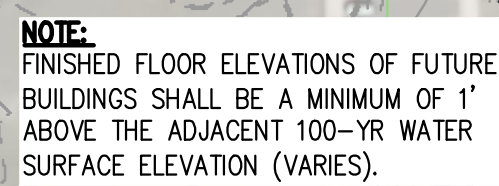


USE BY SPECIAL EXCEPTION

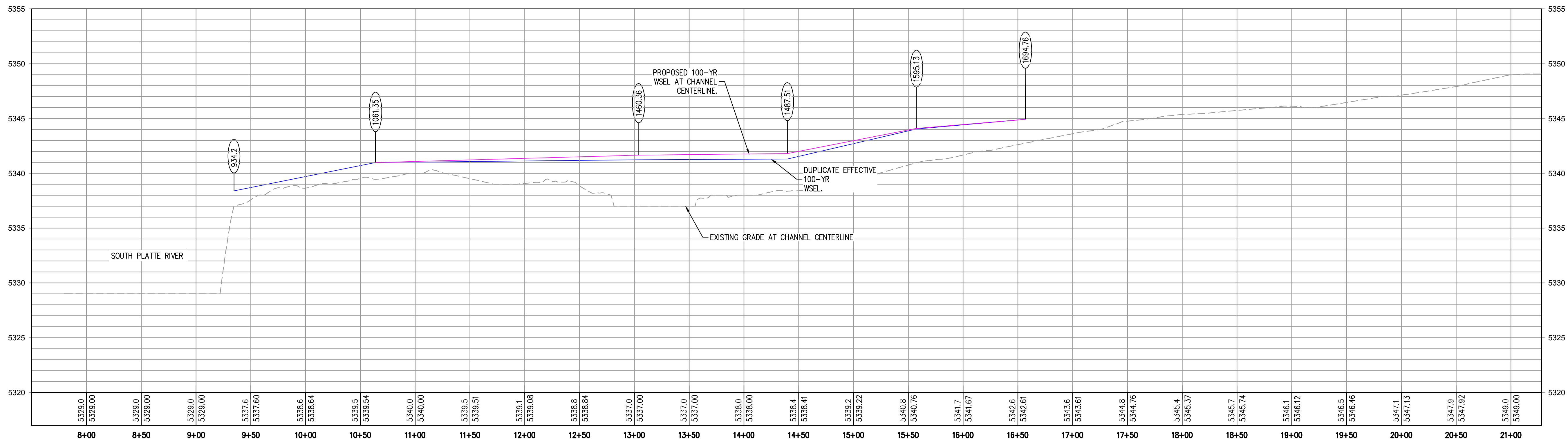


6705 SOUTH SANTA FE DRIVE

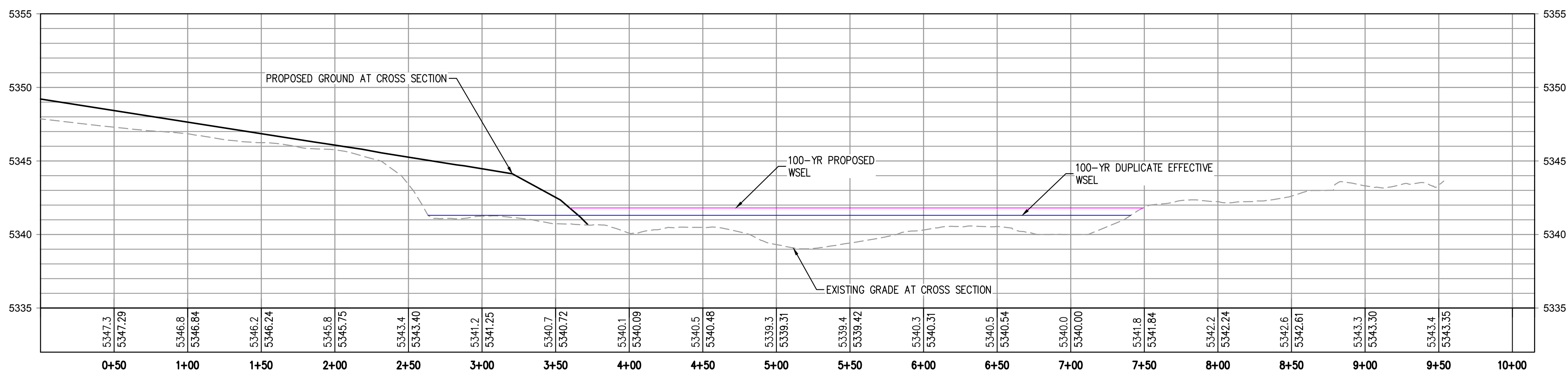
SITUATED IN THE NORTHEAST 1/4 OF SECTION 29 & THE SOUTHEAST 1/4 OF SECTION 20, TOWNSHIP 5 SOUTH,
RANGE 68 WEST OF THE 6TH P.M. COUNTY OF ARAPAHOE, STATE OF COLORADO

CASE # ENG17-0007

USE BY SPECIAL EXCEPTION



RANGEVIEW GULCH WATERCOUSE PROFILE



TYPICAL VALLEY CROSS SECTION (HEC XS 1487.51)

WATER SURFACE ELEVATION COMPARISON TABLE

FHAD*		Proposed Conditions		
FHAD XS	100-YR WSEL	HEC XS	100-YR WSEL	Δ WSEL (Ex to Prop)
1815.5	5346.24	1815.50	5346.24	0.00
1694.76	5344.93	1694.76	5344.93	0.00
1595.13	5344.04	1595.13	5344.10	0.06
1529.71	5341.57	1529.71	5341.88	0.31
1487.51	5341.30	1487.51	5341.80	0.50
1460.36	5341.24	1460.36	5341.66	0.42
1061.35	5340.98	1061.35	5340.98	0.00

*Per Rangeview Gulch Jan2017 FHAD Update

OVERALL VELOCITY COMPARISON TABLE

FHAD*				Proposed Conditions						
FHAD XS	MAIN CHANNEL VELOCITY	RIGHT BANK VELOCITY	LEFT BANK VELOCITY	HEC XS	MAIN CHANNEL VELOCITY	RIGHT BANK VELOCITY	LEFT BANK VELOCITY	Δ VELOCITY MAIN CHANNEL	Δ VELOCITY RIGHT BANK	Δ VELOCITY LEFT BANK
1815.5	1.91	2.04	-	1815.50	1.91	2.04	-	0.00	0.00	-
1694.76	1.72	1.13	-	1694.76	1.74	1.13	-	0.02	0.00	-
1595.13	1.87	0.87	-	1595.13	1.78	0.84	-	-0.09	-0.03	-
1529.71	2.27	3.40	-	1529.71	2.96	3.15	-	0.69	-0.25	-
1487.51	1.18	1.16	0.54	1487.51	1.02	0.88	0.73	-0.16	-0.28	0.19
1460.36	0.52	-	-	1460.36	0.96	-	-	0.44	-	-
1061.35	2.59	2.70	-	1061.35	2.59	2.70	-	0.00	0.00	-
*Per Rangeview Gulch Jan2017 FHAD Update										

*Per Rangeview Gulch Jan2017 FHAD Update

August 3, 2018

City of Littleton
2255 W. Berry Avenue
Littleton, CO 80120

Attn: Ms. Carol Kuhn, AICP, Principal Planner

From: Mr. Mark A. West, PE, CFM, LEEDAP

RE: 6705 SOUTH SANTA FE DRIVE
USE BY SPECIAL EXCEPTION – FLOODPLAIN MEMORANDUM
CITY OF LITTLETON CASE NO. ENG17-0007
HKS PROJECT NO. 161018

Dear Ms. Kuhn,

This memorandum is provided as a technical support document for the Use by Special Exception application. This memo addresses the Use by Special Exception Flood Hazard Area Delineation (FHAD) or 100-Year event flooding limits within and adjacent to the subject Site from Rangeview Gulch (RVG).

In support of the Use by Special Exception Site Plan, the following major items are addressed herein:

1. General Background
2. Existing Flood Hazard Area Delineation (FHAD) and Updates
3. Use by Special Exception HEC-RAS Modeling

1. General Background

The 6705 South Santa Fe Drive site (Site) is located in the Northeast 1/4 of Section 29 and the Southeast 1/4 of Section 20, Township 5 South, Range 68 West of the 6th Principal Meridian, County of Arapahoe, State of Colorado. The Site is comprised of approximately 3.7 acres of land known as Lot 1 of the 6705 South Santa Fe Subdivision. The Site is bounded by Santa Fe Sand & Gravel storage and warehouse to the north, Breckenridge Brewery to the south, Meadowood Village mobile home park to the east, and Reynolds Landing (South Suburban Parks & Recreation) to the west.

The Site is shown to be in a FEMA Zone X (unshaded) Flood Area according to FIRM map 08005C0432K, Arapahoe County, Colorado, December 17, 2010. Zone X (unshaded) areas are described by FEMA as determined to be outside 0.2% annual chance floodplain.

2. Existing Flood Hazard Area Delineation (FHAD) and Updates

The entire Site lies within the Rangeview Gulch drainage basin, which is tributary to the South Platte River. This area of RVG was studied in the Flood Hazard Area Delineation, Lower Dad Clark Gulch and DFA 0068, for Urban Drainage and Flood Control District and City of Littleton, Centennial Engineering, Inc., November 1990. This study was updated in the project area by the Rangeview Gulch FHAD Update for Rangeview Gulch between South Platte River and Turtle Lake, revised January 2017 by Ayres and Associates.

The overall Rangeview Gulch basin is approximately 430 acres in size, extending from of South Cedar Circle and West Dry Creek Road upstream, to the South Platte River downstream, crossing SFD between West Mineral Avenue and West Ridge Road. The upper basin east of the railroad is predominantly established single-family residential, and includes a portion of the Highline Canal and some irrigation ponds. The lower basin west of SFD is a mixture of commercial, warehouse, light industrial, a mobile home park, and parks and open space. The storm drainage system in the area consists of natural channels and some pipe and culvert connections. Most of the ponds that exist in the upper basin are assumed to be private or for irrigation purposes (noted in the 1990 Lower Dad Clark Gulch and DFA 0068 FHAD), not for detention.

As previous studies indicate, major flows from the east combine with flows from Lee Gulch and overtop the railroad and Santa Fe Drive (SFD). Much of the Site and adjacent mobile home park and Santa Fe Sand & Gravel properties are inundated with, at least, shallow flooding.

The 2017 UDFCD Flood Hazard Area Delineation (FHAD) update for the Rangeview Gulch drainageway details the 100-year storm event overtopping the railroad and Santa Fe Drive (SFD). A concrete barrier on the west side of Santa Fe Drive blocks the overflows from flowing directly onto the mobile home park, but it eventually inundates much of the park and into the Site. Shallow flooding extends to adjacent properties. The appendix to this memorandum includes the Floodplain Workmap from the FHAD.

The 2017 FHAD estimates the RVG 100-year flows entering the site area from Santa Fe Drive as 938 cfs from the upper basin, and this existing hydrology will not be revised with this application.

3. Use by Special Exception HEC-RAS Modeling

The Urban Drainage and Flood Control District (UDFCD) and the City of Littleton updated the Flood Hazard Area Delineation for Lower Dad Clark Gulch and DFA 0068 (1990, Centennial Engineers Inc) for a portion of Rangeview Gulch generally from Turtle Lake upstream of Santa Fe Drive to the South Platte River.

The 1990 FHAD identified a split flow hydraulic condition with some flow spilling over the railroad tracks and across Santa Fe and the remainder of the flow continuing north to Lee Gulch. Traffic safety improvements to Santa Fe since 1990 have included jersey barriers and a raised median. Railroad corridor improvements were also constructed since the FHAD was completed. These improvements break up the flow patterns of the 1990 FHAD and the current floodplain delineation is updated to determine the current distribution of flows and extents of the floodplain in this area.

2D Hydraulic Model

For this Use by Special Exception, HEC-RAS modeling prepared for the 2017 FHAD update was obtained from the UDFCD and studied in relation to this application. The modeling contains an SRH-2D hydraulic model used to more clearly define the split flows and flow patterns downstream of SFD. The results of the SRH-2D indicate Monitor Lines to report locations used to develop the 1D model flow splits. As this use by Special Exception application does not interfere with the Monitor Lines (specifically LN10 at the entrance to the Site from Brewery Lane) no revisions were made to the 2D modeling.

As no grading revisions are proposed within the area of the Brewery Lane modeling, no revisions have been made to the Brewery Lane models.

1D Hydraulic Model

With the 2017 FHAD update a 1D HEC-RAS hydraulic model was developed from the results of the 2D hydraulic model to assist with the regulatory functions of the City of Littleton and UDFCD. Cross sections were laid out according to water surfaces contours and flow directions shown in the 2D hydraulic model.

For this Use by Special Exception, minor revisions to the 2017 FHAD update HECRAS model were made to represent the fill proposed on the site and document the results on Water Surface Elevations (WSEL) and the surrounding floodplain.

A duplicate effective model is prepared as a copy of the 2017 FHAD update HECRAS Rangeview Gulch model from Ayres Assoc. and utilizes base mapping as described in the 2017 FHAD Update, as this topography has remained unchanged in the area of the project site. The duplicate effective model includes the addition of Cross Section 1460.36 at Station 13+00 to provide comparisons to the proposed conditions model. A blocked obstruction has been added to the HEC-RAS model set at the WSEL of the pond.

The proposed conditions HEC-RAS model (RV Proposed) is a copy of the duplicate effective model as described above, and includes the addition of a blocked obstruction Cross Section 1487.51 to simulate fill on the subject parcel. The proposed conditions model includes the addition of Cross Section 1460.36 at Station 13+00 the location of maximum fill encroachment to provide comparisons to the proposed conditions model. The model was run in a steady state condition and resulting WSELs noted below.

FHAD*		Proposed Conditions		
FHAD XS	100-YR WSEL	HEC XS	100-YR WSEL	Δ WSEL (Ex to Prop)
1815.5	5346.24	1815.50	5346.24	0.00
1694.76	5344.93	1694.76	5344.93	0.00
1595.13	5344.04	1595.13	5344.10	0.06
1529.71	5341.57	1529.71	5341.88	0.31
1487.51	5341.30	1487.51	5341.80	0.50
1460.36	5341.24	1460.36	5341.66	0.42
1061.35	5340.98	1061.35	5340.98	0.00
*Per Rangeview Gulch Jan2017 FHAD Update				

An overall velocity comparison table is included on the Profile and Details plan sheet 2 of 2 and the velocity increases shown (maximum increase 0.69ft/s) are negligible and should have no effect on the comparatively wide and shallow floodplain.

An additional cross section has been added at station 15+29.71 in the HECRAS model and the resultant proposed condition modeling indicates a BFE of 5341.90 at this location. Mobile home finished floor elevation (FFE) information was surveyed and this information shown on the Site Plan. The lowest finished floor elevation of all residential structures is greater than 1' above the BFE.

The HEC-RAS model files revised with this memorandum, including HEC-RAS report files and modified cross sections, are included in the Appendix.

4. References

1. Rangeview Gulch FHAD Update, FHAD Update for Rangeview Gulch between South Platte River and Turtle Lake, Ayres Associates, January 2017.
2. Flood Hazard Area Delineation, Lower Dad Clark Gulch and DFA 0068, for Urban Drainage and Flood Control District and City of Littleton, Centennial Engineering, Inc., November 1990
3. Urban Storm Drainage Criteria Manual, Vol. 1, Management, Hydrology, and Hydraulics, Urban Drainage and Flood Control District, January 2016.
4. Urban Storm Drainage Criteria Manual, Vol. 2, Structures, Storage, and Recreation, Urban Drainage and Flood Control District, January 2016.

APPENDIX

EXHIBITS

1. Floodplain Workmap from 2017 Rangeview Gulch FHAD Update
2. HEC-RAS Standard Table
 - a. RV_Gulch (2017 FHAD Update)
 - b. RV_Revise (2018 HKS Use by Special Exception)
3. HEC-RAS Cross Sections
4. HEC-RAS Profile

MODEL FILES

HEC RAS

- RV_Gulch_Updated_HK.prj

HEC-RAS River: RangeviewGulch Reach: RVG_Lower Profile: 100-year Steady

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Vel Right (ft/s)	Vel Left (ft/s)	Froude # Chl
RVG_Lower	2106.55	100-year Steady	RV Duplicate	887.00	5348.20	5349.66		5349.72	0.013746	1.82	490.56	646.52	2.14	0.78	0.34
RVG_Lower	2106.55	100-year Steady	RV_Proposed	887.00	5348.20	5349.66		5349.72	0.013672	1.82	491.51	646.78	2.13	0.78	0.34
RVG_Lower	1989.68	100-year Steady	RV Duplicate	887.00	5346.54	5348.12		5348.17	0.011889	1.88	487.86	533.12	1.65	0.52	0.32
RVG_Lower	1989.68	100-year Steady	RV_Proposed	887.00	5346.54	5348.12		5348.17	0.011926	1.88	487.34	532.69	1.65	0.53	0.32
RVG_Lower	1890.38	100-year Steady	RV Duplicate	887.00	5345.44	5347.12		5347.17	0.009363	1.69	529.12	517.46	1.79	0.90	0.29
RVG_Lower	1890.38	100-year Steady	RV_Proposed	887.00	5345.44	5347.12		5347.17	0.009335	1.69	529.63	517.51	1.79	0.90	0.29
RVG_Lower	1815.5	100-year Steady	RV Duplicate	887.00	5344.50	5346.24		5346.30	0.015387	1.91	455.09	490.91	2.04		0.35
RVG_Lower	1815.5	100-year Steady	RV_Proposed	887.00	5344.50	5346.24		5346.30	0.015465	1.91	454.37	490.82	2.04		0.36
RVG_Lower	1694.76	100-year Steady	RV Duplicate	928.00	5343.14	5344.93		5344.98	0.008414	1.72	580.81	568.03	1.13		0.28
RVG_Lower	1694.76	100-year Steady	RV_Proposed	928.00	5343.14	5344.93		5344.97	0.008606	1.74	576.38	567.42	1.13		0.28
RVG_Lower	1595.13	100-year Steady	RV Duplicate	928.00	5341.55	5344.04		5344.09	0.010194	1.87	558.00	515.06	0.87		0.30
RVG_Lower	1595.13	100-year Steady	RV_Proposed	928.00	5341.55	5344.10		5344.14	0.008690	1.78	588.01	517.59	0.84		0.28
RVG_Lower	1529.71	100-year Steady	RV Duplicate	928.00	5341.00	5341.57		5341.74	0.068772	2.27	286.34	268.36	3.40		0.65
RVG_Lower	1529.71	100-year Steady	RV_Proposed	928.00	5341.00	5341.88		5342.03	0.071928	2.96	299.28	313.33	3.15		0.71
RVG_Lower	1487.51	100-year Steady	RV Duplicate	928.00	5338.82	5341.30		5341.32	0.003507	1.18	801.21	639.24	1.16	0.54	0.18
RVG_Lower	1487.51	100-year Steady	RV_Proposed	928.00	5338.82	5341.81		5341.82	0.001370	1.02	1002.76	551.75	0.88	0.73	0.12
RVG_Lower	1460.36	100-year Steady	RV Duplicate	928.00	5336.00	5341.24		5341.25	0.000176	0.52	1788.44	487.48			0.05
RVG_Lower	1460.36	100-year Steady	RV_Proposed	928.00	5336.00	5341.66		5341.67	0.000848	0.96	968.33	342.56			0.10
RVG_Lower	1061.35	100-year Steady	RV Duplicate	928.00	5338.45	5340.98	5340.24	5341.09	0.016306	2.59	348.51	291.53	2.70		0.39
RVG_Lower	1061.35	100-year Steady	RV_Proposed	928.00	5338.45	5340.98	5340.24	5341.09	0.016306	2.59	348.51	291.53	2.70		0.39
RVG_Lower	934.2	100-year Steady	RV Duplicate	928.00	5334.39	5335.89	5335.89	5336.47	0.142174	4.32	154.20	169.43	6.25		1.00
RVG_Lower	934.2	100-year Steady	RV_Proposed	928.00	5334.39	5335.89	5335.89	5336.47	0.142174	4.32	154.20	169.43	6.25		1.00

