



TECHNICAL MEMORANDUM



To: Brianna Greenlaw, P.E., CFM – Carson City Public Works
From: Todd Cochran, P.E., CFM – House Moran Consulting, Inc.
Date: April 21, 2023
RE: Carson City Emergency Operation Center Floodplain Analysis Scenarios

INTRODUCTION

The proposed Carson City Emergency Operations Center (EOC) development has been designed to minimize impacts to the FEMA floodplains. The proposed development is located with a Zone AE special flood hazard area outside of the regulatory floodway along King’s Canyon Creek. The project does not increase the 1% annual chance event (ACE) maximum water surface elevations or Base Flood Elevations (BFE) by 0.01-feet or greater. Although not required by the City’s floodplain ordinance, this project is considered a “No-Rise” or no adverse impact. Compensatory floodplain storage is not provided at the proposed EOC site. However, compensatory floodplain storage is not necessary because the project results in a “No-Rise” condition. A summary of the hydraulic analysis is provided below. The resulting floodplain delineations for each of the modeled scenarios are provided in the attached Exhibits 1 and 2 (Floodplain Mapping Scenarios).

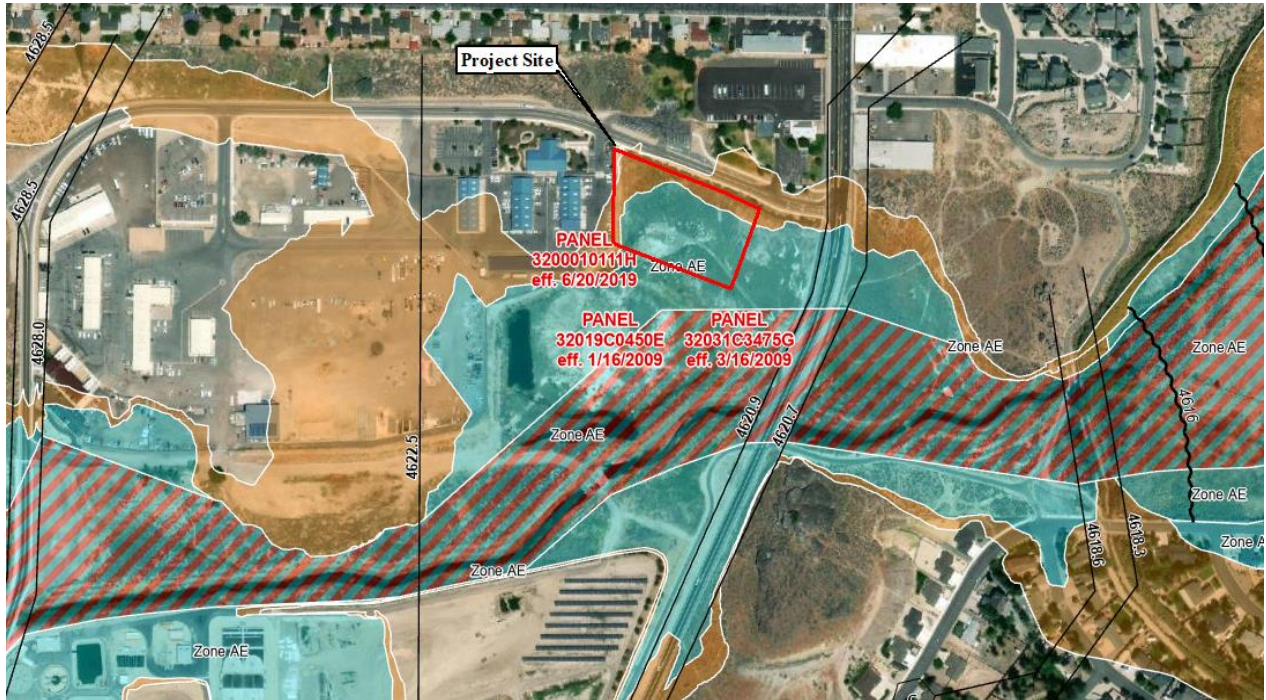


Figure 1. Location Map



HYDRAULIC FLOODPLAIN ANALYSIS

The effective FEMA model was obtained from the Letter of Map Revision case #16-09-1192P. The effective floodplain mapping is shown on the effective Flood Insurance Rate Map panel #3200010111H, which became effective on June 20, 2019.

The effective FEMA hydraulic model was developed in the U.S. Army Corps of Engineer’s HEC-RAS version 5.0.3 program. This model was imported into the latest version (6.3.1) of HEC-RAS and modified to create revised existing conditions and proposed conditions model scenarios.

The revised Existing Conditions Model used the cross sections from the effective FEMA model with additional cross sections added to provide an accurate comparison between existing (pre-project) and proposed (post-project) conditions. Cross sections 1212, 1223, 1552 and 1580 were added to the model. The HEC-RAS RASMapper application was used to update the cross-section geometry data including reach lengths and station-elevation data. The station elevation data for the cross sections was taken from the latest LiDAR data. The 1% ACE water surface elevations for the effective FEMA and revised existing conditions model results are summarized in Table 1.

The Proposed Conditions Model scenario was created by saving the revised existing conditions geometry and editing to incorporate the proposed changes on the Carson City EOC project site. The proposed site plan provided by Carson City was used to modify cross sections 1552, 1447.365, and 1223 to include the proposed site. These cross sections show the fill and excavation that is proposed for the EOC site. The 1% ACE water surface elevations were not increased in the Proposed Conditions Model when compared to the revised Existing Conditions Model. A summary of the model results is shown in Table 1.

Table 1 – Water Surface Elevations from HEC-RAS Model¹

XS ID	Effective FEMA	Existing Conditions	Proposed Conditions	Proposed – Existing Conditions	Description
156.6568	4618.85	4618.85	4618.85	0.00	
1026.7	4620.77	4620.77	4620.77	0.00	
1080.5	Fairview Drive				
1137.728	4621.03	4621.03	4621.03	0.00	
1212	N/A	4621.11	4621.11	0.00	
1223	N/A	4621.11	4621.11	0.00	d/s end of EOC
1447.365	4621.21	4621.22	4621.20	-0.02	EOC
1552	N/A	4621.30	4621.29	-0.01	u/s end of EOC
1580	N/A	4621.29	4621.28	-0.01	
1999	N/A	4621.78	4621.77	-0.01	
2307.066	4622.53	4624.66	4624.66	0.00	
2929.759	4626.42	4627.40	4627.40	0.00	



XS ID	Effective FEMA	Existing Conditions	Proposed Conditions	Proposed – Existing Conditions	Description
3490.956	4628.11	4627.91	4627.91	0.00	
3591.5	Airport Road				
3591.992	4628.52	4628.39	4628.39	0.00	
3923.687	4628.53	4628.40	4628.40	0.00	
4309.763	4628.55	4628.43	4628.43	0.00	
4715.834	4628.64	4628.52	4628.52	0.00	
5179.23	4628.66	4628.55	4628.55	0.00	
5489.854	4628.70	4628.58	4628.58	0.00	
5597	I-580				
5704.987	4628.79	4628.72	4628.72	0.00	

¹ All elevations in feet North American Vertical Datum of 1988 (NAVD88)

The model results show an increase at cross-sections 1447.365, 2307.066, and 2929.759 between the Effective and Existing Conditions Model scenarios. This increase is due to the cross-sections being recut from the latest LiDAR data which shows the left bank being higher than that shown in the Effective Model.

HEC-RAS summary tables and cross section plots are attached for the effective FEMA, Existing Conditions, Proposed Conditions, and Proposed Conditions with the Channel Restoration.

FLOODPLAIN STORAGE VOLUME

The proposed EOC will place fill in the left overbank of the floodplain outside of the regulatory floodway. This fill will reduce the floodplain volume. The Existing and Proposed Conditions floodplain volumes were estimated using the volume calculated by HEC-RAS. This method uses an average end method that uses the cross-sectional area of the 1% annual chance flood multiplied by the cross section reach length to estimate the cumulative floodplain volume between each cross section. The cumulative volume for all four scenarios is summarized in Table 2.

Table 2 – Cumulative Volume from Downstream End of Model

XS ID	Effective FEMA (ac-ft)	Existing Conditions (ac-ft)	Proposed Conditions (ac-ft)	Proposed – Existing (ac-ft)	Description
5	0.00	0.00	0.00	0.00	
1026.7	48.94	48.94	48.94	0.00	
1080.5	Fairview Drive				
1137.728	58.59	58.59	58.59	0.00	



XS ID	Effective FEMA (ac-ft)	Existing Conditions (ac-ft)	Proposed Conditions (ac-ft)	Proposed – Existing (ac-ft)	Description
1212	N/A	73.26	73.26	0.00	
1223	N/A	75.72	75.69	-0.03	d/s end of EOC
1447.365	95.79	86.04	85.46	-0.03	EOC
1552	N/A	95.71	94.48	-1.23	u/s end of EOC
1580	N/A	98.48	97.18	-1.3	
1999	N/A	131.97	130.59	-1.38	
2307.066	172.41	159.31	157.91	-1.4	
2929.759	210.28	213.40	211.99	-1.41	
3490.956	253.56	257.87	256.47	-1.4	
3591.5	Airport Road				
3591.992	261.18	265.65	264.24	-1.41	
3923.687	318.64	321.53	320.12	-1.41	
4309.763	368.40	369.87	368.46	-1.41	
4715.834	467.56	468.11	466.71	-1.4	
5179.23	624.93	625.27	623.86	-1.41	
5489.854	692.29	702.46	701.05	-1.41	
5597	I-580				
5704.987	711.16	726.55	725.14	-1.41	

The floodplain volume is reduced between cross sections 1223 and 1552, which is the location of the proposed EOC, by 1.23 acre-feet. The floodplain volume is further reduced to 1.41 acre-feet upstream of the EOC due to the lower water surface elevation in proposed conditions. This decrease of floodplain volume is not considered significant because the base flood elevation (BFE) is not increased by the proposed EOC project.

CONCLUSIONS

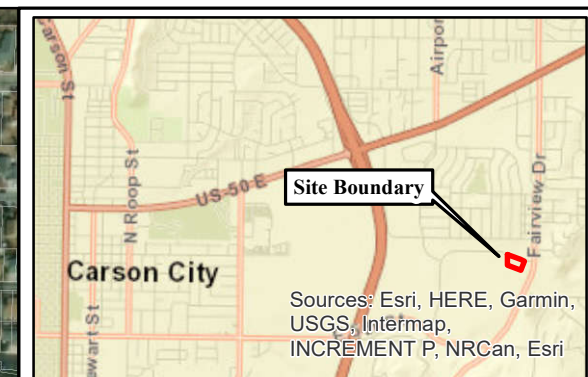
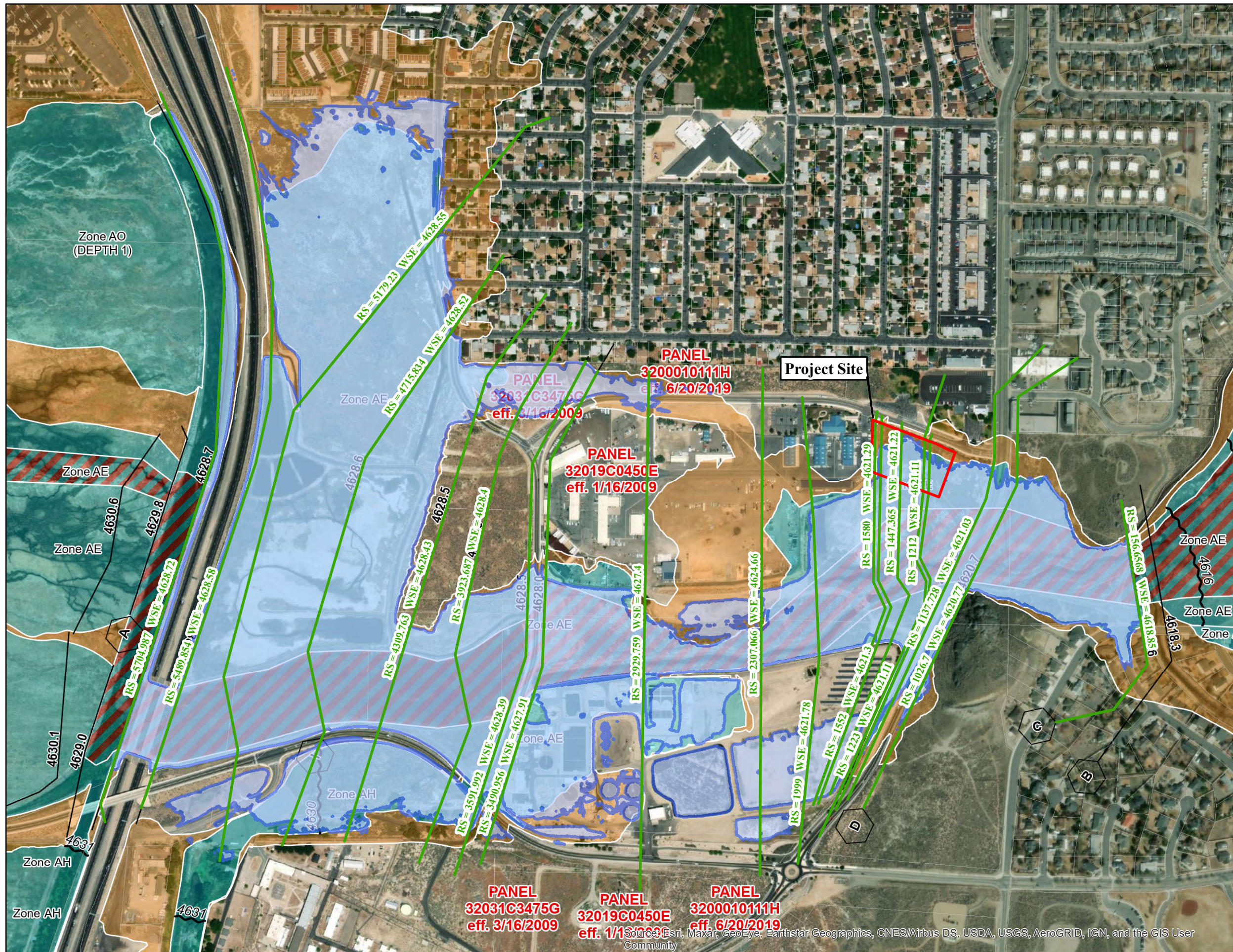
The proposed Carson City EOC development is located within a Zone AE special flood hazard area (outside of the regulatory floodway). The hydraulic analysis showed that the proposed development does not increase the 1% ACE water surface elevations or BFEs by 0.01-feet or greater. The floodplain volume is reduced by a total of 1.41 acre-feet due to the fill and the slightly lower base flood elevations upstream. This project meets the requirements of Carson City’s floodplain development ordinance.



Exhibits

Existing Floodplain Mapping

Proposed Floodplain Mapping



- ### Legend
- Carson City EOC
 - Existing Cross Sections
 - Existing Inundation Boundary 100 yr
 - Parcels
 - FIRM Panels
 - Cross-Sections
 - Base Flood Elevations
 - Flood Hazard Boundaries
 - Limit Lines
 - SFHA / Flood Zone Boundary
 - Flood Hazard Zones
 - 1% Annual Chance Flood Hazard
 - Regulatory Floodway
 - Special Floodway
 - Area of Undetermined Flood Hazard
 - 0.2% Annual Chance Flood Hazard
 - Future Conditions 1% Annual Chance Flood Hazard
 - Area with Reduced Risk Due to Levee
 - Area with Risk Due to Levee

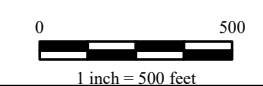


Exhibit 1 Existing Floodplain Mapping

Prepared For:

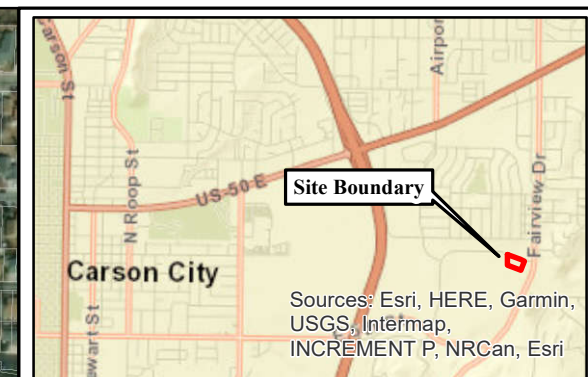
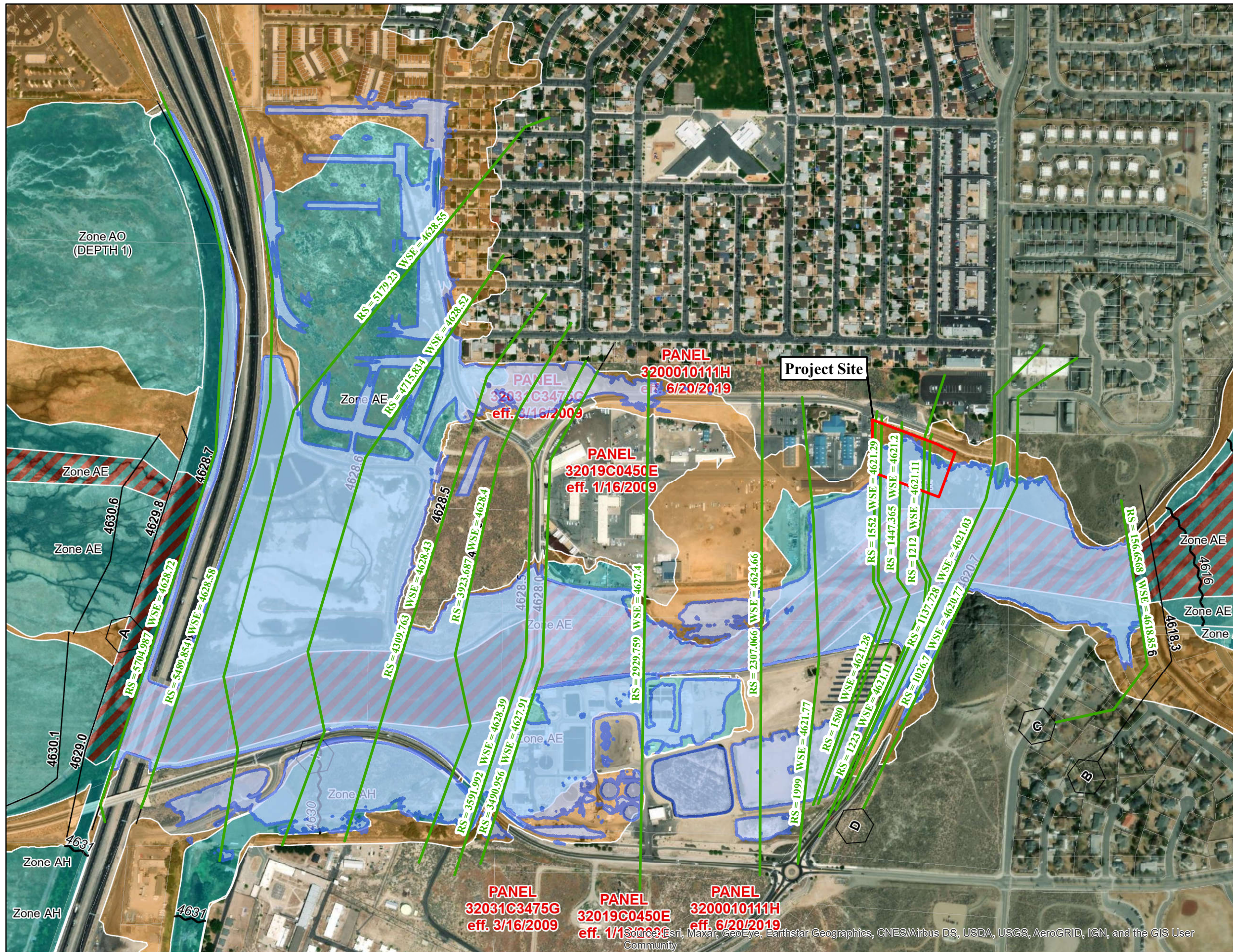
Carson City Public Works
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Carson City, NV 89701

Prepared By:

House Moran Consulting, Inc.
Water Resources and Environmental Engineering
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Office: (775) 293-4000

Prepared On: 3/2/2023

Sources: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Legend

- Carson City EOC
- Proposed Cross Sections
- Proposed Inundation Boundary 100 yr
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0 500
1 inch = 500 feet

Exhibit 2 Proposed Floodplain Mapping

Prepared For:

Carson City Public Works
3505 Butti Way
Carson City, NV 89701

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