

Douglas County 2008 PFIS Appeal, 2010 Effective FIS Restudies (2010-2015), and Alpine View Estates Flood Study



Douglas County 2008 PFIS Appeal, and 2010 Effective FIS Re-Studies (2010-2015)

(Prior to 2008 PFIS)

Chronological Timeline of Past Flood Studies

Following is a timeline of previous flood studies and revisions performed within Douglas County, Nevada:

- <u>February 1979</u> Original hydrologic and hydraulic study completed by U.S. Soil Conservation Service
- <u>September 1992 Revision</u> Hydrologic and hydraulic analyses revised by U.S. Army Corps of Engineers (USACE), Sacramento District
- <u>April 1994 Revision</u> Incorporated results of detailed study along the Carson River; Hydrology developed by Boyle Engineering; Hydraulic analysis performed by the U.S. Geological Survey (USGS)
- <u>June 1997 Revision</u> Incorporated results of detailed study, by USACE (Sacramento District), along the East Fork Carson River, Cottonwood Slough, Henningson Slough, and Rocky Slough
- <u>November 1999 Revision</u> Douglas County FIRM converted to digital format. In addition, detailed flood hazard data for Clear Creek was included at this time. Boyle Engineering performed the hydrologic and hydraulic analyses for the original Clear Creek study in December 1982.
- <u>February 2005 Revision</u> Hydrologic and hydraulic analyses performed by Northwest Hydraulic Consultants (NHC) to provide detailed mapping along Airport Tributary Wash, Airport Wash, Airport Overflow Wash, Bobwhite Wash, Buckeye Creek, Calle de Asco Wash, Calle Hermosa Wash, Johnson Lane Wash, and Juniper Road Wash.
- <u>December 2007</u> MAP-IX Mainland re-delineated 6.5 stream miles along the Carson River, Clear Creek, Pine Nut Road Wash, Rocky Slough and Smelter Creek. In addition, the existing FIRMs were converted from National Geodetic Vertical Datum of 1929 (NGVD) to North American Vertical Datum of 1988 (NAVD) and the 2005 NHC study was incorporated at this time.

1999 and 2008 Flood Zones Compared



Generally, 100-Year Peak Flows Increased by OVER 100%

Douglas County 2008 PFIS Appeal **DENIED** April 2, 2009

PFIS BECAME EFFECTIVE JAN. 20, 2010

After a few more months of headbutting with FEMA, the County was left with 3 options:

- 1) Accept the flawed new Effective DIFRM. **NO WAY!!!!!!!**
- Lawsuit in Federal Court. <u>RISKY!!!</u> We went down this road for a short time (months), but dropped that action to pursue Option 2.
- 3) Restudy each watershed ACCURATELY and submit as LOMRs or PMRs..... THIS WAS THE PATH CHOSEN!



1st Re-Study

Pine Nut Creek, and Cottonwood/Martin Sloughs Watersheds

NOT PART OF THE 2008 APPEAL



December 2010

Pine Nut Creek Watershed

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For this study, 6 models were developed to account for the unique watershed characteristics and project requirements.

- Pine Nut Creek Hydrologic HEC-HMS Model;
- Detailed Study Area Hydrologic SWMM5 Model;
- Regional Hydrologic Response (RHR) Statistical Model;
- Cottonwood Slough Flow Split Hydraulic HEC-RAS Model;
- Detailed Study Area 2-Dimensional Hydraulic FLO-2D Model; and
- Martin Slough LOMR Revised Hydraulic HEC-RAS Model.

Precipitation Details of Note

NOAA Atlas 14 Website

Area-Based Centroids at Each Sub-Basin in HEC-HMS and SWMM5 Using ARC-GIS Software

5,10, 15, 30, 60-Minute, 2, 3, 6, 12, and 24-Hour Rainfall Depths for the 100-Year and 500-Year Storms

Balanced Design Storm Hyetographs for Each Sub-Basin for Both Return Periods of Interest (100-year and 500-year).

In the Pine Nut Study Area "A", Area Reduction Factors (ARFs) Using NOAA Atlas 2 Curves Based on Watershed Area and Storm Duration (5-Minute Durations Received ARF of 0.69 and the 24-Hour Durations Received ARF of 0.95)

Soils Details of Note

NRCS Soil Survey Geographic (SSURGO) Database, and GIS Shapefiles were compiled for the Douglas County Area, Nevada.

There were 48 MUSYMs in the Pine Nut Creek Watershed, in which a Breakdown of up to 3 Named Soil Components is Provided.

These Soil Components are Further Categorized Into One of 13 Common Soil Textures used in the G&A Watershed Abstraction Parameter Development.

Table C-3 SSURGO Map Unit Symbol Conversion to KSAT Values

MUSYM	MUNAME	Component Name	Soil Texture	Percent	KSAT (in/hr)	KSAT*Prcnt	MUSYM_KSAT
1051				100	0.04	4	0.040
	Voltaire varia	nt clay loam Voltaire variant		100	0.04	4	
			clay loam	100	0.04	4	
1062				100	0.4	40	0.400
	Washoe very	gravelly sandy loam, 2 t Washoe	to 8 percent slopes	100	0.4	40	
			sandy loam	100	0.4	40	
1102				85	0.75	21.25	0.250
	Pung-Pula-U	haldi association Pula		85	0.75	21.25	
		Pung	loam	25	0.25	6.25	
		Libaldi	loam	40	0.25	10	
		Unarta	loam	20	0.25	5	
1113				100	0	0	0.000
	Water	Water		100	0	0	
			0	100	0	0	
124				85	0.9	28.75	0.338
	Borda varian	t-Burnborough variant-C Borda variant	Cassiro association	85	0.9	28.75	
		Burnborough variant	sandy loam	50	0.4	20	
		Cassiro	loam	25	0.25	6.25	
		Cussilo	loam	10	0.25	2.5	



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Pine Nut Creek Watershed

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STUDY AREA "A" Pine Nut Creek Watershed HEC-HMS (V 3.3, USACE 2008) Hydrologic Model Green & Ampt (Watershed Abstraction) Snyder Unit Hydrograph (Rainfall Transformation) Muskingum-Cunge Hydrograph Routing Methods







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Pine Nut Creek Watershed

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STUDY AREA "B" East Fork Carson River Regional Hydrologic Model

Statistical Analysis to Route Flood Wave Between Gages and Develop Hydrographs for the 100- and 500-Year Storms at the Cottonwood Slough Split Location Along East Fork Carson River











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Kimley»Horn STUDY AREA "C" HYDRAULIC MODEL Detailed Area – Lower Watershed FLO-2D Model (Surrogate Model)

FLO-2D (Version 2007.06 with 2010 Update) Used to
Combine and Route ALL Runoff Hydrographs from ALL
Flood Sources.....Pine Nut Creek, East Fork Carson,
Local Runoff from Detailed Area, Cottonwood Slough,
and Martin Slough.



Fille NUL Greek HEG-HMS MODE	Model	HMS	HEC-H	Creek	Nut	Pine	
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December 2010



Pine Nut Creek and Cottonwood/Martin Sloughs Hydrology and Floodplain Analysis Town of Gardnerville, NV

WHY 2-D Modeling in Gardnerville?

- Effective FIS simple methodology
- More accurate hydraulic routing
 - More information produced
 - Better graphics
 - Easier to QA/QC

Kimley»Horn 1D Surface Flow Routing



Kimley»Horn 2D Surface Flow Routing

• Diffusive wave in x and y directions

$$S_{f_y} = S_{o_y} - \frac{\partial h}{\partial y}$$
 $S_{f_x} = S_{o_x} - \frac{\partial h}{\partial x}$

- Manning's equation to relate friction and flow $q_x = \frac{1}{n} h_i^{2/3} S_{f_x}^{1/2}$ $q_y = \frac{1}{n} h_j^{2/3} S_{f_y}^{1/2}$
- Continuity equation to relate flow and depth at next time step

$$\frac{\partial h}{\partial t} + \frac{\partial q_x}{\partial x} + \frac{\partial q_y}{\partial x} = 0$$



Kimley»Horn 2-D Computational Platform



Meshes and Grids in Finite Element and Finite Difference Solutions

EXAMPLE OF THE **ADVANTAGES OF 2-D** MODELING (where appropriate)





Kimley Horn Initial FLO-2D Model "In Action" NYE 2005



Illustration of FLO-2D Model Area at 7:00 a.m. on Dec. 31 - Ascending Limb of Hydrograph



Blow-Up FLO-2D Model Area at 7:00 a.m. on Dec. 31 - Ascending Limb of Hydrograph

Back to Pine Nut Creek Watershed....



Table 14.1. 100-Yr & 500-Yr Peak Flow Rates at Key Locations

Flow Node	Description	Effective 100-Yr FIS Peak Flow (cfs)	Proposed 100-Yr Peak Flow (cfs)	Effective 500-Yr FIS Peak Flow (cfs)	Proposed 500-Yr Peak Flow (cfs)
Α	Pine Nut Creek (at the Allerman Canal)	6,563 ¹	5,510	+0	٦,368
в	EFC River (at the Cottonwood Slough flow split)	25.20	70°	0	S '4
с	Cottonwood Slough (at the EFC River flow	ere		flow	21,719
D	Cottony (just upstreet)	rive	FIS	_2	17,934
	Jew reffe	لىر	5,528	_2	14,900
F	Constitution wood	3,650	1,064	_2	3,692
G	at Zerolene Road near the Gardnerville Town limits)	3,689	2,263	_2	3,688

¹ Peak flow rate extracted from the Pine Nut Creek TR-20 model for this Flow Node location.

² 500-year peak flows could not be located in the 2010 Effective FIS.



Restudy LOMR Revised 4 FIRM Panels – Converted 431 Acres (GRAY) from 100-Year Floodplain (Zones AE/AO) to Zone X (0.2% ACE)



Pine Nut Creek

and Cottonwood/Martin Sloughs



Submitted to FEMA on February 18, 2011.

Approved with <u>NO</u> technical comments from FEMA/Baker on May 26, 2011. (3+ months!)



2nd Re-Study

Buckeye Creek Watershed to US 395





HYDRAULIC MODEL Buckeye Creek Upper Watershed

HEC-RAS (V 4.1.0, USACE January 2010) for Restudy of Buckeye Creek and Martin Slough

HYDRAULIC MODEL Detailed Area – Lower Watershed FLO-2D Model (Surrogate Model)

FLO-2D (Version 2007.06 with 2010 Update) Used to Combine and Route ALL Runoff Hydrographs from ALL Flood Sources.....Buckeye Creek, Local Runoff from Detailed Area, and Martin Slough.









Restudy LOMR Revised 7 FIRM Panels Converted 1180 Acres (YELLOW) from 100-Year Floodplain (AE/AO Zones) to Zone X (0.2% ACE)



Annotated FIRMS Spliced

U.S. Department of Homeland Security 500 C Street, SW Washington, DC 20472





November 17, 2010



After Buckeye Creek was submitted as a LOMR, FEMA IX and Douglas County began a partnership of cooperation and entered into Settlement Agreement on Oct. 28, 2011 in accordance to FEMA Procedure Memorandum No. 58 – NIBS **Scientific Resolution Panel (SRP) Process** for **Dispute Resolution**

After a few months "discovery" period, on June 5, 2012, Douglas County, Manhard, and FEMA representatives provided the SRP with Oral Presentations and Q&A.

Follow-up data was requested by the SRP during June 2012.

Panel Decision & Report

SRP NVDC122811 Douglas County, NV

July 16, 2012



http://floodsrp.org/panels/

On July 16, 2012, the SRP published their "Official Ruling", and by a unanimous vote, bound by one (1) of five (5) possible outcomes per Procedure Memorandum No. 58, the SRP determined: "FEMA's data does not satisfy NFIP mapping standards defined in FEMA's Guidelines and **Specifications for Flood Mapping Partners** (NFIP Standards) and must be revisited."

Over the next few months in fall 2012 and spring 2013, a number of **letters/meetings between Douglas County and FEMA IX occurred** regarding what does "revisited" mean, and how do we move forward in a way suitable to both parties.

In spring 2013, in the new light of cooperation and partnership between **Douglas County and FEMA IX, FEMA's** review of our Buckeye Creek study resumed, and we began restudying the rest of Douglas County watershedby-watershed as LOMRs/PMRs. **NOTE: Special kudos to Eric Simmons at FEMA** IX and Mimi Moss with Douglas County.

3rd Re-Study

Airport Wash and Buckeye Creek Phase II (US 395 to East Fork Carson River)



4th Re-Study

Buckbrush Wash, Sunrise Pass, and Johnson Lane Watersheds



Restudy LOMR Revised 12 FIRM Panels Converted 1590 Acres (GRAY) from 100-Year Floodplain (AE/AO Zones) to X Zone



Kimley»Horn <u>NET RESULTS</u>

After the final watersheds have been approved and gone through the Public Notice process, we will have converted 3,200 acres (5.0 square miles) from the 100-year floodplain (Zones AE/AO) to Zone X (0.2% ACE).



Alpine View Estates Flood Study (ONGOING)

10.0 Square Miles

Effective Zone A Floodplains



ALPINE VIEW ESTATES FLOOD STUDY SCOPE

- Topographic Data Collection
- Prepare Basemap
- Hydrologic Model Development
- Hydraulic Model Development
- Floodplain Mapping
- DFIRM Database

Kimley»Horn Topographic Data Development



Clear Creek LiDAR data

Kimley»Horn Basemap Development



Hydrologic Model Development

HEC-HMS Version 4.0

- Subbasin Delineation
- NOAA Atlas 14 Precipitation
- Green & Ampt Infiltration
- Snyder Unit Hydrograph
- Reach Routings (Muskingum-Cunge)


Precipitation

- NOAA Atlas 14 precipitation data
 - 10-year (10% Annual Chance Event)
 - 25-year (4% Annual-Chance Event)
 - 50-year (2% Annual-Chance Event)
 - 100-year (1% Annual-Chance Event)
 - 100-year Plus (1% Plus Annual-Chance Event)
 - 500-year (0.2% Annual-Chance Event)

NOAA Atlas 14 Rainfall Totals



Land Use

- 2011 Douglas County Aerials
- Used to delineate and classify land use



Soils

USDA SSURGO data used to estimate soil textures



Green & Ampt Parameters

- Based on soil texture from SSURGO database
- USACE Flood Hydrology Manual used to estimate:
 - Ksat
 - Wetting Front Suction Head
 - Initial Water Content
 - Saturated Water Content
 - Percent Impervious
 - Depression Storage

Kimley»Horn Regression Analysis Comparison



Hydraulic Modeling – HEC-RAS 1D

- HEC-RAS 1D will be used to model stretches where the current Zone A mapping extends up the channelized sections at the base of the mountains.
- HEC-RAS 1D will be used downstream of Jacks Valley Road.
- The detailed terrain created from the LiDAR will be used to cut cross sections that represent the channel characteristics.

Hydraulic Modeling – HEC-RAS 2D..... IF it is officially released in the next month, otherwise, we'll use FLO-2D

- 10-foot grid created to model shallow flooding across valley
- Input hydrographs taken from HMS elements will be applied at the appropriate locations in the 2D model
- Will more accurately model the various directions the flow velocity vectors travel
- Will produce more reasonable depths due to the spreading of the flow in many directions

Floodplain Mapping

- Currently all Zone A
- Proposed mapping will change the A zones to mostly AO with some AE or AH
- Potentially structures located in the effective Zone A mapping will be removed from the floodplain
- Required to restudy all areas labeled Zone A on the effective mapping

QUESTIONS?