used for the elevations in items a) through h) below.

NGVD 1929 NAVD 1988 Other/Source: _____

Datum used for building elevations must be the same as that used for the BFE.

Check the measurement used.

- | | | | |
|---|---------------|--|---------------------------------|
| a) Top of bottom floor (including basement, crawlspace, or enclosure floor) | <u>2028.4</u> | <input checked="" type="checkbox"/> feet | <input type="checkbox"/> meters |
| b) Top of the next higher floor | <u>2031.4</u> | <input checked="" type="checkbox"/> feet | <input type="checkbox"/> meters |
| c) Bottom of the lowest horizontal structural member (V Zones only) | <u>N/A</u> | <input type="checkbox"/> feet | <input type="checkbox"/> meters |
| d) Attached garage (top of slab) | <u>N/A</u> | <input type="checkbox"/> feet | <input type="checkbox"/> meters |
| e) Lowest elevation of machinery or equipment servicing the building
(Describe type of equipment and location in Comments) | <u>2030.5</u> | <input checked="" type="checkbox"/> feet | <input type="checkbox"/> meters |
| f) Lowest adjacent (finished) grade next to building (LAG) | <u>2027.8</u> | <input checked="" type="checkbox"/> feet | <input type="checkbox"/> meters |
| g) Highest adjacent (finished) grade next to building (HAG) | <u>2028.7</u> | <input checked="" type="checkbox"/> feet | <input type="checkbox"/> meters |
| h) Lowest adjacent grade at lowest elevation of deck or stairs, including structural support | <u>2028.3</u> | <input checked="" type="checkbox"/> feet | <input type="checkbox"/> meters |

SECTION D – SURVEYOR, ENGINEER, OR ARCHITECT CERTIFICATION

This certification is to be signed and sealed by a land surveyor, engineer, or architect authorized by law to certify elevation information. I certify that the information on this Certificate represents my best efforts to interpret the data available. I understand that any false statement may be punishable by fine or imprisonment under 18 U.S. Code, Section 1001.

Were latitude and longitude in Section A provided by a licensed land surveyor? Yes No Check here if attachments.

Certifier's Name William Wing	License Number 52788		
Title Owner/Operator			
Company Name Infinity Land Surveying LLC			
Address 605 E. Tanya Trail, Phoenix, AZ 85086			
City Phoenix	State Arizona		ZIP Code 85086
Signature 	Date 10-05-2021	Telephone 623-266-9915	Ext.

Copy all pages of this Elevation Certificate and all attachments for (1) community official, (2) insurance agent/company, and (3) building owner.

Comments (including type of equipment and location, per C2(e), if applicable)
2 Heat Pump Units found at South end of building on elevated pad structure (Pad Elevation = 2030.5 ft)
The lowest structural member (I-Beam) Elevation for the (Upper Level = 2030.8 ft.) (Lower Level = 2030.5 ft.)
(Building has 2 levels (Top Level Floor Elevation = 2032.4 ft.) (Lower Level Floor Elevation = 2031.4 ft.)
The Vented skirting underneath the MFG home is vinyl breakaway type skirting.
Nathanael Denali Vaughan PE 48058 has determined the Base Flood elevation for the Structure to be 2029.41', stamp date 05-20-2020 (see attachments)

ELEVATION CERTIFICATE

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City Black Canyon City	State Arizona	ZIP Code 85324	Company NAIC Number

SECTION E – BUILDING ELEVATION INFORMATION (SURVEY NOT REQUIRED) FOR ZONE AO AND ZONE A (WITHOUT BFE)

For Zones AO and A (without BFE), complete Items E1–E5. If the Certificate is intended to support a LOMA or LOMR-F request, complete Sections A, B, and C. For Items E1–E4, use natural grade, if available. Check the measurement used. In Puerto Rico only, enter meters.

- E1. Provide elevation information for the following and check the appropriate boxes to show whether the elevation is above or below the highest adjacent grade (HAG) and the lowest adjacent grade (LAG).
- a) Top of bottom floor (including basement, crawlspace, or enclosure) is _____ feet meters above or below the HAG.
- b) Top of bottom floor (including basement, crawlspace, or enclosure) is _____ feet meters above or below the LAG.
- E2. For Building Diagrams 6–9 with permanent flood openings provided in Section A Items 8 and/or 9 (see pages 1–2 of Instructions), the next higher floor (elevation C2.b in the diagrams) of the building is _____ feet meters above or below the HAG.
- E3. Attached garage (top of slab) is _____ feet meters above or below the HAG.
- E4. Top of platform of machinery and/or equipment servicing the building is _____ feet meters above or below the HAG.
- E5. Zone AO only: If no flood depth number is available, is the top of the bottom floor elevated in accordance with the community's floodplain management ordinance? Yes No Unknown. The local official must certify this information in Section G.

SECTION F – PROPERTY OWNER (OR OWNER'S REPRESENTATIVE) CERTIFICATION

The property owner or owner's authorized representative who completes Sections A, B, and E for Zone A (without a FEMA-issued or community-issued BFE) or Zone AO must sign here. The statements in Sections A, B, and E are correct to the best of my knowledge.

Property Owner or Owner's Authorized Representative's Name

Address _____ City _____ State _____ ZIP Code _____

Signature _____ Date _____ Telephone _____

Comments

Check here if attachments.

ELEVATION CERTIFICATE

OMB No. 1660-0008
Expiration Date: November 30, 2022

IMPORTANT: In these spaces, copy the corresponding information from Section A.	FOR INSURANCE COMPANY USE		
Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No. 33150 S. Ha Wa Si Trail	Policy Number:		
City Black Canyon City	State Arizona	ZIP Code 85324	Company NAIC Number

SECTION G – COMMUNITY INFORMATION (OPTIONAL)

The local official who is authorized by law or ordinance to administer the community's floodplain management ordinance can complete Sections A, B, C (or E), and G of this Elevation Certificate. Complete the applicable item(s) and sign below. Check the measurement used in Items G8–G10. In Puerto Rico only, enter meters.

- G1. The information in Section C was taken from other documentation that has been signed and sealed by a licensed surveyor, engineer, or architect who is authorized by law to certify elevation information. (Indicate the source and date of the elevation data in the Comments area below.)
- G2. A community official completed Section E for a building located in Zone A (without a FEMA-issued or community-issued BFE) or Zone AO.
- G3. The following information (Items G4–G10) is provided for community floodplain management purposes.

G4. Permit Number	G5. Date Permit Issued	G6. Date Certificate of Compliance/Occupancy Issued
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- G7. This permit has been issued for: New Construction Substantial Improvement
- G8. Elevation of as-built lowest floor (including basement) of the building: _____ feet meters Datum _____
- G9. BFE or (in Zone AO) depth of flooding at the building site: _____ feet meters Datum _____
- G10. Community's design flood elevation: _____ feet meters Datum _____

Local Official's Name	Title
Community Name	Telephone
Signature	Date

Comments (including type of equipment and location, per C2(e), if applicable)

Check here if attachments.

BUILDING PHOTOGRAPHS

See Instructions for Item A6.

OMB No. 1660-0008

Expiration Date: November 30, 2022

ELEVATION CERTIFICATE

IMPORTANT: In these spaces, copy the corresponding information from Section A.			FOR INSURANCE COMPANY USE
Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No. 33150 S. Ha Wa Si Trail			Policy Number:
City Black Canyon City	State Arizona	ZIP Code 85324	Company NAIC Number

If using the Elevation Certificate to obtain NFIP flood insurance, affix at least 2 building photographs below according to the instructions for Item A6. Identify all photographs with date taken; "Front View" and "Rear View"; and, if required, "Right Side View" and "Left Side View." When applicable, photographs must show the foundation with representative examples of the flood openings or vents, as indicated in Section A8. If submitting more photographs than will fit on this page, use the Continuation Page.



Photo One

Photo One Caption LEFT SIDE VIEW_TAKEN ON 9-23-2021

Clear Photo One



Photo Two

Photo Two Caption FRONT VIEW_TAKEN ON 9-23-2021

Clear Photo Two

BUILDING PHOTOGRAPHS

Continuation Page

OMB No. 1660-0008
Expiration Date: November 30, 2022

ELEVATION CERTIFICATE

IMPORTANT: In these spaces, copy the corresponding information from Section A.			FOR INSURANCE COMPANY USE
Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No. 33150 S. Ha Wa Si Trail			Policy Number:
City Black Canyon City	State Arizona	ZIP Code 85324	Company NAIC Number

If submitting more photographs than will fit on the preceding page, affix the additional photographs below. Identify all photographs with: date taken; "Front View" and "Rear View"; and, if required, "Right Side View" and "Left Side View." When applicable, photographs must show the foundation with representative examples of the flood openings or vents, as indicated in Section A8.



Photo Three

Photo Three Caption SIDE VIEW_TAKEN 9-23-2021

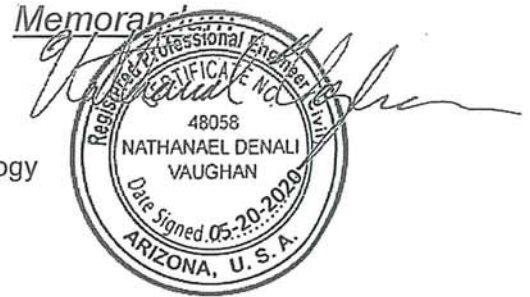
Clear Photo Three



Photo Four

Photo Four Caption REAR VIEW_TAKEN 9-23-2021

Clear Photo Four



DATE: May 20, 2020
 TO: Garrett and Diana Cross
 FROM: Nate Vaughan, P.E., JE Fuller Hydrology & Geomorphology
 RE: Cross Residence APN: 502-10-060E

To Whom It May Concern,

JE Fuller has performed a series of flood-related analyses for parcel APN 502-10-060E in Black Canyon City, Arizona. The property is within the FEMA regulatory floodway of the Agua Fria River and subject to Yavapai County Flood Control District (YCFCD) and Federal Emergency Management Agency (FEMA) regulation. A manufactured home has been placed on the property and was cited for a lack of necessary permitting; this memorandum is intended to serve as documentation for no-rise certification related to development within the floodway. Additionally, a regulatory base flood elevation and scour evaluation, as they relate to the on-site manufactured home, are also included.

Location

The subject parcel is located at 33150 South Ha Wa Si Trail in Black Canyon City. The location and vicinity of the subject parcels are shown in Figure 1 and Figure 2.

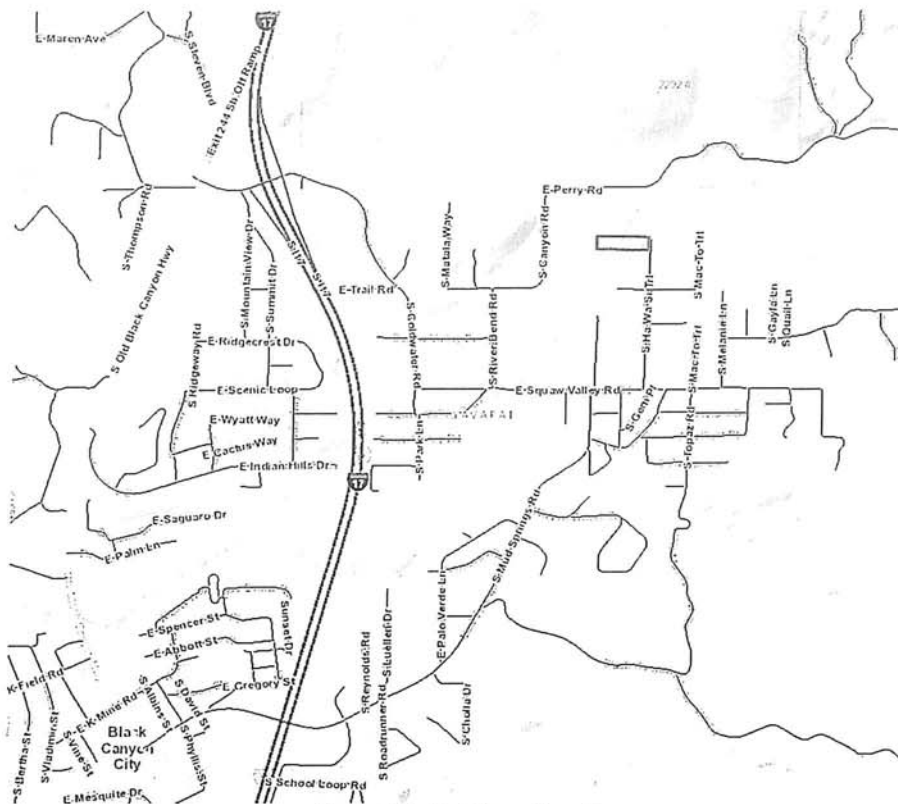


Figure 1 - Subject Parcel Location

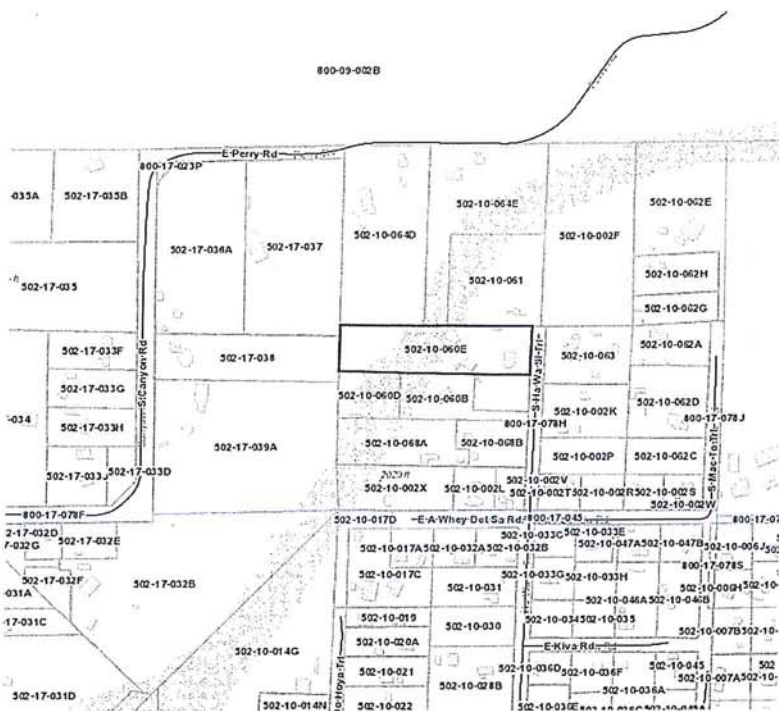


Figure 2 - Subject Parcel Vicinity

Drainage Context

The subject parcel is located within the regulatory floodway of the Agua Fria River; the parcel and floodplain/floodway limits are depicted in Figure 3.

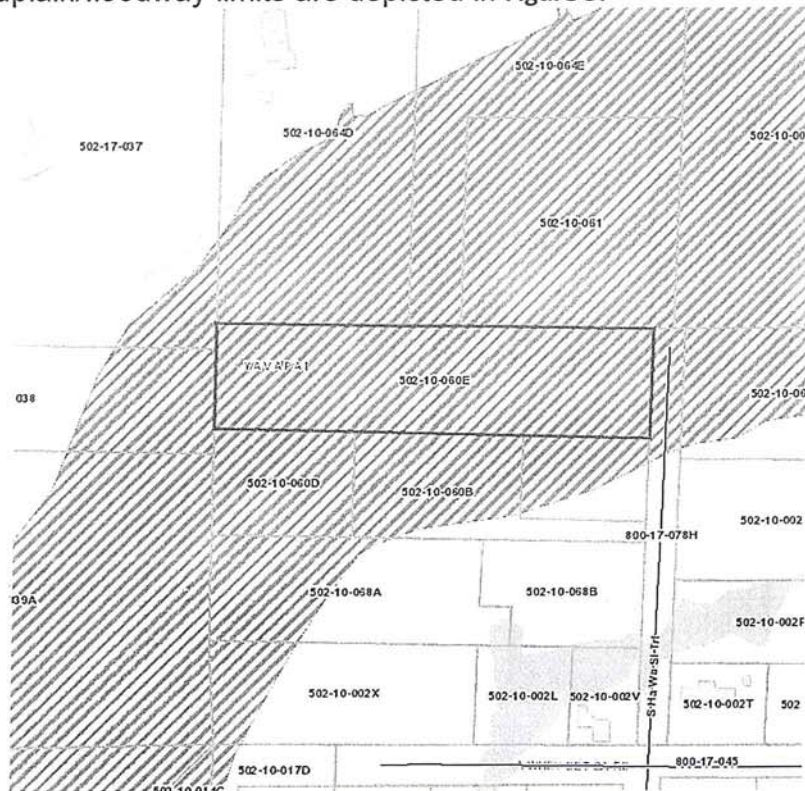


Figure 3 – FEMA Floodplain/Floodway Limits

The manufactured home has been placed on the eastern portion of the lot, located away from the main channel of the Agua Fria River, which occupies the western portion of the subject parcel. Figure 4 illustrates the existing manufactured home location relative to the primary channel of the Agua Fria River and 2005 2' topography of the area provided by Yavapai County. The manufactured home, while located within the regulatory floodway, is located on a flood terrace on the inside of a bend in the river.

Relevant Data Sources

The analyses described in this memorandum are dependent upon multiple external data sources. A summary of each is provided below - some data sources are included as appendices to this document and are indicated as such.

Floodplain Delineation Study of the Agua Fria River and Tributaries Including Black Canyon Creek, Squa Creek, Mud Springs Wash, and Un-Named Tributary (2012) prepared for Yavapai County Flood Control District by JE Fuller Hydrology & Geomorphology

This study was utilized for a copy of the effective HEC-RAS model for the Agua Fria River. Cross-sections upstream and downstream of the project site were compared to lettered sections in the FEMA National Flood Hazard Layer and confirmed matching water surface elevation values at those sections.

Cross Residence Remodel (2019) – Structural Plans by Douglas A Snow and Associates, Inc.

These structural plans show the pier and support wall locations for the manufactured home foundation and the foundation for an addition on the southwest corner of the manufactured home. These plans were used to locate the foundation elements for inclusion in the with-project HEC-RAS model; plans are included digitally in the appendices of this document.

Summary Structural Letter (2020) AZTECH Engineers

This letter describes revisions to the *Cross Residence Remodel (2019)* structural plans. These revisions were requested by JE Fuller based upon preliminary modeling results which indicated an increase in 100-year water surface elevation if perimeter framing and sheathing were implemented, as shown on the original structural plans. The letter indicates that perimeter sheathing and framing, as described in the *Cross Residence Remodel* structural plans, are to be omitted and replaced with breakaway vinyl skirting.

Boundary Survey (2018) by Infinity Land Surveying, LLC

The boundary survey, included in DWG format in the appendices of this document, was also provided to JEF as a hard-copy exhibit. The survey was used to locate the manufactured home and structural plan elements spatially for depiction in GIS and HEC-RAS modeling.



Figure 4 - Manufactured Home Location on Site

Effective Floodplain Model

A copy of the FEMA effective HEC-RAS model was obtained and utilized, with the original 2005 2' topography used in the "Floodplain Delineation Study of Agua Fria River and Tributaries", to add additional cross-sections in the vicinity of the manufactured home to the effective FEMA model.

Model Modifications

Additional cross sections were added at the upstream end of the manufactured home and added at an interval of approximately 5 feet to capture the geometry of the foundation elements so their obstructions could be represented in the model. Overbank model roughness was maintained within the new cross-sections and blocked obstructions added to model the flow impedance associated with the home foundation elements.

Blocked obstructions at cross-section locations were digitized from the structural plans by Douglas A Snow and Associates (2019) included vertical piers and a concrete stem wall at the western perimeter of the addition to the manufactured home. Following expansion/contraction guidance for bridge piers, the obstructed flow area were projected upstream at a 1:1 ratio and downstream at a 3:1 ratio which allows the impacts of obstructions to carry onto adjacent cross-

sections and model cumulative impacts of the groups of foundation elements. The projected obstructions are shown in Figure 5; note that overlapping areas were consolidated into a single obstruction within the HEC-RAS model. Piers were represented as drawn on the structural plans as “jack-type” stands with a width of approximately 1.25’ which represents a conservative estimate of the obstruction represented by typical manufactured home jacks due to their vertical taper. The largest obstruction is the concrete perimeter wall located along the western boundary of the addition (again, shown in Figure 5).

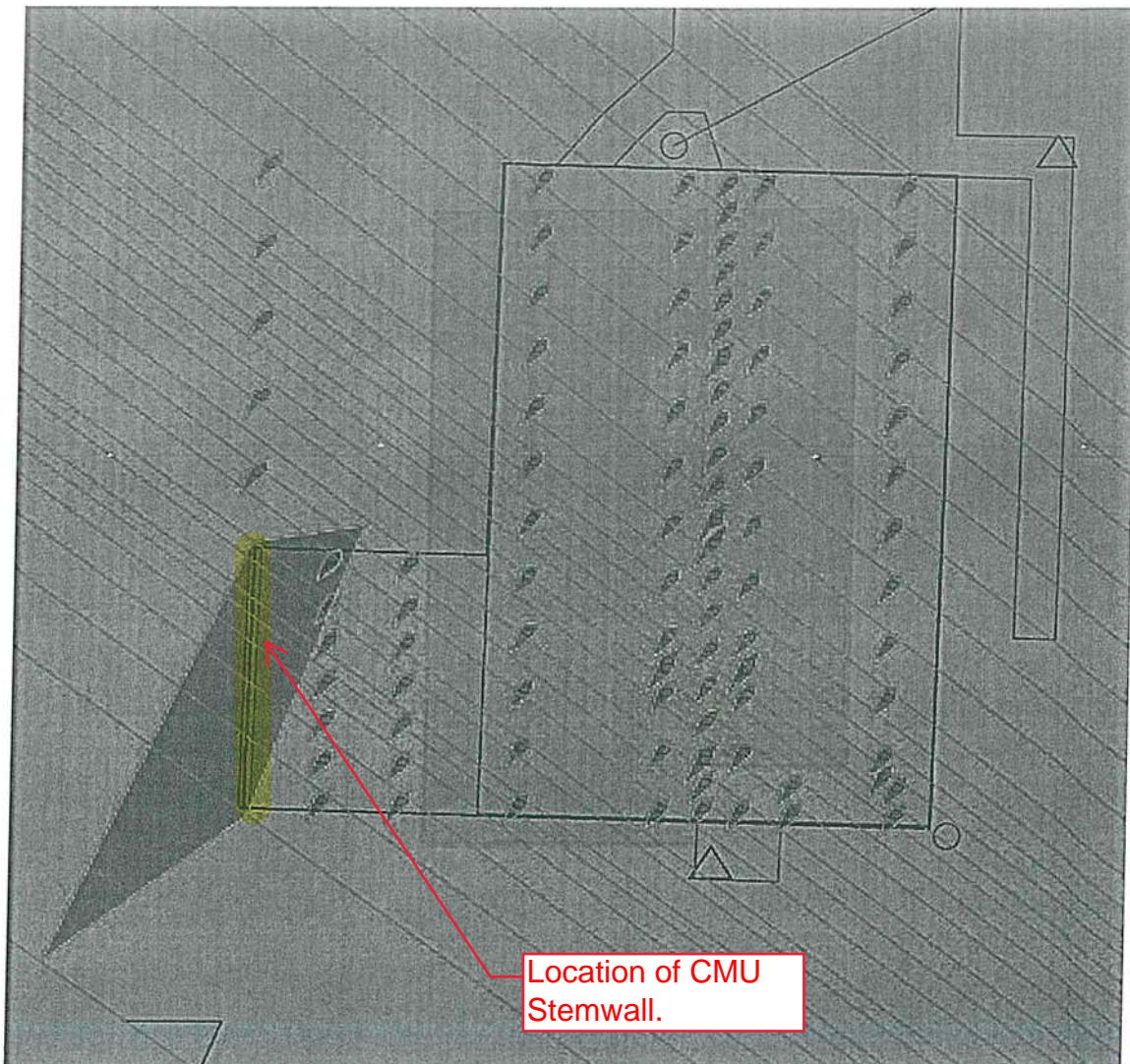


Figure 5 - Pier Blocked Obstructions with Associated Contraction and Expansion Zones (obstructions in magenta)

Abridged model summary results for the with- and without-obstructions conditions are shown in Table 1 with Cross-Sections 27996 and 26570 representing the bounding FIS cross-sections and

Cross-Sections 26571-26600 representing the additional sections added to represent the home; the results indicate benign changes in 100-year water surface elevation for the with-obstructions conditions at some sections. These results suggest improved hydraulic efficiency is achieved by offsetting flow into the lower-roughness, main channel of the Agua Fria River.

Table 1 - WSEL Comparison

Cross-Section	WSEL (ft)		Difference (ft) (DEV - BASELINE)
	DEVELOPED	BASELINE	
27996	2035.76	2035.76	0
26600	2029.41	2029.41	0
26599	2029.41	2029.41	0
26598	2029.39	2029.39	0
26597	2029.37	2029.37	0
26596	2029.35	2029.36	-0.01
26595	2029.33	2029.33	0
26594	2029.31	2029.31	0
26593	2029.27	2029.28	-0.01
26592	2029.23	2029.23	0
26591	2029.19	2029.19	0
26590	2029.16	2029.17	-0.01
26589	2029.14	2029.15	-0.01
26588	2029.13	2029.13	0
26587	2029.12	2029.12	0
26586	2029.11	2029.11	0
26585	2029.09	2029.09	0
26584	2029.07	2029.07	0
26583	2029.05	2029.06	-0.01
26582	2029.04	2029.04	0
26581	2029.02	2029.02	0
26580	2029	2029.01	-0.01
26579	2028.98	2028.99	-0.01
26578	2028.97	2028.98	-0.01
26577	2028.97	2028.97	0
26576	2028.95	2028.96	-0.01
26575	2028.94	2028.95	-0.01
26574	2028.92	2028.93	-0.01
26573	2028.9	2028.9	0
26572	2028.83	2028.83	0
26571	2028.22	2028.21	0.01

26570	2024.29	2024.29	0
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As shown in Table 1, HEC-RAS cross-sectional results indicate little to no change in water surface elevation between the baseline and developed conditions. Cross-Section 26571 is the only section which indicates an increase in water surface elevation, although the geometry in both models at this section are identical (with no blocked obstructions in the developed condition) and a subcritical flow regime is stipulated in the HEC-RAS plans. The result at this section suggests that numerical variance of 0.01 feet may be expected from the model for HEC-RAS v5.07.

The base flood elevation (BFE) for the manufactured home is taken from cross section 26600 with the regulatory flood elevation (RFE) calculated as BFE + 1 ft which equals 2030.41 ft (BFE = 2029.41 ft) NAVD88.

Scour Hazards

The foundation elements for the manufactured home and addition are located on a 4 inch concrete slab and are not individually susceptible to scour during flow events as a result. However, the concrete slab itself may be subjected to undermining during large magnitude flow events. Given that the slab is located on the inside of a bend, outside of the main channel, it is subject to general scour components. Long-term scour is generally not applicable as the manufactured home is not located within the low-flow channel of the Agua Fria River and will only be subjected to scour during infrequent, upper-regime flows.

Using the methodology described in the City of Tucson’s “Standards Manual for Drainage Design and Floodplain Management” (Simons Li and Associates, 1998), total scour was calculated at the project site based upon the 100-year flow hydraulics from the developed-condition hydraulic model. Scour was computed for output flow parameters at HEC-RAS cross-sections 26600 and 26571 due to the former’s presence at the upstream end of the manufactured home and the highest observed overbank velocities in the newly added sections was observed at the latter section; due to the site’s location in the river-left overbank, hydraulic terms for the left overbank were utilized as inputs in the scour computations. Several scour terms were taken as 0 due to the overbank nature of the site including long-term scour (as described above), and low-flow scour. The dominant scour component expressed was bedform scour with a magnitude of less than 0.1 feet with the calculated magnitude owing principally to the low overbank velocities shown in the hydraulic model. A safety factor of 1.3 was applied to the resulting total scour which yielded a design scour depth of 0.1 feet for both sections. Based upon this result, the existing 4” (0.25 ft) concrete slab is sufficiently deep to resist scour during the 100-year flow event. Tabular scour calculation results are included in Appendix A.

Lateral migration of the low-flow channel has not been formerly evaluated with this analysis. However, the project site is located on the “inside” of a bend in the Agua Fria River and is not anticipated to be subject to lateral scour hazards under the present low-flow channel configuration of the Aqua Fria River.

Summary

The attached foundation plan by Douglas A Snow Architects, as modified per the letter by AZTECH Engineers, for the existing manufactured home on APN 502-10-060E meets no-rise criteria within the FEMA Zone AE floodway for the Agua Fria River.

The existing concrete slab, to which the foundation elements will be affixed, extends below the anticipated 100-year scour depth and thus meets the requirements for a “flood safe” foundation as required by the Arizona Department of Housing. While lateral migration of the Agua Fria River is not anticipated under present conditions, the home is located within a floodway corridor and lateral movement of the river is possible. Monitoring of channel bank locations is recommended and mitigation measures should be applied if lateral migration is observed.



www.jefuller.com

Appendix A

Scour Calculation Summary

Douglas A Snow Engineering Structural Plans
AZTECH Engineers Letter

Tempe, AZ

Tucson, AZ

Flagstaff, AZ

Prescott, AZ

Silver City, NM

MAXIMUM ANTICIPATED SCOUR DEPTH (Z_T) FOR SIMPLE CURVED AND STRAIGHT REACHES OF NON-REGIONAL SAND BED CONVEYANCES WITH LOCAL SCOUR AT ABUTMENTS AND BRIDGE PIERS W/O LOCAL SCOUR AT DROPS OR LONG TERM DEGRADATION



Project Address
 Data Sheet Preparer
 Conveyance Subsection

ADDRESS			
N/A	N/A	N/A	N/A
26600	26571	0	0
N	N	N	N

SEC = 26600 26571 0 0

α = N N N N

a_e = N N N N

θ_a = N N N N

L' = N N N N

K₁ = N N N N

θ = N N N N

b_p = N N N N

L = N N N N

Y₁ = N N N N

RF = N N N N

Φ_p = N N N N

a = N N N N

L = N N N N

K₁ = N N N N

K₃ = N N N N

Φ_p = N N N N

Y₁ = N N N N

D₅₀ = N N N N

D₉₅ = N N N N

SF = 1.3 1.3 1.3 1.3

Description

(deg) Bend angle (See BENDS tab)

(ft) Length of abutment projected normal to flow

(deg) Slope angle of abutment face from horizontal

(ft) Length of abutment projected normal to flow

(dim) Coefficient for abutment shape (See ABUTMENTS tab)

(deg) Abutment angle wrt bank (See ABUTMENTS tab)

(ft) Pier width, including anticipated debris blockage

(ft) Length of pier wall

(ft) Flow depth upstream of pier (blank = max depth)

(dim) Reduction factor for nose shape (See PIERS tab)

(deg) Angle of approach flow in relationship to pier wall

(ft) Pier width, including anticipated debris blockage

(ft) Length of pier wall

(dim) Correction factor for nose shape (See PIERS tab)

(deg) Correction factor for bed condition (See PIERS tab)

(ft) Flow direction with respect to pier wall

(ft) Flow depth upstream of pier (blank = max depth)

(mm) Grain size for which 50% of bed material is finer

(mm) Grain size for which 95% of bed material is finer

(dim) Blank = 1.3; text = 0

Step 1. Enter Project Information.

Step 2. Bend Scour? Enter N if no bend scour. If Yes, Enter α.

Step 3a. Abutment scour per SMDDFM? Enter N if no. If Yes, Enter a_e & θ_a.

Step 3b. Abutment scour per HEC-18 (FHWA NHI 01-001 5/01)? Enter N if no local abutment scour. If Yes, Enter L', K₁, & θ.

Step 4a. Pier scour per SMDDFM? Enter N if no local pier scour. If Yes, enter Y₁, b_p, L, Φ_p & RF.

Step 4b. Pier scour per HEC-18 (FHWA NHI 01-001 5/01)? Enter N if no local pier scour. If Yes, enter a, L, K₁, K₃, Φ_p, Y₁, D₅₀, & D₉₅.

Step 5. Enter safety factor for local (pier, abutment) scour.

Step 6. Enter hydraulic characteristics for up to 5 sections in the blue fields below. HEC-RAS output may be pasted into RAS OUT tab to facilitate data entry.

INPUT HYDRAULIC CHARACTERISTICS OF CONVEYANCE.

CALCULATED CHARACTERISTICS

CALCULATED INDIVIDUAL SCOUR COMPONENTS (ft)

S E C	V (fps)	A (ft ²)	T (ft)	WSL (ft)	ELMIN (ft)	S _e (dim)	Q (cfs)	V/A	Y _h (ft)	Y _h A/T	Y _{max} (ft)	F _u (dim)	r _c /T (dim)	Z _{gs} SMDDFM Eq 6.4	Z _{gs} SMDDFM Eq 6.4	Z _{bps} SMDDFM Eq 6.6	Z _a SMDDFM Eq 6.5	Z _{lsp} SMDDFM Eq 6.9	Z _{lse} SMDDFM Eq 6.1	Z _{lsp} HEC-18 Eq 6.1	Z _{lse} HEC-18 Eq 7.17.2	Z _{lf} HEC-18 Eq 6.3	Z _t (ft)	
																								1305
26600	1.8	737.0	508.0	2029.4	2014.9	0.006	1305	1.5	1.5	14.5	0.3	0.0	0.0	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.0	0.1
26571	2.2	797.6	531.1	2028.2	2014.2	0.007	1771	1.5	1.5	14.0	0.3	0.0	0.0	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.0	0.1
0	0.0	0.0	0.0	0.0	0.0	0.000	0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00	0.00	0.0	0.0
0	0.0	0.0	0.0	0.0	0.0	0.000	0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00	0.00	0.0	0.0
0	0.0	0.0	0.0	0.0	0.0	0.000	0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00	0.00	0.0	0.0

GARRETT MH, SHEATHING AT SKIRT #3
33150 S Ha Wa Si Trl, BCC, Az
5/4/2020
1

To: Mr. Nate Vaughn, JE Fuller Hydrology & Geomorphology Inc
143 N McCormick St. #103,
Prescott, Az 86301

Date 5 13 20

Subject: 502 10 060E As-Built, Sheathing at Skirt

Address: 33150 S Ha Wa Si Trl, BCC, Az

Nate, the following structural assessment of the subject Manufactured Home in relation to the FEMA 100-year flood anticipation is offered for your use. Please advise of any concerns.

- (1) The structure has ASTM-approved lateral-to-chassis I-beam hold down straps installed at 8'-9" spacing. It is proposed to install 4 more strap hold downs, longitudinally in line with I-beams, near each end of each outer I-beam.
- (2) The proposed steel piers designed by Snow Engineering will be securely bolted to the concrete slab with 4 each 1/2" diameter bolts, then to the chassis I-beams with 4 each 3/8" diameter bolts, then welded in place. These will secure the units against a seismic pulsation. Because of (1) above, only 8 of the welded piers will be required. The remaining 65 supports can be the standard screw-type mobile home jacks.
- (3) Constructed this way, the existing 5/8" sheathing/frame under the west wall of the west unit should be removed, so as to remove the possibility of any hydrological loads in a 100-year FEMA flood event from impinging on the structure. At present writing, the west side is the only side with sheathing/frame, but the plan is to eliminate any skirt sheathing/frame from any side. Instead, an approved, perforated, break-away plastic skirt is recommended.

For more detailed information, see Garrett MH excel spreadsheet.

Respectfully submitted,

Jerry Osborne, PE, Aztech Engineers

