Exhibit I

Fitzgerald Environmental Associates, LLC.

Applied Watershed Science & Ecology

MEMORANDUM

To: Jeremy Matosky, PE, Trudell Consulting Engineers
From: Frank Piasecki and Evan Fitzgerald, CPESC, CFM
Re: Floodplain and River Corridor Mapping for Great Brook, JE Allstone Quarry, Chester, VT
Date: May 19, 2023

1.0 Introduction

Fitzgerald Environmental Associates (FEA) was retained by Trudell Consulting Engineers (TCE) to assist with the evaluation of hydrology, hydraulics, and river corridor mapping for Great Brook at JE Allstone Chandler Road Quarry in Chester, VT. FEA was tasked with: 1) preparing a hydraulic model of the Great Brook surrounding JE Allstone Quarry that incorporates TCE survey cross sections and ties into the FEMA model; 2) recommending defensible estimates of base flood elevations (BFEs) of Great Brook in the vicinity of JE Allstone Quarry; and 3) preparing maps of proposed floodplain, BFEs and updated River Corridor following VTDEC's "Flood Hazard Area and River Corridor Protection Procedure" related to Criterion 1D. Below is a summary of our observations and conclusions pertinent to the proposed floodplain, BFEs, and updated river corridor. Supporting information is provided in the Attachments.

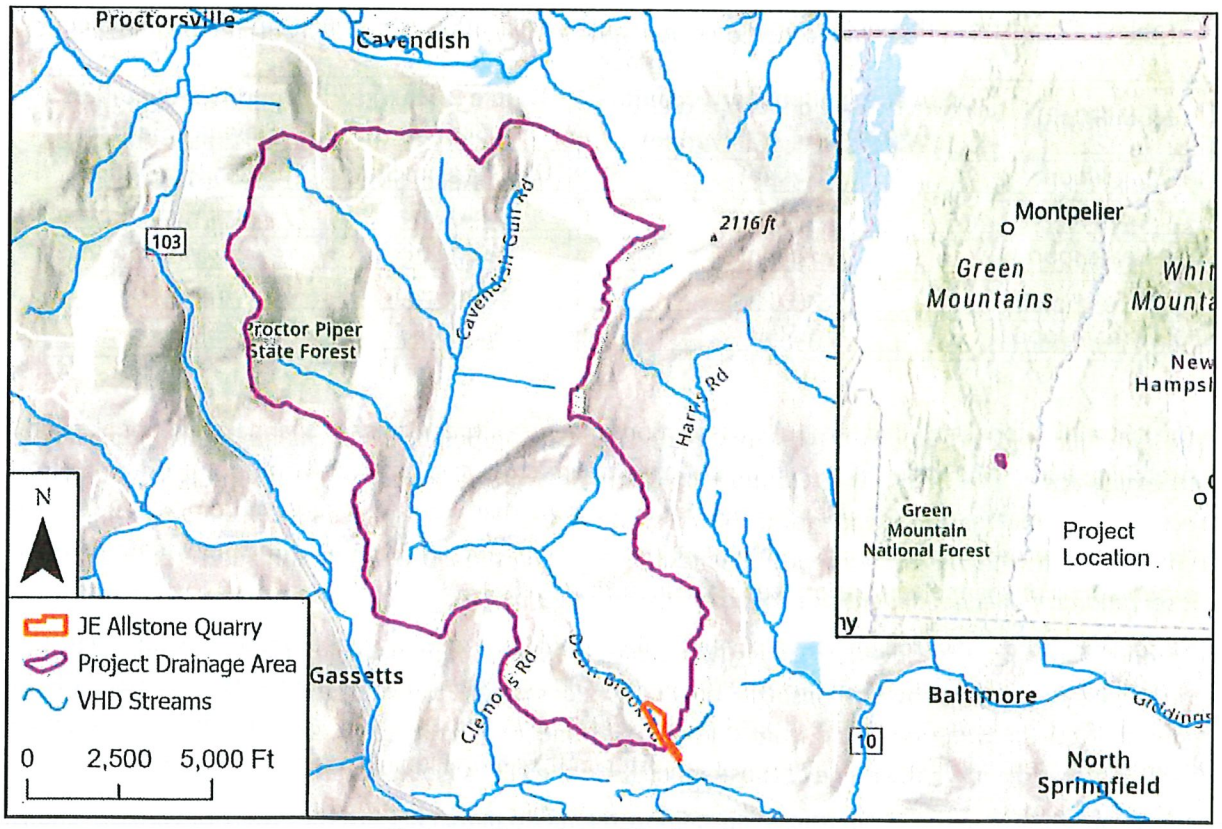


Figure 1: Overview of Project Location

2.0 Hydraulics

2.1 Hydraulic Modeling Methods

HEC-RAS 6.3.1 software (USACE, 2022) was used to create a one-dimensional, steady flow river and floodplain hydraulics model for Great Brook. The model covers Great Brook from approximately 500 feet upstream of the limit of JE Allstone Quarry to approximately 100 feet upstream of Chandler Road at FEMA cross section AQ. FEA acquired a high resolution (0.7 m) digital elevation model (DEM) for the study area from the Vermont Center for Geographic Information (Acquisition Year: 2016). FEA then converted the DEM vertical elevation units from meters to feet and loaded the DEM into RAS Mapper as the base terrain for flood extent mapping.

Modeling and Field Survey Details

To set up the HEC-RAS model in RAS Mapper, FEA digitized the stream centerline and the top of each bank using primarily a Google Satellite imagery service and the terrain model of the 2016 LiDAR hillshade to emphasize topographic relief. FEA constructed the Great Brook hydraulic model as a single reach with known water surface elevations for the downstream boundary conditions, consistent with the FEMA Flood Insurance Study flood elevations for cross section AQ. The downstream boundary conditions for all the modeled floods are summarized in Table 1. The slope of the channel (0.0047 ft/ft) was measured using the LiDAR DEM and used as the upstream boundary condition for all the modeled floods.

Table 1: Downstream boundary condition water surface elevations (NAVD88 Feet) for all modeled floods

Flood Profile	Downstream Boundary Condition (Water Surface Elevation)	Profile Discharge Source	Boundary Condition Elevation Source
2-Year Flood	643.4 ft	USGS Stream Stats	Bankfull Elevation
10-Year Flood	649 ft	FEMA FIS	FEMA FIS
50-Year Flood	649.3 ft	FEMA FIS	FEMA FIS
100-Year Flood	649.6 ft	FEMA FIS	FEMA FIS
500-Year Flood	650 ft	FEMA FIS	FEMA FIS

The hydraulic model included ten (10) cross sections that are perpendicular to channel and floodplain flow stretching across the valley. The two most downstream cross sections were from the FEMA FIS (cross section AR and AQ). TCE provided four (4) cross sections that were field-surveyed on 2/15/2023. The remaining four (4) cross sections were created by adjusting the LiDAR DEM with survey data and field observations of channel dimensions collected in April 2023 by FEA.

Floodplain and channel roughness values (Manning's N values) were assigned based on land cover from aerial imagery and field observations. The roughness values ranged from 0.03 (gravel roads) to 0.12 (dense alder thicket) following guidance from Chow (1959) and Arcement et al. (1989). Selected roughness coefficients were within the range of those reported in the FEMA Flood Insurance Study (FIS).

The steady flow model was run using a mixed flow regime to match BFEs to the two FEMA cross sections. The subcritical flow regime is the conventional and conservative FEMA modeling approach, but it appears that due to the age of the FIS a mixed flow regime method was used for Great Brook.

2.2 Hydraulic Modeling Results

The modeled BFEs at cross sections 303 and 721 (FEMA cross sections AQ and AR respectively) match the BFEs from the FEMA model within one tenth of a foot. According to our model results, the existing access road, buildings, and quarry are all outside of the area of flood risk for the 1% (i.e., 100-year) flood. Our results of flood extents as shown in **Attachment 1** reflect the best available topographic data from TCE's survey or LiDAR (2016). The results of the model are summarized in **Table 2, Attachment 1, and Attachment 3**.

Table 2: Base Flood Elevations (feet) at Modeled Cross Sections

FEA HEC-RAS Model River Station	FEA HEC-RAS Model Water Surface Elevation (NAVD88 ft)	FEMA Water Surface Elevation (NAVD88 ft)	Cross Section Source
303	649.6	649.6	FEMA Section AQ
721	654.6	654.6	FEMA Section AR
796	656.6	-	FEA
1043	658.0	-	TCE
1314	658.8	-	FEA
1368	659.2	-	TCE
1480	659.8	-	FEA
1664	660.8	-	TCE
2073	660.8	-	TCE
2451	662.1	-	FEA

3.0 Updated River Corridor

A Trimble Geo7X centimeter-grade GPS unit was used to survey the break in valley slope along the left (Northeast) bank of Great Brook in the vicinity of JE Allstone Chandler Road Quarry. These data points were compared with the 2016 LiDAR DEM and field observations (**Attachment 4)** to map the valley wall as it existed before recent fill was placed along the slope. This mapped line constituted the "2016 valley wall". A 50-foot buffer from this line was drawn in ESRI ArcGIS Pro to account for the riparian buffer component of river corridors for drainages greater than 2 square miles (VTDEC, 2017).

The updated river corridor mapping indicates that the river corridor boundary should be moved to the southwest in the vicinity of JE Allstone Quarry. The distance between the original corridor and the updated corridor ranges from approximately 15 feet to 45 feet (see **Attachment 2**).

4.0 Conclusions

The hydraulic modeling results indicate that the mapped FEMA AE flood zone does not accurately represent the 100-year flood. The modeled flood is 2-5 feet below the elevation of the Allstone access road and parking area of the quarry.

Our revised mapping of the valley wall indicates that the mapped river corridor does not reflect the "narrowest band of valley bottom and riparian land" outlined in the VTDEC River Corridor Protection Procedures (VTDEC, 2017).

Based on these analyses, we recommend updating the river corridor mapping and the BFEs.

List of Attachments

Attachment 1: 100-Year Flood Modeling Map

Attachment 2: Revised Corridor Map

Attachment 3: HEC-RAS Model Cross Sections

Attachment 4: Site Photo Log

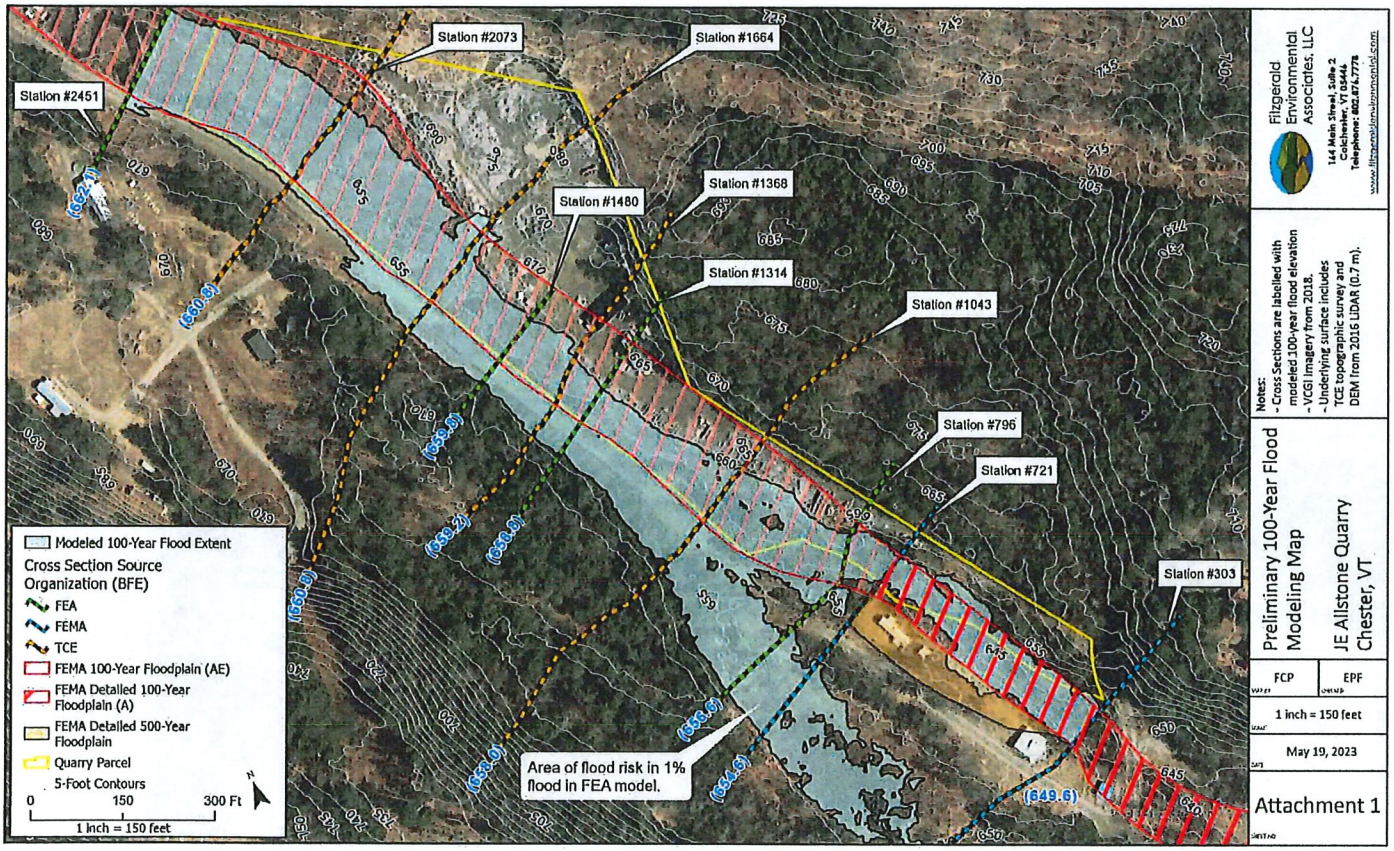
References

Arcement, George J., and V.R. Schneider, 1989. Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains. USGS Paper 2339.

Chow, V.T., 1959. Open Channel Hydraulics. New York, NY: McGraw-Hill Book Co.

USACE (US Army Corps of Engineers), 2023. HEC-RAS River Analysis System, Version 6.3.1. Available at: https://www.hec.usace.army.mil/software/hec-ras/download.aspx

VTDEC (Vermont Department of Environmental Conservation), 2017. Flood Hazard Area and River Corridor Protection Procedure. Available at: https://dec.vermont.gov/sites/dec/files/documents/DEC_FHARCP_Procedure.pdf


Station #2451
Station #2073
Station #1664
Station #1480
Station #1368
Station #1314
Station #1043
Station #796
Station #721
Station #303
(652.1)
(650.8)
(650.8)
(652.2)
(650.8)
(650.8)
(655.5)
(654.6)
(649.6)
Area of flood risk in 1% flood in FEA model.
Modeled 100-Year Flood Extent
Cross Section Source Organization (BFE)
FEA
FEMA
TCE
FEMA 100-Year Floodplain (AE)
FEMA Detailed 100-Year Floodplain (A)
FEMA Detailed 500-Year Floodplain
Quarry Parcel
5-Foot Contours
0
150
300 Ft
1 inch = 150 feet
N
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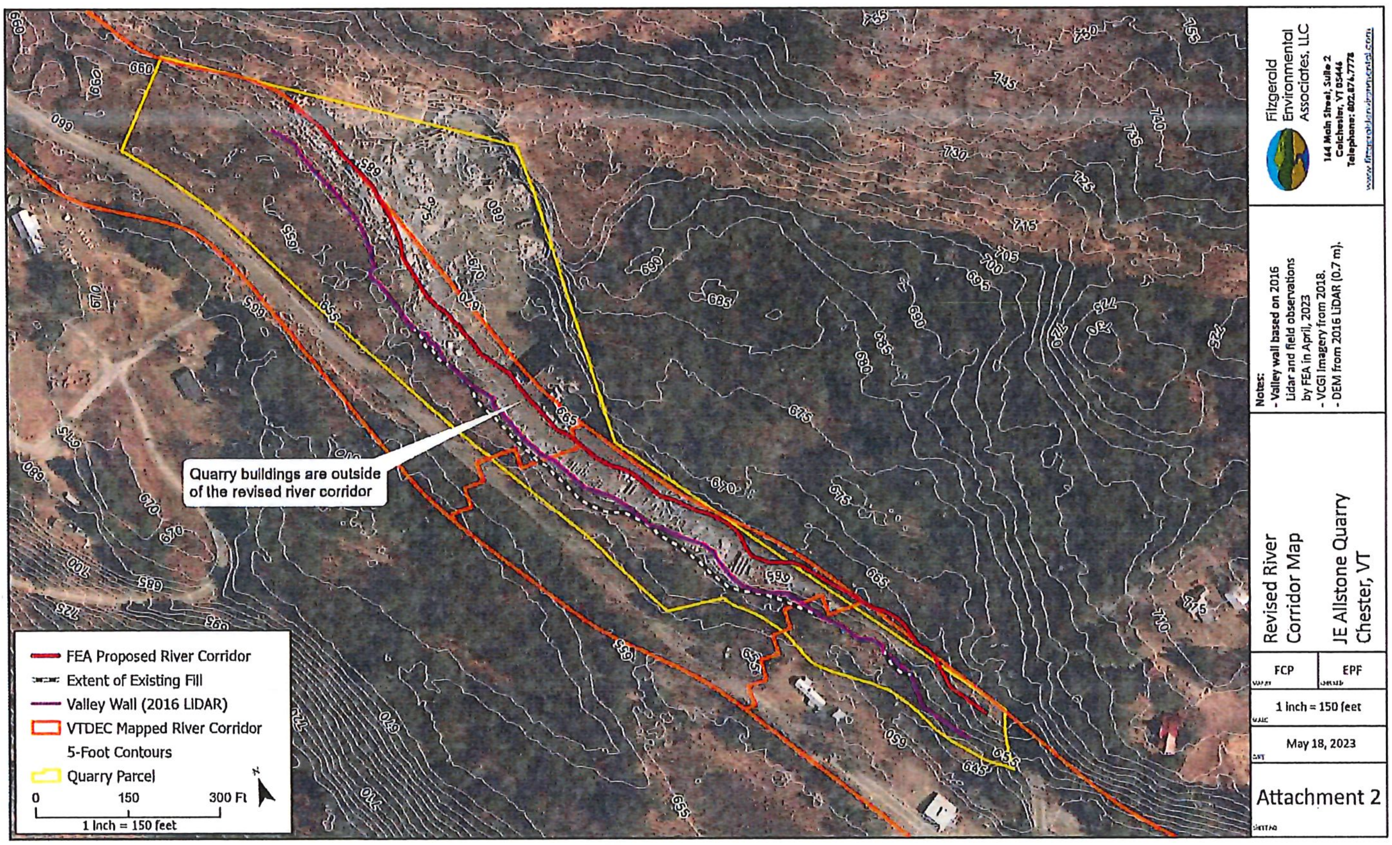
Colchester, VT 05446
Telephone: 802.876.7778
www.fitzgeraldenvironmental.com
Notes:
- Cross Sections are labelled with modeled 100-year flood elevation
- VCGI imagery from 2018.
- Underlying surface includes TCE topographic survey and DEM from 2016 LiDAR (0.7 m).
Preliminary 100-Year Flood Modeling Map
JE Allstone Quarry
Chester, VT
FCP
EPF
1 inch = 150 feet
May 19, 2023
Attachment 1


Quarry buildings are outside of the revised river corridor
FEA Proposed River Corridor
Extent of Existing Fill
Valley Wall (2016 LIDAR)
VTDEC Mapped River Corridor
5-Foot Contours
Quarry Parcel
0
150
300 Ft
1 inch = 150 feet
Fitzgerald Environmental Associates, LLC
144 Main Street, Suite 2
Colchester, VT 05446
Telephone: 802.876.7778
Notes:
- Valley wall based on 2016 Lidar and field observations by FEA in April, 2023
- VCGI imagery from 2018.
- DEM from 2016 LIDAR (0.7 m).
Revised River Corridor Map
JE Allstone Quarry
Chester, VT
FCP
EPF
1 inch = 150 feet
May 18, 2023
Attachment 2

Attachment 3

HEC-RAS Model Cross Sections

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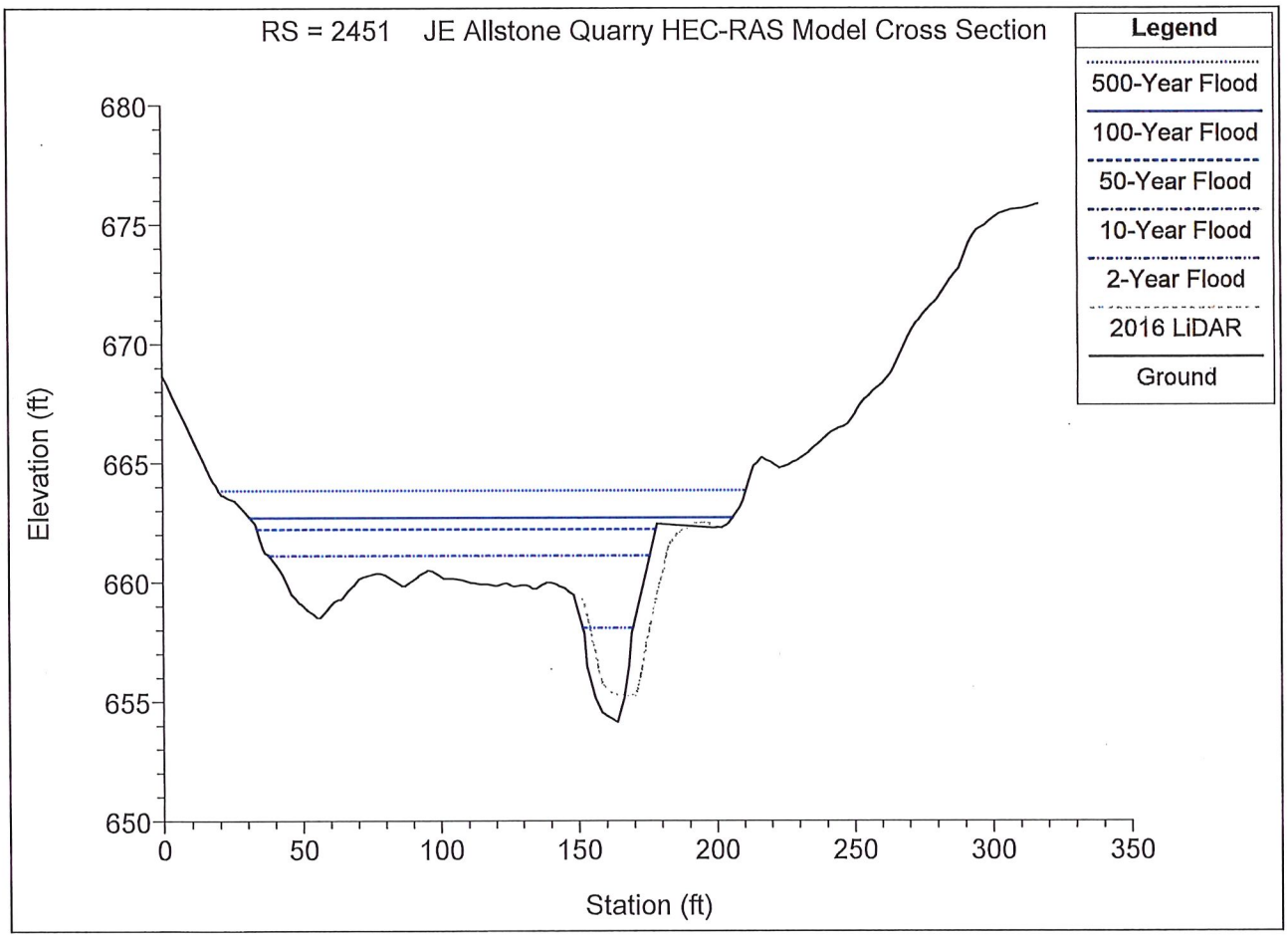
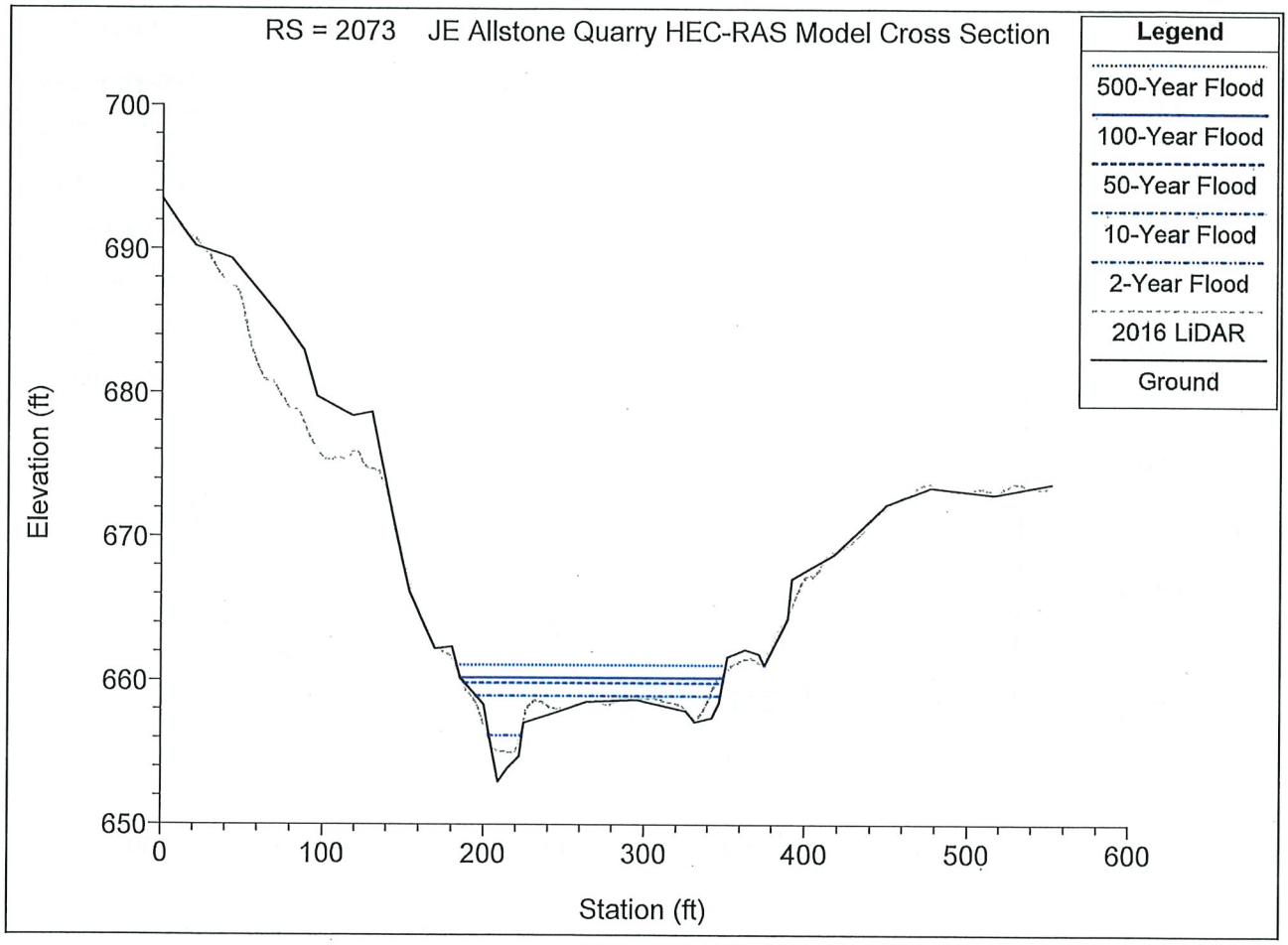
Environmental


RS = 2451 JE Allstone Quarry HEC-RAS Model Cross Section
Legend
500-Year Flood
100-Year Flood
50-Year Flood
10-Year Flood
2-Year Flood
2016 LiDAR
Ground
Elevation (ft)
680
675
670
665
660
655
650
0
50
100
150
200
250
300
350
Station (ft)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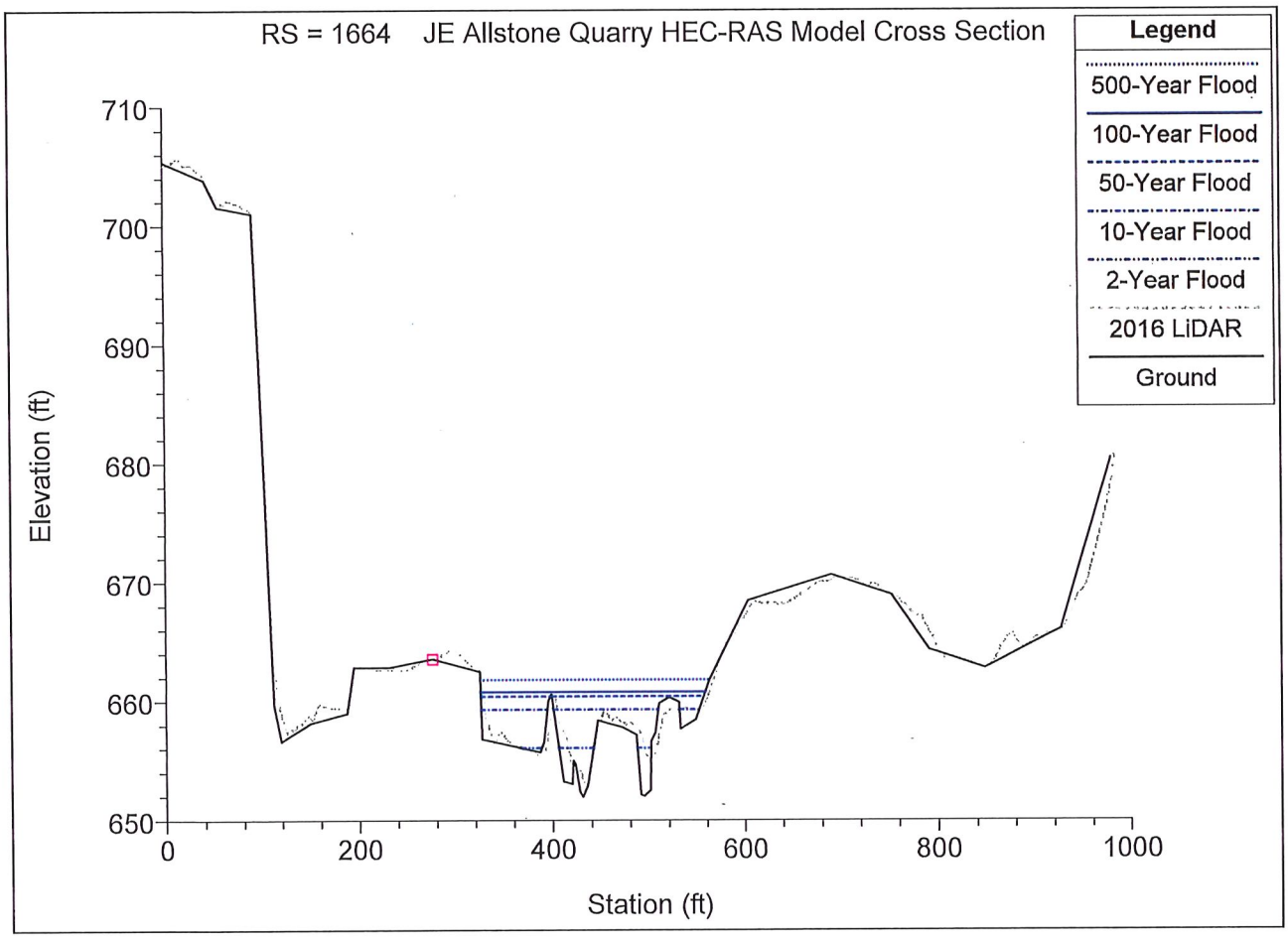
Legend
500-Year Flood
100-Year Flood
50-Year Flood
10-Year Flood
2-Year Flood
2016 LiDAR
Ground
Elevation (ft)
700
690
680
670
660
650
0
100
200
300
400
500
600
Station (ft)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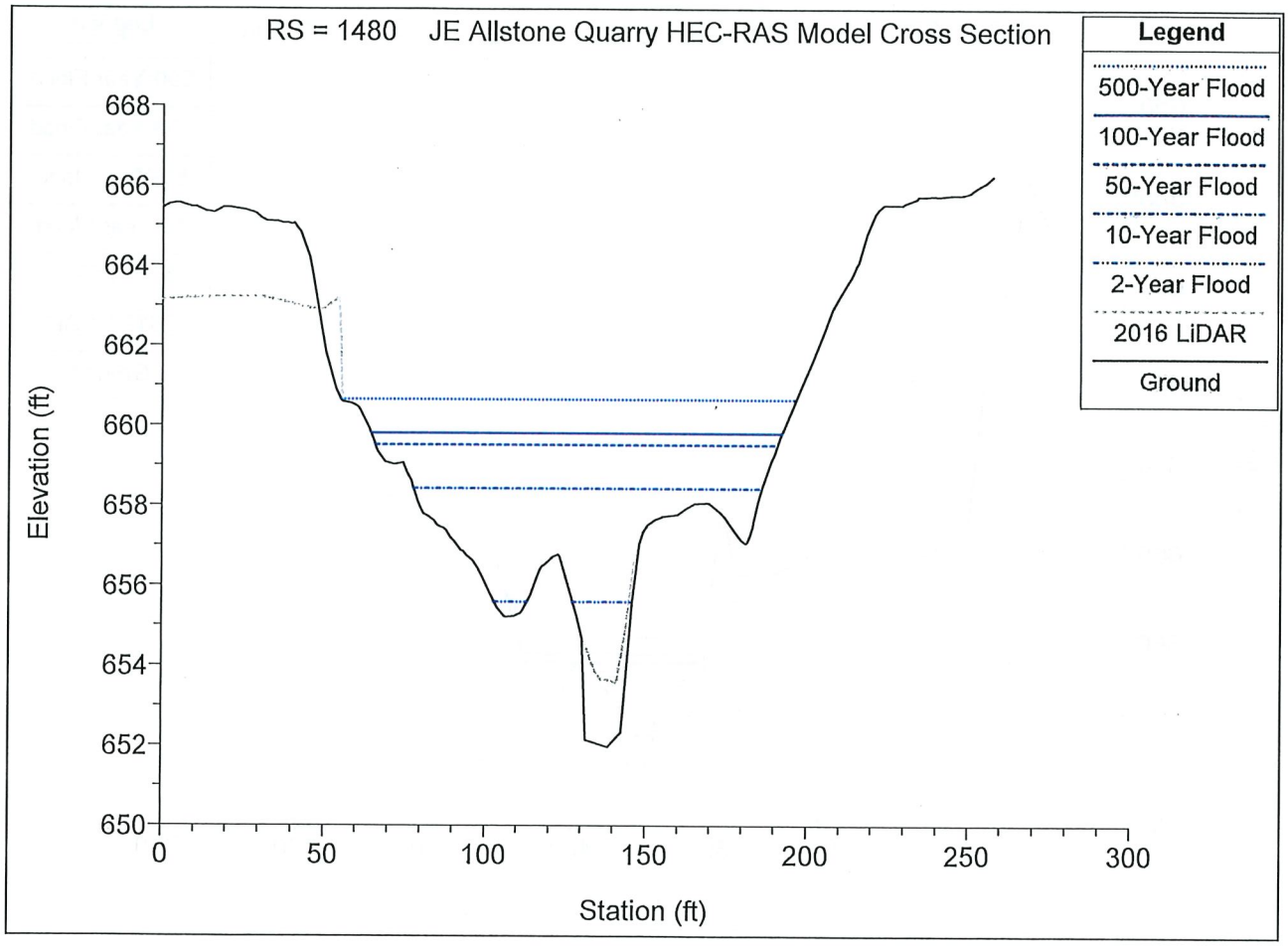
Legend
500-Year Flood
100-Year Flood
50-Year Flood
10-Year Flood
2-Year Flood
2016 LiDAR
Ground
Elevation (ft)
710
700
690
680
670
660
650
0
200
400
600
800
1000
Station (ft)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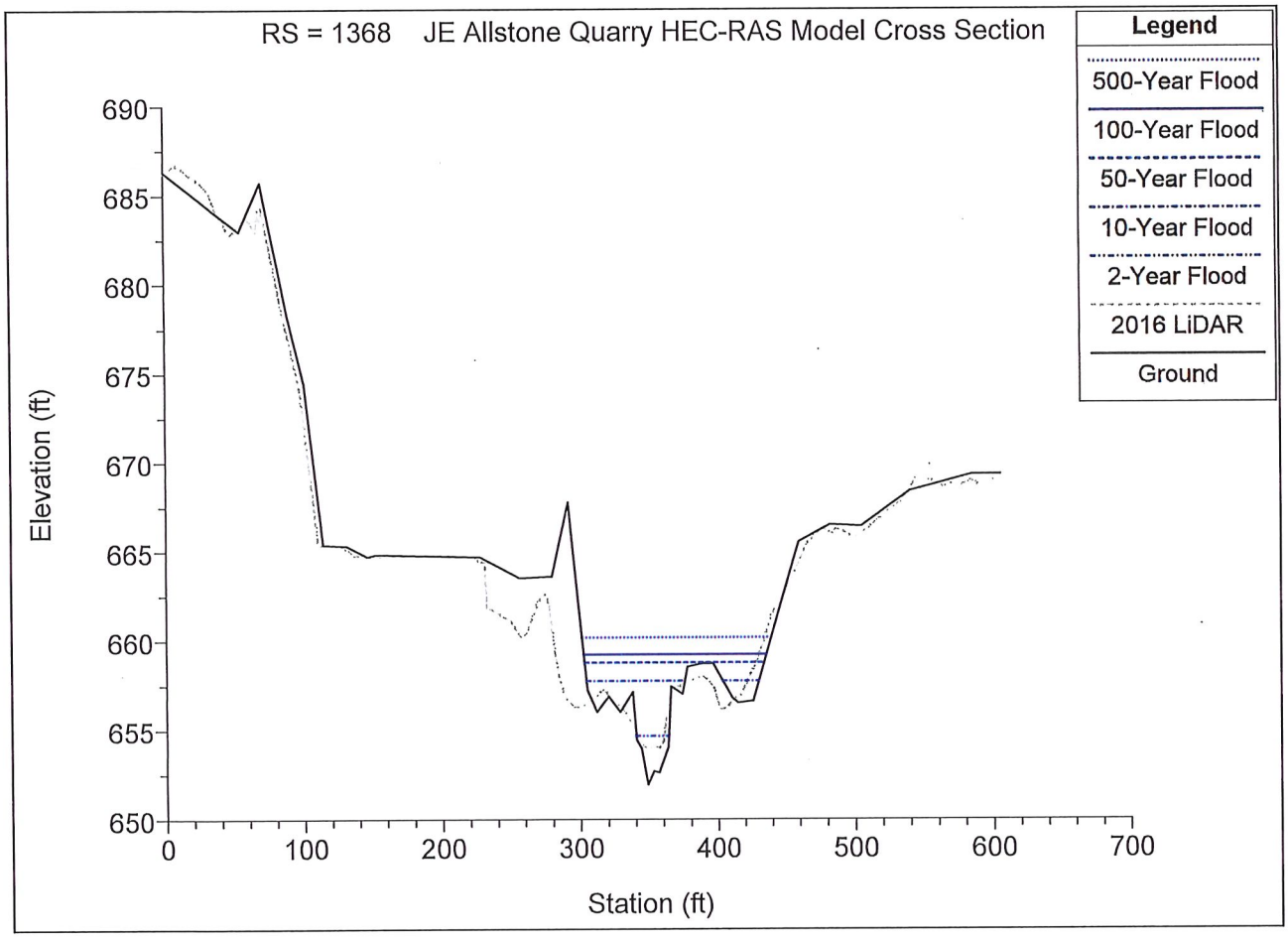
Legend
500-Year Flood
100-Year Flood
50-Year Flood
10-Year Flood
2-Year Flood
2016 LiDAR
Ground
Elevation (ft)
668
666
664
662
660
658
656
654
652
650
0
50
100
150
200
250
300
Station (ft)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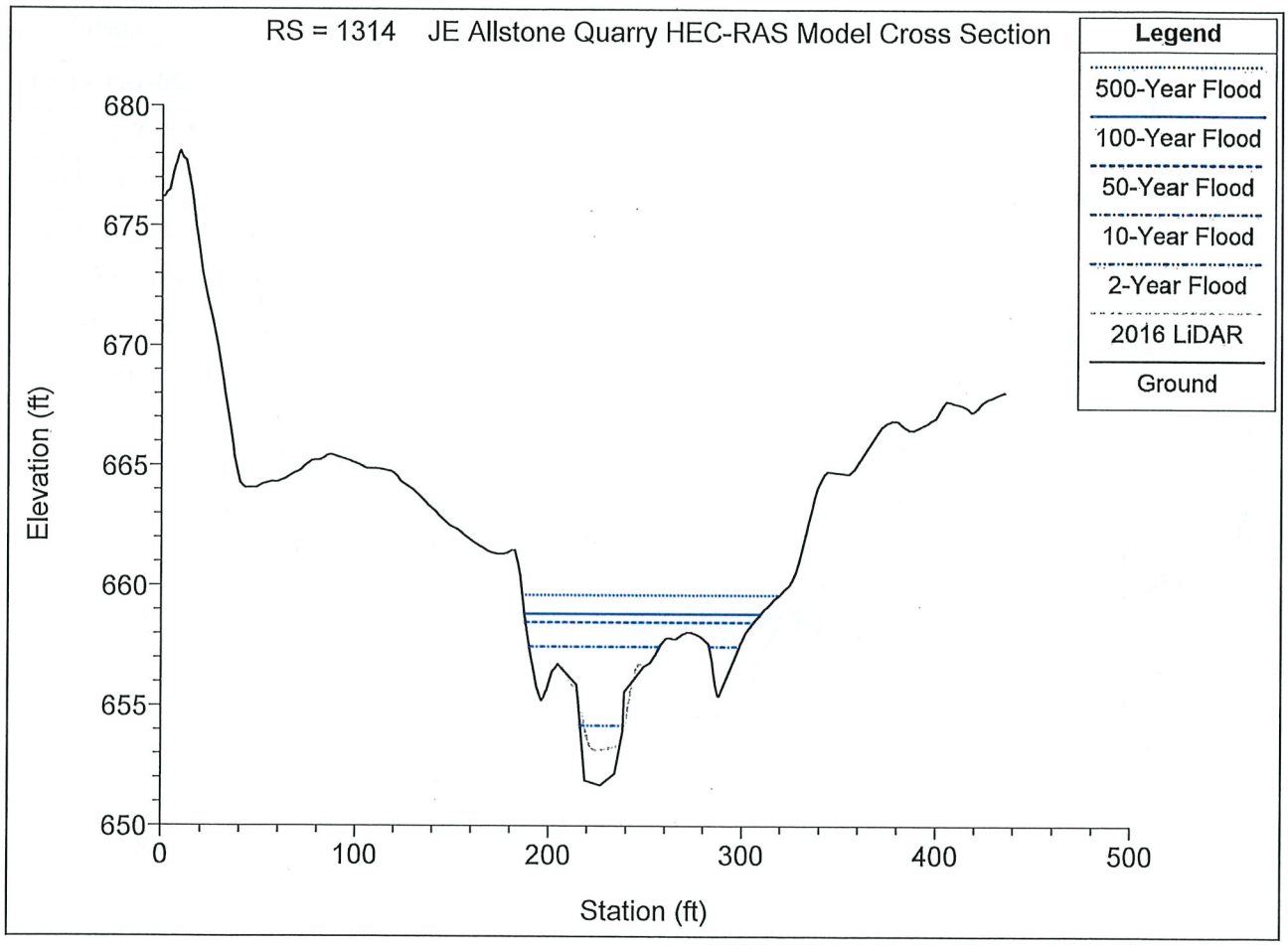
Legend
500-Year Flood
100-Year Flood
50-Year Flood
10-Year Flood
2-Year Flood
2016 LiDAR
Ground
Elevation (ft)
690
685
680
675
670
665
660
655
650
0
100
200
300
400
500
600
700
Station (ft)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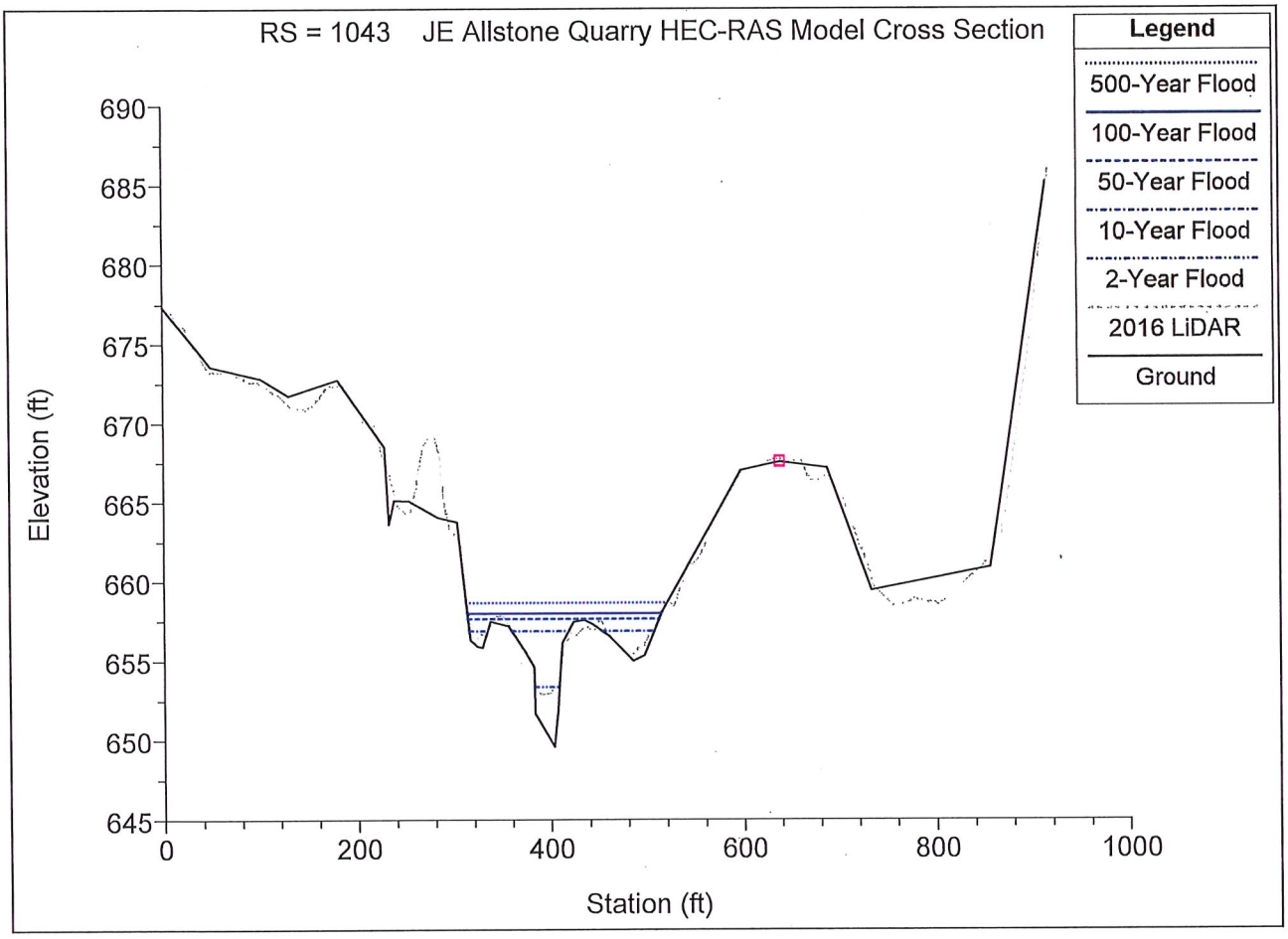
Legend
500-Year Flood
100-Year Flood
50-Year Flood
10-Year Flood
2-Year Flood
2016 LiDAR
Ground
Elevation (ft)
680
675
670
665
660
655
650
0
100
200
300
400
500
Station (ft)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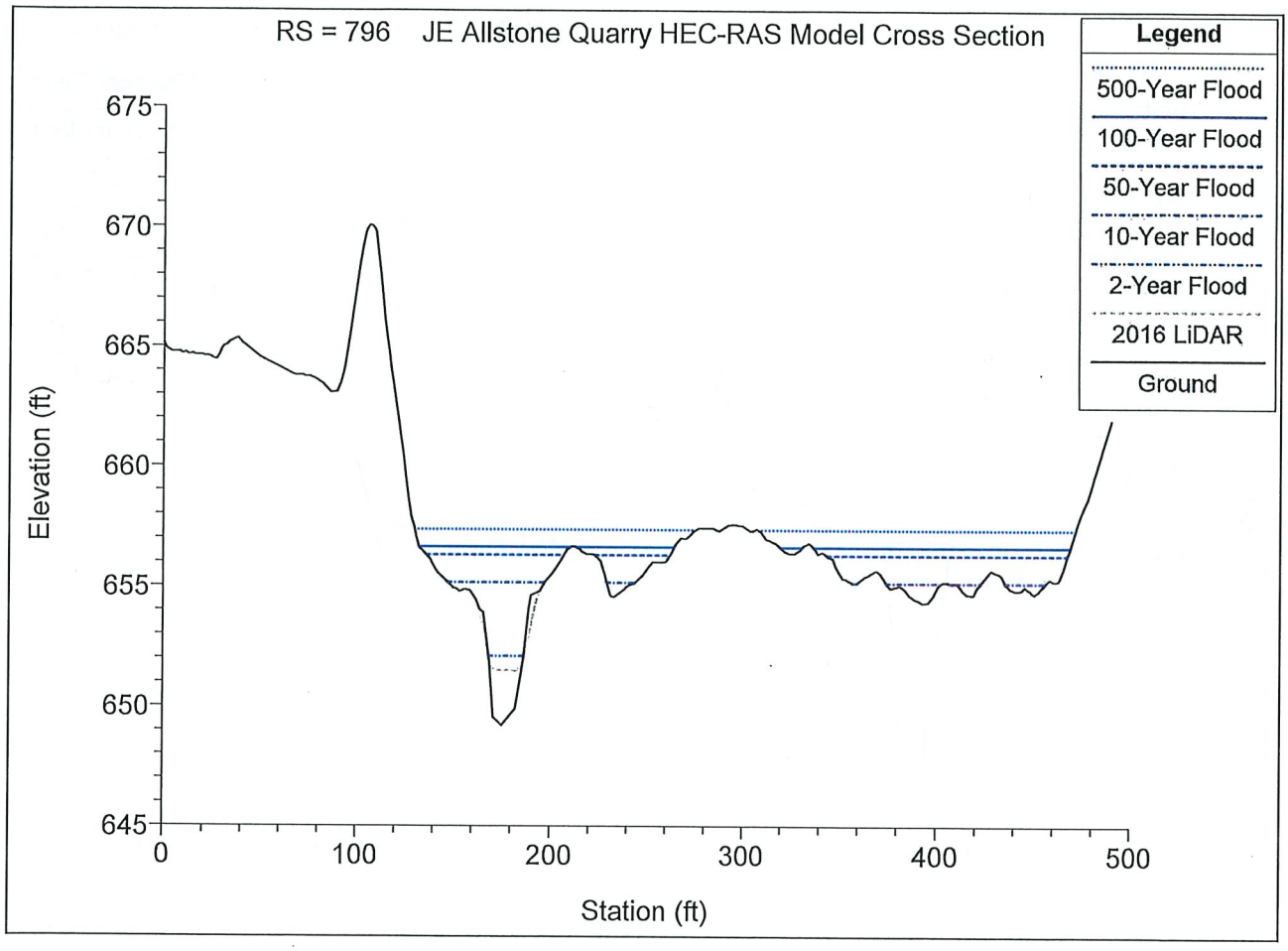
Legend
500-Year Flood
100-Year Flood
50-Year Flood
10-Year Flood
2-Year Flood
2016 LiDAR
Ground
Elevation (ft)
690
685
680
675
670
665
660
655
650
645
0
200
400
600
800
1000
Station (ft)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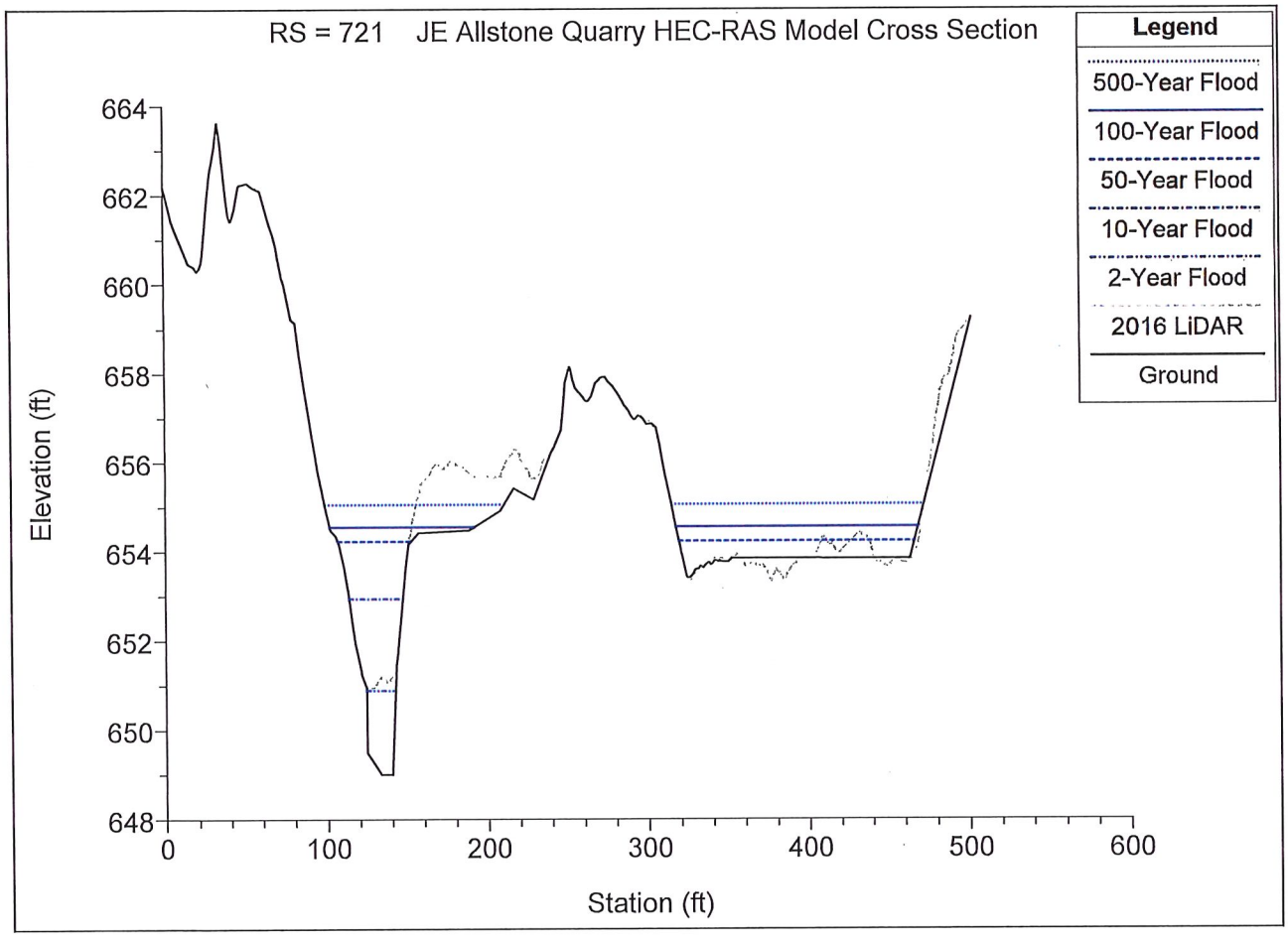
Legend
500-Year Flood
100-Year Flood
50-Year Flood
10-Year Flood
2-Year Flood
2016 LiDAR
Ground
Elevation (ft)
675
670
665
660
655
650
645
0
100
200
300
400
500
Station (ft)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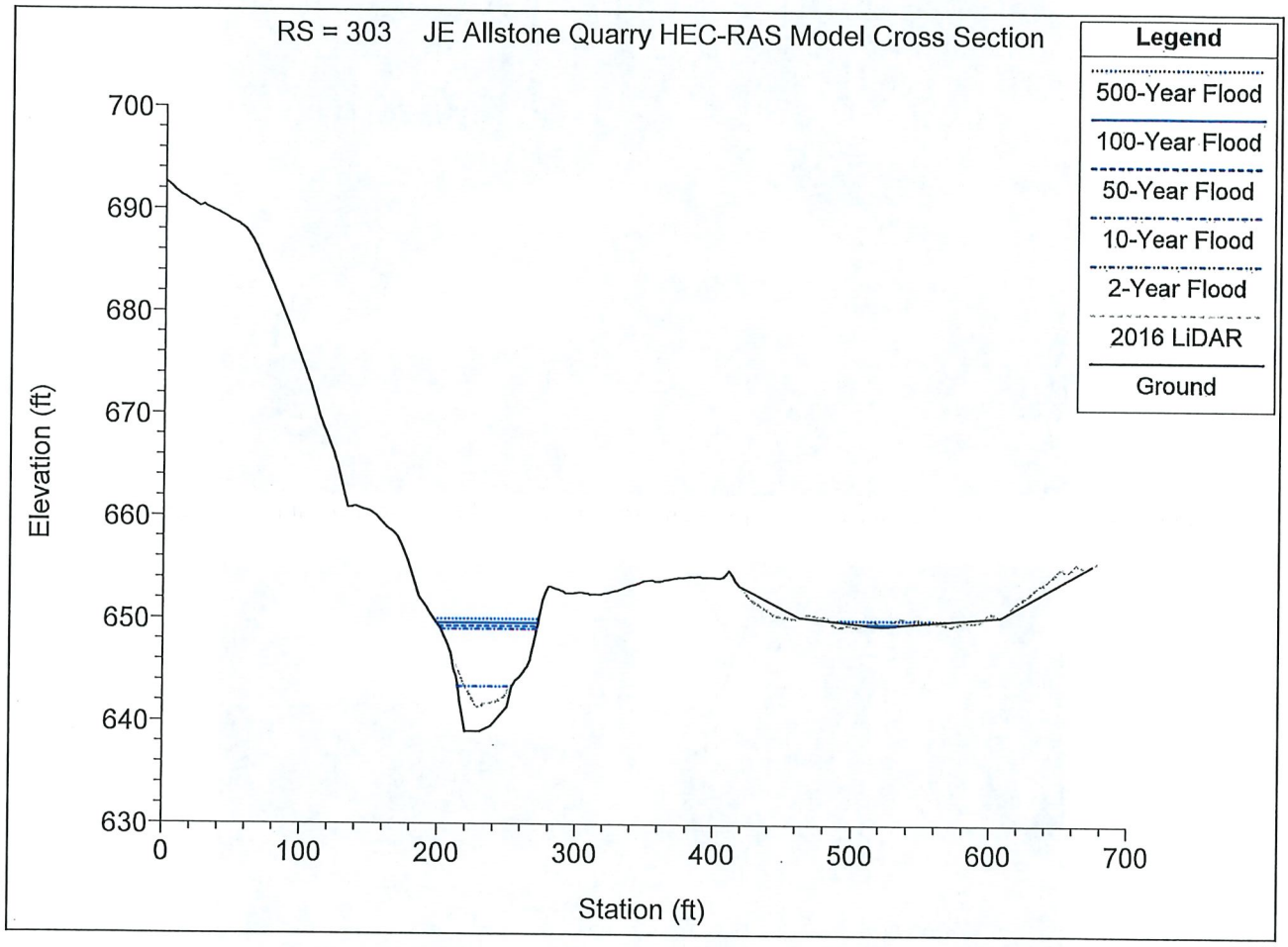
Legend
500-Year Flood
100-Year Flood
50-Year Flood
10-Year Flood
2-Year Flood
2016 LiDAR
Ground
Elevation (ft)
664
662
660
658
656
654
652
650
648
0
100
200
300
400
500
600
Station (ft)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Legend
500-Year Flood
100-Year Flood
50-Year Flood
10-Year Flood
2-Year Flood
2016 LiDAR
Ground
Elevation (ft)
700
690
680
670
660
650
640
630
0
100
200
300
400
500
600
700
Station (ft)

Attachment 4: Site Photo Log

Project: JE Allstone Chandler Road Quarry Floodplain and River Corridor Mapping

Date: May 18, 2023

Photo 1: Great Brook channel looking upstream from location of cross section at river station 721.

Photo 2: Fill encroaching into floodplain, trees growing up through fill show location of previous break in slope.

Photo 3: Fill extending past large tree. Location of tree indicates previous break in slope

Photo 4: Trees growing out of the quarry fill indicating new fill encroaching into floodplain